DISTRICT SURVEY REPORT OF PURBA MEDINIPUR DISTRICT

(For mining of minor minerals)

As per Notification No.S.O.141 (E) New Delhi Dated 15th of January 2016, S.O.3611 (E) New Delhi Dated 25th of July 2018 and Enforcement & Monitoring Guidelines for Sand Mining (EMGSM) January 2020, Issued by Ministry of Environment, Forest and Climate Change (MoEF&CC)



August, 2022





No. 1333 MD

Kolkata, 6th January, 2022.

TO WHOM IT MAY CONCERN

This is to certify that DSRs of concerned districts of West Bengal have been duly validated by respective district authorities and their suggestions/inputs, if any, have been duly incorporated in the DSRs. The DSRs have been finally scrutinised and accepted by the scrutiny committee of DMM, WB and the same have been forwarded to the Dept. of Industry, Commerce and Enterprises along with respective scrutiny reports for onward transmission to SEAC for necessary action.

Director of Mines and Minerals

Govt. of West Bengal



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Abbreviations

% DEP – Departures ° C – Degree Centigrade BGL – Below Ground Level **CD** - Community Development Cft- Cubic Feet CGWB - Central Ground water Board **CRIS - Customized Rainfall Information System** Cum - Cubic meter DGMS - Directorate General of Mines Safety DGPS - Differential Global Positioning system. DL&LRO - District Land & Land Reform officer DSR - District Survey Report EC – Environmental Clearance **EIA-** Environment Impact Assessment EMGSM - Enforcement and Monitoring Guideline for Sand Mining **ENVIS - Environmental Information System** ft – Feet **GIS - Geographical Information System GMEC - Global Management and Engineering Consultant** GSI - Geological Survey of India Ha – Hectare hr - Hour IMD – Indian Meteorological Department ISRO - The Indian Space Research Organization KM - Kilometer LISS - Linear Imaging Self-Scanning Sensor LOI - Letter of Intent LULC - Land Use Land Cover m² - Square meter MBT - Main Boundary Thrust MCT - Main Central Thrust MFT - Main Frontal Thrust



Mcum – Million Cubic Meters

MMDR - Mines & Minerals (Development and Regulation) Act

MMR - Metalliferous Mines Regulation

MOEF & CC - Ministry of Environment, forest & Climate Change

Mph-miles per hour

M-Sand - Mineral Sand

MSME - Micro, Small & Medium Enterprises

Mt - Metric Ton

MT – Million Tons

NGT - National Green Tribunal

NH – National Highway

NIC - National Informatics Centre

OC - Officer In Charge

OGL - Original Ground level

PSU - Public Sector Unit

R/F – Rain Fall

SSMG - Sustainable Sand Mining Guidelines

WBMDTCL- West Bengal Mineral Development and Trading Corporation Limited

The WBMMCR 2016 - The West Bengal Minor Mineral Concession Rules, 2016



Definitions

- **Riverbed:** A riverbed is the area between two banks of river where sediment deposited. During the normal flow period, river water is contained in and flows along the riverbed. However, during a flood, the river overflows the riverbed and flows onto the floodplain.
- *Sandbars*: The sandbar is the ridge of sand or coarse sediment that is built over a period of time.
- *Pre monsoon Sandbars*: Sandbars which are identified from satellite imagery of pre monsoon period.
- **Post monsoon Sandbars**: Sandbars which are identified from satellite imagery of post monsoon period.
- **Restricted** Area: Sandbars or part of sandbars which are falling within restricted area. As per the Enforcement & Monitoring Guidelines for Sand Mining (EMGSM) 2020 the restricted zone for mining is a distance from the bank is ¼th of river width and not be less than 7.5 meters. Also, there is a no mining zone up to a distance of 1 kilometre (1 km) from major bridges and highways on both sides, or five times (5x) of the span (x) of a bridge/public civil structure (including water intake points) on up-stream side and ten times (10x) the span of such bridge on down-stream side, subjected to a minimum of 250 meters on the upstream side and 500 meters on the downstream side. No mining zone has been marked for an area up to a width of 100 meters from the active edge of embankments.
- **Potential Zone:** Sandbars which are falling within the central 3/4th part of the riverbed and which are not falling within the restricted area.

Potential Block: Each individual sand bars of potential zone is Potential Block.

River bed occurrence: River bed occurrence means sand, stone, boulder, pebbles, gravel accumulated in the river bed by natural phenomenon.

Replenishment: Quantum of sand deposited in a mined out void during monsoon period.

- *Aggradations*: Aggradation (or alluviation) is the term used in geology for the increase in land elevation, typically in a river system, due to the deposition of sediment. Aggradation occurs in areas in which the supply of sediment is greater than the amount of material that the system is able to transport.
- Act: It means the Mines and Minerals (Development and Regulation) Act, 1957(67 of 1957), as subsequently amended.

Mineral: It means minor minerals as defined in clause (e) of section 3 of the Act.

Sand: A natural resource, is a minor mineral as defined under S 3(e) of the Mines and Minerals (Development and Regulation) Act, 1957 (" MMDR Act").

Lease: It means a mining lease granted under West Bengal Minor Mineral Concession Rules, 2016.

Mining: Excavation of mineral by manual method or using machineries.



EXECUTIVE SUMMARY

Purba Medinipur district is the southernmost district of West Bengal and bounded by Paschim Medinipur at the northern and western side, state of Odisha is at the southwest border; the Bay of Bengal lies in the south; the Hooghly river and South 24 Parganas district to the east; and Howrah district to the north-east.

Purba Medinipur district is part of the lower Indo-Gangetic Plain and Eastern coastal plains. Topographically, the district can be divided into younger alluvial deposits on the East, West and Northern portion of the district and the coastal alluvial dominated in the southern part of the district.

The district has considerable area close to river basins and deltas that are characterized by Holocene alluvium deposits, which are likely to soften and hence are susceptible to liquefaction during an earthquake. The maximum area of the district falls under the Seismic Zone III and rest of the part fall under Zone II, indicating the district under safe earthquake– prone zone.

As the district area is bounded by water bodies in two sides, it is a formation of fluvialtidal deposition. Geologically the area is of recent origin. This region is 5-7 meters above mean sea level and average slope is 0-5 degree. The Haldi, Kangsabati, Keleghai, Rosulpur, Rupnarayan are important rivers of Purba Medinipur district.

In Purba Medinipur district, as per the report published by Directorate of Mines and Minerals, Government of West Bengal, there is no major or minor in-situ minerals noted. The district is having riverbed deposits which are generating revenue for the district mainly.

The district is generating considerable revenue from mining of minor minerals such as riverbed sand deposits. Revenue generated in the district of Purba Medinipur from Minor minerals during the period of April 2017 to January 2020 is Rs. 53.48 crores.

Potential minor mineral blocks of sand have been identified based on satellite imagery study along with ground truthing and are listed in this District Survey Report. Restriction zones are defined as per the EMGSM guidelines 2020. In Purba Medinipur district, total 0.81 Mcum potential river bed deposits estimated.



1 Preface

The need for District Survey Report (DSR) have been necessitated by Ministry of Environment, Forest and Climate Change (MoEF&CC) vide there Notification No. 125 (Extraordinary, Part II Section 3, Sub-section ii), S.O. 141 (E), dated 15th January 2016. The notification was addressed to bring certain amendments with respect to the EIA notification 2006 and in order to have a better control over the legislation. District level committee's have been introduced in the system. As a part of this notification, preparation of District Survey Reports has been introduced. Subsequently, MOEF& CC has published Notification No. 3611 (E), dt. 25thJuly, 2018 regarding inclusion of the "Minerals Other than Sand" and format for preparation of the DSR has been specified. Enforcement & Monitoring Guidelines for Sand Mining (EMGSM) January 2020, Issued by MoEF& CC is prepared in consideration of various orders/directions issued by Hon'ble NGT in matters pertaining to illegal sand mining and also based on the reports submitted by expert committees and investigation teams. This DSR has been prepared in conformity with the S O 141 (E), S O 3611 (E) and other sand mining guidelines published by MOEF& CC time to time as well as the requirement specified in West Bengal Minor Mineral Concession Rule, 2016.

The purpose of DSR is to identify the mineral potential areas where mining can be allowed; and also to distinguish areas where mining will not be allowed due to proximity to infrastructural structures and installations, areas of erosion, areas of environmental sensitivities etc. The DSR would also help to estimate the annual rate of replenishment wherever applicable.

Preparation of this DSR involved both primary and secondary data generation. The primary data generation involved the site inspection, survey, ground truthing etc. while secondary data has been acquired through various authenticated sources and satellite imagery studies. The secondary data related to district profile, local geology, mineralization and other activities are available in rather a piecemeal fashion.

The district survey report of Purba Medinipur district also describes the general geographical profile of the district, distribution of natural resources, livelihood, climatic condition, inventory of minor minerals and revenue generation.



2 Introduction

The District Survey Report of Purba Medinipur District has been prepared as per the guide line of Ministry of Environment, Forests and Climate Change (MoEF& CC), Government of India vide Notification S.O.-1533(E) dated 14th Sept, 2006 and subsequent MoEF& CC Notification S.O. 141(E) dated 15th Jan, 2016. This report shall guide systematic and scientific utilization of natural resources, so that present and future generation may be benefitted at large. Further, MoEF& CC published a notification S.O. 3611(E) Dated 25th July, 2018 and recommended the format for District Survey Report.

The main objective of DSR is identification of areas of aggradations or deposition where mining can be allowed; and identification of areas of erosion and proximity to infrastructural structures and installations where mining should be prohibited and calculation of annual rate of replenishment and allowing time for replenishment after mining in that area. The DSR would also help to calculate the annual rate of replenishment wherever applicable and allow time for replenishment. Besides the sand mining, the DSR also include the potential development scope of in-situ minor minerals.

The objectives of the District Survey Report are as follows:

- 1. To identify and quantify minor mineral resources for its optimal utilization.
- 2. To regulate sand and gravel mining, identification of site specific end-use consumers and reduction in demand and supply gaps.
- 3. To facilitate use information technology (IT) for surveillance of the sand mining at each step.
- 4. To enable environmental clearance for cluster of sand and gravel mines.
- 5. To restrict illegal mining.
- 6. To reduce occurrences of flood in the area.
- 7. To maintain the aquatic habitats.
- 8. To protect ground water in the area by limiting extraction of material in riverbeds to an elevation above the base flow.
- 9. To maintain data records viz. details of mineral resource, potential area, lease, approved mining plan, co-ordinates of lease hold areas, and revenue generation.
- 10. To design a scientific mining plan and estimate ultimate pit limit.
- 11. To frame a comprehensive guideline for mining of sand and other minor minerals.

District Survey Report Purba Medinipur District, West Bengal



The District Survey Report (DSR) comprises secondary data on geology, mineral resources, climate, topography, land form, forest, rivers, soil, agriculture, road, transportation, irrigation etc of the district collected from various published and un-published literatures and reports as well as various websites. Data on lease and mining activities in the district, revenue etc. have been collected from the DL&LRO office of the district and from West Bengal Mineral Development Corporation Limited.



2.1 Statutory Framework

Ministry of Environment, Forest and Climate Change (MoEF& CC) has published several notifications time to time to formulate and implement the District Survey Report (DSR) for every district. Statutory Framework and its legal aspect with respect to DSR is tabulated in Table 2.1.

Year	Particulars
1994	The Ministry of Environment, Forest & Climate Change (MoEF&CC) published Environmental Impact Assessment Notification 1994 which is only applicable for the Major Minerals more than 5 ha.
2006	In order to cover the minor minerals also into the purview of EIA, the MoEF&CC has issued EIA Notification SO 1533 (E), dated 14th September 2006, made mandatory to obtain environmental clearance for both Major & Minor Mineral more than 5 Ha.
2012	Further, Hon'ble Supreme Court wide order dated the 27th February, 2012 in I.A. No.12- 13 of 2011 in Special Leave Petition (C) No.19628- 19629 of 2009, in the matter of Deepak Kumar etc. Vs. State of Haryana and Others etc., ordered that "leases of minor minerals including their renewal for an area of less than five hectares be granted by the States/Union Territories only after getting environmental clearance from MoEF"; and Hon'ble National Green Tribunal, order dated the 13th January, 2015 in the matter regarding sand mining has directed for making a policy on environmental clearance for mining leases in cluster for minor Minerals.
2016	The MoEF&CC in compliance of above Hon'ble Supreme Court's and NGT'S order has prepared "Sustainable Sand Mining Guidelines (SSMG), 2016" in consultation with State governments, detailing the provisions on environmental clearance (EC) for cluster, creation of District Environment Impact Assessment Authority, preparation of District survey report and proper monitoring of minor mineral. There by issued Notification dated 15.01.2016 for making certain amendments in the EIA Notification, 2006, and made mandatory to obtain EC for all minor minerals. Provisions have been made for the preparation of District survey report (DSR) for River bed mining and other minor minerals.
2016	West Bengal Minor Minerals Concession Rules, 2016 amended the Mines and Minerals (Development and Regulation) Act, 1957 (Act 67 of 1957), to make the rules regulating the grant of mining licenses, prospecting license-cum-mining leases and mining leases in respect of minor minerals by auction process. The rule also incorporates EIA



	2016 also includes SSMG 2016 for minor mineral mining.
2018	MoEF& CC published a notification S.O. 3611(E) Dated 25th July,
	2018 and recommended the format for District Survey Report .The
	notification stated about the objective of DSR i.e."Identification of
	areas of aggradations or deposition where mining can be allowed;
	and identification of areas of erosion and proximity to infrastructural
	structures and installations where mining should be prohibited and
	3
	calculation of annual rate of replenishment and allowing time for
	replenishment after mining in that area".
2020	Enforcement & Monitoring Guidelines for Sand Mining (EMGSM)
	2020 has been published modifying Sustainable sand Mining
	Guidelines, 2016 by MoEF& CC for effective enforcement of
	regulatory provisions and their monitoring. The EMGSM 2020
	directed the states to carry out river audits, put detailed survey
	reports of all mining areas online and in the public domain, conduct
	replenishment studies of river beds, constantly monitor mining with
	drones, aerial surveys, ground surveys and set up dedicated task
	forces at district levels. The guidelines also push for online sales and
	purchase of sand and other riverbed materials to make the process
	transparent. They propose night surveillance of mining activity
	through night-vision drones.

Important statutory Guidelines for sand or gravel mining:

> The West Bengal Minor Minerals Concession Rules (WBMMCR), 2016

 (a) No person shall undertake mining operation in any area prohibited by the 'State Government in the public interest by notification in the *Official Gazette*. Provided that nothing in the sub-rule shall affect any mining operation undertaken in any area in accordance with the terms and conditions of a mining lease or mineral concession already granted.

(b) No person shall transport or store or cause to be transported or stored any mineral otherwise than in accordance with the provisions of these rules and the West Bengal Minerals (Prevention of Illegal Mining, Transportation and Storage) Rules, 2002.

(2) No minor mineral coming out in course of digging of wells or excavation of tanks shall be disposed of by the person digging or excavating without informing the District Authority as well as the Executive Officer of the *Panchayat Samiti* or the Executive Officer of the Municipality concerned, as the case may be, about such occurrence.

Provided that disposal of such minor mineral may be allowed on pre-payment of prices of such minor mineral at the prevailing market rate as determined on the basis of the rates published by the Public Works Department / concerned department of the State Government for the concerned area from time to time.



- (3) No mining of river bed occurrences shall be allowed within 300 meters, upstream and downstream, measured from the centre line of any bridge, regulator or similar hydraulic structure and from the end point of bank protection works.
- (4) No river bed mining shall be allowed beneath 3 meters of the river bed or ground water Ievel, whichever is less.
- (5) No mining operation in case of river bed occurrence shall be done within a distance of three (3) kilometers of a barrage axis or dam on a river unless otherwise permitted by the concerned Executive Engineer or Revenue Officer or authorized officer and such distance shall be reckoned across an imaginary line parallel to the 'barrage, or dam axis, as the case maybe.
- (6) No extraction of river bed occurrence shall 'be allowed beyond the central one third of the river bed, or keeping a distance of 100 meter from the existing bank line whichever is less, unless otherwise permitted by the concerned Executive Engineer or Revenue Officer.
- (7) No extraction of minerals other than river bed occurrence shall be allowed within fifty (50) meters from any road, public structure, embankment, railway line, bridge canal, road and other public works or buildings.
- (8) No mining lease shall be granted without proof of existence of mineral contents in the area for which the application for a mining lease has been made in accordance with such parameters as may be prescribed by the Government from time to time.

N.B- The aforesaid application for mining lease shall succeed the competitive bidding for mining lease for a specified mineral(s).

Sustainable Sand Mining Management Guidelines (SSMMG), 2016 by MoEF& CC.

The sustainable sand Mining Management Guidelines 2016 has been prepared after extensive consultation with the States and Stakeholders over a period of one year. The main objective of the Guideline is to ensure sustainable sand mining and environment friendly management practices in order to restore and maintain the ecology of river and other sand sources.

- a) Parts of the river reach that experience deposition or aggradation shall be identified first. The Lease holder/ Environmental Clearance holder may be allowed to extract the sand and gravel deposit in these locations to manage aggradation problem.
- b) The distance between sites for sand and gravel mining shall depend on the replenishment rate of the river. Sediment rating curve for the potential sites shall be developed and checked against the extracted volumes of sand and gravel.
- c) Sand and gravel may be extracted across the entire active channel during the dry season.
- d) Abandoned stream channels on terrace and inactive flood plains be preferred rather than active channels and their deltas and flood plains. Stream should not be diverted to form inactive channel.
- e) Layers of sand and gravel which could be removed from the river bed shall depend on the width of the river and replenishment rate of the river.
- f) Sand and gravel shall not be allowed to be extracted where erosion may occur, such as at the concave bank.



- g) Segments of braided river system should be used preferably falling within the lateral migration area of the river regime that enhances the feasibility of sediment replenishment.
 - h) Sand and gravel shall not be extracted within 200 to 500 meter from any crucial hydraulic structure such as pumping station, water intakes, and bridges. The exact distance should be ascertained by the local authorities based on local situation. The cross-section survey should cover a minimum distance of 1.0 km upstream and 1.0 km downstream of the potential reach for extraction. The sediment sampling should include the bed material and bed material load before, during and after extraction period. Develop a sediment rating curve at the upstream end of the potential reach using the surveyed cross- section. Using the historical or gauged flow rating curve, determine the suitable period of high flow that can replenish the extracted volume. Calculate the extraction volume based on the sediment rating curve and high flow period after determining the allowable mining depth.
- h) Sand and gravel could be extracted from the downstream of the sand bar at river bends. Retaining the upstream one to two thirds of the bar and riparian vegetation is accepted as a method to promote channel stability.

Flood discharge capacity of the river could be maintained in areas where there are significant flood hazard to existing structures or infrastructure. Sand and gravel mining may be allowed to maintain the natural flow capacity based on surveyed cross- section history.

- i) Alternatively, off-channel or floodplain extraction is recommended to allow rivers to replenish the quantity taken out during mining.
- j) The Piedmont Zone (Bhabhar area) particularly in the Himalayan foothills, where riverbed material is mined, this sandy-gravelly track constitutes excellent conduits and holds the greater potential for ground water recharge. Mining in such areas should be preferred in locations selected away from the channel bank stretches.
- k) Mining depth should be restricted to 3 meter and distance from the bank should be 3 meter or 10 percent of the river width whichever less.

The borrow area should preferably be located on the river side of the proposed embankment, because they get silted up in course of time. For low embankment less than 6 m in height, borrow area should not be selected within 25 m from the toe/heel of the embankment. In case of higher embankment the distance should not be less than 50 m. In order to obviate development of flow parallel to embankment, cross bars of width eight times the depth of borrow pits spaced 50 to 60 meters centre-to-centre should be left in the borrow pits.

l) Demarcation of mining area with pillars and geo-referencing should be done prior to start of mining.

> Enforcement & Monitoring Guidelines for sand Mining, 2020 (MoEF& CC)

The Ministry of Environment Forest & Climate Change formulated the Sustainable Sand Management Guidelines 2016 which focuses on the Management of Sand Mining in the Country. But in the recent past, it has been observed that apart from management and systematic mining practices there is an urgent need to have a guideline for effective enforcement of regulatory provision and their monitoring. Section 23 C of MMDR, Act 1957 empowered the State Government to make rules for preventing illegal mining, transportation and storage of minerals. But in the recent past, it has been observed that



there was large number of illegal mining cases in the Country and in some cases, many of the officers lost their lives while executing their duties for curbing illegal mining incidence. The illegal and uncontrolled illegal mining leads to loss of revenue to the State and degradation of the environment.

- a) Parts of the river reach that experience deposition or aggradation shall be identified. The Leaseholder/ Environmental Clearance holder may be allowed to extract the sand and gravel deposit in these locations to manage aggradation problem.
- b) The distance between sites for sand and gravel mining shall depend on the replenishment rate of the river. Sediment rating curve for the potential sites shall be developed and checked against the extracted volumes of sand and gravel.
- c) Sand and gravel may be extracted across the entire active channel during the dry season.
- d) Abandoned stream channels on the terrace and inactive floodplains be preferred rather than active channels and their deltas and flood plains. The stream should not be diverted to form the inactive channel.
- e) Layers of sand and gravel which could be removed from the river bed shall depend on the width of the river and replenishment rate of the river.
- f) Sand and gravel shall not be allowed to be extracted where erosion may occur, such as at the concave bank.
- g) Segments of the braided river system should be used preferably falling within the lateral migration area of the river regime that enhances the feasibility of sediment replenishment.
- h) Sand and gravel shall not be extracted up to a distance of 1 kilometre (1 km) from major bridges and highways on both sides, or five times (5x) of the span (x) of a bridge/public civil structure (including water intake points) on up-stream side and ten times (10x) the span of such bridge on down-stream side, subjected to a minimum of 250 meters on the upstream side and 500 meters on the downstream side.
- i) The sediment sampling should include the bed material and bed material load before, during and after the extraction period. Develop a sediment rating curve at the upstream end of the potential reach using the surveyed cross-section. Using the historical or gauged flow rating curve, determine the suitable period of high flow that can replenish the extracted volume. Calculate the extraction volume based on the sediment rating curve and high flow period after determining the allowable mining depth.
- j) Sand and gravel could be extracted from the downstream of the sand bar at river bends. Retaining the upstream one to two-thirds of the bar and riparian vegetation is accepted as a method to promote channel stability.
- k) The flood discharge capacity of the river could be maintained in areas where there is a significant flood hazard to existing structures or infrastructure. Sand and gravel mining may be allowed to maintain the natural flow capacity based on surveyed cross-section history. Alternatively, off-channel or floodplain extraction is recommended to allow rivers to replenish the quantity taken out during mining.
- The Piedmont Zone (Bhabhar area) particularly in the Himalayan foothills, where riverbed material is mined, this sandy-gravelly track constitutes excellent conduits and holds the greater potential for groundwater recharge. Mining in such areas should be preferred in locations selected away from the channel bank stretches.



- m) Mining depth should be restricted to 3 meters and distance from the bank should be ¼th or river width and should not be less than 7.5 meters.
- n) The borrow area should preferably be located on the riverside of the proposed embankment because they get silted in the course of time. For low embankment, less than 6 m in height, borrow area should not be selected within 25 m from the toe/heel of the embankment. In the case of the higher embankment, the distance should not be less than 50 m. In order to obviate the development of flow parallels to the embankment, crossbars of width eight times the depth of borrow pits spaced 50 to 60 meter center-to-center should be left in the borrow pits.
- o) Demarcation of mining area with pillars and geo-referencing should be done prior to the start of mining.
- p) A buffer distance /un-mined block of 50 meters after every block of 1000 meters over which mining is undertaken or at such distance as may be the directed/prescribed by the regulatory authority shall be maintained.
- q) A buffer distance /unmined block of 50 meters after every block of 1000 meters over which mining is undertaken or at such distance as may be the directed/prescribed by the regulatory authority shall be maintained.
- r) River bed sand mining shall be restricted within the central 3/4th width of the river/rivulet or 7.5 meters (inward) from river banks but up to 10% of the width of the river, as the case may be and decided by regulatory authority while granting environmental clearance in consultation with irrigation department. Regulating authority while regulating the zone of river bed mining shall ensure that the objective to minimize the effects of riverbank erosion and consequential channel migration are achieved to the extent possible. In general, the area for removal of minerals shall not exceed 60% of the mine lease area, and any deviation or relaxation in this regard shall be adequately supported by the scientific report.
- s) Mining Plan for the mining leases(non-government) on agricultural fields/Patta land shall only be approved if there is a possibility of replenishment of the mineral or when there is no riverbed mining possibility within 5 KM of the Patta land/Khatedari land. For government projects mining could be allowed on Patta land/Khatedari land but the mining should only be done by the Government agency and material should not be used for sale in the open market.

The minerals reserve for riverbed area is calculated on the basis of maximum depth of 3 meters and margins, width and other dimensions as mentioned in para (s) above. The area multiplied by depth gives the volume and volume multiplied with bulk density gives the quantity in Metric Ton. In case of riverbed, mineable material per hectare area available for actual mining shall not exceed the maximum quantity of 60,000 MT per annum.

Demand and Utilisation of Sand

Sand is a multi-purpose topographical material. It is known as one of the three fundamental ingredients in concrete. The composition of sand is diverse. Mostly sand is made of silica which is a common element. It can also come from another source of minerals like quartz, limestone, or gypsum.



From beds to flood plains to coastlines- we can find the sand at almost everywhere. The robustness of sand has played a significant role in everyday life. We use sand practically every other day.

Sand extraction from river beds and brick earth mining for making raw bricks are the main mining activities in the district. With a spurt in construction of real estate sectors and various govt. sponsored projects, the demand for both sand and bricks has increased manifold. The extraction of sand is carried out either manually or through semi- mechanized system. The depth of mining for both river bed sand and brick earth is restricted due to statutory provision in the regulations pertaining to conservation and development of minor minerals.

River sand mining is a common practice as habitation concentrates along the rivers and the mining locations are preferred near the markets or along the transportation route, for reducing the transportation cost.

In the real world, there are a lot of situations where we can find uses of sand. Followings are the common sand uses.

- 1. While bunging metal, we can mix sand with clay binder for frameworks used in the foundries.
- 2. Sand can be used for cleaning up oil leak or any spill by dredging sand on that spill. The material will form clumps by soaking up, and we can quickly clean the mess.
- 3. Sand can be used as a road base which is a protective layer underneath all roads
- 4. Industrial sand is used to make glass, as foundry sand and as abrasive sand.
- 5. One creative usage of sand is serving as a candle holder. We can try putting some sand before pouring tea light or any candle in a glass. It holds the candle still and refrain the candle from rolling by giving it an excellent decoration.
- 6. Adds texture and aesthetic appeal to space.
- 7. Sand is mostly pure to handle, promptly available and economically wise.
- 8. We use sand in aquariums, fabricating artificial fringing reefs, and in human-made beaches
- 9. Sandy soils are ideal for growing crops, fruits and vegetables like watermelon, peaches, peanuts, etc.
- 10. Sand can light a path by filling mason jars with sand and tea light which is another inexpensive way to make a walkway glow.
- 11. Sand helps to improve resistance (and thus traffic safety) in icy or snowy conditions.
- 12. We need sand in the beaches where tides, storms or any form of preconceived changes to the shoreline crumble the first sand.
- 13. Sand containing silica is used for making glass in the automobile and food industry- even household products for the kitchen.
- 14. Sand is a strong strand which is used for plaster, mortar, concrete, and asphalt.
- 15. The usual bricks formulated of clay only are way weaker and lesser in weight than blocks made of clay mixed with sand.



2.2 Methodology of DSR Preparation

The steps followed during the preparation of District Survey Report are given in Figure 2.1. The individual steps are discussed in following paragraphs.



Figure 2.2.1: Steps followed in preparation of DSR

Data source Identification: District Survey Report has been prepared based on the Primary data base and secondary data base collected and collated from different sources. This is very critical to identify authentic data sources before compiling the data set. The secondary data sources which are used in this DSR are mostly taken from public domain and or from the published report in reputed journal. Information related to district profile has been taken from District Census report, 2011 and District Statistical Handbook published by the Govt. of West Bengal. Potential mineral resources of the district have been described based on the published report of Geological Survey of India (GSI) or any other govt. agencies like MECL etc. List of Mining lease, name of lease holder, lease/Block area, resource in already allotted mining lease, revenue from minor mineral sector etc. have been collected from the concern DL&LRO offices of the district. Satellite images have been used for map preparation related to physiography and land use/land cover of the district.

Data Analysis and Map preparation: Dataset which are captured during the report preparation, are gone through detail analysis work. District Survey Report involves the analytical implication of the captured dataset to prepare relevant maps.

Methodology adopted for preparation of relevant maps is explained below.

Land Use and Land Cover Map: Land Use and Land Cover classification is a complex process and requires consideration of many factors. The major steps of image classification may include determination of a suitable classification system via Visual Image Interpretation, selection of training samples, Satellite image (FCC-False Color Composite) pre-processing, selection of suitable classification approaches, post classification processing, and accuracy assessment.

Here LISS-III satellite Imagery has been taken for Supervised Classification as supervised classification can be much more accurate than unsupervised classification, but depends heavily on the training sites, the skill of the individual processing the image, and the spectral distinctness of the classes in broader scale.

According to the Visual Image Interpretation (Tone, Pattern, Texture, Shape, Color etc.) training set of the pixel has been taken. Pictorial descriptions of Land Use classification are explained in Figure 2.2.



Agricultural Land - Based on their Geometrical shape, red and pink color tone, Agricultural Land has been identified.	Vegetation Covered Area - Area with continuous red color tone, Vegetation Covered Area has been classified.
Agricultural Fallow Land - Based on their Geometrical shape, Yellowish green color tone, Agricultural Fallow Land has been identified.	Badland Topography - Area with Non geometrical shape and Yellowish green color tone has been identified as Bad Land Topography.
Settlement – Area with some geometrical shape in a Linear Pattern including Light Cyan Color has been recognized as Settlement Area.	Water Bodies – Area with Blue color has been classified as Water Bodies.

Figure 2.2.2: Pictorial description of Land Use Classification methods

<u>Geomorphological Map</u>: The major step of preparing Geomorphological Map is identifying features like – Alluvial Fan, Alluvial Plain, Hilly Region etc. from Satellite Imagery

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(FCC-False Colour Composite) via Visual Image Interpretation and then digitisation has been taken into the consideration to prepare map including all the Geomorphological features according to their location. Pictorial descriptions of Geomorphological unit's classification are explained in Figure 2.3.



Figure 2.2.3: Pictorial description of Geomorphological Units Classification methods

<u>Physiographical Map</u>: The major step of preparing Physiographical Map is generating contour at a specific interval to show the elevation of the area using Cartosat DEM.

Block Map/Transportation Map/Drainage Map:

- Raw Data collected from National Informatics Centre (NIC Website) during Sept 2020.
- > Data has been geo-referenced using GIS software.
- Digitization of block boundary, district boundary, state boundary, international boundary, and district headquarter, sub-district headquarter, places, road, railway, river, nala etc.
- > Road name, River name, Railway name has been filled in attribute table of the Layers
- > Final layout has been prepared by giving scale, legend, north arrow, etc.

<u>Earthquake Map:</u>

- > Raw data collected from **Ministry of Earth Science**.
- > Data has been geo-referenced using GIS software.
- > Digitization of Earthquake zone and superimposed it over Block Boundary.
- > Zone name has been filled in attribute table of the Layers
- > Final layout has been prepared by giving scale, legend, north arrow, etc.



Soil Map:

- Raw data collected from National Bureau of Soil Survey and Land Use Planning during Sept 2020.
- > Data has been geo-referenced using GIS software.
- > Digitization of Soil classification zone and superimposed it over District Boundary.
- > Soil classification has been filled in attribute table of the Layers.
- > Final layout has been prepared by giving scale, legend, north arrow, etc.

Wildlife Sanctuary and National Park location Map:

- Raw data obtained from ENVIS Centre on Wildlife & Protected Areas during August 2020.
- > Data has been geo-referenced using GIS software.
- Digitization of Wildlife Sanctuary and National Park and superimposed it over Block Boundary.
- Wildlife Sanctuary &National Park name has been filled in attribute table of the Layers Final layout has been prepared by giving scale, legend, north arrow, etc.

Primary Data Collection: To prepare DSR, primary data has been collected and field work has also been carried out for the district. Field study involves assessment of the mineral resources of the district by means of pitting / trenching in specific interval. This provides clear picture of mineral matters characterization and their distribution over the area.

Replenishment study: One of the principal causes of environmental impacts river bed mining is the removal of more sediment than the system can replenish. Therefore, there is a need for replenishment study for riverbed sand in order to nullify the adverse impacts arising due to excess sand extraction. The annual rate of replenishment carried out on every river of the district to have proper assessment of the potential sand reserve.

Four times physical survey has been carried out by GPS/DGPS/ Total Station to define the topography, contours and offsets of the riverbed. The surveys clearly depict the important attributes of the stretch of the river and its nearby important civil and other feature of importance. This information will provide the eligible spatial area for mining.

Report Preparation: The district survey report portrays general profile, geomorphology, land use pattern and geology of the district. The report then describes the availability and distribution of riverbed sands and other minor minerals in the district. Apart from delineation the potential mining blocks, the report also includes inventorization of the minerals, recent trends of production of minor minerals and revenue generation there from. Annual replenishment of the riverbed sand has been estimated using field observation, satellite imagery and empirical formula. The road network connecting arterial road to potential mining blocks has been identified. Potential environmental impacts of mining of these minerals, their



mitigation measures along with risk assessment and disaster management plan have also been discussed. Finally the reclamation strategy for already mined out areas is also chalked out.



3 General Profile of the district

a) General Information

Purba Medinipur district is an administrative unit in the Indian state of West Bengal. It is the southernmost district of Medinipur division – one of the five administrative divisions of West Bengal. Headquarter of the district is in Tamluk. It was formed on 1 January 2002 after the Partition of Medinipur into Purba Medinipur and Paschim Medinipur which lies at the northern and western border of it. The state of Odisha is at the southwest border; the Bay of Bengal lies in the south; the Hooghly river and South 24 Parganas district to the east; and Howrah district to the north-east. The district covers an area of 9368 sq.km (https://PurbaMedinipur.gov.in/).

The district lies between 21°38' North Latitude to 22°31' North Latitude and 87°27' East Longitude to 88°12' East Longitude, covering area of 4713 sq. km (Figure 3.1).

The district has 4 (four) Sub-divisions, viz. Tamluk Sub-division, Haldia Subdivision, Egra Sub-division and Contai Sub-division. There are 25 (twenty-five) Community Development (C.D.) Blocks, 5 (five) Municipalities in the district. Tamluk Subdivision has got 7 C.D. Blocks namely, Nandakumar, Moyna, Tamluk, Shahid Matangini, Panskura, Kolaghat, Chandipur (Nandigram-III). Haldia Sub-division has got 5 C.D. Blocks namely, Mahisadal, Nandigram-I, Nandigram-II, Sutahata and Haldia. Egra Subdivision has got 6 C.D. Blocks namely, Bhagawanpur-I, Bhagawanpur-II, Egra-I, Egra-II, Patashpur-I and Patashpur-II. Contai Sub-division has got 8 C.D. Blocks namely Contai, Deshopran, Contai-III, Khejuri-I, Khejuri-II, Ramnagar-II and Bhagawanpur-II (Figure 3.2) (Census, 2011).





Figure 3.1: Location Map of Purba Medinipur (Source: National Informatics Centre and ESRI Base Map)

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			Panchayat				
Sub-Division	Police Station	C.D. Block / M	Samity	Gram	Gram Sansad		
Tamluk Sub-Div.	6	7/2 Tamluk	7 1	82 12	1217 161		
	Tamluk	Tamluk(M)	-	-	-		
		Sahid Matangini	1	10	152		
	Kolaghat	Kolaghat	1	13	217		
	Panskura	Panskura-I	1	14	208		
		Panskura(M)	-	-	-		
	Moyna	Moyna	1	11	159		
	Nandakumar	Nandakumar	1	12	186		
Haldia Sub-Div.	Chandipur 6	Chandipur 5/1	1 5	10 38	134 544		
Halula Sub-Div.	o Mahishadal	Mahishadal	5	30	544 154		
	Manishadai	Nandigram-I	1	10	154		
	Nandigram	Nandigram-II	1	7	91		
	Sutahata	Sutahata	1	6	89		
	Sulanala	Haldia	1	4	70		
	Durgachak		1	4	70		
	Haldia Bhawanipur	Haldia(M)	-	-	-		
Egra Sub-Div.	3	5/1	5	42	674		
	Potashpur	Potashpur-I Potashpur-II	1 1	9 7	127 124		
	Bhagawanpur	Bhagawanpur-I	1	10	167		
		Egra-I	1	8	122		
	Egra	Egra-II	1	8	134		
		Egra(M)	-	-	-		
Contai Sub-Div.	10	8/1	8	61	943		
	Khejuri	Khejuri-I	1	6	93		
	Talpatighat Coastal^	Khejuri-II	1	5	90		
	Bhupatinagar Ramnagar (P) Digha	Bhagawanpur-II Ramnagar-I	1	9	142 125		
	Digha Mohana Coastal			3	120		
	Ramnagar (P)	Ramnagar-II	1	8	119		
	Patulighat (Junput)^	Contai-I	1	8	129		
		Deshapran	1	8	128		
	Contai & Contai Women	Contai(M)	-	-	-		
	Marishda	Contai-III	1	8	117		
District Total- 4	25	25/5	25	223	3378		

Table 3.1: Block distribution of Purba Medinipur District

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Figure 3.2: Block divisional map of Purba Medinipur

(Source: National Informatics Centre)

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b) Climate Condition

The district experiences a humid sub-tropical type of climate with minimum and maximum temperature varying from 14°C in the winter to 39°C in summer respectively. Humidity in this district is quite high particularly in the monsoon months and shows an upward trend from January onwards. Rainfall fluctuates widely over years and concentrates over a few months of a year under monsoon.

The district of Purba Medinipur experiences an extreme climate with high range of temperature. The climate of the district is characterized by oppressive heat and high humidity in summer with average daily maximum temperature varies between 25°C and 39°C. Winter is generally dry and cold with average winter temperature around 18° C. The year may be divided into four seasons. The cold season is from about the middle of November to the end of February. The period from March to May is the summer season. The south west monsoon season commences about the beginning of June and lasts till the end of September. October and the November first half of mav be termed post monsoon season. as (https://www.imdpune.gov.in/library/public/Climate%20of%20WestBengal.pdf)

c) Rainfall

The average annual rainfall in the district is 1712mm. The variations in the annual rainfall within the district and from year to year are not large. The rainfall during the monsoon season – June to September – constitutes 74 percent of the annual rainfall; July and August are the rainiest months. The district receives a mean annual rainfall varying from 1531 mm to 1929 mm.

(https://hydro.imd.gov.in/hydrometweb/(S(c31xot2fu1lahs45tplr2vuh))/DistrictRaifall.aspx)

The information on annual rainfall for the five years from 2016 to 2020 for the district Purba Medinipur is given in Table 3.2. Average rainfall of the district explained graphically in Figure 3.3.

Month	2016	2017	2018	2019	2020	Average
Jan	5.2	0	0	0	49.6	10.96
Feb	58.4	0	1.1	137.5	10.5	41.5
Mar	13.2	58.7	1	28.6	30.2	26.34
Apr	6	19	66.4	58.7	71.4	44.3
May	138.5	89.1	114.3	61.8	431	166.94
Jun	175.1	158	261.9	143.6	209.5	189.62
Jul	309.5	484.5	347.7	154.7	171.6	293.6
Aug	426.4	223.8	263.5	422.8	403.6	348.02
Sept	268.4	227.7	377.3	421.1	219.4	302.78

Table 3.2: Annual rainfall (in milimeter) recorded in Purba Medinipur District



Oct	153.6	216.2	202.7	330.5	217.2	224.04
Nov	72.5	32.2	9	159	3.8	55.3
Dec	0	22	8.6	10.4	0	8.2
Yearly Total	1626.8	1531.2	1653.5	1928.7	1817.8	1711.6

Source: Website of Indian Meteorological Department, Govt. of India



Figure 3.3: Graphical representation of Purba Medinipur District rainfall

Temperature:

Temperature along with other meteorological conditions of the district is more or less uniform. The cold season commences by about the middle of November when the temperature begins to decrease. January is the coldest month with the mean daily maximum and minimum temperature at 28.8 °C and 14°C respectively. By about the end of February the temperature begins to increase and April is found as the hottest month, the mean maximum daily temperature is 38.6 °C and the mean minimum daily temperature is 25.5 °C. (https://en.climate-data.org/asia/india/west-bengal/Purba Medinipur -55531)

The average maximum and minimum temperature recorded in Purba Medinipur is given in Table 3.3.



Table 3.3: Monthly mean temperature (in °C) distribution of Purba Medinipur District

Parameters	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
Average Temperature (°C)	19.3	22.1	27.3	31.4	32.2	31.2	28.9	28.8	28.7	27	22.7	19.7
Minimum Temperature (°C)	12.5	15.2	20	24.3	26.4	26.4	25.7	25.7	25.3	22.7	16.7	13.1
Maximum	26.2	29	34.6	38.6	38	36	32.1	31.9	32.1	31.4	28.8	26.3

Relative Humidity, Wind speed & Wind direction

Humidity is observed as high throughout the year, but in the summer months, March and April, the relative humidity is comparatively low, begins some 70 to 75 percent in the mornings and 35 to 45 percent in the afternoons. From May the humidity increases. Skies are moderately to heavily cloudy in May. In the south-west monsoon season; the cloudiness increases and skies are mostly heavily clouded or overcast. From October the cloudiness decreases and in the next six months skies are clear or lightly clouded. Winds are generally light or moderate, with a slight increase in force in the summer seasons.

d) Topography & Terrain

Topographically, the district can be divided into two parts viz. (i) Flat plains on the East, West and Northern portion of the district, and (ii) The Contai Coastal plain at the Southern part.

The land of Purba Medinipur district is a quaternary alluvial deposition. As the district area is bounded by water bodies in two sides, it is a formation of fluvial-tidal deposition. Geologically the area is of recent origin. This region is 5-7 meters above mean sea level and average slope is 0-5 degree (Figure 3.4).

The Kasai-Haldi, Keleghai, Rosulpur, Rupnarayan are important rivers of Purba Medinipur district. The soil of the district is alluvial type, as the district under coastal alluvium and its deposition. Soil of this region consists of different layers like sand, silt and clay. The district is situated on flood plains of the rivers Rupnarayan and river Haldi and therefore huge amount of clay is dominating in soil texture. Due to this specialty of soil, water logging in this region during monsoon is very common. Due to poor permeability, the soils are imperfect to poorly drain. Due to this physical quality of the soils, land use pattern of the area is also affected to a larger extent (Census, 2011).





Figure 3.4: Physiographic map of Purba Medinipur District

(Source: Cartosat-1, Bhuvan India)

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e) Water Course & Hydrology

Hydrological condition of the district is guided by topography, geology, and rainfall of the region. Central Ground Water Board (CGWB) has carried out detail hydrogeological investigation of the district. Figure 3.5 represents hydrogeological map showing the hydrogeological scenario of the district.

As per the CGWB report, the district Purba Medinipur displays diversified hydrogeological characters. The Quaternary sediments is underlain by Tertiary sediments. A 30 – 50 m thick blanket of clay at the top is underlain by sand –clay sequence down to explored depth of 400 mbgl. Ground Water in the district occurs under semi-confined to confined condition in both the litho units. In general the area is underlain by a single aquifer in each litho system, which splits up into multiple aquifers with the intervening clay / sand clay layers.

http://wbwridd.gov.in/swid/mapimages/WEST%20MIDNAPORE.pdf)

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Figure 3.5: Hydrogeological map of Un-divided Purba Medinipur district

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f) Ground Water Development

Central Groundwater Board (CGWB) has carried out hydrogeological investigation in the Purba Medinipur district. The present report incorporates data published by CGWB. Water level data has been collected from both dug-wells and tube-wells.

Depth to Ground Water Level – Depth to piezometric surface in these aquifers varies from 2.71 to 16.34 mbgl in pre-monsoon period and from 3.05 to 11.63 mbgl in post monsoon period. Flow of water is from NW to SE with a gradient varying from 0.44 m / km to 0.10 m / km.

Aquifer Parameters- Aquifers in both the litho- systems are being recharged in the western platform area. The laterite cover in the platform area in the North west plays a vital role in recharging the lower litho-system by direct vertical infiltration and also the older alluvium in the upper litho system by lateral flow of ground water.

Long Term Water Trend- The trend of ground water level indicates a falling trend in the blocks of Postaspur, Egra – I & II, Sutahata – I & II, Moyna, Nandigram showing declining trend, whereas Bhagwanpur – I & II, Panskura, and Mahishadal rising trend. The declining trend varies from 0.06 m/ year in Mahishadal to 0.607 m/year in Potashpur.

Figure 3.6 represents water level fluctuation graph. Depth to water level in dug wells measured by CGWB varied from 5.23 m to 10.57 m bgl during pre-monsoon period with an average depth of 8.67 m. During post-monsoon period, water level varies from 5.23 m to 9.57 m with 2011 bgl an average of 7.47 m in the year to 2021. (https://indiawris.gov.in/wris/#/groundWater%20(CGWB%20website%20for%20Ground%20 water%20data)



Figure 3.6: Graphical representation of pre-monsoon and post-monsoon water level data of Bhagwanpur, Purba Medinipur



Hydrographs showing variation in water level observed in between 2011 to 2021 in the district is given in Figure 3.7.







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Figure 3.7: Block wise Hydrograph showing variation of water level during 2011 to 2021





g) Drainage System

The rivers of district Purba Medinipur, owing to the typical physiographical condition of the district, emerge from the Chhotanagpur Plateau to the West, flows East or South-East ward direction according to the slope of the land and meets Bay of Bengal. All the rivers in this region are rain-fed and flow to the fullest during monsoon.

The river system of district Purba Medinipur primarily consists of Haldi River, Rasulpur River and Rupnarayn River their tributaries.

Drainage map of Purba Medinipur district is furnished as Figure 3.8 and in Plate 1A.





Figure 3.8: Drainage map of Purba Medinipur District

(Source: National Informatics Centre)

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h) Demography

Purba Medinipur is one of districts of West Bengal in India, Purba Medinipur population in 2022 is 5,426,953 (estimates as per aadhar uidai.gov.in Dec 2020 data). As per 2011 census of India, Purba Medinipur has a population of 5,095,875 in 2011 out of which 2,629,834 are male and 2,466,041 are female. Literate people are 3,923,194 out of 2,149,073 are male and 1,774,121 are female. People living in Purba Medinipur depend on multiple skills, total workers are 1,910,320 out of which men are 1,516,096 and women are 394,224. Total 241,789 Cultivators are depended on agriculture farming out of 227,108 are cultivated by men and 14,681 are women. 277,268 people works in agricultural land as labor, men are 250,205 and 27,063 are women. Purba Medinipur sex ratio is females per 1000 of males. 938 (https://www.indiagrowing.com/West Bengal/Purba Medinipur).

Table 3.4 shows the district demographic profile based on Census 2011. Block-wise literacy rate of the population is described as the percentage of literates. Figures 3.9 and 3.10 representing block wise population distribution and literacy rate respectively.

Sub-Division / C.D.Block / M	Area (Sq. km.)	Male	Female	Total Population	Literacy Rate (%)
Tamluk Sub-Division	1084.30	806563	760895	1567458	85.98
Tamluk	123.50	105031	99391	204422	87.06
Sahid Matangini	97.82	90987	85320	176307	86.98
Panskura-I	246.92	152806	145333	298139	83.65
Kolaghat (Panskura-II)	147.91	132067	124815	256882	84.93
Moyna	154.51	101919	94583	196502	86.33
Nandakumar	165.70	117879	111583	229462	85.56
Chandipur (Nandigram-III)	137.58	82191	77723	159914	87.81
Tamluk(M)	10.36	23683	22147	45830	90.18
Haldia Sub- Division	683.94	421895	398254	820149	86.67
Mahishadal	146.48	93284	88907	182191	86.21
Nandigram-I	181.84	89053	85638	174691	84.89
Nandigram-II	105.74	53236	51401	104637	89.16
Sutahata	79.54	54543	51795	106338	85.42
Haldia	65.44	41886	39733	81619	85.96
Haldia(M)	104.90	89893	80780	170673	88.54
Egra Sub-Division	940.96	423576	404147	827723	86.18
Potashpur-I	172.26	77651	73958	151609	86.02
Potashpur-II	191.74	77268	73283	150551	86.50
Bhagawanpur-I	174.24	101643	97255	198898	88.13
Egra-I	197.90	74036	71018	145054	82.83
Egra-II	184.71	80120	76311	156431	86.47

Table 3.3.4: Demographic distribution of Purba Medinipur District

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Sub-Division / C.D.Block / M	Area (Sq. km.)	Male	Female	Total Population	Literacy Rate (%)
Egra(M)	20.11	12858	12322	25180	87.14
Contai Sub- Division	1251.21	616288	585759	1202047	89.19
Khejuri-I	130.51	58835	55808	114643	88.90
Khejuri-II	137.46	60197	57241	117438	85.37
Bhagawanpur-II	180.20	85506	82045	167551	90.98
Ramnagar-I	139.43	74082	71331	145413	87.84
Ramnagar-II	163.27	70102	67267	137369	89.38
Contai-I	155.27	77843	73863	151706	89.32
Deshapran (Contai-II)	170.30	78868	74197	153065	88.33
Contai-III	160.52	70466	66883	137349	89.89
Contai(M)	14.25	40389	37124	77513	93.69
District Total	4713.00	2268322	2149055	4417377	87.02

(Source: Census, 2011)



Figure 3.9: Population distribution of the District

(Source: Census, 2011)



Figure 3.10: Block-wise Literacy rate of the District

(Source: Census, 2011)

i) Cropping pattern

The soils of the district are alluvial types. The soils are deep to very deep. As the district is under coastal alluvium and has been formed by the recent alluvial deposition, the soils of this region are developed mostly on tertiary sediments comprising of sand, silt and clay. The district is situated on flood plains of the Rupnarayan and Haldi rivers. As a result, huge amount of clay particles dominates in soil texture. Due to the presence of high amount of clay content, this region is vulnerable to water logging during monsoon season.

On the basis of soil type, rainfall, sources of irrigation, the entire district has been categorised under three Agro Ecological Situations (AES) viz. (i) AES-I : Loamy clay soil covering 6 C.D. Blocks (ii) AES-II : Coastal saline soil covering 13 C.D. Blocks, and (iii) AES-III : Clay loamy soil covering 6 C.D. Blocks.

The major crops grown in the district are Paddy, Wheat, Potato, Oil seeds, Vegetables, Pulses, Jute, Betel vine, Mat stick etc (Census, 2011).



j) Land Form and Seismicity

The region has considerable area close to river basins and deltas that are characterized by Holocene alluvium deposits, which are likely to soften and hence are susceptible to liquefaction during an earthquake.

The seismic hazard map of India was updated in 2000 (Figure 3.11) by the Bureau of Indian Standards (BIS). There are no major changes in the zones in West Bengal with the exception of the merging of Zones I and II of the 1984 BIS map. Western sections of the northern districts of Jalpaiguri and Coochbehar lie in Zone V. The remaining parts of these two districts, along with the districts of Darjeeling, Uttar Dinajpur, Dakshin Dinajpur, Maldah, 24 North Parganas and 24 South Parganas lie in Zone IV. The rest of the state along with the city of Kolkata lies in Zone III.

The maximum area of the district falls under the Seismic Zone III and rest of the part fall under Zone II, indicating the district under safe earthquake–prone zone.





Figure 3.11: Earthquake zonation map of West Bengal highlighting the Purba Medinipur district position

(Source: <u>https://pib.gov.in/PressReleasePage.aspx?PRID=1740656</u>)

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Floods:

Flood incidents are caused by heavy rain, cyclonic events, and riverbank or coastal erosion under the influence of climatic variability. The pluvial flood is very common, especially in the vast flood plain areas of tropical monsoon. The presence of river channel acts as an exposure and increases the risk of flood. The major rivers of the district are Keleghai, Rupnarayan, Haldi, and Rasulpur rivers.

Approximately 55.8% of the region is susceptible to floods. Furthermore, complicacy is implicated by the origination of major flood-producing rivers beyond the state jurisdictional limits.

Panskura, Moyna, and Patashpur-I blocks are very high flood prone and have experienced more than eleven floods from 2002 to 2019. Panskura block is mainly flooded by the New Kasai (also known as New Cossye) river [30] and Patashpur-I is usually flooded by the Keleghai river. More than 70% of the soil in the Patashpur-I block is clay-like in texture [71] Moyna block is surrounded by rivers and a canal on three sides. The Kasai river (also known as the New Cossve river) flows in the east; the Chandia river flows in the west; the Chandia and Keleghai rivers flow in the south; and the Baksi canal is on the northern part of the block [72] and forms a basin-like topography. The whole Moyna block is situated in a low land [73]. All these factors make the Movna block extremely vulnerable to flood and waterlogging. The New Cossye and Keleghai rivers are mainly responsible for the floods in the Purba Medinipur district. The reoccurrence interval of high magnitude flood events in the Keleghai river is 1 in 2.1 years [74]. From 2002 to 2019, the New Cossye river crossed the danger level thirteen times (Figure 6). The water level of Keleghai also crossed the danger level eleven times (Figure 7) within the study period (2002–2019). The Rupnarayan and Rasulpur rivers are also responsible for floods in the district

(http://wbdmd.gov.in/writereaddata/uploaded/DP/Disaster%20Management%20Plan%20of% 20Purba%20Medinipur.pdf).

k) Flora

Purba Medinipur district has a visible coastline of approximately 60 km. with Bay of Bengal and the coastal area is geographically contiguous with the Mangrove forest under Sundarban Reserve Forests lying towards East. The Forest area under district turbidity and thinner vegetative coverage affected by shore currents. The coastal tract extending from the estuary of river Hugli (Hooghly) to the North-East and Junput to the South-West; is enriched with a rich ecological diversity. There are fifty seven species of Mangroves found in this area including Avicenna officinal is, Avicenna Alba, Exococaria agallocha, Acanthus ilicifolius, Sueda maritima, Salicornia brachiate, Rizophora mucronata, Ipomea pescaprae. Twenty eight species of benthic algae providing an opulent source of food, energy and cover for many organisms; eight species of phytoplankton's and many plant varieties associated with Mangroves have been identified so far in the district.



Along the beachfront seashore grows Spinifex littoreus (Ravan's Moustache), which is a perennial grass with stolon-forming stems. This species is an efficient sand binder, forming large colonies and stabilizing dunes. At the mobile dunes, grows Ipomoea pescaprae (Goat's foot/Beach Morning Glory flower) which is also a salt-tolerant plant and being associated with Spinifex, helps in binding the dunes. In the more stabilised dunes tall evergreen shrubs and trees of Casuarina species grows abundantly. Most famous species among them is known as Jhau in colloquial Bengali. Shrubs and bushes of species Pandanus (known as Keora/Keya or Ketaki in Bengali language) which is a small branched tree or shrub with fragrant flowers, also grows copiously in this region. The distillate water generated from this plant has a powerful aroma and is used widely for medicinal and culinary purposes. The large evergreen tree of Cashew nut is also grown in the coastal areas of the district, both commercially and in natural habitat. The plant species grown around the seashore acts as the major contributor for stabilizing the tender coastline and creates buffer against the soil erosion caused by natural as well as human induced forces. Mat-reeds (Cyperus corymbosus) known as Madur Kathi in Bengali grows in abundance in the low lying water-logged areas, swamps and marshy lands in the mouth of rivers Hooghly and Haldi (Census, 2011).

l) Fauna

Due to pressure of expanding population forces, the availability of natural diversity of wild fauna in the district Purba Medinipur is limited to the coastal region only. Despite having a small expansion, there is still significant diversification of animal species in the coastal areas of the district. The major types fauna observed in the coastal Purba Medinipur are Rabbits, Crabs, Horseshoe Crabs, Rats, different types of Snakes like Cobra, Krait, Banded Krait; Snails, Oysters, Clams, Starfish, Jellyfish, Limpets (Patella vulgata), large predatorysea-snails like Shankha or Conch (Turbinella pyrum), Sea-Urchins etc.

Zoological classification of the large varieties of fauna of district Purba Medinipur depicts that there are about 68 species of Arthropods including 12 types of Crabs, 13 varieties of Prawns and 21 varieties of Shrimps living nearby the seacoast. A total of 51 species of Fish variety has been reported so far by fishermen folks and the zoologists. Among the smaller animals living inside the sea waters are 17 species of Zooplanktons – including Copepoda (small crustaceans), Chaetognatha (predatory Marine-Worm), Rotifera (microscopic and near-microscopic pseudo-coelomate animals), larvae of Blue Shrimp (Meen); 22 species of polychaete (paraphyletic class of annelid marine worms), 12 species of Actinaria (Sea Animones - a group of water-dwelling, predatory animals). Sea- Cucumber (Holothuroida), Sea-pen (Cnidaria), Lingula (Brachyopoda) is found in the coastal islands of Talsari, Sankarpur, Junput and Nayachar islands. Around forty eight species of Mollusca have also been reported so far along the sea coast of district Purba Medinipur (Census, 2011).

Location of Wild Life Sanctuary and National Parks are shown in the Map of West Bengal (Figure 3.12). As per the map of ENVIS Centre on Wildlife and Protected Areas, there is no National Park or Sanctuary situated within the Purba Medinipur district. Hence, mining of river bed can be promoted in the district.

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(Source: http://wiienvis.nic.in/)

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4 Physiography of the district

4.1 General Landforms

Purba Medinipur district is part of the lower Indo-Gangetic Plain and Eastern coastal plains. Topographically, the district can be divided into two parts viz.

- Flat plains on the East, West and Northern portion of the district,
- The Contai Coastal plain at the Southern part.

The land of Purba Medinipur district is a quaternary alluvial deposition. As the district area is bounded by water bodies in two sides, it is a formation of fluvial-tidal deposition. Geologically the area is of recent origin. This region is 5-7 meters above mean sea level and average slope is 0-5 degree. The Kasai-Haldi, Keleghai, Rosulpur, Rupnarayan are important rivers of Purba Medinipur district. The soil of the district is alluvial type, as the district under coastal alluvium and its deposition. Soil of this region consists of different layers like sand, silt and clay. The district is situated on flood plains of the rivers Rupnarayan and river Haldi and therefore huge amount of clay is dominating in soil texture. Due to this specialty of soil, water logging in this region during monsoon is very common. Due to poor permeability, the soils are imperfect to poorly drain. Due to this physical quality of the soils, land use pattern of the area is also affected to a larger extent.

4.2 Soil and rock pattern

The Purba Medinipur district has a vast expanse of younger alluvial soils. It is divided into three parts. First, there is a strip of purely deltaic country composed of younger alluvial soils or Entisols bordering the Rupnarayan River and the Holdi River. The second division consits of the coastal alluvial soils of Entisols group. There is a long narrow and elongated strip of saline and alkali soils of Aridisols group, stretching from Digha to the east of the Haldi River. The remaining portion consists of older alluvium belonging to Alfisols group along the Western portion near Egra and in a very small part to the north west along the river Kangsabati. Soil of this region consists of different layers like sand, silt and clay. The district is situated on flood plains of the rivers Rupnarayan and river Haldi and therefore huge amount of clay is dominating in soil texture.

Based on the National Bureau of Soil Survey and Land Use Planning (NBSS & LUP), within the entire Purba Medinipur district ten major diversified soil types have been found. Most of the areas (1777.08 km²) remain under the fine vertic haplaquepts type of soil. The other nine soil types with taxonomic name, their material composition and hydrological characteristics, and the spatial extents are furnished in Table 4.1.



Table 4.1: Soil characteristics of the Purba Medinipur district and their percent of
area covered

Soil Code	Description	Taxonomic name
W036	Very deep, poorly drained, fine cracking soils occuring on level to nearly level low lying alluvial plains with	Fine, Vertic Ochraqualfs
	clayey surface associated with very deep, imperfectly drained, fine soils	Fine, Typic Ustochrepts
W038	Very deep, very poorly drained, fine cracking soils occuring on level to nearly level low lying alluvial	Very Fine, Vertic Haplaquepts
W 038	plains with clayey surface associated with very deep, poorly drained, fine soils	Fine, Typic Haplaquepts
W044	Very deep, poorly drained, fine cracking soils occuring on level to nearly level low lying alluvial plains with	Fine, Vertic Haplaquepts
W 044	loamy surface associated with very deep, poorly drained, fine soils	Fine, Aeric Haplaquepts
W047	Very deep, poorly drained, fine soils occuring on level to nearly level low lying alluvial plain with clayey	Very Fine, Aeric Haplaquepts
W 047	surface and severely flooding associated with very deep, moderately well drained, fine loamy soils	Fine loamy, Typic Ustochrepts
W065	Very deep, moderately well drained, fine loamy soils occuring on very gently sloping flood plain with loamy	Fine loamy, Typic Ustifluvents
W 005	surface, moderate erosion and moderate flooding associated with very deep, well drained, sandy soils	Typic Ustifluvents
W073	Very deep, moderately well drained, sandy soils occuring on gently sloping dunes in coastal plain with sandy surface and severe erosion and strong salinity	Aquic Ustipsamments
W074	Very deep, well drained, sandy soils occuring on moderately sloping coastal plain with sandy surface and severe erosion and slight salinity	Typic Ustipsamments
	Very deep, poorly/imperfectly drained, fine soils occuring on level to nearly level marshes in coastal	Fine, Aeric Haplaquepts
W075	plain with clayey surface moderate flooding and salinity associated with very deep, well drained, sandy soils	Typic Ustipsamments
WOZE	Very deep, poorly/imperfectly drained, fine soils occuring on level to nearly level marshes in coastal	Fine, Aeric Haplaquepts
W076	plain with clayey surface moderate flooding and salinity associated with deep, well drained, sandy soils	Typic Ustipsamments
W077	Very deep, poorly drained, fine soils occuring on nearly level to gently sloping coastal plain with clayey surface	Fine, Typic Haplaquepts



Soil Code	Description	Taxonomic name
	moderate flooding and slight to moderate salinity(limited extent) associated with very deep, poorly drained, fine creacking soils	Fine, Vertic Haplaquepts
W070	Very deep, poorly drained, fine cracking soils occuring on nearly level to very gently sloping coastal plain with	Fine, Vertic Haplaquepts
W078	clayey surface moderate flooding and moderate salinity(moderate extent) associated with deep, poorly drained, fine soils	Fine, Typic Haplaquepts
W087	Very deep, poorly drained, fine soils occuring on level to nearly level lower delta with surface severe flooding	Fine, Aeric Haplaquepts
W 087	and strong salinity(moderate extent) associated with deep, very poorly drained, fine soils	Fine, Typic Haplaquepts

The coastal belt of this study area is characterized by sandy alluviums, loamy soils and clayey soils of saline environment. Sandy alluviums are mostly distributed in the beach ridges and sand dunes, and loamy soils exhibit the productive lands of estuarine floodplain towards the east. However, the clayey alluvium dominates over the lowland basins and wetlands of the coast which support the vegetative growth in salt-affected areas. Fluvio-marine deposits have produced a large tract of loamy soils in the coastal plains, and this tract is acting as productive agricultural land.

Figure 4.1 is showing soil pattern of the Purba Medinipur district.





Figure 4.1: Soil Map of Purba Medinipur District

(Source: <u>https://esdac.jrc.ec.europa.eu/content/west-bengal-soils-sheet-2</u>)

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4.3 Different geomorphologic units

The 17 micro-level geomorphological features are explored for the entire Purba Medinipur district. According to the areal extents of the geomorphic features the ancient tidal deposit, lagoonal deposit, palaeo channel with levee, basinal deposit of Rupnarayan and Kasai system, Holocene fluvial deposit, ancient delta of Subarnarekha system, Holocene tidal deposit, levee deposit of Rupnarayan system and beach ridge with sand dune are extended with the areal extent of 768.58 km², 671.74 km², 514.02 km², 465.70 km², 347.44 km², 283.90 km², 245.60 km², 187.38 km², and 136.17 km², respectively. The other morphological features remained within the areal coverage of 92.39 km² to 2.96 km².

The coastal plain with tidal and fluvial deposits remain as topographic low and modified after repeated flood deposits of Keleghai, Kasai, Haldi and Rasulpur rivers of the region. They are susceptible to inundation by heavy rain during the occurrences of coastal floods.

The coastal wetlands with tidal spill basins and drainage channels are indicating as very low-lying surface immediately behind the shore fringe sand dunes and connected with the open marine environments by tidal channels or tidal inlets. They are flooded twice daily by the rising tides and dissected with tidal creeks to support the colony of halophytic grasslands and mangroves. The wetlands act as a buffer and good flood reservoir of advanced seawater during the seasonal high level of the sea (June-November) in the coastal belts.

Figure 4.2 shows the geomorphological variation of Purba Medinipur district.





Figure 4.2: Geomorphological map of Purba Medinipur District

(Source: Resourcesat-1&2 – Liss-3, Bhuvan India)

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5 Land use pattern of the district

Purba Medinipur district is one of the most important agricultural districts of West Bengal. The Land Use and Land Cover (LULC) classification of the Purba Medinipur district shows the six main classes. Most of the area (46.41%) to the total land is used for the agricultural practices. About 33.06% area remain under the vegetation cover, along with the other land uses of wetlands (12.27%), water bodies (3%), built-up area (5.05%) and sandy tract (0.20%). Here, in the wetland class, the areas of fisheries and other natural low-lying areas are considered, whereas, only the ponds and river water parts are considered under the water bodies. The significant level of the built-up area observed in the urban and municipality areas of Haldia, Contai, Digha, Panskura, Mecheda, Egra, Tamluk and in the areas of Patashpur-Amarshi.

Census (2011), shows that the total forest land of the district is 900 ha. Total land for agricultural use was 289150 ha in 2013-14. Table 5.1 gives land utilization status of Purba Medinipur district. Figure 5.1 is the pie diagram representing broad land use pattern of the district.

Year	2009-10	2010-11	2011-12	2012-13	nd hectares) 2013-14
Reporting Area (In Thousand Hectares)	396.59	396.59	396.59	396.59	396.59
Forest Area	0.90	0.90	0.90	0.90	0.90
Area under Non-agricultural use	101.83	102.24	102.28	102.76	103.21
Barren & unculturable land	0.52	0.69	0.41	0.32	0.20
Permanent pastures & other grazing land	0.05	0.18	0.07	0.04	0.04
Land under Misc. tree groves not included in Net area sown	1.96	2.15	2.16	2.00	2.03
Culturable waste land	0.21	0.29	0.17	0.12	0.08
Fallow land other than Current fallow	0.28	0.24	0.10	0.06	0.03
Current fallow	1.79	1.85	1.55	1.16	0.95
Net area sown	289.05	288.05	288.95	289.23	289.15

 Table 5.1: Classification of Land Utilisation Statistics in the district

Source: Census, 2011





Figure 5.1: Land use pattern of Purba Medinipur District

Name of C.D. Block	Total area (in Hectares)	Percentage of cultivable area to total area	Percentage of irrigated area to cultivable area
Panskura	22506	90.56	41.16
Kolaghat	13187.6	90.06	59.45
Tamluk	11107.4	95.25	77.02
Sahid Matangini	8832.59	90.87	64.04
Nanda Kumar	16330.2	84.24	50.99
Mahisadal	13932.3	92	57.42
Moyna	15339.4	89.99	47.29
Potashpur-I	17091	90.02	50.75
Potashpur-II	18783	85.88	37.76
Bhagawanpur-II	18001.9	86.9	41.24
Bhagawanpur-I	16969.1	83.2	37.17
Chandipur	13268.5	87.38	26.61
Sutahata	7183.8	88.05	26.18
Haldia	6543.92	81.08	40.45
Nandigram-I	17927.8	89.2	25.26
Nandigram-II	10288.7	76.97	25.67
Khejuri-I	13051.3	91.28	35.2
Khejuri-II	13729.6	84.86	23.92

Table 5.2: Distribution of Villages according to Agricultural Land Use, 2011

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Name of C.D. Block	Total area (in Hectares)	Percentage of cultivable area to total area	Percentage of irrigated area to cultivable area
Contai-I	15432.8	87.49	20.59
Deshopran	16827.3	86.38	13.93
Contai-III	16051.7	89.66	18.67
Egra-I	19218.33	78.1	15.24
Egra-II	18381.57	83.07	36.25
Ramnagar-I	12932.94	83.3	28.83
Ramnagar-II	15840.42	77.26	25.6

Table 5.2 shows the distribution of agricultural land, both irrigated and non-irrigated land in different blocks of Purba Medinipur district. In the district around 86.5% land area is available for cultivation. Irrigation is considered as an important factor for cultivation. As per the Census 2011 dataset, 37% of the cultivable land is under irrigation. The proportions of cultivable area in Nandigram-II block with respect to its total area are lowest. Contai-III, Egra-I and Deshopran blocks have less than 20% proportion of irrigated area. Figure 5.2 is the Land Use Land Cover map of the district.

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Figure 5.2: Land Use Land Cover map of Purba Medinipur District

(Source: Resourcesat-1&2 – Liss-3, Bhuvan India)

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5.1 Forest -detail of the district

Although forest is important natural resources of the economy, district Purba Medinipur does not have too large of an area under forests. Due expansion of human habitation, forest is limited to the area nearby the sea and does not generate large volume of forest produce. At present there are no Reserved Forests or Protected Forests in the district. As per the District Statistical Hand Book 2010-11 published by the Government of West Bengal, the entire forest area of the district of about 1831.97 Hectares is under the category of Unclassed State Forests. The production of Timber, Fuel etc. vis-à-vis the revenue and expenditure of district Purba Medinipur is given in Table 5.3 (Census, 2011).

Table 5.3: Classification of Forest Area, Out-turn of Forest Produce, Revenue andExpenditure of Forest Department

Item	Unit	2009-10	2010-11	2011-12	2012-13	2013-14
1. Area by class of forest						
Reserved forest	Hectare	-	-	-	-	-
Protected forest	"	-	-	-	-	-
Unclassed state forest	"	1675.80 (R)	1675.80 (R)	1675.80 (R)	1675.80 (R)	1675.80
Khas forest	"	156.17 (R)	156.17 (R)	156.17 (R)	156.17 (R)	156.17
Vested waste land	"	-	-	-	-	-
Forest owned by corporate bodies	"	-	-	-	-	-
Forest owned by private individuals	"	-	-	-	-	-
Total		1831.97	1831.97	1831.97	1831.97	1831.97
2. Forest Produce	-					
Timber	Thousand cu.metre	0.177		0.091	0.023	0.416
Fuel	"	0.293		0.302	0.290	1.466
Pole	Number	1816		4131	3819	6221
3. Revenue & Expenditure	-					
Revenue	Rs. in thousand	3419	1921	3301	2878	12694
Expenditure	"	44948	60026	49300	16099	32895

Source: <u>http://wbpspm.gov.in/publications/District%20Statistical%20Handbook</u>



5.2 Agriculture and Irrigation

Agriculture is an important part of the economy of Purba Medinipur district. Agricultural land is their asset, their capital and most importantly their means of sustenance as well as survival. Agriculture has the largest share in their income; it is the source of livelihood for major portion of the people. A very high percentage of working population in Purba Medinipur district is engaged in agriculture.

Land and water resources are inseparable, as water is indispensable to agriculture. A regular, abundant and continuous supply of water is essential for increase in agricultural production. Purba Medinipur district is one of those districts which are blessed with rainfall and perennial rivers. The area receives more than 1,800-2,250 milimetres. of rainfall during rainy season. As the district is low lying flat surface characterized with clay to silty clay type of soils, water logging during kharif seasons is a major threat to exploitation of land potentiality. The major crop grown in the district are Paddy, (Aus, Aman and Boro), Wheat, Potato, Oilseed, Vegetables, Pulses, Jute, Betel vine, Mat stick etc. (Census, 2011).

Purba Medinipur district is well endowed with rivers and canals. Land and water resources are inseparable as water is indispensable to agriculture. Purba Medinipur district has a special position in West Bengal with a large area being covered with irrigation facilities. Paddy cultivation dominates in the district where irrigation facility is utilised extensively. Various sources of irrigation like river, canal, tank etc. are available in the district.

Table 5.4 shows the crop production capacity of the Purba Medinipur district.

					(In Tho	usand tonnes)
	Crops	2009-10	2010-11	2011-12	2012-13	2013-14
Fo	odgrains :					
1.	Rice	2357	2734	2527	2635	2254
	Aus	1786	2050	1859	1985	2034
	Aman	2033	2285	2107	2307	1585
	Boro	2934	3503	3457	3310	3408
2.	Wheat	2449	2570	2431	2564	2625
3.	Barley	-	-	-	-	-
4.	Maize	-	-	1602	1603	1602
5.	Other Cereals	-	-	-	-	-
	Total Cereals	2357	2734	2527	2634	2255
6.	Gram	-	-	-	-	-
7.	Tur	-	-	-	1333	-
8.	Other Pulses	95	1341	1332	1674	1437

Table 5.4: Production of Principal Crops in the Purba Medinipur District

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	Crops	2009-10	2010-11	2011-12	2012-13	2013-14
	Total Pulses	95	1341	1332	1674	1437
	Total Foodgrains	2312	2713	2506	2618	2238
Oil	Seeds :					
1.	Rapeseed & Mustard	1182	1107	729	1280	955
2.	Linseed	-	-	-	-	-
3.	Other Oil seeds	1434	1466	3675	2077	2172
	Total Oil seeds	1393	1363	2876	2030	2075
Fib	ores: *					
1.	Jute	13.8	17.5	18.7	15.7	13.54
2.	Mesta	-	-	-	-	-
3.	Other Fibres	4.0	4.0	4.0	4.0	4.0
	Total Fibres	12.2	16.8	17.2	13.2	10.4
Mi	scellaneous crops :					
1.	Sugarcane	83097	-	-	-	-
2.	Potato	28314	26601	25170	25222	29972
3.	Tobacco	-	-	-	-	-
4.	Теа	-	-	-	-	-
5.	Chillies (dry)	2029	2055	2038	2037	2029
6.	Ginger	1558	1565	1563	1563	1572
	Total Miscellaneous crops	16394	14579	13273	13225	14440

(Source: http://wbpspm.gov.in/publications/District%20Statistical%20Handbook)

5.3 Horticulture

The district has a suitable agro-climatic condition for cultivation and horticulture crops such as mango, banana, papaya, citrus and Sapota. The major agricultural fruit crops grown in the district are given in Table 5.5.

Name of Fruits / Vegetables			Production (Thousand tonnes)						
		2009-10	2010-11	2011-12	2012-13	2013-14			
Α.	Fruits :								
	Mango	17.70	17.90	18.51	18.85	6.75			
	Banana	52.02	52.52	52.99	53.10	52.00			

Table 5.5: Production of Fruits and Vegetables in the district



Name of Fruit	ts /	Produc	tion (Thousand	tonnes)	
Vegetables		2010-11	2011-12	2012-13	2013-14
Pineapple	4.13	4.13	4.05	3.90	3.40
Papaya	16.92	17.04	17.18	17.21	17.00
Guava	9.98	9.98	9.98	10.10	9.40
Jackfruit	5.29	5.29	5.30	4.90	5.00
Litchi	0.29	0.29	0.29	0.31	0.32
Mandarin Orar	nge -	-	-	-	-
Other Citrus	8.15	8.15	8.35	8.38	8.40
Sapota	9.45	9.55	9.55	9.58	9.59
Others	9.12	9.22	8.54	8.30	8.34
Total	49.17	133.05	134.07	134.74	134.63
B. Vegetables :	·	·	·	·	
Tomato	17.27	17.50	19.50	19.61	20.01
Cabbage	28.20	28.59	30.59	31.89	33.00
Cauliflower	27.36	27.72	29.36	32.46	32.50
Peas	1.05	1.08	1.08	1.22	1.12
Brinjal	148.66	117.61	157.52	158.60	164.72
Onion	7.25	7.45	7.71	7.81	7.82
Cucurbits	117.46	121.72	123.09	122.68	123.31
Ladies Finger	47.82	49.06	49.11	48.24	50.26
Radish	12.63	3.16	13.22	14.41	14.76
Others	70.77	117.53	78.71	77.95	77.95
Total	838.47	478.47	491.42	509.89	514.8 7

(Source: http://wbpspm.gov.in/publications/District%20Statistical%20Handbook)

Horticulture has become an exceptionally specific and escalated type of agribusiness in Purba Medinipur locale of West Bengal. Two Blocks to be specific Panskura and Kolaghat have developed as significant bloom developing locale of the area. Flower cultivation is the most significant economic activity in this region. The floriculture of the district consists of various types of orchids, decorative plants, temperate and tropical flowers, etc. Flowers like Tuberose, Marigold, Rose and seasonal flowers are main of Purba Medinipur district (Table 5.6).

Name of Flowers	Production					
Name of Flowers	Unit	2009-10 2010-11 2		2011-12	2012-13	2013-14
Rose	Crore Cut Flower	33.460	34.232	34.532	34.545	34.590
Chrysanthemum	"	5.660	5.720	6.430	6.432	6.435

Table 5.6: Production of Flowers in the district



Name of Flowers		Production					
Name of Flowers	Unit	2009-10	2010-11	2011-12	2012-13	2013-14	
Gladiolus	"	4.700	5.280	6.000	6.080	6.100	
Tuberose	"	15.940	17.430	17.880	16.941	17.110	
Marigold	' 000 MT	11.150	11.400	11.900	11.929	12.000	
Jasmine	"	0.384	0.384	0.394	0.394	0.396	
Seasonal Flower	"	1.967	1.982	2.040	2.058	2.063	
Misc.Flower	"	0.545	0.549	0.549	0.550	0.556	

(Source: <u>http://wbpspm.gov.in/publications/District%20Statistical%20Handbook</u>)

5.4 Mining

In Purba Medinipur district, as per the report published by Directorate of Mines and Minerals, Government of West Bengal, there is no major or minor in-situ minerals noted. The district is having riverbed deposits which are generating revenue for the district mainly.



6 Geology

As per the Geological map, the entire Purba Medinipur district is originated with the composition six different types of geological formations (Figure 6.1) during the Late Pleistocene to Late Holocene period (Table 6.1). Among these, most of the areas formed with the Panskura formation during the Middle Holocene period with the composition of fine sand, silt and clay type of materials. The Haldia urban centre is situated within the areas of Panskura formation. The parallel dune ridges were formed as recent dune sand deposit during the Late Holocene period with the composition of semi-compact medium-grained grey sands, over which the main urban areas of Contai and Digha is situated. Some part of the Contai town area is also extended over the Panskura formation. Some part of the Digha urban centre is situated over the Basudebpur formation made up by dark grey to black clay with mudflats deposited during the Middle - Late Holocene period. At the shorefront area, the Late Holocene Beach formation made up by very fine, white to grey sands mixed with clay. The Sijua formation of Late Pleistocene to Early Holocene period with the composition of sand, sandy loam, silt and silty clay with impregnation of caliche nodules have existed in the south-western part of the district. Also, the Kasai formation was formed during the Late Holocene period with the composition of unoxidised sand and silt in the palaeo and recent river courses (Kasai, Rupnarayan, Rasulpur) and their surroundings (Jana & Paul, 2018).

The coastal plain is occupied by younger and unconsolidated alluviums of Holocene to recent deposit along the fringe areas of the Bay of Bengal. The Holocene to Late Holocene beach ridges and sand dunes separated with palaeo tidal basins are extended over the coastal plain of Contai and Digha. Haldia region is made up of estuarine floodplain alluviums during the Late Holocene to Late Pleistocene period (Niyogi, 1975; Paul, 2002; Chakrabarti, 2005). Recent to sun-recent deposits of tidal flats, beaches and bars, sand dunes and swampy tracts are found on the emerged and submerged surfaces of the region. Channel fringe tidal flats and backwater wetlands are deposited and filled with mud and finer sand or silt in places of tidal influences.

Figure 6.1 is the geological map of un-divided Medinipur district.

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Figure 6.1: Geological map of Medinipur district (Source: GSI, 2007)

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AGE	GEOLOGICAL UNIT	LITHOLOGY		
	Present day flood plain deposits	Alternating layers of sand and silt		
Holocene	Present day beach deposits	Fine medium greyish brown sands		
	Recent dune sand	Well sorted white to greyish yellow sands		
	Basudebpur Formation	Sand, silt and clay (un-oxidized or occasionally oxidized)		
	Panskura Formation	Laterite		
Upper Pleistocene to Holocene	Sijua Formation	Clay and grit		
Pleistocene	Lalgarh Formation	Fragments of quartz, phyllite, granite occasionally laterite		
	Laterite	Laterite with occasional ring like growth of silica		
Carboniferous to Triassic	Tertiary Gravel bed	Gravels of different size		
	Bhairab Banki	Clay, grit and conglomerate		
Meso-proterozoic	Younger Volcanics	Tourmaline-quartz rock		
Meso-proterozoic	Tounger voicanies	Kuilapal granite		
	Dalma Volcanics	Quartzite		
		Epidote/ hornblende schist		
Paleo-Proterozoic		Quartzite		
		Mica schist, occasionally garnetiferous		
	Singhbhum Group	Calc-gneiss and granulite		
		Garnet-staurolite schist with kayanite		
		Garnetiferous phyllite		

Table 6.1: Geological succession of Purba Medinipur

(Source: GSI, 2007)



7 Mineral wealth

7.1 Overview of mineral resources:

Occurrence of major minerals in the district of Purba Medinipur is not well established. Main mineable mineral of the district is sand the riverbed.

7.2 Details of Resources:

The mineral resources of the district whose categorization and estimation have been done are furnished in this section.

7.2.1. Sand and other riverbed minerals:

I. Drainage

The rivers of district Purba Medinipur, owing to the typical physiographical condition of the district, emerge from the Chhotanagpur Plateau to the West, flows East or South-East ward direction according to the slope of the land and meets Bay of Bengal to the South East or tributaries of Hugli (Hooghly) to the East. All the rivers in this region are rain-fed and flow to the fullest during Monsoon. Brief description the few major rivers (Table 7.1 and Table 7.2) of district Purba Medinipur are given in the subsequent paragraphs.

River Rupnarayan: River Rupnarayan forms natural boundary of Purba Medinipur district, separating it from Haora district to the East. In its path, Rupnarayan acts as the Eastern boundary of the C.D. Blocks Kolaghat, Sahid Matangini, Tamluk and a small part of C. D. Block Nanda Kumar before meeting river Hugli (Hooghly) at the border of C. D. Block Mahisadal. River Rupnarayan is one of the largest rivers in the region and has a large flood plain. The flow is usually very narrow during the dry season but overflows during Monsoon. During its journey it carries sizable amount of sediments and depositions. The present flow of the river in the district is from North to South with slight tilt towards North-West and South-East. Mention of this river has been made several times in the documented history, including maps prepared by the British. During last few centuries, the traceable path of Rupnarayan has changed many times. The river emerges from the Chhotanagpur Plateau near district Purulia and joins river Hugli (Hooghly) as a tributary. Upper portion of Rupnarayan is known as Dwarakeswar. There are no large tributaries of Rupnarayan inside the district. However, during its course many small water channels and Canals meet the river, most notable among them is Medinipur High Level Canal.

River Haldi: River Haldi is flowing from West to East direction in Purba Medinipur district and due to its typical path of flow, bisects the district between Northern and Southern portions. River Haldi is formed from the confluence two rivers- Keleghai (also known as Keleghai) flowing from West to East and river Kangsabati (locally known as Kansai or Kasai or Cossey) flowing from North to South. These two streams meet at Tangrakhali under Mahisadal Police Station in Tamluk subdivision to create river Haldi. Finally the course meets river Hugli



(Hooghly) as a tributary near Haldia town. This river is entirely contained inside the district Purba Medinipur with a length of about 25 Kilometres. Although of smaller length, river Haldi has a large mouth augmenting the formation of Haldia Port. Large volume of slit deposition is another important characteristic of the river.

River Kangsabati (also known as Kasai or Kansai or Cossey): River Kangsabati is originated at Murguma near Jhalda in Purulia district at the Chhota Nagpur Plateau and passes through districts of Puruliya, Bankura and Paschim Medinipur before entering Purba Medinipur district to ultimately meet river Keleghai to form river Haldi. The Northern Branch of this river flows inside district Paschim Medinipur to join river Rupnarayan and the Southern Branch enters Purba Medinipur to form Haldi. Kangshabati Irrigation Project was formed on the upper course of this river. However, the length of the course of this river inside Purba Medinipur district is small.

River Keleghai (also known as Keleghai): Like Kangsabati, river Keleghai also has a small course flowing through Purba Medinipur district. River Keleghai originates at Chhotanagpur Plateau from Baminigram near Dhudhkundi at Jhargram Sub-division of Paschim Medinipur district. It flows from West to East and crosses C.D. Blocks Keshiari, Narayangarh, Sabang and Potashpur of Paschim Medinipur district before entering Purba Medinipur district at C.D. Block Bhagawanpur-I. It then joins with river Kangsabati to form river Haldi. Although the flow of Keleghai inside Purba Medinipur is short, due uneven river surface, it sometimes cause flood in its catchment area.

River Rasulpur: Rasulpur River is the third tributary of Haldi River. This river originated as Bugda in Paschim Medinipur district and flows through Purba Medinipur district to meet Hugli (Hooghly) River.

Sl.No.	Name of the River	Area drained (Sq.km)	% Area drained in the district
1	Rupnarayan	5.23	0.001
2	Haldi	5.21	0.001
3	Rasulpur	4.71	0.0009
4	Kangasabati	2.69	0.0005
5	Keleghai	1.62	0.0003

Table 7 1. Drainage system with description of main rivers

a) Drainage System with description of main rivers


b) Salient Features of important rivers and streams

S.No.	Name of the River or Stream	Total Length in District (in Km)	Place of origin	Altitude at Origin
1	Rupnarayan	42.39	Emerges from the Chhota Nagpur Plateau near district Purulia	6m
2	Haldi	16.67	Tangrakhali under Mahisadal Police Station in Tamluk subdivision	8m
3	Rasulpur	17.84	Bugda in Paschim Medinipur	7m
4	Kangsabati	54.63	Jabor Pahar, near Jhalda in Purulia district at the Chhotanagpur Plateau	250m
5	Keleghai	27.32	Chhotanagpur Plateau from Baminigram near Dhudhkundi at Jhargram	82m

Table.7.2: Salient Features of important rivers and streams

II. Annual deposition of riverbed minerals

Annual deposition of riverbed minerals is dependent on various factors which are explained below.

A) Geomorphological studies

Geomorphological characteristic of a river is foremost factor for annual deposition of sedimentary load. The study includes following parameter:

i) Place of Origin

Details of origin of rivers of Purba Medinipur District are furnished in Table 7.3.

S.No.	Name of the River or Stream	Place of origin
1	Rupnarayan	Emerges from the Chhota Nagpur Plateau near district Purulia
2	Haldi	Tangrakhali under Mahisadal Police Station in Tamluk subdivision
3	Rasulpur	Bugda in Paschim Medinipur
4	Kangasabati	Murguma near Jhalda in Purulia district at the Chhotanagpur Plateau
5	Keleghai	Chhotanagpur Plateau from Baminigram near Dhudhkundi at Jhargram

Table 7.3: Place of Origin of important rivers and streams

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ii) Catchment Area

The Purba Medinipur district is mainly drained by the Kangsabati, Haldi and Rasulpur River. These rivers and its tributary rivers are forming the main catchment area.

iii) General profile of river stream

River profile has been studied along the cross-section lines which was chosen based on the drastic variation of the river widths, proximity of the operating sand 'ghats' and the position of the sand bars.

Relative disposition of rivers in Purba Medinipur district along with the distribution of the section lines are shown in Figure 7.1. River profile section and cross section views are presented in Figures 7.2 and 7.3.





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Figure 7.2A: Profile section of Kangsabati River



Figure 7.2B: Profile section of Rasulpur River



Figure 7.3A: Cross section view of Haldi River



Figure 7.3B: Cross section view of Kangsabati River





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iv) Annual deposition factor

Annual deposition of riverbed materials depends on various factors, such as process of deposition, mode of sediment transport, sediment transport rate, and sediment yield of the river.

1. Process of deposition

Deposition is the processes where material being transported by a river is deposited. Deposition occurs when the forces responsible for sediment transportation are no longer sufficient to overcome the forces of gravity and friction, creating a resistance to motion; this is known as the null-point hypothesis. This can be when a river enters a shallow area or towards its mouth where it meets another body of water.

The principle underlying the null point theory is due to the gravitational force; finer sediments remain in the water column for longer durations allowing transportation outside the surf zone to deposit under calmer conditions. The gravitational effect or settling velocity determines the location of deposition for finer sediments, whereas a grain's internal angle of friction determines the deposition of larger grains on a shore profile.

Deposition of non-cohesive sediments: Large-grain sediments transported by either bedload or suspended load. In case of bedload, when there is insufficient bed shear stress and fluid turbulence are insufficient to keep the sediment moving, the grain cease horizontal movement and rapidly come to rest. In case of suspended load the grain settle longer distance vertically through the fluid before coming to rest.

Deposition of cohesive sediments: The cohesion of sediment occurs with the small grain sizes associated with silts and clays, or particles smaller than 4Φ or 62.5 µm. If these fine particles remain dispersed in the water column, Stokes law applies to the settling velocity of the individual grains. The face of a clay platelet has a slight negative charge where the edge has a slight positive charge when two platelets come into close proximity with each other the face of one particle and the edge of the other are electrostatically attracted, and then have a higher combined mass which leads to quicker deposition through a higher fall velocity.

2. Mode of sediment transport in rivers

Sediment transport in rivers provides a dynamic linkage between flow and channel form. Mainly there are three processes by which sediment load is transported and these are (i) rolling or traction, in which the particle moves along a sedimentary bed



but is too heavy to be lifted from it; (ii) saltation; and (iii) suspension, in which particles remain permanently above the bed, sustained there by the turbulent flow of the water.

Another name for sediment transport is sediment load. The total load includes all particles moving as bedload, suspended load, and wash load.

Bed load: Bedload is the portion of sediment transport that rolls, slides or bounces along the bottom of a waterway. This sediment is not truly suspended, as it sustains intermittent contact with the streambed, and the movement is neither uniform nor continuous. Bedload occurs when the force of the water flow is strong enough to overcome the weight and cohesion of the sediment. While the particles are pushed along, they typically do not move as fast as the water around them, as the flow rate is not great enough to fully suspend them. Bedload transport can occur during low flows (smaller particles) or at high flows (for larger particles). Approximately 5-20% of total sediment transport is bedload. In situations where the flow rate is strong enough, some of the smaller bedload particles can be pushed up into the water column and become suspended.

Suspended load: While there is often overlap, the suspended load and suspended sediment are not the same thing. Suspended sediment are any particles found in the water column, whether the water is flowing or not. The suspended load, on the other hand, is the amount of sediment carried downstream within the water column by the water flow. Suspended loads require moving water, as the water flow creates small upward currents (turbulence) that keep the particles above the bed. The size of the particles that can be carried as suspended load is dependent on the flow rate. Larger particles are more likely to fall through the upward currents to the bottom, unless the flow rate increases, increasing the turbulence at the streambed. In addition, suspended sediment will not necessarily remain suspended if the flow rate slows.

Wash load: The wash load is a subset of the suspended load. This load is comprised of the finest suspended sediment (typically less than 0.00195 mm in diameter). The wash load is differentiated from the suspended load because it will not settle to the bottom of a waterway during a low or no flow period. Instead, these particles remain in permanent suspension as they are small enough to bounce off water molecules and stay afloat. However, during flow periods, the wash load and suspended load are indistinguishable.

3. Sediment Transport Rate

The rate at which sediment is moved past a cross section of the flow is called either the sediment transport rate or the sediment discharge. It's related to the sediment



load, but it's different, just because different fractions of the sediment load are transported at different rates. It can be measured in mass per unit time, or in weight per unit time, or in volume per unit time. The sediment transport rate is commonly denoted by Qs.

4. Estimation of Sedimentation

There are two approaches to obtaining values describing sediment loads in streams. One is based on direct measurement of the quantities of interest, and the other on relations developed between hydraulic parameters and sediment transport potential.

The total bed material load is equal to the sum of the bedload and the bed material part of the suspended load; in terms of volume transport per unit width, qt = qb + qs. Here wash load, i.e. that part of the suspended load that is too fine to be contained in measurable quantities in the river bed, is excluded from qs.

There are number of equations to compute the total sediment load. Most of these equations have some theoretical and empirical bases.

In 1973, Ackers and White developed a general theory for sediment transport which was calibrated against the flume-transport data then available. Their functions have been widely accepted as one of the best available procedures for estimating the total bed over the full width of the flow section.

Dendy-Bolton formula is often used to calculate the sedimentation yield. But use of these equations to predict sediment yield for a specific location would be unwise because of the wide variability caused by local factors not considered in the equations development. However, they may provide a quick, rough approximation of mean sediment yields on a regional basis. Computed sediment yields normally would be low for highly erosive areas and high for well stabilized drainage basins with high plant density because the equations are derived from average values. The equations express the general relationships between sediment yield, runoff, and drainage area.

5. Sediment Yield

The water that reaches a stream and its tributaries carries sediment eroded from the entire area drained by it. The total amount of erosional debris exported from such a drainage basin is its sediment load or sediment discharge and the sediment yield is the sediment discharge divided by the total drainage area of the river upstream of the cross section at which the sediment discharge is measured or estimated. Sediment yield is generally expressed as a volume or weight per unit area of drainage basin—e.g., as tons



per square kilometre. Further, sediment yield is usually measured during a period of years, and the results are thus expressed as an annual average.

v) Replenishment Study (As per EMGSM guidelines, 2020):

Replenishment study for a river solely depends on estimation of sediment load for any river system and the estimation is a time consuming and should be done over a period. The process in general is very slow and hardly measurable on season-to-season basis except otherwise the effect of flood is induced which is again a cyclic phenomenon. Usually, replenishment or sediment deposition quantities can be estimated in the following ways as given below:

- A. Replenishment study based on satellite imagery involves demarcation of sand bars potential for riverbed mining. Both pre and post monsoon images need to be analysed to established potential sand bars. Volume estimation of sand is done by multiplying Depth and Area of the sand bar. The sand bars are interpreted with the help of satellite imagery. Ground truthing has been done for 100% of the total identified sand bars. During ground truthing, width and length of each segment were physically measured. It has also been observed that in few cases, sand bars have attained more than 3 meters height from the average top level of the river beds. Considerations of sand resources have been restricted within 3 meters from the average top surface of the river bed.
- B. Direct field measurement of the existing leases involving estimation of the volume difference of sand during pre and post-monsoon period. With systematic data acquisition, a model has developed for calculation of sediment yield and annual replenishment with variable components.
- C. The replenishment estimation based on a theoretical empirical formula with the estimation of bed-load transport comprising of analytical models to calculate the replenishment estimation.

A. Replenishment estimation based on satellite imagery study

Sedimentation in any river is dependent on sediment yield which depends on soil erosion in river's catchment area. Catchment yield is computed using Strange's Monsoon runoff tables for runoff coefficient against rainfall return period. Peak flood discharge is calculated by using Dickens, Jarvis and Rational formula at 25, 50 and 100 years return period. The estimation of bed load transport is done using Ackers and White Equation.

Methodology Adopted: To delineate replenishment percentage in the river bed of the district, below mentioned steps have been followed.



• Field data collation:

Field data collations were done during June 2020 for pre monsoon period and during December 2020 for post monsoon period for the river ghats on continuous basis. However, the non-operational areas were covered through traverses. In both the cases, relative elevation levels were captured through GPS/DGPS/ Electronic Total Station. Thickness of the sand bars was measured through sectional profiles. In few instances, sieve analysis of the sands was carried out to assess their particle size distribution.

• Selection of Study profiles:

Study profiles are selected based on the occurrence of the sand bars in the channel profiles. Aerial extents of each of the profiles are mapped from satellite imagery.

• Data Compilation:

Following data were compiled for generation of the annual replenishment report:

- > Elevation levels of the different sand ghats and sand bars as measured at site.
- > Extents of the sand bars are measured from the pre monsoon satellite imagery.
- > Sand production data of the district.

• Assessment of sediment load in the river:

Assessment of sediment load in a river is subjective to study of the whole catchment area, weathering index of the various rock types which acts as a source of sediments in the specific river bed, rainfall data over a period not less than 20 years, and finally the detail monitoring of the river bed upliftment with time axis. Again, the sediment load estimation is not a dependent variable of the district boundary, but it largely depends upon the aerial extent of the catchment areas, which crosses the district and state boundaries.

• Estimation of annual sand deposition:

The major sand producing rivers of Purba Medinipur district are Kangsabati Rivers, Haldi and Rasulpur River. Planning has been done for systematic sand mining in the rivers.

While calculation of the areas of sand bar, a classification system has been adopted with three categories of land identified within the channel areas which is as follows:

a. The untapped sand bars.

- b. The sand bars worked in the pre-monsoon period.
- c. Main channel course within the channel.

A summary of sediment load comparison between pre- and post-monsoon periods for different rivers Purba Medinipur district is given in Table 7.4 and details of each sand bars along



with their sand resources in pre monsoon and post monsoon period are provided in Annexure-2. Maps showing distribution of sand bars on rivers of the Purba Medinipur district during preand post-monsoon periods are depicted in Plate-2A and 2B respectively.

River Name	Pre- Monsoon no of ghats	Post- Monsoon no of ghats	Pre-Monsoon Sediment Load (Mcum)	Post Monsoon Sediment Load (Mcum)	Difference (Mcum)	Difference (%)
Haldi River	7.0	6	2.14	2.26	0.12	6%
Kangsabati River	23.0	20	0.74	0.79	0.05	7%
Keleghai River	9.0	12	0.78	0.82	0.04	6%
Total	39.0	38	3.658781	3.876471	0.21769	6%

Table 7.4: Sediment Load comparison between Pre- and Post-monsoon periods fordifferent rivers

Thus, in Purba Medinipur district, about 0.218 million cum of sand has been found as an incremental volume increase when compared between pre- and post-monsoon sand reserve data. Percentage difference is about 106% which is replenishment and aggradation rate for the year.

Long-term satellite imagery study has also been carried out for sand producing rivers of Purba Medinipur district to analyse the changes in river course. A representative map, showing long-term (from 1985-2010-to 2022) erosion-accretion areas on both the banks of Haldi River, Purba Medinipur has been prepared and furnished in Plate No. 5. Map shows changes in river channel through erosion and accretion of river bank and in the process the river shows widening of width of the river course by almost 314m to 618m from 2001 to 2021.

B. Replenishment estimation based on field investigation

The study was carried out on existing mining leases. In order to assess the annual replenishment rate, an approach of direct measurement methodology has been adopted. The depth and area of the mining leases are measured through DGPS/Total station just before the closure of the mines in pre-monsoon period and the same areas are resurveyed in the post-monsoon period. The differences between the depths of the surveyed areas are accounted for the volumetric measurement of the replenished sand.

Table 7.5 represents field measurement of replenishment rate estimated for major rivers.



		I	able	/.5: кеј	piemsi	men	rate of th	ie distric			
River Name	Location (Mauza)	Area	Surf ace RL	Thick ness	Volu me	Afte r mini ng floo r RL	Surface RL after Replenish ment	Thickne ss Repleni shed	Volume Repleni shed	Differe nce in RL	Replenish ment Rate
		m2	m	m	cum	m	m	m	cum	m	%
Haldi	Jalpai	4700. 00	6.00	2.60	12220. 00	3.40	5.96	2.56	12036.70	0.04	98.50%
Haldi	Banskhana Jalpai	12100 .00	5.00	2.70	32670 .00	2.30	4.94	2.64	31951.26	0.06	97.80%
Haldi	Keshabpur Jalpai	4090. 00	4.00	2.50	10225. 00	1.50	3.97	2.47	10102.30	0.03	98.80%
Rupnara yan	Bholsara	12100 .00	5.00	2.88	34848 .00	2.12	4.95	2.83	34290.43	0.05	98.40%

Table 7.5: Replenishment rate of the district

Based on field investigation, the average replenishment rate for the year 2020 is about 98.38%.

C. Replenishment estimation based on a empirical formula:

The river reaches with sand provide the resource and thus it is necessary to ascertain the rate of replenishment of the mineral. Regular replenishment study needs to be carried out to keep a balance between deposition and extraction.

Sediment load deposition in a river is dependent on catchment area, weathering index of the various rock types of the catchment area, land-use pattern of the area, rainfall data and grain size distribution of the sediments. Again, the sediment load estimation is not a dependent variable of the district boundary, but it largely depends upon the aerial extents of the catchment areas, which crosses the district and state boundaries.

i. Methodology of the study:

The replenishment estimation is based on a theoretical empirical formula with the estimation of bedload transport comprising of analytical models to calculate the replenishment estimation. Sedimentation in riverbed depends on catchment yield, peak flood discharge due to rainfall, bed load transport rates and sediment yield characteristic of the river. Some of the common methods used for replenishment study are explained below.

a. Catchment Yield Calculation:

The total quantity of surface water that can be expected in a given period from a stream at the outlet of its catchment is known as yield of the catchment in that period. The annual yield from a catchment is the end product of various processes such as precipitation, infiltration and evapotranspiration operating on the catchment. District Survey Report Purba Medinipur District, West Bengal





Figure 7.4: Watershed map of Purba Medinipur district

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Catchment Yield can be estimated using following formula:

Catchment Yield (m³) =Catchment area (m²) × Runoff coefficient (%)×Rainfall (m)

The runoff generated from the watershed is analyzed using Strange's Table to get the reliable yield results. Runoff from a catchment is dependent upon annual rainfall as well as catchment characteristics such as soil types and the type of groundcover / land usage. Remote sensing was used for demarcation of catchment area relevant to the drainage system. Runoff coefficient of the catchment has been established based on Strange's Table.

Strange (1892) studied the available rainfall and runoff and obtained yield ratios as functions of indicators representing catchment characteristics (Subramanya, 2008). Catchments are classified as good, average and bad according to the relative magnitudes of yield of sediment. For example, catchment with good forest cover and having soils of high permeability would be classified as bad, while catchment having soils of low permeability and having little or no vegetal cover is termed good. Based on the study Strange established runoff coefficient table as given in Table 7.6.

Total Runoff coefficient (%)				Total	Ru	Runoff coefficient (%)			
monsoon rainfall (mm)	Good catchment	Average catchment	Bad catchment	monsoon rainfall (mm)	Good catchment	Average catchment	Bad catchment		
25.4	0.1	0.1	0.1	787.4	27.4	20.5	13.7		
50.8	0.2	0.2	0.1	812.8	28.5	21.3	14.2		
76.2	0.4	0.3	0.2	838.2	29.6	22.2	14.8		
101.6	0.7	0.5	0.3	863.6	30.8	23.1	15.4		
127	1	0.7	0.5	889	31.9	23.9	15.9		
152.4	1.5	1.1	0.7	914.4	33	24.7	16.5		
177.8	2.1	1.5	1	939.8	34.1	25.5	17		
203.2	2.8	2.1	1.4	965.2	35.3	26.4	17.6		
228.6	3.5	2.6	1.7	990.6	36.4	27.3	18.2		
254	4.3	3.2	2.1	1016	37.5	28.1	18.7		
279.4	5.2	3.9	2.6	1041.4	38.6	28.9	19.3		
304.8	6.2	4.6	3.1	1066.8	39.8	29.8	19.9		
330.2	7.2	5.4	3.6	1092.2	40.9	30.6	20.4		
355.6	8.3	6.2	4.1	1117.6	42	31.5	21		
381	9.4	7	4.7	1143	43.1	32.3	21.5		
406.4	10.5	7.8	5.2	1168.4	44.3	33.2	22.1		
431.8	11.6	8.7	5.8	1193.8	45.4	34	22.7		
457.2	12.8	9.6	6.4	1219.2	46.5	34.8	23.2		
482.6	13.9	10.4	6.9	1244.6	47.6	35.7	23.8		
508	15	11.3	7.5	1270	48.8	36.6	24.4		
533.4	16.1	12	8	1295.4	49.9	37.4	24.9		

Table 7.6: Runoff coefficient of the catchment based on Strange's table

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Total	Ru	noff coefficient	(%)	Total	Runoff coefficient (%)			
monsoon rainfall (mm)	Good catchment	Average catchment	Bad catchment	monsoon rainfall (mm)	Good catchment	Average catchment	Bad catchment	
558.8	17.3	12.9	8.6	1320.8	51	38.2	25.5	
584.2	18.4	13.8	9.2	1346.2	52.1	39	26	
609.6	19.5	14.6	9.7	1371.6	53.3	39.9	26.6	
635	20.6	15.4	10.3	1397	54.4	40.8	27.2	
660.4	21.8	16.3	10.9	1422.4	55.5	41.6	27.7	
685.8	22.9	17.1	11.4	1447.8	56.6	42.4	28.3	
711.2	24	18	12	1473.2	57.8	43.3	28.9	
736.6	25.1	18.8	12.5	1498.6	58.9	44.4	29.4	
762	26.3	19.7	13.1	1524	60	45	30	

Rainfalls return period for 25, 50 and 100 years calculated as below:

As per Weibull's Formula (Subramanya, 2008),

Return period/Recurrence interval = (n+1)/m

Where: n number of years on record;

m is the rank of observed occurrences when arranged in descending order.

b. Peak Flood Discharge Calculation:

The term "peak discharge" stands for the highest concentration of runoff from the basin area. The accurate estimation of flood discharge remains one of the major challenges as it depends upon physical characteristic of the catchment area and the flood intensity, duration and distribution pattern. There have been many different approaches for determining the peak runoff from an area. As a result many different models (equations) for peak discharge estimation have been developed. Formulas used for Peak Discharge calculation areas below:

As per Dicken's formula (Subramanya, 2008),

$\mathbf{Q} = \mathbf{C}\mathbf{A}^{3/4}$

Where: Q is Maximum flood discharge (m3/sec) in a river

A is Area of catchment in Sq. Km

C is Constant whose value varies widely between 2.8 to 5.6 for catchments in plains and 14 to 28 for catchments in hills

As per Jarvis formula (Subramanya, 2008),

 $Q = CA^{1/2}$

Where: Q is Maximum flood discharge (m³/sec) in a river

A is Area of catchment in Sq. Km

C is Constant whose value varies between 1.77 as minimum and 177 as maximum. Limiting or 100 percent chance floods are given by the value of C of 177



As per Rational formula ((Subramanya, 2008),

 $\mathbf{Q} = \mathbf{CIA}$

Where: Q is Maximum flood discharge (m³/sec) in a river
A is Area of catchment in Sq. Km
C is Runoff coefficient which depends on the characteristics of the catchment area. It is a ratio of runoff: rainfall
I is Intensity of rainfall (in m/sec)

c. Bed Load Transport Calculation:

The most important problems in river engineering are to predict bed load transport rates in torrential floods flowing from mountainous streams. Three modes of transport namely; rolling, sliding and saltation may occur simultaneously in bed load transport. The different modes of transportation are closely related and it is difficult, if not impossible, to separate them completely. There are number of equations to compute the total sediment load. Most of these equations have some theoretical and empirical bases.

Ackers and White Equation:

Ackers and White (1973) used dimensional analysis based on flow power concept and their proposed formula is as follows.

$$C_{t} = C_{s}G_{s} (d_{50}/h) (V/U_{*}) n' [(Fgr/A_{1}) - 1] m$$

The dimensionless particle d_{gr} is calculated by:

$$d_{gr} = d_{50} (g(G_s-1)/v^2)^{1/3}$$

The particle mobility factor F_{gr}is calculated by:

$$F_{\rm sr}=(U\times n'/(Gs-1)g d_{50})^{1/2} \times (V/(5.66\log(10h/d_{50}))^{1-n'})$$

Where,

- A_1 = Critical particle mobility factor
- C_s = Concentration coefficient in the sediment transport function
- C_t = Total sediment concentration
- d_{50} = Median grain size
- d_{gr} = Dimensionless particle diameter
- F_{gr} = Particle mobility parameter
- g = Acceleration of gravity
- $D_s, S_g =$ Specific gravity
- h =Water depth
- *m* = Exponent in the sediment transport function
- n' = Manning roughness coefficient
- U_* = Shear velocity
- *V* = Mean flow velocity
- ν = Kinematic viscosity



Meyer – Peter's equation (Source: Hydrologic Engineering Center):

Meyer-Peter's equation (Ponce, 1989) is based on experimental work carried out at the Federal Institute of Technology, Zurich. Mayer-Peter gave a dimensionless equation based on rational laws. Mayer- Peter equation gave an empirical formula of bed load transport rates in flumes and natural rivers. The simplified Meyer-Peter's equation is given below:

$g_b = 0.417 [\tau 0 (\eta' / \eta)^{1.5} - \tau c]^{1.5}$

Where,

gb = Rate of bed load transport (by weight) in N per m width of channel per second.

 η' = Manning's coefficient pertaining to grain size on an unrippled bed and Strickler formula i.e. $\eta' = (1/24) \times d1/6$ where d is the median size (d₅₀) of the bed sediment in m.

 η = The actual observed value of the rugosity coefficient on rippled channels. Its value is generally taken as 0.020 for discharges of more than 11cumecs, and 0.0225 for lower discharges.

 τc = Critical shear stress required to move the grain in N/m2 and given by equation τc = 0.687da, where da is mean or average size of the sediment in mm. This arithmetic average size is usually found to vary between d₅₀ and d₆₀.

 τ_0 = Unit tractive force produced by flowing water i.e. γ wRS. Truly speaking, its value should be taken as the unit tractive force produced by the flowing water on bed = 0.97 γ wRS. R is the hydraulic mean depth of the channel (depth of flow for wider channel) and S is the bed slope.

d. Sediment Yield Estimation:

Sedimentation occurs as the velocity decreases along with its ability to carry sediment. Coarse sediments deposit first, then interfere with the channel conveyance, and may cause additional river meanders and distributaries. The area of the flowing water expands, the depth decreases, the velocity is reduced, and eventually even fine sediments begin to deposit. As a result, deltas may be formed in the upper portion of reservoirs. The deposited material may later be moved to deeper portions of the reservoir by hydraulic processes within the water body.

There are many sediment transport equations which are suitable for use in the prediction of the rate of replenishment of river. Some of the famous sediment transport equations are:

1. Dendy – Bolton Equation

- 2. Yang Equations
- 3. Engelund-Hansen Equation

4. Modified Universal Soil Loss Equation (MUSLE) developed by Williams and Berndt (1977)



Dendy – Bolton Equation:

Dendy – Bolton formula (Dendy and Bolton 1976) is often used to calculate the sedimentation yield because:

- The formula uses catchment area and mean annual runoff as key determinants.
- It does not differentiate in basin wide smaller streams and their characteristics.
- Dendy and Bolton equation calculates all types of sediment yield i.e. sheet and rill erosion sediments, gully erosion sediments, channel bed and bank erosion sediments and mass movement etc.

Dendy-Bolton determined the combined influence of runoff and drainage area on sediment yield to compute the sediment yield. They developed two equations i.e. for run off less than 2 inch and for run off more than 2 inch, which are given below:

For run off less than 2 inch:

(Q<2in) S=1289× (Q) ^{0.46}× [1.43-0.26 Log (A)]

For run off more than 2 inches:

 $(Q > 2 \text{ in}): S = 1958 \times (e^{-0.055} \times Q) \times [1.43-0.26 \text{ Log } (A)]$ Where: S = Sediment yield (tons/sq miles/yr)

Q = Mean Annual runoff (inch)

A = Net drainage are in sq mile

Dendy-Bolton formula is often used to calculate the sediment yield. But use of these equations to predict sediment yield for a specific location would be unwise because of the wide variability caused by local factors not considered in the equations development. However, they may provide a quick, rough approximation of mean sediment yields on a regional basis for preliminary watershed planning. Computed sediment yields normally would be low for highly erosive areas and high for well stabilized drainage basins with high vegetation density because the equations are derived from average values. The equations express the general relationships between sediment yield, runoff, and drainage area. Many variables influence sediment yield from a drainage basin. They include climate, drainage area, soils, geology, topography, vegetation and land use. The effect of any of these variables may vary greatly from one geographic location to another, and the relative importance of controlling factors often varies within a given land resource area. Studies revealed that sediment yield per unit area generally decreases; and there is less probability of an intense rainstorm over the entire basin. Both phenomena tend to decrease sediment yield per unit area.



Modified Universal Soil Loss Equation (MUSLE):

Modified universal soil loss equation (MUSLE) for estimation of sediment yield is also widely used. MUSLE is a modification of the Universal Soil Loss Equation (USLE). USLE is an estimate of sheet and rill soil movement down a uniform slope using rainfall energy as the erosive force acting on the soil (Wischmeier and Smith 1978). Depending on soil characteristics (texture, structure, organic matter, and permeability) some soils erode easily while others are inherently more resistant to the erosive action of rainfall.

MUSLE is similar to USLE except for the energy component. USLE depends strictly upon rainfall as the source of erosive energy. MUSLE uses storm-based runoff volumes and runoff peak flows to simulate erosion and sediment yield (Williams 1995). The use of runoff variables rather than rainfall erosivity as the driving force enables MUSLE to estimate sediment yields for individual storm events. The generalized formula of MUSLE is as below:

$Y=11.8 \times (Q \times qP).56 \times K \times Ls \times C \times P$

Where,

Y = sediment yield of stream (t/yr/km2), Q = average annual runoff (m3), K = soil erodibility factor, qP = Highest discharge recorded (m3/s), Ls = gradient/slope length, C = cover management factor, P = erosion control practice

ii. Estimation of Replenishment:

Purba Medinipur district is mainly drained by the Haldi, Kangsabati, Rasulpur and Rupnarayan Rivers. These rivers and its tributary rivers are forming the main catchment area.

For replenishment study, following assumption/calculation are taken in to consideration:

- Catchment area (Watershed area) against each river has been calculated based on remote sensing data.
- Rainfall runoff coefficient as per Strange's table for the catchment area is consider 45%, as the rainfall in the district is more than 1485mm and the characteristic of the catchment of the district is average in nature.
- Peak flood discharge of the river of the district calculated based on Dicken's formula which is more applicable to north Indian and central Indian catchment. Here Dicken constant C is taken as 12 in present study as per published literature by Saha (2002).
- Bed load transport has not been computed in the regional aspect of the district, as the values are highly dependent on local factors such as particle mobility factor, roughness coefficient, Shear velocity, Mean flow velocity, Kinematic viscosity etc.
- Sedimentation yield calculated as per Dendy and Bolton formula as the equations express the general relationships between sediment yield, runoff, and drainage area.



- Computed sediment yields by Dendy Bolton formula normally would be low for highly erosive areas and high for well stabilized drainage basins with high plant density because the equations are derived from average values.
- Dendy and Boltan formula also says that actual sediment yield from individual drainage basin may vary 10-fold or even 100-fold from computed yields. Since the district river basins comprise sedimentary rocks with good average rainfall therefore the estimated replenishment is considered as 50-fold of computed results sediment yield.

The data estimated for each river in the district are given in Table 7.7.

Table 7.7: Replenishment parameter estimated for each river in the district					
Estimation parameter	Haldi	Rupnarayan			
Catchment Area (m²)	1143950000	482830000			
Annual Rainfall (m) (in 2020)	1.82	1.82			
Strange Runoff coefficient (%)	45%	45%			
Annual Run-off (m) (in 2020)	0.4004	0.4004			
Catchment Yield (m ³)	936895050	395437770			
Peak Flood Discharge (m³/sec)	74642560.37	39086513.29			
Flow depth d (m)	0.5	0.5			
Channel width b (m)	420	25			
Mean velocity v (m/s)	0.06	0.05			
Channel slope S _o (m/m)	0.001	0.001			
Sediment Yield (Tons/year)	11409.36	5447.31			
Estimated Annual Replenishment (in million m3)	0.21366	0.10201			

Table 7.7: Replenishment parameter estimated for each river in the district

Sedimentation rate of a river is dependent on the annual rainfall of the district. Sedimentation rate for the period 2016-2020 of each river is presented in Table 7.8 and Figure 7.5.

Year	Haldi	Rupnarayan	Annual Rainfall
2016	15.08	17.06	1627
2017	18.57	21	1531
2018	14.23	16.09	1654
2019	7.84	8.87	1929
2020	9.97	11.28	1818

Table 7.8:Year-wise sedimentation rate for last 5 years of each river





Figure 7.5: Graphical representation of year-wise sedimentation rate

The estimation of sedimentation rate based on empirical formula need critical analysis of different factors related to the LULC property of the catchment area, slope geometry, sediment erosion factor of catchment litho-type. This will help to assess replenishment rate more precisely.

Replenishment studies based on empirical formula for existing mining leases have also been conducted and are given in Table 7.9.

River Name	Location	Lease Area	Surface RL Before mining	Mine out Thickness	Mine out Volume	Annual Rainfall- 2020	Estimated Replenished Volume as per Dandy- Bolton	Replenishment Rate
		m2	m	m	cum	m	cum	%
Haldi	Jalpai	4700.00	6.00	2.60	12220.00		8798.40	72.00%
Haldi	Banskhana Jalpai	12100.00	5.00	2.70	32670.00	1.82	24339.15	74.50%
Haldi	Keshabpur Jalpai	4090.00	4.00	2.50	10225.00	1.82	7464.25	73.00%
Rupnarayan	Bholsara	12100.00	5.00	2.88	34848.00		26484.48	76.00%

Table 7.9: River wise replenishment rate estimation based on empirical formula

Illustration of Replenishment Estimation is given in Table 7.10.



Table 7.10: Illustration of replenishment rate calculation based on 3 methods

Based on Satellite imageries		Based on field i	nvestigation	Based on empirical formula		
Particulars	Estimation	Particulars	Estimation	Particulars	Estimation	
Particulars		River Name	Haldi	River Name	Haldi	
River	Haldi	Location	Jalpai	Location	Jalpai	
Total Premonsoon Sand Bar Area	1069391 (sq.m)	Mining Area	4700 (Sq.m)	Lease Area	4700 (Sq.m)	
Average Pre monsoon Thickness	2.0 (m)	Pre monsoon RL	6 (m)	Surface RL Before mining	6 (m)	
Total Volume	2.14 (Mcum)	Sand Thickness	2.6 (m)	Mine out Thickness	2.6 (m)	
Total Postmonsoon Sand Bar Area	753014 (sq.m)	Volume excavated (Cum)	12220.00 (Cum)	Mine out Volume (Cum)	12220.00 (Cum)	
Average Postmonsoon Thickness	3 (m)	Post monsoon RL	3.4 (m)	Drainage area for lease block	0.07 (Sq.km)	
Total Volume	2.26 (M.cum)	Thickness	2.56 (m)	Monsoon Rainfall-2020	1.82 (m)	
Total Pre and Post monsoon Volume Difference	0.12 (M.cum)	Volume deposited (Cum)	12036.70 (Cum)	Estimated Volume as per Dendy- Bolton (S = 1280 Q0.46[1.43 - 0.26 log(A)]) Where, Q is runoff, A is drainage area)	8798.00 (Cum)	
Replenishment and Agrredation %	106%	Replenishme nt Rate	98.50%	Replenishment Rate	72.0%	

Replenishment studies have been carried out in the district based on three different methodologies as illustrated in Table 7.10. Table 7.11 explained comparison of the outcome of these three methodologies adopted for the district.

Table 7.11: Comparison of replenishment study

Replenishment Study Method	Haldi	Rupnarayan
Estimated Annual Replenishment based on Satellite imagery (*)	106%	
Estimated Annual Replenishment based on field investigation	98.73%	98.4%
Estimated Annual Replenishment based on empirical formula	73.17%	76%

(*) Replenishment study based on satellite imagery involves estimation of replenish volume along with aggredation volume.



vi) Total potential of minor mineral in the river bed

The major sand producing rivers of the Purba Medinipur district are Kangsabati, Haldi and Keleghai Rivers. The total mineable potential sand resources are 0.81 Mcum.

B. Geological studiesi) Lithology of the catchment area

Purba Medinipur district is part of the lower Indo-Gangetic Plain and Eastern coastal plains. The considerable area of the district has close to river basins and deltas that are characterized by Holocene alluvium deposit.

ii) Tectonics and structural behavior of rocks

The land of Purba Medinipur district is a quaternary alluvial deposition. As the district area is bounded by water bodies in two sides, it is a formation of fluvial-tidal deposition. Geologically the area is of recent origin. This region is 5-7 meters above mean sea level and average slope is 0-5 degree.

C. Climate Factors

i) Intensity of rainfall

The average annual rainfall in the district is 1712mm. The variations in the annual rainfall within the district and from year to year are not large. The rainfall during the monsoon season – June to September – constitutes 70 percent of the annual rainfall; July and August are the rainiest months. The district receives a mean annual rainfall varying from 1531 mm to 1929.

ii) Climate zone

Purba Medinipur district belongs to humid tropical monsoon climatic region. According to District Meteorological Department, there is very minor variation of temperature, rainfall and relative humidity in the district.

The climate of this district is characterized by an oppressive hot summer, high humidity nearly all the year round and a well distributed rainfall in the south west monsoon season. The year may be divided into four seasons. The cold season is from about the middle of November to the end of February. The period from March to May is the summer season. The south west monsoon season commences about the beginning of June and lasts till the end of September. October and the first half of November may be termed as post-monsoon season.

iii) Temperature variation

Temperature along with other meteorological conditions of the district is more or less uniform. The cold season commences by about the middle of November when the temperature



begins to decrease. January is the coldest month with the mean daily maximum and minimum temperature at 28.8°C and 14°C respectively. By about the end of February the temperature begins to increase and April is s the hottest month, the mean maximum daily temperature is 39°C and the mean minimum daily temperature is 25.5°C.

Annual Deposition:

Annual deposition of riverbed minerals has been calculated on post-monsoon sand volume. The pre-monsoon sand volume of the river is the depleted resources and is replenished by the monsoon rainfall. For the purpose of estimating mineable mineral potential, the thickness of the sand bar considered extractable based on base flow level is given in Table 7.12.

River Name	Considered Mining Thickness (m)
Haldi	3.00
Kangsabati	2.50
Keleghai	2.50

Table 7.12: River wise Thickness of sand bar considered mineable

Based on geomorphology, geology, climate and mineable thickness of sand bar the annual deposition of riverbed minerals has been estimated. Sand bar area recommended for mineral concession in the table is calculated as per the Enforcement and Monitoring Guidelines for Sand Mining (EMGSM) 2020. As per guidelines, mining depth restricted to 3 meters depth and distance from the bank is ¹/₄th of river width and not less than 7.5 meters. Also mining is prohibitated up to a distance of 1 kilometre (1 km) from major bridges and highways on both sides, or five times (5x) of the span (x) of a bridge/public civil structure (including water intake points) on up-stream side and ten times (10x) the span of such bridge on down-stream side, subjected to a minimum of 250 meters on the upstream side and 500 meters on the downstream side. The annual minable mineral potential is given in Table 7.13.

Sl. No.	River or Stream	Portion of the river stream recommended for mineral concession	Length of area recommended for mineral concession (in meter)	Average width of area recommended for mineral concession (in meters)	Area recommended for mineral concession (in Sqm)	Mineable mineral potential (in Mcum) (60% of total mineral potential	
1	Haldi	4%	4344.023	437.2365	191211.192	0.34	
2	Kangsabati	8%	4169.83	166.8796	204130.6754	0.31	
3	Keleghai	6%	3952.987	249.3929	103567.3898	0.155351	



III. Riverbed Mineral Potential Process of disposition etc:

Sand: Huge quantities of quality sands are found to occur in part of rivers. Smaller patches are also available locally in the other smaller rivers as well. Table 7.14 summarizes the potential riverbed mineral deposits of the district.

Table 7.14: Resources of Potential Riverbed Mineral

Boulder (Mcum)	Pebbles/Gravel (Mcum)	Sand/White sand (Mcum)	Total Mineable, Mineral Potential (Mcum)
-	-	0.81	0.81

Based on satellite imagery study and field investigation, potential zones for riverbed deposits for each river of the district have been identified and the details of the zones are provided in Table 7.15.

		Location of potential zones									
						Co-ord	inates	within prohibite d zone as			
Sl.N o	Rivers or Streams	Administrative Block	Mouza	JL No.	Zon e	Latitude	Longitude	per rule 3 of WBMMC Rules, 2016 (in sq.m)			
		NANDAKUMAR	MANJHABERIA			22° 9' 42.834" N	87° 50' 35.752" E	23931.1350			
		NANDAKUMAK	CHAK		1	22° 9' 45.289" N	87° 51' 15.495" E	3			
			DHARANIDHAR		_	22° 9' 9.421" N	87° 51' 59.559" E	.0			
1	HALDI	NANDAKUMAR	CHAK		2	22° 8' 33.139" N	87° 52' 51.737" E	48451.7185			
						22° 6' 6.891" N	87° 57' 14.022" E	26794.0910			
		MAHISHADAL	MANGLACHAK		3	22° 5' 58.150" N	87° 57' 28.901" E	9			
		DANGUIZUDA		12		22° 26' 33.971" N	87° 38' 56.062" E				
		PANSHKURA	SHYAMPUR		1	22° 26' 20.923" N	87° 39' 16.340" E	4673.15985			
		PANSHKURA	MAHAPUR	13		22° 26' 23.948" N	87° 39' 34.740" E	10273.6190			
		PANSHKUKA	MAHAPUK		2	22° 26' 41.085" N	87° 39' 44.102" E	6			
		PANSHKURA	JAGATPUR			22° 27' 9.996" N	87° 41' 13.832" E	1931.37428			
		PANSHKUKA	JAGAIPUK	16	3	22° 27' 1.128" N	87° 41' 5.713" E	8			
2	KANGSAB ATI RIVER	PANSHKURA	GOBINDANAGAR			22° 26' 51.613" N	87° 41' 4.463" E				
		PANSHKUKA	GOBINDANAGAR	15	4	22° 26' 46.213" N	87° 41' 6.637" E	606.833534			
		PANSHKURA	FAKIRBAZAR	19	_	22° 26' 39.542" N	87° 41' 31.448" E	1997.04367			
		PANSIKUKA	FARINDAZAN	19	5	22° 26' 42.632" N	87° 41' 40.975" E	6			
		PANSHKURA			6	22° 26' 36.624" N	87° 41' 47.576" E	1997.04367			
		PANSHKUKA	FAKIRBAZAR	19	0	22° 26' 32.354" N	87° 41' 45.910" E	6			
		PANSHKURA	BRINDABANPUR	20	7	22° 26' 21.827" N	87° 42' 9.643" E	1479.43163			

Table 7.15: Potential Zone of Riverbed Mineral

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			Loc	cation of	potentia	al zones		Area within	
						Co-ord	inates	prohibite d zone as	
Sl.N o	Rivers or Streams	Administrative Block Mouza		JL No.	Zon e	Latitude	Longitude	per rule 3 of WBMMC Rules, 2016 (in sq.m)	
						22° 26' 21.531" N	87° 42' 18.100" E	2	
		PANSHKURA	BAJU	62	8	22° 26' 14.512" N	87° 42' 21.619" E	2959.84225	
		PANSHKUKA	BAJU	02	0	22° 25' 48.608" N	87° 42' 13.478" E	6	
		MOYNA	NAICHANPUR	250		22° 10' 22.009" N	87° 49' 20.632" E	8539.74979 8	
		MOINA	NAICHANFUK	250	9	22° 10' 17.625" N	87° 49' 35.895" E		
		MOYNA	NAICHANPUR	050	1	22° 9' 41.062" N	87° 49' 11.280" E	10905.6844 2	
		MOINA	NAICHANFUK	250	1	22° 9' 51.580" N	87° 49' 21.003" E		
		MOYNA	NARIKELDAHA	0.40	2	22° 10' 3.222" N	87° 48' 3.089" E	6060.95733	
		MOINA	NAKIKELDAHA	249	2	22° 9' 52.482" N	87° 48' 14.957" E	8	
	KELEGHAI	MOYNA	NARIKELDAHA	0.40		22° 9' 56.989" N	87° 47' 23.808" E	14135.5076	
3	RIVER	MOINA	NAKIKELDAHA	249	3	22° 10' 2.557" N	87° 47' 54.507" E	9	
		MOYNA	BARUNA	0.41		22° 10' 5.079" N	87° 45' 34.526" E	20896.4973	
		MOINA	DARUNA	241	4	22° 9' 54.895" N	87° 46' 30.543" E	6	
		MOYNA	KHIDIRPUR	009	_	22° 10' 26.888" N	87° 43' 56.971" E	2537.58827	
		MOINA	KHIDIKPUK	238	5	22° 10' 33.227" N	87° 44' 1.369" E	5	

NO MINING ZONE:

As per the Enforcement and Monitoring Guidelines for Sand Mining (EMGSM) 2020 the restricted zone for mining is a distance from the bank is ¼th of river width and not be less than 7.5 meters. Also there is a no mining zone up to a distance of 1 kilometre (1 km) from major bridges and highways on both sides, or five times (5x) of the span (x) of a bridge/public civil structure (including water intake points) on up-stream side and ten times (10x) the span of such bridge on down-stream side, subjected to a minimum of 250 meters on the upstream side and 500 meters on the downstream side.

No mining zone has been marked for an area up to a width of 100 meters from the active edge of embankments. Also the concave side of the river is marked as no mining zone, as mining is this area will affect the course of river in future and will erode the river bank. A representative map of no mining zone shown on River Kangsabati of Purba Medinipur district is given in Figure 7.6. Table 7.16 summarized the area of no mining zones demarcated for each river of the district.

Sl.No	Dissona on Otrosomo	Location of potential zones	Area within prohibited zone as per rule 3 of WBMMC		
	Rivers or Streams	Administrative Block	Rules, 2016 (in sq.m)		
	HALDI RIVER	NANDAKUMAR	23931.13503		
1	HALDI KIVEK	NANDAKUMAR	48451.7185		

Table 7.16: No mining zone in the district

District Survey Report Purba Medinipur District, West Bengal



Sl.No	Rivers or Streams	Location of potential zones	Area within prohibited zone as per rule 3 of WBMMC
51.NO	Rivers or Streams	Administrative Block	Rules, 2016 (in sq.m)
		MAHISHADAL	26794.09109
		PANSHKURA	4673.15985
		PANSHKURA	10273.61906
		PANSHKURA	1931.374288
		PANSHKURA	606.833534
2	KANGSABATI RIVER	PANSHKURA	1997.043676
		PANSHKURA	1997.043676
		PANSHKURA	1479.431632
		PANSHKURA	2959.842256
		MOYNA	8539.749798
		MOYNA	10905.68442
		MOYNA	6060.957338
3	KELEGHAI RIVER	MOYNA	14135.50769
		MOYNA	20896.49736
		MOYNA	2537.588275



Figure 7.6: A representative map showing no-mining zone demarcated on Kangsabati River

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B) In-situ Minerals:

I. Mineral Reserve

Mineral resources of the district are still not well established, the district does not have reserve of any major mineral deposits.

II. Mineral Potential

Sand is the important riverbed mineral found to be potential for mining. Considerable quantity of quality sands are found to occur in the riverbed of the district.

	Na me				Wh	Name of	Miner al		tion of neralize			Area with in proh ibite d zone	Infras tructu
Na me of mi ner al	of asso ciate d min eral s, if any	Host rock of miner alizati on	Area of miner alizati on	Depth of miner alizati on	r virgi n or part ially exca vate d	land (whether free for mining/fore st/agricultur al	reserv e (appro ximate) menti oning grade	Admin istrativ e Block	M ou za	P lo t N o. s	Co- ordi nat es	as per rule 3(7) of WB MM C Rule s, 201 6	re availa ble near the miner alized zone
Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil		Nil	l		Nil	Nil

Table 7.3: In-situ Minerals Occurrences

7.3 Mineral development prospect of the district with respect to Minor Mineral

The district is not very rich in mineral resources and there are no mines in the district. However, collections of sand from the river-bed are the minor mineral sources. In this district some of big rivers are flowing like Kangsabati, Haldi, Keleghai, Rasulpur, so in this region it has seen that the different geomorphic features like Alluvium Plain, Alluvial Fan etc, which are create by river deposition activity. So in this region there is huge deposition of sand, clay has found, so the sand mining or the sand industry should the very useful for this district.

7.4 Exploration requirement of the district

In this district the sand industry might be very much useful. Therefore, there is a need more scientific sand mining procedure. So the scope of sand Exploration in this district is very high. It is highly recommended to conduct detailed exploration (G2 level) to establish mineral resources of the district.



8 Overview of mining activity in the district

8.1 General overview

The district is not very rich in mineral resources and there are no large mines in the district. However, collection of sand, Bricks, from the river-bed is the minor mineral sources. These materials are primarily utilized for construction purpose.

8.2 List of existing mining leases of the districts

Details of List of existing mining leases of the districts are furnished in Table 8.1.

District Survey Report Purba Medinipur District, West Bengal



ID	Block	Mouza	JL No	River	Road	Plot No	Area in Hectare S	Latitu de	Longitude	Bidder Name	Date of Issuanc e of Environ mental Clearan ce (E.C.)	Date of Executi on of Lease Deed	Lease Agreem ent Start Date (date of effect)	Lease Agreem ent Expiry Date	Quantu m of Sand Extracti on permissi ble as per Mining Plan (tonnes)	Reas ons for non- exec utio n of leas e deed
1847/SB 2021	NANDAKU MAR	JALPAI	070	Haldi	Metal/Black top/Pitch/Puc ca Road	9094	0.47	22° 7' 55.24 ''N	87° 54' 6.48''E	ARUN KAR	22-08- 2017	12-12- 2018	13-12- 2018	11-Dec- 23	11320.4 54	
1852/SB 2021	HALDIA	BANSKH ANA JALPAI	055	Haldi	Metal/Black top/Pitch/Puc ca Road	962/192 8	1.21	22° 4' 57.38 ''N	88° 0' 8.29''E	RANJIT GAYEN OF MS SHRI DURGA TRADING CO	18-10- 2017	20-07- 2018	20-07- 2018	19-Jul- 23	8837.11 5	
1846/SB 2021	NANDAKU MAR	JALPAI	070	Haldi	Metal/Black top/Pitch/Puc ca Road	7369,73 70,7371 ,7372	0.39	22° 8' 21.50 ''N	87° 53' 17.51''E	TAPAN KUMAR BERA	22-08- 2017	29-11- 2018	29-11- 2018	28-Nov- 23	9565.64	
1853/SB 2021	HALDIA	BANSKH ANA JALPAI	055	Haldi	Metal/Black top/Pitch/Puc ca Road	355, 356/175 2, 352/220 0	1.21	22° 4' 57.38 ''N	88° 0' 8.29''E	GEE DEE MINING PVT LTD	14-03- 2018	03-12- 2019	03-12- 2019	02-Dec- 24	9867.90 9	
1854/SB 2021	MAHISHA DAL	BHOLSA RA	95	Rupna rayan	Metal/Black top/Pitch/Puc ca Road	168/818	1.21	22° 15' 56.78 ''N	87° 57' 19.36''E	GEE DEE MINING PVT LTD	14-03- 2018	29-11- 2019	29-11- 2019	28-Nov- 24	9867.90 9	
1851/SB 2021	HALDIA	BANSKH ANA JALPAI	055	Haldi	Metal/Black top/Pitch/Puc ca Road	374, 378, 382, 381/214 2, 381/221 5	1.21	22° 5' 3.55'' N	88° 0' 14.03''E	BISHWAJIT KUMAR SINGH OF MA BISHALAXMI TRADING AGENCY	22-08- 2017	20-07- 2018	20-07- 2018	19-Jul- 23	8837.11 5	
1845/SB 2021	MAHISHA DAL	KESHAB PUR JALPAI	133	Haldi	Kachha Road	4733	0.409	22° 6' 42.86 ''N	87° 56' 38.64''E	SEKH MUKTAR KAJI OF BANDHU ENTERPRISE	22-08- 2017	01-08- 2018	02-08- 2018	31-Jul- 23	9867.90 9	

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ID	Block	Mouza	JL No	River	Road	Plot No	Area in Hectare S	Latitu de	Longitude	Bidder Name	Date of Issuanc e of Environ mental Clearan ce (E.C.)	Date of Executi on of Lease Deed	Lease Agreem ent Start Date (date of effect)	Lease Agreem ent Expiry Date	Quantu m of Sand Extracti on permissi ble as per Mining Plan (tonnes)	Reas ons for non- exec utio n of leas e deed
1850/SB 2021	HALDIA	BANSKH ANA JALPAI	055	Haldi	Metal/Black top/Pitch/Puc ca Road	357, 358	0.4	22° 5' 7.09'' N	88° 0' 9.51''E	SK AHAMUDULL A	22-08- 2017	21-12- 2018	22-12- 2018	20-Dec- 18	9700.16 2	
1855/SB 2021	MAHISHA DAL	BHOLSA RA	95	Rupna rayan	Metal/Black top/Pitch/Puc ca Road	27, 33, 34, 35, 36	1.21	22° 15' 8.72'' N	87° 58' 3.33''E	GEE DEE MINING PVT LTD	14-03- 2018	29-11- 2019	29-11- 2019	28-Nov- 24	9867.90 9	
1881/SB 2021	CHANDIP UR	1ST PART BHAGW ANKHAL I 1	038	Haldi	Metal/Black top/Pitch/Puc ca Road	675	1.21	22° 8' 20.63 ''N	87° 53' 9.44''E	EXCELL MOVERS					0	EC Awa iting



8.3 Detail of production of sand and other minerals during last three years

Last 3 years production of minor mineral of Purba Medinipur district is furnished in Table 8.2.

Table 8.2: Details of production of sand as per mine plan in Purba Medinipurdistrict

Sl. No.	Year	Name of mineral	Total Production (inCft.)	Total Production in cum
1	2017-2018	Sand	-	-
2	2018-2019	Sand	350,000	9910.8028
3	2019-2020	Sand	2,181,252	61765.595

Conversion factor: 1cum=35.315 cft



9 Details of revenue generated from mineral sector during last three years

Revenue generated for last 3 years in Purba Medinipur district is furnished in Table

9.1.

Year	Royalty amount
2017-18	18,61,40,101
2018-19	17,72,11,610
2019-20	17,14,47,874

Table 9.1: District revenue generation from mineral sector



10 Transport

The district has an excellent transport and communication network of National Highways and Railways (Figure 10.1). Two important National Highways are passing through this district. NH-6, which connects Panskura and Kolaghat, is a well-maintained highway passing through the district. NH-41 at Kolaghat connecting Tamluk and Haldia is another National Highway in the district. The Tamluk-Contai road connects the Southern parts of the district. The Belda-Contai road is also an important road connecting with the Contai- Digha road. Nandigram-Mahishadal road and Basudebpur-Mahishadal-Sutahata coast roads are equally important roads in the district.

A large portion of the district Purba Medinipur is connected with well-defined railway network with State capital Kolkata and other places. The railway line from the busiest Sea Beach in West Bengal at Digha is connected with Kolkata through Ramnagar and Contai-I C. D. Block. Panskura is another important railway station catering large volume of trade of locally produced flowers to the outside world. Haldia Sub-division is connected to Sealdah (in Kolkata) through Panskura - Haldia railway line (Census, 2011).

A transportation map demarcating approach road to the potential sand blocks from the nearest National Highway/ Sate Highway has been prepared and presented in Figure 10.2.





Figure 10.1: Transportation map of Purba Medinipur District

(Source: National Informatics Centre)





Figure 10.2: Map showing approach road to potential sand bars

(Source: National Informatics Centre)



11 Remedial measure to mitigate the impact of mining

11.1 Environmental Sensitivity

Purba Medinipur district represents a unique geo-environmental setup. As human population increases, forests are being depleted for the extension of agricultural lands, introduction of new settlements, roadways etc

Due to unprecedented growth of population during the last few decades, nature has started reacting sharply to the accumulated human guilt. Soil erosion and its conservation play an important role.

The land use practices play the most important role in determining the stability factors in respect of landslide hazards. Stone quarrying from the slope is another way of human intervention that causes occasional slope failure.

11.2 Sand mining Impact

Another serious environmental problem around the globe in recent years is of sand and gravel mining. Sand mining is a process of extraction of sand from an open pit, river bed, sea beaches, ocean floor, river banks, deltas and island dunes. The extracted sand could be utilised for various types of manufacturing, such as concrete used in the construction of building and other structures. The sand can also be used as an abrasive. The demand for sand will increase with population growth and urbanization. The high demand of sand has has led to unsustainable sand mining process resulting in illegal mining.

Although most jurisdictions have legal limit on the location and volume of sand that can be mined, illegal sand extraction is taking place in many parts of the country due to rapid urbanisation and industrialisation.

Removal or extraction of too much sand from rivers leads to erosion of river banks. Deltas can recede due to sand mining. These destructive effects of sand mining ultimately results in loss of fertile land and property. It also destabilizes the ground and causes failure of engineering structures.

In-stream mining directly alters the channel geometry and bed elevation. Removing sediment from the channel disrupts the pre-existing balance between sediment supply and transporting capacity, typically inducing incision upstream and downstream of the extraction site. The resultant incision alters the frequency of floodplain inundation along the river courses, lowers valley floor water table and frequently leads to destruction of bridges and channelization structures.



Sand Mining in beaches disturbs the ecosystem of different fauna of the beaches. The sand mining from natural barriers, made up of sand, causes flooding of the natural habitat. The sand mining activity destroys the aesthetic beauty of beaches and river bank and makes the ecosystem unstable. If there are popular tourist destination, tourism potential of such areas will decline.

It can be concluded that there has been little in depth research on the environmental, social and political effects of land use practices and calls for urgent attention by the competent authority.

11.3 Remedial measure

11.3.1 Sustainable Mining Practices:

- The depth of mining in riverbed shall not exceed 3 meter or base flow level whichever is less, provided that where the Joint Inspection Committee certifies about excessive deposit or over accumulation of mineral in certain reaches requiring channelization, it can go above 3 meters.
- Mining shall be done in layers of 1 meter depth to avoid ponding effect and after first layer is excavated, the process will be repeated for the next layers.
- No stream should be diverted for the purpose of sand mining. No natural water course and/ or water resources are obstructed due to mining operations.
- No blasting shall be resorted to in river mining and without permission at any other place.

11.3.2 Monitoring the Mining of Mineral and its Transportation:

- For each mining lease site the access should be controlled in a way that vehicles carrying mineral from that area are tracked and accounted for.
- There should be regular monitoring of the mining activities in the State to ensure effective compliance of stipulated EC conditions and of the provisions under the Minor Mineral Concessions Rules framed by the State Government.

11.3.3 Noise Management:

- Noise arising out of mining and processing shall be abated and controlled at source to keep within permissible limit.
- Restricted sand mining operation has to be carried out between 6 am to 7 pm.

11.3.4 Air Pollution and Dust Management:

• The pollution due to transportation load on the environment will be effectively controlled and water sprinkling will also be done regularly.


- Air pollution due to dust, exhaust emission or fumes during mining and processing phase should be controlled and kept in permissible limits specified under environmental laws.
- The mineral transportation shall be carried out through covered trucks only and the vehicles carrying the mineral shall not be overloaded. Wheel washing facility should be installed and used.

11.3.5 Bio-Diversity Protection:

- Restoration of flora affected by mining should be done immediately. Five times the number of trees destroyed by mining to be planted preferably of indigenous species. Each EC holder shall have to undertake plantation of trees over at least 20% of the total area of lease in the same plot or plots utilised for such working.
- No mining lease shall be granted in the forest area without forest clearance in accordance with the provisions of the Forest Conservation Act, 1980 and the rules made there under.
- Protection of natural home of any wild animal shall have to be ensured.
- No felling of tree near quarry is allowed. For mining lease within 10km of the National Park / Sanctuary or in Eco-Sensitive Zone of the Protected Area, recommendation of Standing Committee of National Board of Wild Life (NBWL) have to be obtained as per the Hon'ble Supreme Court order in I.A. No. 460 of 2004.
- Spring sources should not be affected due to mining activities. Necessary protection measures are to be incorporated.

11.3.6 Management of Instability and Erosion:

- Removal, stacking and utilization of top soil should be ensured during mining. Where top soil cannot be used concurrently, it shall be stored separately for future use keeping in view that the bacterial organism should not die and should be spread nearby area.
- The EC should stipulate conditions for adequate steps to check soil erosion and control debris flow etc. by constructing engineering structures
- Use of oversize material to control erosion and movement of sediments
- No overhangs shall be allowed to be formed due to mining and mining shall not be allowed in area where subsidence of rocks is likely to occur due to steep angle of slope.
- No extraction of stone / boulder / sand in landslide prone areas.
- Controlled clearance of riparian vegetation to be undertaken.



11.3.7 Waste Management:

- Site clearance and tidiness is very much needed to have less visual impact of mining.
- Dumping of waste shall be done in earmarked places as approved in Mining Plan.
- Rubbish burial shall not be done in the rivers.

11.3.8 Pollution Prevention:

- Take all possible precautions for the protection of environment and control of pollution.
- Effluent discharge should be kept to the minimum and it should meet the standards prescribed.

11.3.9 Protection of Infrastructure:

- Mining activities shall not be done for mine lease where mining can cause danger to site of flood protection works, places of cultural, religious, historical, and archeological importance.
- For carrying out mining in proximity to any bridge or embankment, appropriate safety zone should be worked out on case to case basis, taking into account the structural parameters, location aspects and flow rate, and no mining should be carried out in the safety zone so worked out.

Mining shall not be undertaken in a mining lease located in 300-500 meter of bridge, 300 meter upstream and downstream of water supply / irrigation scheme, 100 meters from the edge of National Highway and railway line, 50 meters from a reservoir, canal or building, 25 meter from the edge of State Highway and 10 meters from the edge of other roads except on special exemption by the Sub-Divisional level Joint Inspection Committee.



12 Suggested reclamation plan for already mined out areas

As per statute all mines/quarries are to be properly reclaimed before final closure of the mine. Reclamation plans should include:

a) A baseline survey of river cross section. The study of cross section is basis for delineating channel form. Cross-sections must be surveyed between two monumented endpoints set on the river banks, and elevations should be referenced based on benchmark set in the area;

b) The proposed mining cross-section data should be plotted over the baseline data to illustrate the vertical extent of the proposed excavation;

c) The cross-section of the replenished bar should be the same as the baseline data. This illustrates that the bar elevation after the bar is replenished will be the same as the bar before extraction;

d) A planimetric map showing the aerial extent of the excavation and extent of the riparian buffers;

e) A planting plan developed by a plant ecologist familiar with the flora of the river for any areas such as roads that need to be restored;

f) Each EC holder shall have to undertake plantation of trees over at least 20% of the total area of the plot or plots of land as subject to such working in accordance with a plan approved by the concerned Divisional Forest Officer holding jurisdiction, provided further the competent authority l.e, The Divisional Forest Officer may fix up norms for plantation of trees in a particular area regarding choice of species, spacing, nos of trees and maintenance etc.

f) A monitoring plan has to establish.



13 Risk assessment and disaster management plan

Risk analysis is the systematic study of risks encountered during various stages of mining operation. Risk analysis seek to identify the risks involved in mining operations, to understand how and when they arise, and estimate the impact (financial or otherwise) of adverse outcomes. The sand mining operation in the district is mainly done manually.

13.1 Identification of risk due to river sand mining

There is no land degradation due to mining activities as mining is done only on river bed dry surface. There will be no OB or waste generation as the sand is exposed in the river bed and is completely saleable. There will be neither any stacking of soil nor creation of OB dumps. The mining activity will be carried out upto a maximum depth of 3m below the surface level. So there is no chance of slope failure, bench failure in the mines. However there are some identified risks in the mining activity which are as follows:

- 1. Accident during sand loading and transportation
- 2. Inundation/ Flooding
- 3. Quick Sand Condition

13.2 Mitigation measures

13.2.1 Measures to prevent accidents during loading and transportation:

- During the loading, trucks should be brought to a lower level so that the loading operation suits the ergonomic condition of the workers.
- The workers will be provided with gloves and safety shoes during loading.
- Opening of the side covers of the truck should be done carefully and with warning to prevent injury to the loaders.
- Mining operations will be done during daylight only.
- The truck will be covered with tarpaulin and maintained to prevent any spillage.
- To avoid danger while reversing the trackless vehicles especially at the embankment and tipping points, all areas for reversing of lorries should be made man free as far as possible.
- All transportation within the main working will be carried out directly under the supervision and control of the management.
- Overloading should not be permitted and the maximum permissible speed limit should be ensured.
- There will be regular maintenance of the trucks and the drivers will have valid driving license.



13.2.2Measures to prevent incidents during Inundation/ Flooding:

To minimize the risk of flooding/ inundation following measures should be under taken:

- Mining will be completely closed during the monsoon months.
- Proper weather information particularly on rain should be kept during the operational period of mines so that precautionary measures will be undertaken.

13.2.3 Measures for mitigation to quick sand condition:

- Quick sand zone and deep water zone will be clearly demarcated and all the mine workers will be made aware of the location.
- Mining will be done strictly as per the approved mining plan.

13.3 Disaster management plan

As the depth of mining will be maximum of 3m below the surface level considering local condition, the risk related to mining activity is much less. The mining operation will be carried out under the supervision of experienced and qualified Mines Manager having Certificate of Competency to manage the mines granted by DGMS. All the provisions of Mines Act 1952, MMR 1961 and Mines Rules 1955 and other laws applicable to mine will strictly be complied. During heavy rainfall and during the monsoon season the mining activities will be closed. Proper coordination with Irrigation Department should be maintained so that at the time of releasing water, if any, from the dam suitable warning/information is given in advance. Special attention and requisite precautions shall be taken while working in areas of geological weakness like existence of slip, fault etc. The mining site will be supplied with first aid facilities and the entire mines worker will have access to that.



14 Conclusions and Recommendations

The District Survey Report has been prepared in conformity with the S O 141 (E), S O 3611 (E) and other sand mining guidelines published by MoEF&CC time to time as well as the requirement specified in WBMMCR, 2016.

Potential areas of economic mineralization and mineral deposition have been identified and list is furnished in the report. Estimation of annual sand deposition by replenishment study has been incorporated in the report.

The district survey report has been prepared by utilizing both primary and secondary data. The primary data generation involved the satellite imagery study, site inspection, survey, ground truthing etc. while secondary data has been acquired through various authenticated sources and satellite imagery studies.

The land of Purba Medinipur district is a quaternary alluvial deposition. As the district area is bounded by water bodies in two sides, it is a formation of fluvial-tidal deposition. Geologically the area is of recent origin. This region is 5-7 meters above mean sea level and average slope is 0-5 degree. The Haldi, Kangsabati, Keleghai, Rosulpur, Rupnarayan are important rivers of Purba Medinipur district.

In Purba Medinipur district, as per the report published by Directorate of Mines and Minerals, Government of West Bengal, there is no major or minor in-situ minerals noted. The district is having riverbed deposits which are generating revenue for the district mainly.

The district is generating considerable revenue from mining of minor minerals such as riverbed sand deposits. Revenue generated in the district of Purba Medinipur from Minor minerals during the period of April 2017 to January 2020 is Rs. 53.48 crores.

The district has an upside potential for development of riverbed sand. The occurrence has been reported by Directorate of Mines and Minerals, Government of West Bengal and others in previous instances. It requires further systematic and scientific approach to quantify the resource along with their grade assessment. The occurrences are mostly observed in the river Kangsabati, Keleghai and Haldi River. This report also recommends undertaking detail exploration (G2 level) program to assess the mineral occurrences in the major rivers of the district and should have a proper development and production plan for the specified minerals.



14.1. Conclusion

- I. The river beds of the district are enriched with sand which is highly potential for mining.
- II. The replenishment study has been carried out during the preparation of this DSR. Both field-based surveys coupled with satellite imagery study and empirical studies were carried out to determine the rate of replenishment in each river of the district.
- III. The determined values of various methods as adopted for replenishment study gives a comparable value and in all cases the values are found to be much more as compared to the capping limit (60%) as suggested in the Enforcement & Monitoring Guidelines for Sand Mining (EMGSM) January 2020, Issued by Ministry of Environment, Forest and Climate Change (MoEF&CC) 2020.
- IV. Field base study shows variation of replenishment from 97.80 to 98.8% in the district and for theoretical replenishment study based on mining lease shows variation from 72% to 76% with an average of 73.88% of replenishment rate in the district.
- V. The total potential river bed deposit for the district comes to about 0.81 Mcum.

14.2. Recommendation:

- 1. The mining lease distribution for the district must be carried out by involving a district level committee constituted with inter-disciplinary members of various departments including irrigation and waterways, DL&LRO, forest, biodiversity, wetland management, SWID or any other relevant department which the district authority may find suitable to include.
- 2. While recommending for Mining Leases, the District Level Committee should ensure the protection of Biodiversity Zones as recorded by relevant Government Agenesis from time to time.
- 3. During finalization of mining leases for the district, strict adherence of Supreme Court orders No 1501 dated 03/06/2022 should be followed.
- 4. Efforts should be given to restrict distribution of mining leases along the confluence zone of the rivers where rich aquatic habitats are reported.
- 5. Since the state of West Bengal has royalty system in volumetric measurement, specific gravity for sand and gravel has not been determined during this study. However, during the finalization of mining lease if it is found necessary to conduct such test may be initiated by the state government on case-to-case basis.
- 6. It is recommended to have a periodical review along with primary data collection during pre and post-monsoon periods to record the seasonal variance of the sedimentation rate on annual basis and update replenishment rate of the district.



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PLATE 1 DRAINAGE MAP OF THE DISTRICT

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Plate 1A: Drainage Map of the District (Source: National Informatics Centre -NIC Website, Sept 2020)

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Plate No 1B: Location Map of dams, barrages, bridge showing on drainage system of the district (Source: National Informatics Centre -NIC Website, Sept 2020)

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PLATE 2A

DISTRIBUTION MAP OF SAND BARS ON RIVERS DURING PRE-MONSOON PERIOD

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Plate 2A1: Distribution Map of Sand Bars on Rivers During Pre-Monsoon Period of Purba Medinipur District (Source: ISRO RESOURCE Sat 2 LISS III Sensor, March 2020)

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Plate 2A2: Distribution Map of Sand Bars on Rivers During Pre-Monsoon Period of Purba Medinipur District (Source: ISRO RESOURCE Sat 2 LISS III Sensor, March 2020)

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Plate 2A3: Distribution Map of Sand Bars on Rivers During Pre-Monsoon Period of Purba Medinipur District (Source: ISRO RESOURCE Sat 2 LISS III Sensor, March 2020)

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Plate 2A4: Distribution Map of Sand Bars on Rivers During Pre-Monsoon Period of Purba Medinipur District (Source: ISRO RESOURCE Sat 2 LISS III Sensor, March 2020)

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Plate 2A5: Distribution Map of Sand Bars on Rivers During Pre-Monsoon Period of Purba Medinipur District (Source: ISRO RESOURCE Sat 2 LISS III Sensor, March 2020)

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Plate 2A6: Distribution Map of Sand Bars on Rivers During Pre-Monsoon Period of Purba Medinipur District (Source: ISRO RESOURCE Sat 2 LISS III Sensor, March 2020)

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Plate 2A7: Distribution Map of Sand Bars on Rivers During Pre-Monsoon Period of Purba Medinipur District (Source: ISRO RESOURCE Sat 2 LISS III Sensor, March 2020)

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Plate 2A8: Distribution Map of Sand Bars on Rivers During Pre-Monsoon Period of Purba Medinipur District (Source: ISRO RESOURCE Sat 2 LISS III Sensor, March 2020)

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Plate 2A9: Distribution Map of Sand Bars on Rivers During Pre-Monsoon Period of Purba Medinipur District (Source: ISRO RESOURCE Sat 2 LISS III Sensor, March 2020)

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PLATE 2B

DISTRIBUTION MAP OF SAND BARS ON RIVERS DURING POST-MONSOON PERIOD

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Plate 2B1: Distribution Map of Sand Bars on Rivers During Post-Monsoon Period of Purba Medinipur District (Source: ISRO RESOURCE Sat 2 LISS III Sensor, November 2020)

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Plate 2B2: Distribution Map of Sand Bars on Rivers During Post-Monsoon Period of Purba Medinipur District (Source: ISRO RESOURCE Sat 2 LISS III Sensor, November 2020)

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Plate 2B3: Distribution Map of Sand Bars on Rivers During Post-Monsoon Period of Purba Medinipur District (Source: ISRO RESOURCE Sat 2 LISS III Sensor, November 2020)

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Plate 2B4: Distribution Map of Sand Bars on Rivers During Post-Monsoon Period of Purba Medinipur District (Source: ISRO RESOURCE Sat 2 LISS III Sensor, November 2020)

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Plate 2B5: Distribution Map of Sand Bars on Rivers During Post-Monsoon Period of Purba Medinipur District (Source: ISRO RESOURCE Sat 2 LISS III Sensor, November 2020)

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Plate 2B6: Distribution Map of Sand Bars on Rivers During Post-Monsoon Period of Purba Medinipur District (Source: ISRO RESOURCE Sat 2 LISS III Sensor, November 2020)

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Plate 2B7: Distribution Map of Sand Bars on Rivers During Post-Monsoon Period of Purba Medinipur District (Source: ISRO RESOURCE Sat 2 LISS III Sensor, November 2020)

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Plate 2B8: Distribution Map of Sand Bars on Rivers During Post-Monsoon Period of Purba Medinipur District (Source: ISRO RESOURCE Sat 2 LISS III Sensor, November 2020)

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PLATE 3

WATERSHED MAP OF THE DISTRICT

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Plate 3A: Watershed Map of Purba Medinipur District (Source: World Wild Fund for Nature, September 2020)

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Plate 3B: District Watershed map showing ground water level during Pre-monsoon period (Source: World Wild Fund for Nature, September 2020)

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Plate 3C: District Watershed map showing ground water level during Post-monsoon period (Source: World Wild Fund for Nature, September 2020)

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PLATE 4

FIELD SURVEY PHOTOGRAPHS

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PLATE 5

LONG TERM EROSION-ACCRETION MAP OF RIVER BANK

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Plate 5: Map showing long-term (10-year or more) erosion-accretion areas on both the banks of Haldi River, Purba Medinipur (Source: ISRO RESOURCE Sat 2 LISS III Sensor)

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Annexure 1 Compliance as per Enforcement & Monitoring Guidelines for sand Mining, 2020 (MoEF& CC) for preparation of District Survey Report



SI. No.	Particulars	Status
1	District Survey Report for sand mining shall be prepared before the auction/e-auction/grant of the mining lease/Letter of Intent (LoI) by Mining department or department dealing the mining activity in respective states.	Noted.
2	In order to make the inventory of River Bed Material, a detailed survey of the district needs to be carried out, to identify the source of River Bed Material and alternative source of sand (M-Sand). The source will include rivers, de-siltation of reservoir/dams, Patta lands/Khatedari Land, M-sand etc.	Complied with and explained in Chapter 7 pg no 58 to 85.
3	District Survey Report is to be prepared in such a way that it not only identifies the mineral-bearing area but also define the mining and no mining zones considering various environmental and social factors.	Complied with and furnished in pg no 83-84.
4	Identification of the source of Sand & M-Sand. The sources may be from Rivers, Lakes, Ponds, Dams, De-silting locations, Patta land/Khtedari lands. The details in case of Rivers such as [name, length of river, type (Perennial or Non-Perennial), Villages, Tehsil, District], in case of Lakes, Ponds, Dams, De-silting locations [Name, owned/maintained by (State Govt./PSU), area, Villages, Tehsil, District] in case of Patta land/Khtedari lands [Owner Name, Sy No, Area, Agricultural/Non-Agricultural, Villages, Tehsil, District], in case of M-Sand Plant [Owner Name, Sy No, Area, Quantity/Annum, Villages, Tehsil, District], needs to be recorded.	
5	Defining the sources of Sand/M-Sand in the district is the next step for identification of the potential area of deposition/aggradation wherein mining lease could be granted. Detailed survey needs to be carried out for quantification of minerals. The purpose of mining in the river bed is for channelization of rivers so as to avoid the possibility of flooding and to maintain the flow of the rivers. For this, the entire river stretch needs to be surveyed and original ground level (OGL) to be recorded and area of aggradation/deposition needs to be ascertained by comparing the level difference between the outside riverbed OGL and water level. Once the area of aggradation/deposition is identified, then the quantity of River Bed Material available needs to be calculated. The next step is channelization of the river bed and for this central ³ / ₄ th part of the river, width needs to be identified on a map. Out of the ³ / ₄ th part area, where there is a deposition/aggradation of the material needs to be identified. The remaining ¹ / ₄ th area needs to be kept as no mining zone for the protection of banks. The specific gravity of the material also needs to be ascertained by analyzing the sample from a NABL accredited lab. Thus, the quantity of material available in metric ton needs to be calculated for mining and no mining zone.	Complied with and given in table 7.15 pg 82 to 83.

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SI. No.	Particulars	Status
6	The permanent boundary pillars need to be erected after identification of an area of aggradation and deposition outside the bank of the river at a safe location for future surveying. The distance between boundary pillars on each side of the bank shall not be more than 100 meters.	Benchmark pillars are established in strategic locations while boundary pillars will be fixed while fixation of the mining lease boundary subsequent to district level verification.
7	Identifying the mining and no mining zone shall follow with defining the area of sensitivity by ascertaining the distance of the mining area from the protected area, forest, bridges, important structures, habitation etc. and based on the sensitivity the area needs to be defined in sensitive and non-sensitive area.	Complied with and furnished in pg no 83 to 84.
8	Demand and supply of the Riverbed Material through market survey needs to be carried out. In addition to this future demand for the next 5 years also needs to be considered.	Complied with and given in pg no 10-11.
9	It is suggested that as far as possible the sensitive areas should be avoided for mining, unless local safety condition arises. Such deviation shall be temporary & shall not be a permanent feature.	Complied with and furnished in pg no 82 to 83.
10	Sand and gravel could be extracted from the downstream of the sand bar at river bends. Retaining the upstream one to two-thirds of the bar and riparian vegetation is accepted as a method to promote channel stability.	Noted. The DSR is composing of all the potential sand zones for defining the resources. In a subsequent phase blocking of potential zones shall be done in due consultation with the district level committee. The areas mentioned in the observation points shall be excluded while blocking of sand mining leases which are part of these potential zones marked in this DSR.
11	The final area selected for the mining should be then divided into mining lease as per the requirement of State Government. It is suggested the mining lease area should be so selected as to cover the entire deposition area. Dividing a large area of deposition/aggradation into smaller mining leases should be avoided as it leads to loss of mineral and indirectly promote illegal mining.	Shall be Complied with.
12	Cluster situation shall be examined. A cluster is formed when one mining lease of homogenous mineral is within 500 meters of the other mining lease. In order to reduce the cluster formation mining lease size should be defined in such a way that distance between any two clusters preferably should not be less than 2.5 Km. Mining lease should be defined in such a way that the total area of the mining leases in a cluster should not be more than 10 Ha.	Noted. Due care will be taken while distribution of mining leases either to prevent cluster situation or keeping the prescribed distance in-between two mining clusters.
13	The number of a contiguous cluster needs to be ascertained. Contiguous cluster is formed when one cluster is at a distance of 2.5 Km from the other cluster.	Noted and shall be complied with.



Sl. No.	Particulars	Status
14	The mining outside the riverbed on Patta land/Khatedari land be granted when there is possibility of replenishment of material. In case, there is no replenishment then mining lease shall only be granted when there is no riverbed mining possibility within 5 KM of the Patta land/Khatedari land. For government projects, mining could be allowed on Patta land/Khatedari land but the mining should only be done by the Government agency and material should not be used for sale in the open market. Cluster situation as mentioned in para k above is also applicable for the mining in Patta land/Khatedari land.	Noted.
15	The State Government should define the transportation route from the mining lease considering the maximum production from the mines as at this stage the size of mining leases, their location, the quantity of mineral that can be mined safely etc. is available with the State Government. It is suggested that the transportation route should be selected in such a way that the movement of trucks/tippers/tractors from the villages having habitation should be avoided. The transportation route so selected should be verified by the State Government for its carrying capacity.	Noted and final transport route will be submitted during preparation of mine plan.
16	Potential site for mining having its impact on the forest, protected area, habitation, bridges etc, shall be avoided. For this, a sub-divisional committee may be formed which after the site visit shall decide its suitability for mining.	Shall be Complied with.
17	Public consultation-The Comments of the various stakeholders may be sought on the list of mining lease to be auctioned. The State Government shall give an advertisement in the local and national newspaper for seeking comments of the general public on the list of mining lease included in the DSR. The DSR should be placed in the public domain for at least one month from the date of publication of the advertisement for obtaining comments of the general public. The comments so received shall be placed before the sub-divisional committee for active consideration. The final list of sand mining areas [leases to be granted on riverbed &Patta land/Khatedari land, de-siltation location (ponds/lakes/dams), M-Sand Plants (alternate source of sand)] after the public hearing needs to be defined in the final DSR.	After publication of the West Bengal Sand Mining Policy, 2021, it is now eminent that State owned The West Bengal Mineral Development and Trading Corporation Limited (WBMDTCL) shall be responsible for mining of sand/ gravel/ river bed materials in whole state of West Bengal. However, the existing mining leases which were in effect before hand of this Gazzate notification July 2021 will be in operation till the year 2027-28. In order to have the rational distribution of mining leases as per the prevailing norms and guidelines grant of mining leases in the state of West Bengal shall be carried out in phases till all the blocks are under the ambit of WBMDTCL. This DSR thus consist of the identified potential sand deposite areas within which the existing and future mining leases as and when granted shall follow the procedure described in EMGSM 2020 and prevailing norms.
18	The LOI should not be granted for mining area falling on both riverbed and outside riverbed. Therefore, in the same lease, both types of area should not be included.	Shall be Complied with.



Annexure 2

Estimation of Sand Resources based on sediment load comparison between Pre and Post Monsoon period



Abbreviation used in the table as below

PERIOD	PRE	PRE MONSOON
	PO	POST MONSOON
DISTRICT	PBS	PURBA MEDINIPUR
	PS	PANSHKURA
	NK	NANDAKUMAR
BLOCK	MY	MOYNA
	MH	MAHISHADAL
	BG	BAGWANPUR 1
	KS	KANGSABATI
	HD	HALDI
RIVER	KL	KELEGHAI
KIVEK	RS	RASULPUR
	RN	RUPNARAYAN
	НО	HOOGLY

	Pre monsoon						Post monsoon				
S L No	Sand Bar_Code	RL (m)	Area in sq.m.	Sand Thickn ess in m.	Sand Volum e in M. Cum	S L N o	Sand Bar_Code	RL (m)	Area in sq.m.	Sand Thickne ss in m.	Sand Volume in M. Cum
	Estimation of Sand Resources in Pre monsoon period & Post monsoon period of Haldi River										
1	PR_PBM_MY_HD_01	4.0	31198.49145	2.00	0.06	1	PO_PBM_MY_HD_0 1	5	22625.79959	3.00	0.07
2	PR_PBM_NK_HD_02	4.0	70260.05929	2.00	0.14	2	PO_PBM_NK_HD_0 2	5	41422.83429	3.00	0.12
3	PR_PBM_NK_HD_03	4.0	130203.5071	2.00	0.26	3	PO_PBM_NK_HD_0 3	5	43016.03588	3.00	0.13
4	PR_PBM_NK_HD_04	4.0	129424.7935	2.00	0.26	4	PO_PBM_NK_HD_0 4	5	-		
5	PR_PBM_NK_HD_05	4.0	182170.3544	2.00	0.36	5	PO_PBM_NK_HD_0 5	5	233502.8401	3.00	0.70
6	PR_PBM_NK_HD_06	4.0	267141.2359	2.00	0.53	6	PO_PBM_NK_HD_0 6	5	331350.1778	3.00	0.99
7	PR_PBM_NK_HD_07	4.0	258992.7743	2.00	0.52	7	PO_PBM_NK_HD_0 7	5	-		
8	PR_PBM_MH_HD_0 8	4.0	-			8	PO_PBM_MH_HD_ 08	5	81096.34873	3.00	0.24
	Estimat	tion of	Sand Resources	in Pre mo	onsoon pe	riod a	& Post monsoon period	l of Ka	ngsabati River		
1	PR_PBM_PS_KS_01	4.5	56977.58924	2.00	0.11	1	PO_PBM_PS_KS_01	5	100666.648	2.50	0.25
2	PR_PBM_PS_KS_02	3.5	7132.092306	2.00	0.01	2	PO_PBM_PS_KS_02	4	8663.363335	2.50	0.02
						3	PO_PBM_PS_KS_03	4	2284.829379	2.50	0.01
3	PR_PBM_PS_KS_03	3.5	76989.34821	2.00	0.15	4	PO_PBM_PS_KS_03 A	4	3011.693767	2.50	0.01
						5	PO_PBM_PS_KS_03	4	68516.12239	2.50	0.17

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Pre monsoon					Post monsoon						
S L	Sand Bar_Code	RL	Area in sq.m.	Sand	Sand Volum	S I	Sand Bar_Code	RL	Area in	Sand	Sand
No		(m)		Thickn	Volum	"	_04	(m)	64 M	Thickno	Volumo
						6	PO_PBM_PS_KS_04 (IVA)	4	3167.265105	2.50	0.01
						7	PO_PBM_PS_KS_04 (IVB)	4	4562.396279	2.50	0.01
4	PR_PBM_PS_KS_04	3.5	59562.5152	2.00	0.00	9	PO_PBM_PS_KS_04 (IVC)	4	18675.65878	2.50	0.05
						10	PO_PBM_PS_KS_04 A	4	1271.69371	2.50	0.003
						11	PO_PBM_PS_KS_04 B	4	647.065529	2.50	0.002
5	PR_PBM_PS_KS_05	3.5	15255.78567	2.00	0.03	12	PO_PBM_PS_KS_05	4	25019.41234	2.50	0.06
6	PR_PBM_PS_KS_06	3.0	7474.555076	2.00	0.01	12	_06	т	23013.41234	2.50	0.00
7	PR_PBM_PS_KS_07	3.0	13062.93696	2.00	0.03	13	PO_PBM_PS_KS_07	4			
8	PR_PBM_PS_KS_08	3.0	8710.434812	2.00	0.02	14	PO_PBM_PS_KS_08 A	4	2951.508279	2.50	0.01
						15	PO_PBM_PS_KS_08 _09	4	3559.647726	2.50	0.01
9	PR_PBM_PS_KS_09	3.5	3615.819795	2.00	0.01	16	PO_PBM_PS_KS_09 A	4	1689.052674	2.50	0.00
						17	PO_PBM_PS_KS_09 B	4	4106.60957	2.50	0.01
10	PR_PBM_PS_KS_10	3.5	6505.851375	2.00	0.01	18	PO_PBM_PS_KS_10	4	19226.64248	2.50	0.05
11	PR_PBM_PS_KS_11	3.5	19581.08776	2.00	0.04	19	PO_PBM_PS_KS_11	4	1898.389218	2.50	0.005
12	PR_PBM_PS_KS_12	3.5	8059.049881	2.00	0.02	20	PO_PBM_PS_KS_12	4			
13	PR_PBM_NK_KS_13	3.5	13173.9296	2.00	0.03	21	PO_PBM_PS_KS_13	4			
14	PR_PBM_MY_KS_14	3.5	9020.720167	2.00	0.02	22	PO_PBM_PS_KS_14	5			
15	PR_PBM_MY_KS_15	3.5	7418.195227	2.00	0.01	23	PO_PBM_PS_KS_15	3			
16	PR_PBM_MY_KS_16	3.5	7483.92916	2.00	0.01	24	PO_PBM_PS_KS_16	4			
17	PR_PBM_MY_KS_17	3.5	15291.68165	2.00	0.03	25	PO_PBM_PS_KS_17	4			
18	PR_PBM_MY_KS_18	3.5	10980.02496	2.00	0.02	26	PO_PBM_PS_KS_18	3			
19	PR_PBM_MY_KS_19	3.5	19232.80696	2.00	0.04	27	PO_PBM_PS_KS_19	4			
20	PR_PBM_MY_KS_20	3.5	21733.71438	2.00	0.04	28	PO_PBM_MY_KS_2 0	4	22693.12152	2.50	0.06
21	PR_PBM_MY_KS_21	3.5	24072.50497	2.00	0.05	29	PO_PBM_MY_KS_2 1	5	11382.34894	2.50	0.03
22	PR_PBM_MY_KS_22	4.0	10833.06635	2.00	0.02	20	PO_PBM_MY_KS_2	~	19009 40045	9.50	0.00
23	PR_PBM_MY_KS_23	4.0	7366.64248	2.00	0.01	30	2_23	5	12982.48945	2.50	0.03
	Estima	ation o	f Sand Resource	s in Pre m	ionsoon p	eriod	& Post monsoon perio	od of K	eleghai River		•
1	PR_PBM_MY_KL_01	90. 0	16001.52672	2.00	0.03		PO_PBM_MY_KL_0 1		57308.83382	2.50	0.14
2	PR_PBM_MY_KL_02	76.0	19481.95247	2.00	0.04	1	PO_PBM_MY_KL_0 2	76			
3	PR_PBM_MY_KL_03	77.0	90329.44077	2.00	0.18	2	PO_PBM_MY_KL_0 3	77	17567.13299	2.50	0.04
4	PR_PBM_MY_KL_04	71.0	30375.12621	2.00	0.06	3	PO_PBM_MY_KL_0 4	72	37263.68582	2.50	0.09
5	PR_PBM_MY_KL_05		30103.50501	2.00	0.06		PO_PBM_MY_KL_0 5		49231.21274	2.50	0.12
6	PR_PBM_MY_KL_06		51823.34231	2.00	0.10	4	PO_PBM_MY_KL_0 6	70	29969.96298	2.50	0.07

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	-											
	Pre monsoon						Post monsoon					
S L No	Sand Bar_Code	RL (m)	Area in sq.m.	Sand Thickn	Sand Volum	S	Sand Bar_Code	RL (m)	Area in	Sand Thickne	Sand Volume	
5	PR PBM MY KL 07	70.0	21487.39494	2.00	0.04	5	PO_PBM_MY_KL_0 7	71	33322.29175	2.50	0.08	
5	FK_FBM_WI_KL_07	70.0	21407.39494	2.00	00 0.04	6	PO_PBM_MY_KL_0 7A	70	26651.64909	2.50	0.07	
	PR_PBM_MY_KL_08	67.0	7.0 29119.64979	2.00		7	PO_PBM_MY_KL_0 8	69	26360.51184	2.50	0.07	
6					2 00	0.06	8	PO_PBM_MY_KL_0 8A	66	17521.58646	2.50	0.04
0					0.00	0.00	9	PO_PBM_MY_KL_0 8B	62	16100.32142	2.50	0.04
						10	PO_PBM_MY_KL_0 8C	60	9252.389889	2.50	0.02	
7	PR_PBM_BG_KL_09	55.0	33148.62925	2.00	0.07		PO_PBM_BG_KL_9	53				
8	PR_PBM_MY_KL_10	54.0	49012.28355	2.00	0.10	11	PO_PBM_MY_KL_1 0	53	9445.920621	2.50	0.02	
9	PR_PBM_MY_KL_11		19144.64539	2.00	0.04	12	PO_PBM_MY_KL_11	54				



Annexure 3 Boundary Coordinates of Potential Blocks of Purba Medinipur District



Abbreviation used in the table as below

	ABBREVIATION FORM							
PERIOD	PRE	PRE MONSOON						
	PO	POST MONSOON						
DISTRICT	PBS	PURBA MEDINIPUR						
	PS	PANSHKURA						
	NK	NANDAKUMAR						
BLOCK	MY	MOYNA						
	MH	MAHISHADAL						
	BG	BAGWANPUR 1						
	KS	KANGSABATI						
	HD	HALDI						
	KL	KELEGHAI						
RIVER	RS	RASULPUR						
	RN	RUPNARAYAN						
	НО	HOOGLY						

CODE	POINT_NO	LATITUDE	LONGITUDE
	1	22° 9' 45.362" N	87° 49' 15.306" E
	2	22° 9' 41.062" N	87° 49' 11.280" E
	3	22° 9' 42.833" N	87° 49' 12.083" E
	4	22° 9' 43.964" N	87° 49' 13.042" E
	5	22° 9' 46.191" N	87° 49' 14.481" E
PBM_MY_KL_01	6	22° 9' 48.075" N	87° 49' 16.777" E
	7	22° 9' 50.268" N	87° 49' 18.764" E
	8	22° 9' 51.468" N	87° 49' 20.375" E
	9	22° 9' 51.580" N	87° 49' 21.003" E
	10	22° 9' 50.226" N	87° 49' 19.146" E
	11	22° 9' 48.873" N	87° 49' 17.626" E
	1	22° 9' 52.487" N	87° 48' 15.088" E
	2	22° 9' 52.482" N	87° 48' 14.957" E
	3	22° 9' 52.728" N	87° 48' 12.120" E
	4	22° 9' 54.003" N	87° 48' 8.831" E
DDM MY VI 04	5	22° 9' 55.689" N	87° 48' 7.597" E
PBM_MY_KL_04	6	22° 9' 58.156" N	87° 48' 6.323" E
	7	22° 10' 1.363" N	87° 48' 4.020" E
	8	22° 10' 3.222" N	87° 48' 3.089" E
	9	22° 10' 3.049" N	87° 48' 3.456" E
	10	22° 10' 1.938" N	87° 48' 5.690" E

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CODE	POINT_NO	LATITUDE	LONGITUDE
	11	22° 9' 58.964" N	87° 48' 8.706" E
	12	22° 9' 57.144" N	87° 48' 9.802" E
	13	22° 9' 56.665" N	87° 48' 10.090" E
	14	22° 9' 56.660" N	87° 48' 10.093" E
	15	22° 9' 55.950" N	87° 48' 10.530" E
	16	22° 9' 55.679" N	87° 48' 10.720" E
	17	22° 9' 54.895" N	87° 48' 11.270" E
	18	22° 9' 53.730" N	87° 48' 12.777" E
	19	22° 9' 53.072" N	87° 48' 14.216" E
	20	22° 9' 52.838" N	87° 48' 15.288" E
	1	22° 9' 57.674" N	87° 47' 49.032" E
	2	22° 9' 55.707" N	87° 47' 45.497" E
	3	22° 9' 57.539" N	87° 47' 46.381" E
PBM_MY_KL_05	4	22° 10' 0.911" N	87° 47' 51.274" E
	5	22° 10' 2.555" N	87° 47' 54.399" E
	6	22° 10' 2.557" N	87° 47' 54.498" E
	7	22° 10' 2.020" N	87° 47' 54.786" E
	1	22° 9' 56.182" N	87° 47' 34.450" E
	2	22° 9' 56.061" N	87° 47' 36.619" E
	3	22° 9' 56.225" N	87° 47' 37.941" E
	4	22° 9' 56.230" N	87° 47' 37.978" E
	5	22° 9' 56.314" N	87° 47' 38.656" E
	6	22° 9' 56.564" N	87° 47' 39.210" E
	7	22° 9' 56.100" N	87° 47' 38.857" E
	8	22° 9' 55.195" N	87° 47' 37.376" E
	9	22° 9' 54.867" N	87° 47' 35.403" E
PBM_MY_KL_06	10	22° 9' 55.113" N	87° 47' 32.072" E
	11	22° 9' 56.223" N	87° 47' 26.275" E
	12	22° 9' 57.017" N	87° 47' 23.801" E
	13	22° 9' 58.374" N	87° 47' 23.470" E
	14	22° 9' 58.135" N	87° 47' 26.542" E
	15	22° 9' 57.324" N	87° 47' 29.522" E
	16	22° 9' 56.909" N	87° 47' 31.047" E
	17	22° 9' 56.899" N	87° 47' 31.082" E
	18	22° 9' 56.885" N	87° 47' 31.134" E
	19	22° 9' 56.792" N	87° 47' 31.476" E
	1	22° 9' 56.744" N	87° 46' 28.952" E
PBM_MY_KL_08	2	22° 9' 54.877" N	87° 46' 30.539" E
	3	22° 9' 54.484" N	87° 46' 30.451" E

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CODE	POINT_NO	LATITUDE	LONGITUDE
	4	22° 9' 55.824" N	87° 46' 28.683" E
	5	22° 9' 56.715" N	87° 46' 25.839" E
	6	22° 9' 56.715" N	87° 46' 21.796" E
	7	22° 9' 56.487" N	87° 46' 18.571" E
	8	22° 9' 56.580" N	87° 46' 19.084" E
	9	22° 9' 57.443" N	87° 46' 20.852" E
	10	22° 9' 57.937" N	87° 46' 23.812" E
	11	22° 9' 57.361" N	87° 46' 27.760" E
	1	22° 9' 58.499" N	87° 46' 13.424" E
	2	22° 9' 58.053" N	87° 46' 10.922" E
	3	22° 9' 58.259" N	87° 46' 8.558" E
	4	22° 9' 58.670" N	87° 46' 6.776" E
	5	22° 9' 59.972" N	87° 46' 4.481" E
PBM_MY_KL_08A	6	22° 10' 0.863" N	87° 46' 2.870" E
	7	22° 10' 1.120" N	87° 46' 2.352" E
	8	22° 10' 0.533" N	87° 46' 6.382" E
	9	22° 9' 59.471" N	87° 46' 10.699" E
	10	22° 9' 58.734" N	87° 46' 14.354" E
	11	22° 9' 58.499" N	87° 46' 13.424" E
	1	22° 9' 59.526" N	87° 45' 58.553" E
	2	22° 9' 58.847" N	87° 46' 0.142" E
	3	22° 9' 59.045" N	87° 45' 57.845" E
DDM MV KI OOD	4	22° 9' 59.657" N	87° 45' 48.044" E
PBM_MY_KL_08B	5	22° 10' 0.177" N	87° 45' 49.610" E
	6	22° 10' 0.657" N	87° 45' 49.713" E
	7	22° 10' 0.966" N	87° 45' 53.687" E
	8	22° 10' 0.417" N	87° 45' 56.223" E
	1	22° 10' 2.645" N	87° 45' 44.607" E
	2	22° 10' 2.439" N	87° 45' 41.249" E
	3	22° 10' 3.090" N	87° 45' 38.029" E
PBM_MY_KL_08C	4	22° 10' 4.700" N	87° 45' 35.356" E
	5	22° 10' 5.079" N	87° 45' 34.526" E
	6	22° 10' 3.343" N	87° 45' 40.547" E
	7	22° 10' 2.691" N	87° 45' 45.005" E
	1	22° 10' 30.705" N	87° 43' 58.914" E
	2	22° 10' 26.888" N	87° 43' 56.971" E
PBM_MY_KL_10	3	22° 10' 27.657" N	87° 43' 56.983" E
	4	22° 10' 29.199" N	87° 43' 57.189" E
	5	22° 10' 30.604" N	87° 43' 57.771" E

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CODE	POINT_NO	LATITUDE	LONGITUDE
	6	22° 10' 32.454" N	87° 43' 59.279" E
	7	22° 10' 33.071" N	87° 44' 0.341" E
	8	22° 10' 33.227" N	87° 44' 1.369" E
	1	22° 9' 43.357" N	87° 50' 40.856" E
	2	22° 9' 42.834" N	87° 50' 35.752" E
	3	22° 9' 44.056" N	87° 50' 37.585" E
	4	22° 9' 46.482" N	87° 50' 41.861" E
PBM_NK_HD_02	5	22° 9' 48.661" N	87° 50' 45.685" E
	6	22° 9' 49.689" N	87° 50' 49.509" E
	7	22° 9' 48.866" N	87° 50' 52.880" E
	8	22° 9' 47.378" N	87° 50' 55.420" E
	9	22° 9' 47.195" N	87° 50' 50.656" E
	1	22° 9' 45.824" N	87° 51' 15.001" E
	2	22° 9' 45.289" N	87° 51' 15.495" E
	3	22° 9' 46.317" N	87° 51' 12.205" E
	4	22° 9' 46.810" N	87° 51' 10.067" E
	5	22° 9' 47.386" N	87° 51' 8.464" E
PBM_NK_HD_03	6	22° 9' 48.085" N	87° 51' 6.490" E
	7	22° 9' 48.990" N	87° 51' 4.763" E
	8	22° 9' 49.894" N	87° 51' 3.858" E
	9	22° 9' 49.031" N	87° 51' 8.916" E
	10	22° 9' 48.250" N	87° 51' 11.671" E
	1	22° 8' 57.044" N	87° 52' 11.289" E
	2	22° 8' 56.235" N	87° 52' 11.148" E
	3	22° 8' 57.634" N	87° 52' 8.659" E
	4	22° 9' 1.869" N	87° 52' 3.972" E
	5	22° 9' 5.447" N	87° 52' 0.271" E
PBM_NK_HD_05	6	22° 9' 9.147" N	87° 51' 59.572" E
	7	22° 9' 9.421" N	87° 51' 59.559" E
	8	22° 9' 9.481" N	87° 52' 0.214" E
	9	22° 9' 7.667" N	87° 52' 3.560" E
	10	22° 9' 1.993" N	87° 52' 6.726" E
	11	22° 8' 57.470" N	87° 52' 10.715" E
	1	22° 8' 36.312" N	87° 52' 48.686" E
	2	22° 8' 33.139" N	87° 52' 51.737" E
DEM NE HE OG	3	22° 8' 34.143" N	87° 52' 48.867" E
PBM_NK_HD_06	4	22° 8' 35.514" N	87° 52' 36.189" E
	5	22° 8' 39.626" N	87° 52' 24.951" E
	6	22° 8' 40.672" N	87° 52' 23.239" E

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CODE	POINT_NO	LATITUDE	LONGITUDE
	7	22° 8' 40.972" N	87° 52' 24.290" E
	8	22° 8' 41.451" N	87° 52' 29.498" E
	9	22° 8' 41.177" N	87° 52' 33.884" E
	10	22° 8' 39.327" N	87° 52' 41.559" E
	1	22° 5' 58.150" N	87° 57' 28.901" E
	2	22° 5' 57.514" N	87° 57' 25.370" E
	3	22° 5' 57.771" N	87° 57' 21.515" E
	4	22° 5' 59.741" N	87° 57' 18.346" E
PBM_MH_HD_08	5	22° 6' 2.054" N	87° 57' 16.204" E
	6	22° 6' 3.767" N	87° 57' 14.834" E
	7	22° 6' 6.891" N	87° 57' 14.022" E
	8	22° 6' 4.435" N	87° 57' 15.516" E
	9	22° 5' 59.336" N	87° 57' 23.630" E
	1	22° 26' 24.240" N	87° 39' 36.341" E
	2	22° 26' 23.581" N	87° 39' 35.768" E
	3	22° 26' 24.229" N	87° 39' 33.955" E
	4	22° 26' 26.430" N	87° 39' 35.468" E
	5	22° 26' 28.650" N	87° 39' 36.928" E
	6	22° 26' 30.994" N	87° 39' 38.860" E
	7	22° 26' 32.248" N	87° 39' 39.559" E
	8	22° 26' 35.743" N	87° 39' 41.122" E
	9	22° 26' 38.529" N	87° 39' 42.396" E
PBM_PS_KS_01A	10	22° 26' 41.279" N	87° 39' 43.695" E
	11	22° 26' 40.889" N	87° 39' 44.513" E
	12	22° 26' 39.059" N	87° 39' 43.773" E
	13	22° 26' 37.517" N	87° 39' 42.992" E
	14	22° 26' 34.865" N	87° 39' 41.964" E
	15	22° 26' 33.323" N	87° 39' 41.738" E
	16	22° 26' 31.946" N	87° 39' 41.512" E
	17	22° 26' 31.591" N	87° 39' 41.667" E
	18	22° 26' 29.818" N	87° 39' 40.603" E
	19	22° 26' 26.858" N	87° 39' 38.561" E
	1	22° 26' 21.629" N	87° 39' 16.604" E
	2	22° 26' 19.904" N	87° 39' 15.957" E
	3	22° 26' 21.156" N	87° 39' 14.096" E
PBM_PS_KS_01B	4	22° 26' 24.103" N	87° 39' 10.135" E
	5	22° 26' 26.118" N	87° 39' 8.038" E
	6	22° 26' 27.009" N	87° 39' 6.572" E
	7	22° 26' 29.037" N	87° 39' 3.625" E

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CODE	POINT_NO	LATITUDE	LONGITUDE
	8	22° 26' 30.517" N	87° 39' 2.159" E
	9	22° 26' 32.505" N	87° 38' 57.978" E
	10	22° 26' 33.176" N	87° 38' 56.389" E
	11	22° 26' 33.388" N	87° 38' 55.904" E
	12	22° 26' 33.788" N	87° 38' 56.012" E
	13	22° 26' 34.620" N	87° 38' 56.238" E
	14	22° 26' 34.557" N	87° 38' 56.558" E
	15	22° 26' 33.899" N	87° 38' 58.202" E
	16	22° 26' 32.611" N	87° 39' 0.683" E
	17	22° 26' 30.829" N	87° 39' 3.164" E
	18	22° 26' 28.362" N	87° 39' 7.029" E
	19	22° 26' 26.443" N	87° 39' 9.496" E
	20	22° 26' 24.593" N	87° 39' 11.963" E
	21	22° 26' 22.592" N	87° 39' 14.608" E
	1	22° 27' 9.477" N	87° 41' 14.438" E
	2	22° 27' 9.378" N	87° 41' 14.057" E
	3	22° 27' 9.323" N	87° 41' 13.591" E
	4	22° 27' 9.392" N	87° 41' 13.153" E
	5	22° 27' 9.351" N	87° 41' 12.879" E
	6	22° 27' 8.282" N	87° 41' 11.755" E
	7	22° 27' 7.021" N	87° 41' 10.425" E
DDM DC VC 09 04	8	22° 27' 6.514" N	87° 41' 9.699" E
PDM_P3_N3_03_04	9	22° 27' 5.746" N	87° 41' 8.972" E
PBM_PS_KS_03_04	10	22° 27' 5.349" N	87° 41' 8.643" E
	11	22° 27' 4.417" N	87° 41' 8.164" E
	12	22° 27' 4.115" N	87° 41' 7.739" E
	13	22° 27' 3.814" N	87° 41' 6.807" E
	14	22° 27' 3.839" N	87° 41' 6.520" E
	15	22° 27' 8.976" N	87° 41' 11.349" E
	16	22° 27' 10.708" N	87° 41' 13.000" E
	1	22° 27' 5.304" N	87° 41' 10.411" E
	2	22° 27' 5.150" N	87° 41' 10.119" E
	3	22° 27' 5.219" N	87° 41' 9.897" E
	4	22° 27' 4.773" N	87° 41' 9.040" E
PBM_PS_KS_04(IVB)	5	22° 27' 4.636" N	87° 41' 8.526" E
	6	22° 27' 5.732" N	87° 41' 9.160" E
	7	22° 27' 6.298" N	87° 41' 10.359" E
	8	22° 27' 6.829" N	87° 41' 10.736" E
	9	22° 27' 7.291" N	87° 41' 11.079" E

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CODE	POINT_NO	LATITUDE	LONGITUDE	
	10	22° 27' 7.720" N	87° 41' 11.524" E	
	11	22° 27' 8.645" N	87° 41' 12.621" E	
	12	22° 27' 9.056" N	87° 41' 13.734" E	
	13	22° 27' 8.217" N	87° 41' 13.169" E	
	14	22° 27' 7.737" N	87° 41' 12.758" E	
	15	22° 27' 7.360" N	87° 41' 12.655" E	
	16	22° 27' 6.521" N	87° 41' 11.987" E	
	17	22° 27' 6.332" N	87° 41' 11.524" E	
	18	22° 27' 6.024" N	87° 41' 11.147" E	
	19	22° 27' 5.818" N	87° 41' 11.079" E	
	1	22° 27' 0.890" N	87° 41' 6.831" E	
	2	22° 27' 0.441" N	87° 41' 6.516" E	
	3	22° 27' 1.295" N	87° 41' 5.518" E	
	4	22° 27' 1.792" N	87° 41' 5.682" E	
	5	22° 27' 3.060" N	87° 41' 6.333" E	
	6	22° 27' 3.814" N	87° 41' 7.841" E	
	7	22° 27' 4.533" N	87° 41' 8.886" E	
PBM_PS_KS_04(IVC)	8	22° 27' 4.996" N	87° 41' 9.708" E	
	9	22° 27' 5.064" N	87° 41' 9.999" E	
	10	22° 27' 5.099" N	87° 41' 10.479" E	
	11	22° 27' 4.585" N	87° 41' 10.171" E	
	12	22° 27' 3.985" N	87° 41' 9.160" E	
	13	22° 27' 2.597" N	87° 41' 7.944" E	
	14	22° 27' 2.049" N	87° 41' 7.447" E	
	15	22° 27' 1.261" N	87° 41' 7.001" E	
	1	22° 26' 48.002" N	87° 41' 6.471" E	
	2	22° 26' 47.244" N	87° 41' 6.860" E	
	3	22° 26' 47.435" N	87° 41' 6.350" E	
	4	22° 26' 48.121" N	87° 41' 5.545" E	
	5	22° 26' 48.532" N	87° 41' 5.237" E	
	6	22° 26' 49.371" N	87° 41' 5.100" E	
	7	22° 26' 49.782" N	87° 41' 5.237" E	
PBM_PS_KS_04(IVD)	8	22° 26' 50.057" N	87° 41' 5.305" E	
	9	22° 26' 50.262" N	87° 41' 5.134" E	
	10	22° 26' 50.519" N	87° 41' 5.185" E	
	11	22° 26' 50.776" N	87° 41' 5.048" E	
	12	22° 26' 51.102" N	87° 41' 4.637" E	
	13	22° 26' 51.510" N	87° 41' 4.187" E	
	14	22° 26' 51.873" N	87° 41' 5.156" E	

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CODE	POINT_NO	LATITUDE	LONGITUDE	
	15	22° 26' 51.661" N	87° 41' 5.182" E	
	16	22° 26' 50.290" N	87° 41' 5.662" E	
	1	22° 26' 46.090" N	87° 41' 6.452" E	
	2	22° 26' 46.002" N	87° 41' 6.372" E	
	3	22° 26' 46.821" N	87° 41' 6.039" E	
	4	22° 26' 47.419" N	87° 41' 5.714" E	
PBM_PS_KS_04B	5	22° 26' 47.241" N	87° 41' 6.082" E	
	6	22° 26' 46.727" N	87° 41' 6.904" E	
	7	22° 26' 46.604" N	87° 41' 6.493" E	
	8	22° 26' 46.501" N	87° 41' 6.514" E	
	9	22° 26' 46.336" N	87° 41' 6.596" E	
	10	22° 26' 46.213" N	87° 41' 6.637" E	
	1	22° 26' 39.626" N	87° 41' 31.792" E	
	2	22° 26' 39.542" N	87° 41' 31.448" E	
	3	22° 26' 40.066" N	87° 41' 31.828" E	
	4	22° 26' 40.642" N	87° 41' 32.856" E	
	5	22° 26' 40.847" N	87° 41' 34.069" E	
	6	22° 26' 41.053" N	87° 41' 35.282" E	
	7	22° 26' 41.176" N	87° 41' 35.981" E	
	8	22° 26' 41.258" N	87° 41' 36.906" E	
DDM DC VC OF OCA	9	22° 26' 41.341" N	87° 41' 37.770" E	
PBM_PS_KS_05_06A	10	22° 26' 41.505" N	87° 41' 38.592" E	
	11	22° 26' 41.875" N	87° 41' 39.291" E	
	12	22° 26' 42.184" N	87° 41' 40.093" E	
	13	22° 26' 42.430" N	87° 41' 40.380" E	
	14	22° 26' 42.629" N	87° 41' 40.976" E	
	15	22° 26' 41.465" N	87° 41' 41.257" E	
	16	22° 26' 41.421" N	87° 41' 40.893" E	
	17	22° 26' 40.846" N	87° 41' 38.618" E	
	18	22° 26' 40.243" N	87° 41' 35.328" E	
	1	22° 26' 33.282" N	87° 41' 47.411" E	
	2	22° 26' 33.014" N	87° 41' 47.083" E	
	3	22° 26' 33.199" N	87° 41' 46.692" E	
	4	22° 26' 33.097" N	87° 41' 46.507" E	
PBM_PS_KS_05_06B	5	22° 26' 32.521" N	87° 41' 46.199" E	
	6	22° 26' 32.354" N	87° 41' 45.910" E	
	7	22° 26' 34.706" N	87° 41' 46.553" E	
	8	22° 26' 36.765" N	87° 41' 47.140" E	
	9	22° 26' 36.525" N	87° 41' 47.885" E	

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CODE	POINT_NO	LATITUDE	LONGITUDE
	10	22° 26' 36.222" N	87° 41' 47.761" E
	11	22° 26' 35.810" N	87° 41' 47.350" E
	12	22° 26' 35.317" N	87° 41' 47.185" E
	13	22° 26' 34.577" N	87° 41' 47.247" E
	14	22° 26' 33.631" N	87° 41' 47.370" E
	1	22° 26' 22.865" N	87° 42' 13.375" E
	2	22° 26' 22.619" N	87° 42' 14.013" E
	3	22° 26' 22.290" N	87° 42' 14.732" E
	4	22° 26' 22.230" N	87° 42' 14.358" E
	5	22° 26' 22.302" N	87° 42' 13.578" E
DDM DG WG OOA	6	22° 26' 21.827" N	87° 42' 9.643" E
PBM_PS_KS_08A	7	22° 26' 22.146" N	87° 42' 9.757" E
	8	22° 26' 22.578" N	87° 42' 10.661" E
	9	22° 26' 22.763" N	87° 42' 11.381" E
	10	22° 26' 22.783" N	87° 42' 11.833" E
	11	22° 26' 22.742" N	87° 42' 12.224" E
	12	22° 26' 22.824" N	87° 42' 12.882" E
	1	22° 26' 22.557" N	87° 42' 15.657" E
	2	22° 26' 22.434" N	87° 42' 15.246" E
	3	22° 26' 22.639" N	87° 42' 14.609" E
	4	22° 26' 22.927" N	87° 42' 13.848" E
	5	22° 26' 23.153" N	87° 42' 13.170" E
	6	22° 26' 23.400" N	87° 42' 13.293" E
PBM_PS_KS_08_09	7	22° 26' 23.813" N	87° 42' 13.628" E
	8	22° 26' 23.838" N	87° 42' 14.615" E
	9	22° 26' 23.235" N	87° 42' 17.850" E
	10	22° 26' 23.180" N	87° 42' 17.941" E
	11	22° 26' 23.174" N	87° 42' 17.405" E
	12	22° 26' 23.071" N	87° 42' 16.726" E
	13	22° 26' 22.804" N	87° 42' 16.212" E
	1	22° 26' 21.796" N	87° 42' 18.268" E
	2	22° 26' 21.531" N	87° 42' 18.100" E
	3	22° 26' 22.028" N	87° 42' 16.559" E
	4	22° 26' 22.138" N	87° 42' 15.363" E
PBM_PS_KS_09A	5	22° 26' 22.331" N	87° 42' 15.719" E
	6	22° 26' 22.516" N	87° 42' 16.562" E
	7	22° 26' 22.701" N	87° 42' 17.035" E
	8	22° 26' 22.680" N	87° 42' 17.466" E
	9	22° 26' 22.475" N	87° 42' 17.528" E

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CODE	POINT_NO	LATITUDE	LONGITUDE	
	10	22° 26' 22.269" N	87° 42' 17.836" E	
	11	22° 26' 22.043" N	87° 42' 18.248" E	
	1	22° 26' 10.243" N	87° 42' 22.719" E	
	2	22° 26' 8.735" N	87° 42' 22.792" E	
	3	22° 26' 8.920" N	87° 42' 22.585" E	
	4	22° 26' 9.660" N	87° 42' 21.928" E	
	5	22° 26' 10.708" N	87° 42' 21.640" E	
	6	22° 26' 12.230" N	87° 42' 21.290" E	
	7	22° 26' 12.703" N	87° 42' 21.311" E	
PBM_PS_KS_09B	8	22° 26' 13.299" N	87° 42' 21.187" E	
	9	22° 26' 14.244" N	87° 42' 21.372" E	
	10	22° 26' 14.512" N	87° 42' 21.619" E	
	11	22° 26' 13.710" N	87° 42' 21.804" E	
	12	22° 26' 13.429" N	87° 42' 21.974" E	
	13	22° 26' 13.298" N	87° 42' 21.980" E	
	14	22° 26' 11.836" N	87° 42' 22.328" E	
	1	22° 25' 49.366" N	87° 42' 14.988" E	
	2	22° 25' 48.298" N	87° 42' 14.113" E	
	3	22° 25' 48.608" N	87° 42' 13.478" E	
	4	22° 25' 49.152" N	87° 42' 13.146" E	
	5	22° 25' 49.783" N	87° 42' 13.678" E	
	6	22° 25' 50.646" N	87° 42' 14.223" E	
	7	22° 25' 53.802" N	87° 42' 16.186" E	
	8	22° 25' 55.200" N	87° 42' 17.214" E	
	9	22° 25' 57.811" N	87° 42' 19.023" E	
	10	22° 26' 1.285" N	87° 42' 20.925" E	
	11	22° 26' 4.184" N	87° 42' 21.521" E	
PBM_PS_KS_10	12	22° 26' 6.764" N	87° 42' 21.634" E	
	13	22° 26' 7.088" N	87° 42' 21.590" E	
	14	22° 26' 6.638" N	87° 42' 22.030" E	
	15	22° 26' 5.384" N	87° 42' 22.051" E	
	16	22° 26' 4.459" N	87° 42' 22.195" E	
	17	22° 26' 3.698" N	87° 42' 22.277" E	
	18	22° 26' 2.937" N	87° 42' 22.339" E	
	19	22° 26' 1.909" N	87° 42' 22.154" E	
	20	22° 26' 0.121" N	87° 42' 21.126" E	
	21	22° 25' 58.024" N	87° 42' 19.995" E	
	22	22° 25' 57.942" N	87° 42' 19.625" E	
	23	22° 25' 57.325" N	87° 42' 19.193" E	

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CODE	POINT_NO	LATITUDE	LONGITUDE
	24	22° 25' 56.687" N	87° 42' 19.049" E
	25	22° 25' 55.433" N	87° 42' 18.474" E
	26	22° 25' 54.447" N	87° 42' 17.836" E
	27	22° 25' 53.449" N	87° 42' 17.522" E
	28	22° 25' 52.408" N	87° 42' 16.828" E
	1	22° 10' 13.824" N	87° 49' 25.219" E
	2	22° 10' 13.495" N	87° 49' 22.834" E
	3	22° 10' 14.030" N	87° 49' 21.518" E
	4	22° 10' 15.510" N	87° 49' 20.531" E
	5	22° 10' 17.402" N	87° 49' 20.202" E
PBM_MY_KS_20	6	22° 10' 19.046" N	87° 49' 20.613" E
	7	22° 10' 21.020" N	87° 49' 20.942" E
	8	22° 10' 22.009" N	87° 49' 20.632" E
	9	22° 10' 21.342" N	87° 49' 21.114" E
	10	22° 10' 15.277" N	87° 49' 24.403" E
	11	22° 10' 14.436" N	87° 49' 26.176" E
	1	22° 10' 12.720" N	87° 49' 30.357" E
	2	22° 10' 12.350" N	87° 49' 29.124" E
	3	22° 10' 12.707" N	87° 49' 27.713" E
	4	22° 10' 13.208" N	87° 49' 28.755" E
	5	22° 10' 14.893" N	87° 49' 30.358" E
PBM_MY_KS_21	6	22° 10' 16.333" N	87° 49' 32.044" E
	7	22° 10' 17.114" N	87° 49' 33.401" E
	8	22° 10' 17.689" N	87° 49' 35.292" E
	9	22° 10' 17.625" N	87° 49' 35.895" E
	10	22° 10' 16.004" N	87° 49' 32.983" E



Annexure 4 Map showing of Potential Blocks of Purba Medinipur District



	POINT_NO	LAITTUDE	LONGITUDE			J	LEGEND			
	1	22° 9' 43.357" N	87° 50' 40.856" E		•	• COORDINATE				
	2	22° 9' 42.834" N	87° 50' 35.752" E				L BLOCK			
	3	22° 9' 44.056" N	87° 50' 37.585" E			SAFETY B	ARRIER			
	4	22° 9' 46.482" N	87° 50' 41.861" E			RIVER				
N"08	5	22° 9' 48.661" N	87° 50' 45.685" E				RATIVE_BLOCK_BOUNDARY	22°9'30"N		
22°9'30"N	6	22° 9' 49.689" N	87° 50' 49.509'' E		BOUNDARY	22°9				
	7	22° 9' 48.866" N	87° 50' 52.880" E			ABBRE	VIATION			
	8	22° 9' 47.378" N	87° 50' 55.420'' E		DISTRICT	PBM	PURBA MEDINIPUR			
	9	22° 9' 47.195" N	87° 50' 50.656" E		BLOCK	NK	NANDAKUMAR			
	0.065 0.0325 0	0.065 Kilometers	0.13 0.195		RIVER	HD	HALDI			
	87°50'35"E	87°50'40"	E	87°50'45"E	3	37°50'50"E	87°50'55"E			



	1	22 7 43.024 11	67 51 15.001 L					I	LEGEND	
7	2	22° 9' 45.289" N	87° 51' 15.495" E				•	COORDIN	ATE	z
22°9'40"N 	3	22° 9' 46.317" N	87° 51' 12.205" E					POTENTIA	L BLOCK	22°9'40"N
22°	4	22° 9' 46.810" N	87° 51' 10.067" E					SAFETY B	ARRIER	22
	5	22° 9' 47.386" N	87° 51' 8.464'' E					RIVER		
	6	22° 9' 48.085" N	87° 51' 6.490" E						RATIVE_BLOCK_BOUNDARY	
	7	22° 9' 48.990" N	87° 51' 4.763'' E					DISTRICT	BOUNDARY	
	8	22° 9' 49.894" N	87° 51' 3.858" E				F	ABBRE	VIATION	
	9	22° 9' 49.031" N	87° 51' 8.916" E			DISTR	ICT	PBM	PURBA MEDINIPUR	-
	10	22° 9' 48.250" N	87° 51' 11.671" E			BLOC	К	NK	NANDAKUMAR	-
	0.04 0.02 0	0.04	0.08 0.	12		RIVER		HD	HALDI	
		Kilometers								<u>></u>
	87°51'5"E				87°51'10"E				87°51'15"E	-



	1		07 52 11.209 E			LEGEND
	2	22° 8' 56.235" N	87° 52' 11.148" E	•	COORDIN	ATE
	3	22° 8' 57.634'' N	87° 52' 8.659" E			
	4	22° 9' 1.869" N	87° 52' 3.972" E		SAFETY B	
	5	22° 9' 5.447'' N	87° 52' 0.271" E			
	6	22° 9' 9.147'' N	87° 51' 59.572" E			
	7	22° 9' 9.421" N	87° 51' 59.559" E		 • •	RATIVE_BLOCK_BOUNDARY
	8	22° 9' 9.481" N	87° 52' 0.214'' E			BOUNDART
	9	22° 9' 7.667" N	87° 52' 3.560'' E		ABBRE	VIATION
	10	22° 9' 1.993" N	87° 52' 6.726" E	DISTRICT	PBM	PURBA MEDINIPUR
	11	22° 8' 57.470" N	87° 52' 10.715" E	BLOCK	NK	NANDAKUMAR
0.04	0.02 0	0.04	0.08 0.1			
		Kilometers		RIVER	HD	HALDI
	87°52'0"E				87°52'1	0"E









	10	22 20 35.170 N					EGEND	
4"N	11	22° 26' 33.388" N	87° 38' 55.904'' E			COORDINA	TE	14"N
22°26'14"N	12	22° 26' 33.788" N	87° 38' 56.012" E	_				1 22°26'14"N
22,	13	22° 26' 34.620" N	87° 38' 56.238" E					52
	14	22° 26' 34.557" N	87° 38' 56.558" E			SAFETY BA	RRIER	
N"S	15	22° 26' 33.899" N	87° 38' 58.202'' E			RIVER		2"N
22°26'12"N	16	22° 26' 32.611" N	87° 39' 0.683" E				ATIVE_BLOCK_BOUNDARY	22°26'13
22	17	22° 26' 30.829" N	87° 39' 3.164" E			DISTRICT B	OUNDARY	5
	18	22° 26' 28.362" N	87° 39' 7.029" E					
N"0.	19	22° 26' 26.443" N	87° 39' 9.496" E			ABBREVIATI	ON	10"N
22°26'1	20	22° 26' 24.593" N	87° 39' 11.963" E		DISTRICT	PBM	PURBA MEDINIPUR	22°26'
7	21	22° 26' 22.592" N	87° 39' 14.608'' E		BLOCK	PS	PANSKURA	
	0.065 0.0325	0 0.065 Kilometer:	0.13	0.195	RIVER	KS	KANGSABATI	N"8'č
	87°38'56"E	87°38'58"E 87°39'0"I		87°39'4"E	87°39'6"E 87°39'8"E	87°39'10"E 87°39'12"E	87°39'14"E 87°39'16"E	22°26'



				10	22° 27' 5.34	19" N	87° 41' 8.643" E	
				11	22° 27' 4.41	7" N	87° 41' 8.164" E	
		1		12	22° 27' 4.11	5" N	87° 41' 7.739" E	
2"N	LEGEND			13	22° 27' 3.81	4" N	87° 41' 6.807" E	22°27'2''N
22°27	COORDINATE			14	22° 27' 3.83	39" N	87° 41' 6.520" E	22°2′
	POTENTIAL BLOCK			15	22° 27' 8.97	76" N	87° 41' 11.349" E	
	SAFETY BARRIER			16	22° 27' 10.7	08" N	87° 41' 13.000" E	
	RIVER]
	ADMINISTRATIVE_BLOCK_BOUNDARY			ABBR	EVIATIO	JN		
	DISTRICT BOUNDARY		DISTRICT	P	BM	PURI	BA MEDINIPUR	
			BLOCK]	PS	F	PANSKURA	
	0.025 0.0125 0 0.025 0.05 Kilometers	0.075	RIVER	I	KS	K	ANGSABATI	
	87°41'8"E	87°41'10"E		87°41'12"E			87°41'14"E	±



22°274"N		12	22 21 9	2.030 IN 87 41	15./54 E
		13	22° 27' 8	.217" N 87° 41'	13.169" E
		14	22° 27' 7	7.737" N 87° 41'	12.758" E
LEGEND		15	22° 27' 7	7.360" N 87° 41'	12.655" E
		16	22° 27' 6	5.521" N 87° 41'	11.987" E
		17	22° 27' 6	5.332" N 87° 41'	11.524" E
POTENTIAL BLOCK		18	22° 27' 6	5.024" N 87° 41'	11.147" E
SAFETY BARRIER		19	22° 27' 5	5.818" N 87° 41'	11.079'' E
	VER ARREVIATION				
ADMINISTRATIVE BLOCK BOUNDARY					
DISTRICT BOUNDARY	DISTR	RICT 2	PBM	PURBA MEI	DINIPUR
			PANSK	URA	
0.015 0.0075 0 0.015 0.03 Kilometers		{	KS	KANGSA	BATI
87°41'8"E 87°41'	10"E	87°41'12	2"Е		





POTENTIAL BLOCK PBM_PS_KS_04B OF KANGSABATI RIVER

87°41'6"E




POTENTIAL BLOCK PBM_PS_KS_05_06B OF KANGSABATI RIVER



	87°41'46"E		87°41'48"E		87°41'	50"E
22°26'36"N			9 10			E 22°26'36"N
22°2634"N		PAD 114	SKURA	PBM_PS_KS_	05 06B	22°26'34"N
22°26'32"N		Barrier and a second and a se	POINT_ 1 2 3 4 5 6 7 8 9 10	NO LATITUI 22° 26' 33.282 22° 26' 33.014 22° 26' 33.014 22° 26' 33.097 22° 26' 33.097 22° 26' 33.097 22° 26' 32.521 22° 26' 32.521 22° 26' 32.521 22° 26' 34.706 22° 26' 36.765 22° 26' 36.525 22° 26' 36.525	DE LONGITUDE "N 87° 41' 47.411" E "N 87° 41' 47.083" E "N 87° 41' 46.692" E "N 87° 41' 46.507" E "N 87° 41' 46.199" E "N 87° 41' 46.507" E "N 87° 41' 46.507" E "N 87° 41' 46.507" E "N 87° 41' 46.553" E "N 87° 41' 47.140" E "N 87° 41' 47.761" E	22°26'32"N
PC	LEGEND ORDINATE DTENTIAL BLOCK FETY BARRIER VER MINISTRATIVE_BLOCK_BOUNDARY STRICT BOUNDARY	03 0.045	11 12 13 14 DISTRICT BLOCK RIVER 87°41'48"E	22° 26' 35.810 22° 26' 35.317 22° 26' 34.577 22° 26' 33.631 ABBREVIATI PBM PS KS	 " N 87° 41' 47.185" E " N 87° 41' 47.247" E " N 87° 41' 47.370" E ON PURBA MEDINIPUR PANSKURA KANGSABATI 	

POTENTIAL BLOCK PBM_PS_KS_08A OF KANGSABATI RIVER



			8	22° 26' 22.578" N	87° 42' 10.661" E	
			9	22° 26' 22.763" N	87° 42' 11.381" E	
			10	22° 26' 22.783" N	и 87° 42' 11.833" Е	
	LEGEND		11	22° 26' 22.742" N	и 87° 42' 12.224" Е	
	COORDINATE POTENTIAL BLOCK		12	22° 26' 22.824" N	и 87° 42' 12.882" Е	
	SAFETY BARRIER			ABBREVIATI	ON	
	ADMINISTRATIVE_BLOCK_BOUNDARY		DISTRICT	PBM	PURBA MEDINIPUR	
			BLOCK	PS	PANSKURA	
	0.015 0.0075 0 0.015	0.03 0.045	RIVER	KS	KANGSABATI	
0	Kilometers					

POTENTIAL BLOCK PBM_PS_KS_08_09 OF KANGSABATI RIVER



-	87°42'14"E			87	°42'16"E				87°42'18"E	
	0.015 0.0075 0 0.015 Kilometers	0.03	0.045	RIVER			KS	K	KANGSABATI	
				BLOCK			PS		PANSKURA	
	ADMINISTRATIVE_BLOCK_BOUNDARY			DISTRIC	T]	PBM	PUR	BA MEDINIPUR	
	RIVER					ABB	REVIATI	ON		
	SAFETY BARRIER									
	COORDINATE POTENTIAL BLOCK				1	13	22° 26' 22.80	4" N	87° 42' 16.212'' E	
]]	12	22° 26' 23.07	'1" N	87° 42' 16.726'' E	
					1	1	22° 26' 23.17	'4" N	87° 42' 17.405'' E	
					1	10	22° 26' 23.18	80" N	87° 42' 17.941" E	
22°26'20"N						9	22° 26' 23.23	5" N	87° 42' 17.850'' E	22°2€
20"N						8	22° 26' 23.83	8" N	87° 42' 14.615" E	22°26'20"N
						7	22° 26' 23.81	3" N	87° 42' 13.628'' E	

POTENTIAL BLOCK PBM_PS_KS_09A OF KANGSABATI RIVER





5

22° 26' 22.331" N

87° 42' 15.719" E

22°26'20"N

POTENTIAL BLOCK PBM_PS_KS_09B OF KANGSABATI RIVER









22°10'10"N



	FOINT_NO	LAIIIUDE	LUNGITUDE				LEGEND	22°10'10"N			
22°10'10"N J	1	22° 10' 12.720" N	87° 49' 30.357" E			COORDINATE					
22°1(2	22° 10' 12.350" N	87° 49' 29.124'' E			POTENTIAL BLOCK					
	3	22° 10' 12.707" N	87° 49' 27.713" E		SAFETY BARRIER						
	4	22° 10' 13.208" N	87° 49' 28.755" E		RIVER						
	5	22° 10' 14.893" N	87° 49' 30.358" E								
	6	22° 10' 16.333" N	87° 49' 32.044" E		DISTRICT BOUNDARY						
	7	22° 10' 17.114" N	87° 49' 33.401" E								
	8	22° 10' 17.689" N	87° 49' 35.292'' E			ABBREVIAT	ION				
	9	22° 10' 17.625" N	87° 49' 35.895" E		DISTRICT	PBM	PURBA MEDINIPUR				
	10	22° 10' 16.004" N	87° 49' 32.983" E		BLOCK	MY	MOYNA				
	0.025 0.0125 0	0.025 Kilometers	0.05 0.07	25	RIVER	KS	KANGSABATI				
			в 87°49'30"Е				87°49'35"E				





	_							LEGEND	
		10	22° 10' 1.938" N	87° 48' 5.690" E					
		11	22° 9' 58.964" N	87° 48' 8.706" E			COORDIN		z
N"84'0°CC		12	22° 9' 57.144" N	87° 48' 9.802'' E			POTENTIA	AL BLOCK	22°9'48"N
<u>,,,,</u>		13	22° 9' 56.665" N	87° 48' 10.090'' E			SAFETY B	ARRIER	22°
		14	22° 9' 56.660" N	87° 48' 10.093" E			RIVER		
		15	22° 9' 55.950" N	87° 48' 10.530'' E			ADMINIST	RATIVE_BLOCK_BOUNDARY	
		16	22° 9' 55.679" N	87° 48' 10.720'' E			DISTRICT	BOUNDARY	
		17	22° 9' 54.895" N	87° 48' 11.270'' E					
		18	22° 9' 53.730" N	87° 48' 12.777" E			ABBREV	IATION	
	,	19	22° 9' 53.072" N	87° 48' 14.216'' E		DISTRICT	PBM	PURBA MEDINIPUR	z
0'45"N		20	22° 9' 52.838" N	87° 48' 15.288" E		BLOCK	MY	MOYNA	22°9'45"N
220		.055 0.0275	0	0.055	0.11 0.165		17.1		22
				Kilometers		RIVER	KL	KELEGHAI	
		87°48'3"E		87°48'6"E	87°48'9"E	87°	48'12"E	87°48'15"E	





	9		22° 9' 54.867'' N	87° 47' 35.403" E						LEGEND	
	10)	22° 9' 55.113" N	87° 47' 32.072'' E						IATE	
	11		22° 9' 56.223" N	87° 47' 26.275'' E						AL BLOCK	
	12	2	22° 9' 57.017" N	87° 47' 23.801" E					SAFETY E	BARRIER	
	13	}	22° 9' 58.374" N	87° 47' 23.470'' E					RIVER		
	14	ŀ	22° 9' 58.135" N	87° 47' 26.542'' E		BHAGWAN	PUR 1			RATIVE_BLOCK_BOUNDAR	
22°9'45"N I	15	5	22° 9' 57.324" N	87° 47' 29.522'' E					DISTRICT	BOUNDARY	22°9'45"N
22°9'.	16	5	22° 9' 56.909" N	87° 47' 31.047" E							22°5
	17	7	22° 9' 56.899" N	87° 47' 31.082'' E					ABBREV	IATION	
	18	8	22° 9' 56.885" N	87° 47' 31.134'' E				DISTRICT	- PBM	PURBA MEDINIPU	ЛR
	19)	22° 9' 56.792" N	87° 47' 31.476" E				BLOCK	MY	MOYNA	
	0.06 0	.03	0	0.06 0.1	2	0.18					
			Ki	lometers				RIVER	KL	KELEGHAI	
'		879	°47'25"E		ا 87°47'	'30''E			87°47'35"E		87°47'40"E









		NO LAIIIODE	LUNUITUDE				LEGEND	
	1	22° 9' 59.526" N	87° 45' 58.553" E			• COORDIN	ATE	
	2	22° 9' 58.847" N	87° 46' 0.142'' E				L BLOCK	
	3	22° 9' 59.045" N	87° 45' 57.845" E			SAFETY B	ARRIER	
	4	22° 9' 59.657" N	87° 45' 48.044" E				RATIVE BLOCK BOUNDARY	-
	5	22° 10' 0.177" N	87° 45' 49.610'' E	ANPUR 1			BOUNDARY	
0"N	6	22° 10' 0.657" N	87° 45' 49.713'' E			ABBREV	ΙΑΤΙΟΝ	50"N
22°9'50"N	7	22° 10' 0.966" N	87° 45' 53.687" E		DISTRICT		PURBA MEDINIPUR	22°9'50"N
	8	22° 10' 0.417" N	87° 45' 56.223" E	1				
					BLOCK	MY	MOYNA	
	0.045 0.0225	0 0.045 Kilometers	0.09 0.133		RIVER	KL	KELEGHAI	
		87°45'50"E			87°45'55"E		87°46'0"E	•

POTENTIAL BLOCK PBM_MY_KL_08C OF KELEGHAI RIVER



POTENTIAL BLOCK PBM_MY_KL_10 OF KELEGHAI RIVER



		PBM_MY_KL	_10				LEGEND	
	POINT_	NO LATITUDE	LONGITUDE			• COORDIN	IATE	
	1	22° 10' 30.705" N	87° 43' 58.914" E		•	POTENTI	AL BLOCK	z
10'25"N	2	22° 10' 26.888" N	87° 43' 56.971" E			SAFETY E	BARRIER	22°10'25"N
22°1(3	22° 10' 27.657" N	87° 43' 56.983" E	-		RIVER		22°1
	4	22° 10' 29.199" N	87° 43' 57.189" E				RATIVE_BLOCK_BOUNDARY	
	5	22° 10' 30.604" N	87° 43' 57.771" E	•			BOUNDARY	
	6	22° 10' 32.454" N	87° 43' 59.279" E			ABBREV	IATION	
	7	22° 10' 33.071" N	87° 44' 0.341" E	DI	ISTRICT	PBM	PURBA MEDINIPUR	
	8	22° 10' 33.227" N	87° 44' 1.369" E	BL	LOCK	MY	MOYNA	-
	0.03 0.015	0 0.03 Kilometers	0.06	0.09 RI	VER	KL	KELEGHAI	
		87°43'55"E			87°4	I 44'0"E	·	•



Annexure 5 SEIAA 73rd Meeting (8th September, 2022) Minutes of Meeting

State Environment Impact Assessment Authority Pranisampad Bhawan, 5th Floor, Sector-III, Salt Lake, Kolkata - 700106 (West Bengal) Minutes of SEIAA Meeting

Subject:- 73rd meeting of SEIAA

Conference Room of Environment Department, Prani Sampad Bhavan, 5th Floor, LB Block, Venue:-Sector III, Salt Lake, Kolkata 700106.

From :- 08 September 2022

To :-08 September 2022

1. Proposal No. :- SIA/WB/IND2/152174/2020 File No- EN/T-II-1/013/2020

Proposed Exploratory Drilling (10 wells) in NELP VII Block WB-ONN-2005/4, situated in North Type-24 Parganas and Nadia Districts, West Bengal by M/s. Oil & Natural Gas Corporation Limited, EC **HSE MBA Basin**

INTRODUCTION

The proponent made online application vide proposal no. SIA/WB/IND2/152174/2020 dated 17 Jul 2020 along with copies of EIA/EMP seeking environment clearance under the provisions of the EIA Notification, 2006 for the above mentioned project. The proposed project activity is listed at SL.No. 1(b) Offshore and onshore oil and gas exploration, development & production, under Category "B2" of EIA Notification 2006 and the proposal is appraised at State level.

SEAC recommended the proposed project for Environmental Clearance with the following additional condition:

1. Short term need-based activities to be identified and implemented. Name of the beneficiary should be displayed at site.

11	State of the project			
S. No.	State	District	Tehsil	Village
1.	West Bengal	Nadia	Ranaghat - I	Noapara
2.	West Bengal	Nadia	Ranaghat - II	Matikumra
3.	West Bengal	Nadia	Haringhata	Haringhata
4.	West Bengal	North 24 Parganas	Habra - I	Asokenagar
5.	West Bengal	North 24 Parganas	Habra - II	Beraberi

PROJECT DETAILS

The production details / project configuration is as follows

Project configuration/product details

S. No.	Project configuration/product details	Quantity	Unit	Other Unit	Mode of Transport/Transmission of Product	Other Mode of Transport
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1. Crude Oil & Natural Gas	0	9	MMT (oil) and BCM (Gas)	Road	
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Raw Material Requirement is as follows :

	Raw	Material F	Requir	ement d	etails			
S. No.	Item	Quantity per annum	Unit	Other Unit	Source	Mode of Transport/Transmission of Product	Other Mode of Transport	Distance of Source from Project Site(Kilometers)
1.	High speed diesel	600	9	Kilo Liters	IOC Depot	Road		45

DELIBERATION IN SEIAA

SEIAA considered the recommendation of SEAC and accepted the same.

RECOMMENDATIONS OF SEIAA

The application for EC is approved.

Conclusion

Recommended

S.No	10	Conditions
	A. Sp	ecific conditions:-
	i)	No drilling shall be carried out in Protected Areas/forest area.
	ii)	Approach road shall be made pucca to minimize generation of suspended dust.
(1)	iii) iv)	Total water requirement shall not exceed 22 KLD/well proposed to be met through tankers. Mobile ETP shall be installed coupled with RO to reuse the treated water in drilling system. Size of the waste shall not exceed from the hole volume of the well + volume of drill cutting expected to be generated and volume of discarded mud if any. Two feet free board may be left to accommodate rain water. There shall be separate storm water channel and rain water shall not be allowed to mix with waste water. Alternatively, if possible, pit less drilling be practiced instead of above. No lead acid batteries shall be utilized in the project/site.
	P.C.	neral Conditions
1		tatutory compliance
	(i)	The project proponent shall obtain forest clearance under the provisions of Forest (Conservation) Act, 1986, if drilling is carried in Forest areas.
	(ii)	The project proponent shall obtain Consent to Establish / Operate under the provisions of Air (Prevention & Control of Pollution) Act, 1981 and the Water (Prevention & Control of Pollution) Act, 1974 from the State pollution Control Board.
1.	(iii)	Necessary authorization required under the Hazardous and Other Wastes (Management and Trans-Boundary Movement) Rules, 2016, Solid Waste Management Rules, 2016

shall be obtained and the provisions contained in the Rules shall be strictly adhered to.

(iv) The project proponent shall obtain and adhere to statutory clearance under the Coastal Regulation Zone Notification, 2011, if applicable.

II. Air quality monitoring and preservation

- The National Ambient Air Quality Emission Standards issued by the Ministry vide G.S.R. No. 826(E) dated 16th November, 2009 shall be complied with.
- ii) The locations of ambient air quality monitoring stations shall be decided in consultation with the State Pollution Control Board (SPCB) and it shall be ensured that at least one stations each is installed in the upwind and downwind direction as well as where maximum ground level concentrations are anticipated.
- iii) Ambient air quality shall be monitored at the nearest human settlements as per the National Ambient Air Quality Emission Standards issued by the Ministry vide G.S.R. No. 826(E) dated 16th November, 2009 for PM10, PM2.5, SO2, NOX, CO, CH4, HC, Nonmethane HC etc.
- iv) During exploration, production, storage and handling, the fugitive emission of methane, if any, shall be monitored.
- The project proponent also to ensure trapping/storing of the CO₂ generated, if any, during the process and handling.
- vi) Approach road shall be made pucca to minimize generation of suspended dust.

III. Water quality monitoring and preservation

- As proposed by the project proponent, Zero Liquid Discharge shall be ensured and no waste/treated water shall be discharged to any surface water body, sea and/or on land. Domestic sewage shall be disposed off through septic tank/soak pit.
- ii) The effluent discharge shall conform to the standards prescribed under the Environment (Protection) Rules, 1986, or as specified by the State Pollution Control Board while granting Consent under the Air/Water Act, whichever is more stringent.
- iii) The project proponent shall construct the garland drain all around the drilling site to prevent runoff of any oil containing waste into the nearby water bodies. Separate drainage system shall be created for oil contaminated and non-oil contaminated. Effluent shall be properly treated and treated wastewater shall conform to CPCB standards.
- iv) Drill cuttings separated from drilling fluid shall be adequately washed and disposed in HDPE lined pit. Waste mud shall be tested for hazardous contaminants and disposed according to HWMH Rules, 2016. No effluent/drilling mud/drill cutting shall be discharged/disposed off into nearby surface water bodies. The project proponent shall comply with the guidelines for disposal of solid waste, drill cutting and drilling fluids for onshore drilling operation notified vide GSR.546(E) dated 30th August, 2005.

IV. Noise monitoring and prevention

- i) Acoustic enclosure shall be provided to DG set for controlling the noise pollution.
- The overall noise levels in and around the drilling location areas shall be kept well within the standards by providing noise control measures including acoustic hoods, silencers, enclosures etc. on all sources of noise generation.
- The ambient noise levels should conform to the standards prescribed under E(P)A Rules, 1986 viz. 75 dB(A) during day time and 70 dB(A) during night time.

V. Energy Conservation measures

i) The energy sources for lighting purposes shall preferably be LED based.

VI. Waste management

- Oil spillage prevention and mitigation scheme shall be prepared. In case of oil spillage/ contamination, action plan shall be prepared to clean the site by adopting proven technology. The recyclable waste (oily sludge) and spent oil shall be disposed of to the authorized recyclers.
- Oil content in the drill cuttings shall be monitored by Authorized agency and report shall be sent to the State Environment Impact Assessment Authority.

VII. Safety and Human health issues

- Emergency preparedness plan based on the Hazard identification and Risk Assessment (HIRA) and Disaster Management Plan shall be implemented.
- Blow Out Preventer system shall be installed to prevent well blowouts during drilling operations. BOP measures during drilling shall focus on maintaining well bore hydrostatic pressure by proper pre-well planning and drilling fluid logging etc.
- iii) The project proponent shall prepare operating manual in respect of all activities, which would cover all safety & environment related issues and measures to be taken for protection. One set of environmental manual shall be made available at the drilling site/ project site. Awareness shall be created at each level of the management. All the schedules and results of environmental monitoring shall be available at the project site office. Remote monitoring of site should be done.
- iv) On completion of drilling, the project proponent should plug the drilled wells safely and obtain certificate from environment safety angle from the concerned authority.
- v) The project proponent shall take measures after completion of drilling process by well plugging and secured enclosures, decommissioning of rig upon abandonment of the well and drilling site shall be restored the area in original condition. In the event that no economic quantity of hydrocarbon is found a full abandonment plan shall be implemented for the drilling site in accordance with the applicable Indian Petroleum Regulations.
- vi) The project proponent shall take necessary measures to prevent fire hazards, containing oil spill and soil remediation as needed. Possibility of using ground flare shall be explored. At the place of ground flaring, the overhead flaring stack with knockout drums shall be installed to minimize gaseous emissions during operation.
- vii) Training shall be imparted to all employees on safety and health aspects of chemicals handling. Pre-employment and routine periodical medical examinations for all employees shall be undertaken on regular basis. Training to all employees on handling of chemicals shall be imparted.
- viii) The project proponent shall develop a contingency plan for H₂S release including all necessary aspects from evacuation to resumption of normal operations. The workers shall be provided with personal H₂S detectors in locations of high risk of exposure along with self-containing breathing apparatus
- ix) Provision shall be made for the housing of construction labour within the site with all necessary infrastructure and facilities such as fuel for cooking, mobile toilets, mobile STP, safe drinking water, medical health care, creche etc. The housing may be in the form of temporary structures to be removed after the completion of the project.
- Occupational health surveillance of the workers shall be done on a regular basis and records maintained as per the Factories Act.
- xi) The project proponent shall carry out long term subsidence study by collecting base line data before initiating drilling operation till the project lasts. The data so collected shall be submitted six monthly to the Ministry of Environment, Forests & Climate

Change / State Environment Impact Assessment Authority / State Pollution Control Board.

VIII. Environment Management Plan (EMP)

- The project proponent should submit the proposed EMP on a six monthly basis. The Office Memorandum issued by the MoEF & CC vide F. No. 22-65/2017-IA.III dated 30.09.2020 should be strictly followed.
- ii) Need based activities for local people is part of the EMP.
- iii) The company shall have a well laid down environmental policy duly approve by the Board of Directors. The environmental policy should prescribe for standard operating procedures to have proper checks and balances and to bring into focus any infringements/deviation/violation of the environmental / forest /wildlife norms/ conditions. The company shall have defined system of reporting infringements / deviation / violation of the environmental / forest / wildlife norms / conditions and / or shareholders / stake holders. The copy of the board resolution in this regard shall be submitted to the Ministry of Environment, Forests & Climate Change / State Environment Impact Assessment Authority / State Pollution Control Board as a part of six-monthly report.
- iv) A separate Environmental Cell both at the project and company head quarter level, with qualified personnel shall be set up under the control of Senior Executive, who will directly report to the head of the organization.
- v) Action plan for implementing EMP and environmental conditions along with responsibility matrix of the company shall be prepared and shall be duly approved by competent authority. The year wise funds earmarked for environmental protection measures shall be kept in separate account and not to be diverted for any other purpose.
- Vi) Year wise progress of implementation of action plan shall be reported to the Ministry of Environment, Forests & Climate Change / State Environment Impact Assessment Authority / State Pollution Control Board along with the Six-Monthly Compliance Report.
- vii) Self environmental audit shall be conducted annually. Every three years third party environmental audit shall be carried out.

IX. Additional conditions

 Short term need-based activities to be identified and implemented. Name of the beneficiary should be displayed at site.

X. Miscellaneous

- The environmental clearance accorded shall be valid for a period of 10 years for the proposed project or till the exploration period whichever is earlier.
- This is EC issued for exploratory wells only and those wells shall not be converted to production wells without prior permission from State Environment Impact Assessment Authority.
- iii) The project proponent shall make public the environmental clearance granted for their project along with the environmental conditions and safeguards at their cost by prominently advertising it at least in two local newspapers of the District or State, of which one shall be in the vernacular language within seven days and in addition this shall also be displayed in the project proponent's website permanently.
- iv) The copies of the environmental clearance shall be submitted by the project proponents to the Heads of local bodies, Panchayats and Municipal Bodies in addition to the relevant offices of the Government who in turn has to display the same for 30 days from the date of receipt.

- v) The project proponent shall upload the status of compliance of the stipulated environment clearance conditions, including results of monitored data on their website and update the same on half-yearly basis.
- vi) The project proponent shall submit six-monthly reports on the status of the compliance of the stipulated environmental conditions to Ministry of Environment, Forests & Climate Change / State Environment Impact Assessment Authority / State Pollution Control Board.
- vii) The project proponent shall submit the environmental statement for each financial year in Form-V to the State Pollution Control Board as prescribed under the Environment (Protection) Rules, 1986, as amended subsequently and put on the website of the company.

viii)

- The project proponent shall inform the State Environment Impact Assessment Authority, the date of financial closure and final approval of the project by the concerned authorities, commencing the land development work and start of production operation by the project.
- Restoration of the project site shall be carried out satisfactorily and report shall be sent to the State Environment Impact Assessment Authority.
- The project authorities must strictly adhere to the stipulations made by the State Pollution Control Board and the State Government.
- xi) The project proponent shall abide by all the commitments and recommendations made in the EMP report and also that during their presentation to the State Expert Appraisal Committee.
- xii) No further expansion or modifications in the project shall be carried out without prior approval of the State Environment Impact Assessment Authority.
- xiii) The State Environment Impact Assessment Authority / State Pollution Control Board shall monitor compliance of the stipulated conditions.
- xiv) The project authorities should extend full cooperation to the officer(s) of the State Environment Impact Assessment Authority / State Pollution Control Board by furnishing the requisite data / information/monitoring reports.
- xv) The State Environment Impact Assessment Authority reserves the right to stipulate additional conditions, if found necessary at subsequent stages and the project proponent shall implement all the said conditions in a time bound manner. The State Environment Impact Assessment Authority may revoke or suspend the environmental clearance, if implementation of any of the above conditions is not found satisfactory.
- xvi) Concealing factual data or submission of false/fabricated data and failure to comply with any of the conditions mentioned above may result in withdrawal of this clearance and attract action under the provisions of Environment (Protection) Act, 1986.
- xvii) Any appeal against this environmental clearance shall lie with the National Green Tribunal, if preferred, within a period of 30 days as prescribed under Section 16 of the National Green Tribunal Act, 2010.
- xviii) The above conditions will be enforced, inter-alia under the provisions of the Water (Prevention & Control of Pollution) Act, 1974, the Air (Prevention & Control of Pollution) Act, 1981, the Environment (Protection) Act, 1986, the Hazardous Waste (Management, Handling and Transboundary Movement) Rules, 2016 and the Public Liability Insurance Act, 1991 read with subsequent amendments therein.

2. Proposal No. :- SIA/WB/IND2/277881/2022 File No- EN/T-II-1/042/2022

Proposed Onshore Exploratory drilling of 7 wells in Bengal Onshore OALP-III Block BPONHP-Type-2018/1 situated in North 24 Parganas district (villages Phulsara, Uttar Shibpur, Aziznagar, EC Patharghata) and South 24 Parganas district (villages Begampur, Andulgari, Netra), West Bengal by M/s. Oil & Natural Gas Corporation Limited

INTRODUCTION

The proponent made online application vide proposal no. SIA/WB/IND2/277881/2022 dated 13 Jun 2022 along with copies of EIA/EMP seeking environment clearance under the provisions of the EIA Notification, 2006 for the above mentioned project. The proposed project activity is listed at SL.No. 1(b) Offshore and onshore oil and gas exploration, development & production, under Category "B2" of EIA Notification 2006 and the proposal is appraised at State level.

SEAC recommended the proposed project for Environmental Clearance with the following additional condition:

1. Short term need-based activities to be identified and implemented. Name of the beneficiary should be displayed at site.

PROJECT DETAILS

State of the project

The project of M/s OIL AND NATURAL GAS CORPORATION LIMITED located in as follows :

	State of the proje	et		
S. No.	State	District	Tehsil	Village
1.	West Bengal	North 24 Parganas	Gaighata	Phulsara, Mondalpara
2.	West Bengal	North 24 Parganas	Deganga	Aziznagar
3.	West Bengal	North 24 Parganas	Baduria	Uttar Shibpur, Chandipur
4.	West Bengal	North 24 Parganas	Rajarhat	Chatkabaria, Patharghata
5.	West Bengal	South 24 Parganas	Bhangar - I	Andulgari, Hadiya
6.	West Bengal	South 24 Parganas	Canning - II	Netra
7.	West Bengal	South 24 Parganas	Baruipur	Begampur

The production details / project configuration is as follows :

S. No.	Project configuration/product details	Quantity	Unit	Other Unit	Mode of Transport/Transmission of Product	Other Mode of Transport
1.	Drilling of 7 no.s of exploratory wells within OALP-III Block BP-ONHP-2018/1 to a maximum depth of 2500-6000 m	7	9	No.s	Others	Not Applicable

	Raw Material Requirement is as follows : Raw Material Requirement details								
S. No.	Item	Quantity per annum	Unit	Other Unit	Source	Mode of Transport/Transmission of Product	Other Mode of Transport	Distance of Source from Project Site(Kilometers)	
(1.)	HSD for DGs	6	4		IOC Depot	Road		45	

DELIBERATION IN SEIAA

SEIAA considered the recommendation of SEAC and accepted the same.

RECOMMENDATIONS OF SEIAA

The application for EC is approved.

Conclusion

S.No

(1)

Recommended

- A. Specific conditions:-
- i) No drilling shall be carried out in Protected Areas/forest area.
- ii) Approach road shall be made pucca to minimize generation of suspended dust.
- iii) Total water requirement shall not exceed 22 KLD/well proposed to be met through tankers. Mobile ETP shall be installed coupled with RO to reuse the treated water in drilling system. Size of the waste shall not exceed from the hole volume of the well + volume of drill cutting expected to be generated and volume of discarded mud if any. Two feet free board may be left to accommodate rain water. There shall be separate storm water channel and rain water shall not be allowed to mix with waste water. Alternatively, if possible, pit less drilling be practiced instead of above.

Conditions

iv) No lead acid batteries shall be utilized in the project/site.

B. General Conditions

i)

I. Statutory compliance

- The project proponent shall obtain forest clearance under the provisions of Forest (Conservation) Act, 1986, if drilling is carried in Forest areas.
- The project proponent shall obtain Consent to Establish / Operate under the provisions of Air (Prevention & Control of Pollution) Act, 1981 and the Water (Prevention & Control of Pollution) Act, 1974 from the State pollution Control Board.
- iii) Necessary authorization required under the Hazardous and Other Wastes (Management and Trans-Boundary Movement) Rules, 2016, Solid Waste Management Rules, 2016 shall be obtained and the provisions contained in the Rules shall be strictly adhered to.
- iv) The project proponent shall obtain and adhere to statutory clearance under the Coastal Regulation Zone Notification, 2011, if applicable.

II. Air quality monitoring and preservation

 The National Ambient Air Quality Emission Standards issued by the Ministry vide G.S.R. No. 826(E) dated 16th November, 2009 shall be complied with.

- ii) The locations of ambient air quality monitoring stations shall be decided in consultation with the State Pollution Control Board (SPCB) and it shall be ensured that at least one stations each is installed in the upwind and downwind direction as well as where maximum ground level concentrations are anticipated.
- Ambient air quality shall be monitored at the nearest human settlements as per the National Ambient Air Quality Emission Standards issued by the Ministry vide G.S.R. No. 826(E) dated 16th November, 2009 for PM10, PM2.5, SO2, NOX, CO, CH4, HC, Nonmethane HC etc.
- iv) During exploration, production, storage and handling, the fugitive emission of methane, if any, shall be monitored.
- v) The project proponent also to ensure trapping/storing of the CO₂ generated, if any, during the process and handling.
- vi) Approach road shall be made pucca to minimize generation of suspended dust.

III. Water quality monitoring and preservation

- As proposed by the project proponent, Zero Liquid Discharge shall be ensured and no waste/treated water shall be discharged to any surface water body, sea and/or on land. Domestic sewage shall be disposed off through septic tank/soak pit.
- The effluent discharge shall conform to the standards prescribed under the Environment (Protection) Rules, 1986, or as specified by the State Pollution Control Board while granting Consent under the Air/Water Act, whichever is more stringent.
- iii) The project proponent shall construct the garland drain all around the drilling site to prevent runoff of any oil containing waste into the nearby water bodies. Separate drainage system shall be created for oil contaminated and non-oil contaminated. Effluent shall be properly treated and treated wastewater shall conform to CPCB standards.
- iv) Drill cuttings separated from drilling fluid shall be adequately washed and disposed in HDPE lined pit. Waste mud shall be tested for hazardous contaminants and disposed according to HWMH Rules, 2016. No effluent/drilling mud/drill cutting shall be discharged/disposed off into nearby surface water bodies. The project proponent shall comply with the guidelines for disposal of solid waste, drill cutting and drilling fluids for onshore drilling operation notified vide GSR.546(E) dated 30th August, 2005.

IV. Noise monitoring and prevention

- i) Acoustic enclosure shall be provided to DG set for controlling the noise pollution.
- The overall noise levels in and around the drilling location areas shall be kept well within the standards by providing noise control measures including acoustic hoods, silencers, enclosures etc. on all sources of noise generation.
- The ambient noise levels should conform to the standards prescribed under E(P)A Rules, 1986 viz. 75 dB(A) during day time and 70 dB(A) during night time.

V. Energy Conservation measures

i) The energy sources for lighting purposes shall preferably be LED based.

VI. Waste management

- i) Oil spillage prevention and mitigation scheme shall be prepared. In case of oil spillage/ contamination, action plan shall be prepared to clean the site by adopting proven technology. The recyclable waste (oily sludge) and spent oil shall be disposed of to the authorized recyclers.
- Oil content in the drill cuttings shall be monitored by Authorized agency and report shall be sent to the State Environment Impact Assessment Authority.

VII. Safety and Human health issues

- Emergency preparedness plan based on the Hazard identification and Risk Assessment (HIRA) and Disaster Management Plan shall be implemented.
- Blow Out Preventer system shall be installed to prevent well blowouts during drilling operations. BOP measures during drilling shall focus on maintaining well bore hydrostatic pressure by proper pre-well planning and drilling fluid logging etc.
- iii) The project proponent shall prepare operating manual in respect of all activities, which would cover all safety & environment related issues and measures to be taken for protection. One set of environmental manual shall be made available at the drilling site/ project site. Awareness shall be created at each level of the management. All the schedules and results of environmental monitoring shall be available at the project site office. Remote monitoring of site should be done.
- iv) On completion of drilling, the project proponent should plug the drilled wells safely and obtain certificate from environment safety angle from the concerned authority.

v) The project proponent shall take measures after completion of drilling process by well plugging and secured enclosures, decommissioning of rig upon abandonment of the well and drilling site shall be restored the area in original condition. In the event that no economic quantity of hydrocarbon is found a full abandonment plan shall be implemented for the drilling site in accordance with the applicable Indian Petroleum Regulations.

- vi) The project proponent shall take necessary measures to prevent fire hazards, containing oil spill and soil remediation as needed. Possibility of using ground flare shall be explored. At the place of ground flaring, the overhead flaring stack with knockout drums shall be installed to minimize gaseous emissions during operation.
- vii) Training shall be imparted to all employees on safety and health aspects of chemicals handling. Pre-employment and routine periodical medical examinations for all employees shall be undertaken on regular basis. Training to all employees on handling of chemicals shall be imparted.
- viii) The project proponent shall develop a contingency plan for H₂S release including all necessary aspects from evacuation to resumption of normal operations. The workers shall be provided with personal H₂S detectors in locations of high risk of exposure along with self-containing breathing apparatus
- ix) Provision shall be made for the housing of construction labour within the site with all necessary infrastructure and facilities such as fuel for cooking, mobile toilets, mobile STP, safe drinking water, medical health care, creche etc. The housing may be in the form of temporary structures to be removed after the completion of the project.
- Occupational health surveillance of the workers shall be done on a regular basis and records maintained as per the Factories Act.
- xi) The project proponent shall carry out long term subsidence study by collecting base line data before initiating drilling operation till the project lasts. The data so collected shall be submitted six monthly to the Ministry of Environment, Forests & Climate Change / State Environment Impact Assessment Authority / State Pollution Control Board.

VIII. Environment Management Plan (EMP)

- The project proponent should submit the proposed EMP on a six monthly basis. The Office Memorandum issued by the MoEF & CC vide F. No. 22-65/2017-IA.III dated 30.09.2020 should be strictly followed.
- ii) Need based activities for local people is part of the EMP.
- iii) The company shall have a well laid down environmental policy duly approve by the Board of

Directors. The environmental policy should prescribe for standard operating procedures to have proper checks and balances and to bring into focus any infringements/deviation/violation of the environmental / forest /wildlife norms/ conditions. The company shall have defined system of reporting infringements / deviation / violation of the environmental / forest / wildlife norms / conditions and / or shareholders / stake holders. The copy of the board resolution in this regard shall be submitted to the Ministry of Environment, Forests & Climate Change / State Environment Impact Assessment Authority / State Pollution Control Board as a part of six-monthly report.

- iv) A separate Environmental Cell both at the project and company head quarter level, with qualified personnel shall be set up under the control of Senior Executive, who will directly report to the head of the organization.
- v) Action plan for implementing EMP and environmental conditions along with responsibility matrix of the company shall be prepared and shall be duly approved by competent authority. The year wise funds earmarked for environmental protection measures shall be kept in separate account and not to be diverted for any other purpose.
- vi) Year wise progress of implementation of action plan shall be reported to the Ministry of Environment, Forests & Climate Change / State Environment Impact Assessment Authority / State Pollution Control Board along with the Six-Monthly Compliance Report.
- vii) Self environmental audit shall be conducted annually. Every three years third party environmental audit shall be carried out.

IX. Additional conditions

 Short term need-based activities to be identified and implemented. Name of the beneficiary should be displayed at site.

X. Miscellaneous

- The environmental clearance accorded shall be valid for a period of 10 years for the proposed project or till the exploration period whichever is earlier.
- This is EC issued for exploratory wells only and those wells shall not be converted to production wells without prior permission from State Environment Impact Assessment Authority.
- iii) The project proponent shall make public the environmental clearance granted for their project along with the environmental conditions and safeguards at their cost by prominently advertising it at least in two local newspapers of the District or State, of which one shall be in the vernacular language within seven days and in addition this shall also be displayed in the project proponent's website permanently.
- iv) The copies of the environmental clearance shall be submitted by the project proponents to the Heads of local bodies, Panchayats and Municipal Bodies in addition to the relevant offices of the Government who in turn has to display the same for 30 days from the date of receipt.
- v) The project proponent shall upload the status of compliance of the stipulated environment clearance conditions, including results of monitored data on their website and update the same on half-yearly basis.
- vi) The project proponent shall submit six-monthly reports on the status of the compliance of the stipulated environmental conditions to Ministry of Environment, Forests & Climate Change / State Environment Impact Assessment Authority / State Pollution Control Board.
- vii) The project proponent shall submit the environmental statement for each financial year in Form-V to the State Pollution Control Board as prescribed under the Environment (Protection) Rules, 1986, as amended subsequently and put on the website of the company.

	viii)	The project proponent shall inform the State Environment Impact Assessment Authority, the date of financial closure and final approval of the project by the concerned authorities
	ix)	commencing the land development work and start of production operation by the project. Restoration of the project site shall be carried out satisfactorily and report shall be sent to the State Environment Impact Assessment Authority.
1	x)	The project authorities must strictly adhere to the stipulations made by the State Pollution Control Board and the State Government.
	xi)	The project proponent shall abide by all the commitments and recommendations made in the EMP report and also that during their presentation to the State Expert Appraisal Committee.
	xii)	No further expansion or modifications in the project shall be carried out without prior approval of the State Environment Impact Assessment Authority.
	xiii)	The State Environment Impact Assessment Authority / State Pollution Control Board shall monitor compliance of the stipulated conditions.
	xiv)	The project authorities should extend full cooperation to the officer(s) of the State Environment Impact Assessment Authority / State Pollution Control Board by furnishing the requisite data / information/monitoring reports.
	xv)	The State Environment Impact Assessment Authority reserves the right to stipulate additional conditions, if found necessary at subsequent stages and the project proponent shall implement all the said conditions in a time bound manner. The State Environment Impact Assessment Authority may revoke or suspend the environmental clearance, if implementation of any of the above conditions is not found satisfactory.
	xvi)	Concealing factual data or submission of false/fabricated data and failure to comply with any of the conditions mentioned above may result in withdrawal of this clearance and attract action under the provisions of Environment (Protection) Act, 1986.
	xvii)	Any appeal against this environmental clearance shall lie with the National Green Tribunal, if preferred, within a period of 30 days as prescribed under Section 16 of the National Green Tribunal Act, 2010.
	xviii)	The above conditions will be enforced, inter-alia under the provisions of the Water (Prevention & Control of Pollution) Act, 1974, the Air (Prevention & Control of Pollution) Act, 1981, the Environment (Protection) Act, 1986, the Hazardous Waste (Management, Handling and Transboundary Movement) Rules, 2016 and the Public Liability Insurance Act, 1991 read with subsequent amendments therein.

 Proposal No. :- SIA/WB/MIS/267917/2022 File No- EN/T-II-1/026/2022
 Proposed construction of Business Building at Premises No.-22-0706, Plot No- SV-7, Diplomatic Enclave in AA-II E, New Town, Rajarhat, West Bengal by M/s. Nxtra Data Limited

INTRODUCTION

The proponent made online application vide proposal no. SIA/WB/MIS/267917/2022 dated 14 Apr 2022 along with copies of EIA/EMP seeking environment clearance under the provisions of the EIA Notification, 2006 for the above mentioned project. The proposed project activity is listed at SL.No. 8(a) Building and Construction projects, under Category "B2" of EIA Notification 2006 and the proposal is appraised at State level.

SEAC recommended the project for Environmental Clearance.

Type-

EC

	St	ate of the pr	oject							
S. N	lo.		State			District T		Tehsil	Village	
(1.	I.) Maharashtra					Thane Am		Ambarnath	Badlar	our MIDC
(2.) West Bengal						North 24 Parganas Rajarhat		-		
1	4.	Project con	figurat	ion/prod	luct de	tail	s			
S. No.	con	Project onfiguration/product details				nit	Other Unit	Mode of Transport/Transmission of Product		Other Mode o Transport
		nent of an B4 area is 29857	.970 sq						101/12	
	R	w Material	Requir	ement d	etails					
S. No.	Iten	Quantity per annum	Unit	Other Unit	Source	re Transport/Transmission Mode of Transport				Distance of Source from Project Site(Kilometers

DELIBERATION IN SEIAA

SEIAA considered the recommendation of SEAC and observed that in the sanction plan, in the title of the project the predominant use is mentioned as 'Business' Building. The project application, the project is mentioned as Data Centre which falls under 'IT & ITES' use category. Further in the Building Permit as well as the population calculation sheet, the use is mentioned as 'Residential'. A clarification regarding the building use category is required to be submitted by the PP.

RECOMMENDATIONS OF SEIAA

Therefore, the application for EC is deferred (Additional Information).

Conclusion

Deferred

4. Proposal No. :- SIA/WB/MIS/55503/2019 File No- SIA/WB/NCP/82292/2018
Proposed expansion of Residential Complex at Rajarhat Road, R.S. Dag No. 470(P), 473, 474, 475, 476, 477, 478, 479, 480, 481(P), 483, 489, 490, 491, 492, 493, 494, 495, 496, 497, 499, 500, 501(P), 502(P), 503(P), 504(P), 506(P), 507(P), 509(P), 526(P), 531, 532, 533 & 501/716(P) recorded in L.R. Khatian Nos. 2821, 3233, 3281, 3283, 3248, 3285, 3286, 3282, 2849, 2848, 2887, 2846, 3234, 3315, 2855, 2856, 2857, 2858, 2859, 3318, 3317, 3412, 3341, 3340, 2803, 2806, 2805, 2802, 2801, 2800, 2804, 2807, 3302, 3304, 3306, 3301, 3303, 3305, 3312, 2853, 3136, 3307, 3309, 3311, 3310, 3308, 3313, 3411, 3314, 3288, 3287, 2830, 2829, 2828, 2827, 2826, 2825, 2845, 2844, 2843, 2842, 2841, 2840, 2839, 2838, 2837, 2836, 2835, 2834, 2833, 2832, 3240, 2815, 3316, 2854, 2809, 2808, 2814, 2819, 2850, 2851, 2852, 2822, 2823, 2824, 2796.

2797, 2798, 2799, 2816, 2817, 2818, 2810, 2811, 2812, 2813, 2792, 2793, 2794, 2795, 2820, 3073, 3072, 3238, 3236, 3237, 3235, 3239, 3296, 2860, 2861, 2862, 2863, 2864, 3071, 3265, 4092, 3279, 3070, 2866, 2831 & 2865, J.L. No. 28, Mouza: Bhatenda, Under Rajarhat Bishnupur Gram Panchayat 1, P.O. & P.S. – Rajarhat, Dist. – North 24 Parganas, West Bengal by M/s. Ganesh Tracom Pvt. Ltd. & Others (VIOLATION CASE)

INTRODUCTION

The proponent made online application vide proposal no. SIA/WB/MIS/55503/2019 dated 30 Sep 2020 along with copies of EIA/EMP seeking environment clearance under the provisions of the EIA Notification, 2006 for the above mentioned project. The proposed project activity is listed at SL.No. 8(b) Townships and Area Development projects, under Category "B1" of EIA Notification 2006 and the proposal is appraised at State level.

Earlier the project proponent (PP) had obtained EC vide No. 2704/EN/T-II-1/082/2014 dated 07.12.2016 for residential complex at Rajarhat Road, Mouza: Bhatenda, J.L. No. 28, PS – Rajarhat, Under Rajarhat Bishnupur GP 1, Dist. – North 24 Parganas.

The project proponent obtained ToR vide Memo No. 976-2N-49/2014(E) dated 02.09.2019.

SEAC recommended the proposed project for Environmental Clearance under violation category with the condition that the project proponent shall develop tree plantation as approved by DFO.

PROJECT DETAILS

The project of M/s GANESH TRACOM PVT LTD AND OTHERS located in as follows :

S. No.	State	e	6	District	Tehsil	Village		
(1.)	(1.) West Bengal		Bengal North 24 Pargan		Rajarhat Bhaten		da	
14.	Project configuration	n/product de	etails			a chean	Sec. 2. Barrie	
S. Project No. configuration/product Quantity Unit details				Other Unit	Mode o Transport/Tran of Produ	smission	Other Mode of Transport	
West Be rotal nu expansio rhus, to phases) i he exis expansio	oing phase obtained En engal (EC No. 2704/EN imbers of flats in exist on phase, another 144 in otal number of flats (i in this project will be 12 ting phase is 1,44,24 on phase additional buil tal built up area includi	1/T-1I-1/082/2 ing phase is residential fl including th 15+144=1 6.78 sq. m. It up area v	2014 da 1215. ats will e ongo 359 not and will be	ated 07.12.2016). In the proposed I be constructed. bing & proposed s. Built up area of in the proposed 18,410.65 sq.m.				

Raw Material Requirement is as follows :

	Raw Mater	rial Requir	ement	details		and the second second		
S. No.	Item	Quantity per annum	Unit	Other Unit	Source	Mode of Transport/Transmission of Product	Other Mode of Transport	Distance of Source from Project Site(Kilometers)
(1.)	Building & construction raw materials	1000	1		Local	Road		10

4	(sand, Cement & steel)				
	Details of previous Tol	R is as follows :			
	Details of previous 7				
	1	FoR issued vide Mem	o No. 976-2N-49/2014(1	E) dated 02.09.2019	it is a second
_	1	FoR issued vide Mem	o No. 976-2N-49/2014(I	E) dated 02.09.2019	
60	T Expansion Details		o No. 976-2N-49/2014(I	E) dated 02.09.2019	
s.		:	o No. 976-2N-49/2014(1 Quantity		01-U-U
S. No.	Expansion Details	:		E) dated 02.09.2019 Unit	Other Unit

DELIBERATION IN SEIAA

SEIAA considered the recommendation of SEAC and accepted the same.

RECOMMENDATIONS OF SEIAA

The application for EC is approved based on the Building Plan approved by the Executive Officer, Rajarhat Panchayat Samity vide No. 926/RPS dated 28.08.2018.

Conclusion

Recommended

S.No	Conditions
(1)	 Statutory compliance: The project proponent shall obtain all necessary clearance/ permission from all relevant agencies including town planning authority before commencement of work. All the construction shall be done in accordance with the local building byelaws. The approval of the Competent Authority shall be obtained for structural safety of buildings due to earthquakes, adequacy of firefighting equipment etc. as per National Building Code including protection measures from lightening etc. The project proponent shall obtain forest clearance under the provisions of Forest (Conservation) Act, 1986, in case of the diversion of forest land for non-forest purpose involved in the project. The project proponent shall obtain Consent to Establish / Operate under the provisions of Air (Prevention & Control of Pollution) Act, 1981 and the Water (Prevention & Control of Pollution) Act, 1974 from the concerned State Pollution Control Board/ Committee. The project proponent shall obtain the necessary permission for drawl of ground water /surface water required for the project from the competent authority. A certificate of adequacy of available power from the agency supplying power to the project along with the load allowed for the project should be obtained. All other statutory clearances such as the approvals for storage of diesel from Chief Controller of Explosives, Fire Department, Civil Aviation Department shall be obtained, as applicable, by project

proponents from the respective competent authorities.

- The provisions of the Solid Waste (Management) Rules, 2016, e-Waste (Management) Rules, 2016, and the Plastics Waste (Management) Rules, 2016 shall be followed.
- The project proponent shall follow the ECBC/ECBC-R prescribed by Bureau of Energy Efficiency, Ministry of Power strictly.
- The project proponent should strictly comply with the guidelines for High Rise Buildings, issued by MoEF, GoI vide No. 21-270/2008-IA.III dated 07.02.2012.
- The project proponent shall comply with the EMP as proposed in terms of Office Memorandum issued by the MoEF & CC vide F. No. 22-65/2017-IA.III dated 30.09.2020.

II. Air quality monitoring and preservation

- Notification GSR 94(E) dated 25.01.2018 of MoEF&CC regarding Mandatory Implementation of Dust Mitigation Measures for Construction and Demolition Activities for projects requiring Environmental Clearance shall be complied with.
- A management plan shall be drawn up and implemented to contain the current exceedance in ambient air quality at the site.
- iii. The project proponent shall install system to carryout Ambient Air Quality monitoring for common/criterion parameters relevant to the main pollutants released (e.g. PM10 and PM25) covering upwind and downwind directions during the construction period.
- iv. Diesel power generating sets proposed as source of backup power should be of enclosed type and conform to rules made under the Environment (Protection) Act, 1986. The height of stack of DG sets should be equal to the height needed for the combined capacity of all proposed DG sets. Use of low sulphur diesel. The location of the DG sets may be decided with in consultation with State Pollution Control Board.
- v. Construction site shall be adequately barricaded before the construction begins. Dust, smoke & other air pollution prevention measures shall be provided for the building as well as the site. These measures shall include screens for the building under construction, continuous dust/ wind breaking walls all around the site (at least 3 meter height). Plastic/tarpaulin sheet covers shall be provided for vehicles bringing in sand, cement, murram and other construction materials prone to causing dust pollution at the site as well as taking out debris from the site.
- vi. Sand, murram, loose soil, cement, stored on site shall be covered adequately so as to prevent dust pollution.
- vii. Wet jet shall be provided for grinding and stone cutting.
- viii. Unpaved surfaces and loose soil shall be adequately sprinkled with water to suppress dust.
- ix. All construction and demolition debris shall be stored at the site (and not dumped on the roads or open spaces outside) before they are properly disposed. All demolition and construction waste shall be managed as per the provisions of the Construction and Demolition Waste Rules 2016.
- x. The diesel generator sets to be used during construction phase shall be low sulphur diesel type and shall conform to Environmental (Protection) prescribed for air and noise emission standards.
- xi. The gaseous emissions from DG set shall be dispersed through adequate stack height as per CPCB standards. Acoustic enclosure shall be provided to the DG sets to mitigate the noise pollution. Low sulphur diesel shall be used. The location of the DG set and exhaust pipe height shall be as per the provisions of the Central Pollution Control Board (CPCB) norms.
- xii. For indoor air quality the ventilation provisions as per National Building Code of India.

III. Water quality monitoring and preservation

- i. The natural drain system should be maintained for ensuring unrestricted flow of water. No construction shall be allowed to obstruct the natural drainage through the site, on wetland and water bodies. Check dams, bio-swales, landscape, and other sustainable urban drainage systems (SUDS) are allowed for maintaining the drainage pattern and to harvest rain water.
- Buildings shall be designed to follow the natural topography as much as possible. Minimum cutting and filling should be done.
- iii. Total fresh water use shall not exceed the proposed requirement as provided in the project details.
- iv. The quantity of fresh water usage, water recycling and rainwater harvesting shall be measured and recorded to monitor the water balance as projected by the project proponent. The record shall be submitted to the Regional Office of Ministry of Environment, Forest and Climate Change (MoEF&CC) along with State Level Environment Impact Assessment Authority (SEIAA) and West Bengal Pollution

Control Board (WBPCB) along with six monthly Monitoring reports.

- v. A certificate shall be obtained from the local body supplying water, specifying the total annual water availability with the local authority, the quantity of water already committed, the quantity of water allotted to the project under consideration and the balance water available. This should be specified separately for ground water and surface water sources, ensuring that there is no impact on other users.
- vi. At least 20% of the open spaces as required by the local building bye-laws shall be pervious. Use of Grass pavers, paver blocks with at least 50% opening, landscape etc. would be considered as pervious surface.
- vii. Installation of dual pipe plumbing for supplying fresh water for drinking, cooking and bathing etc. and other for supply of recycled water for flushing, landscape irrigation, car washing, thermal cooling, conditioning etc. shall be done.
- viii. Use of water saving devices/ fixtures (viz. low flow flushing systems; use of low flow faucets tap aerators etc.) for water conservation shall be incorporated in the building plan.
- Separation of grey and black water should be done by the use of dual plumbing system. In case of single stack system separate recirculation lines for flushing by giving dual plumbing system be done.
- Water demand during construction should be reduced by use of pre-mixed concrete, curing agents and other best practices referred.
- xi. The local bye-law provisions on rain water harvesting should be followed. If local byelaw provision is not available, adequate provision for storage and recharge should be followed as per the Ministry of Urban Development Model Building Byelaws, 2016. Rain water harvesting recharge pits/storage tanks shall be provided for ground water recharging as per the CGWB norms.
- xii. A rain water harvesting plan needs to be designed where the recharge bores of minimum one recharge bore per 5,000 square meters of built up area and storage capacity of minimum one day of total fresh water requirement shall be provided. In areas where ground water recharge is not feasible, the rain water should be harvested and stored for reuse. The ground water shall not be withdrawn without approval from the Competent Authority.
- xiii. All recharge should be limited to shallow aquifer.
- xiv. No ground water shall be used during construction phase of the project.
- xv. Any ground water dewatering should be properly managed and shall conform to the approvals and the guidelines of the State Water Investigation Directorate (SWID) in the matter. Formal approval shall be taken from the SWID for any ground water abstraction or dewatering.
- xvi. Sewage shall be treated in the STP with tertiary treatment. The treated effluent from STP shall be recycled/re-used for flushing, AC make up water and gardening.
- xvii. No sewage or untreated effluent water would be discharged through storm water drains.
- xviii. Onsite sewage treatment of capacity of treating 100% waste water to be installed. The installation of the Sewage Treatment Plant (STP) shall be certified by an independent expert and a report in this regard shall be submitted to the Regional Office of MoEF&CC along with SEIAA and WBPCB before the project is commissioned for operation. Treated waste water shall be reused on site for landscape, flushing, cooling tower, and other end-uses. Excess treated water shall be discharged as per statutory norms notified by MoEF&CC. Natural treatment systems shall be promoted.
- Periodical monitoring of water quality of treated sewage shall be conducted. Necessary measures should be made to mitigate the odour problem from STP.
- xx. Sludge from the onsite sewage treatment, including septic tanks, shall be collected, conveyed and disposed as per the Ministry of Urban Development, Central Public Health and Environmental Engineering Organization (CPHEEO) Manual on Sewerage and Sewage Treatment Systems, 2013.

IV. Noise monitoring and prevention

- i. Ambient noise levels shall conform to residential area/commercial area/industrial area/silence zone both during day and night as per Noise Pollution (Control and Regulation) Rules, 2000. Incremental pollution loads on the ambient air and noise quality shall be closely monitored during construction phase. Adequate measures shall be made to reduce ambient air and noise level during construction phase, so as to conform to the stipulated standards by CPCB / SPCB.
- Noise level survey shall be carried as per the prescribed guidelines and report in this regard shall be submitted to Regional Office of the MoEF&CC along with SEIAA and WBPCB as a part of six-monthly compliance report.
- iii. Acoustic enclosures for DG sets, noise barriers for ground-run bays, ear plugs for operating personnel
shall be implemented as mitigation measures for noise impact due to ground sources.

V. Energy Conservation measures

- Compliance with the Energy Conservation Building Code (ECBC) of Bureau of Energy Efficiency shall be ensured. Buildings in the States which have notified their own ECBC, shall comply with the State ECBC.
- ii. Outdoor and common area lighting shall be LED.
- iii. Concept of passive solar design that minimize energy consumption in buildings by using design elements, such as building orientation, landscaping, efficient building envelope, appropriate fenestration, increased day lighting design and thermal mass etc. shall be incorporated in the building design. Wall, window, and roof u-values shall be as per ECBC specifications.
- Energy conservation measures like installation of CFLs/ LED for the lighting the area outside the building should be integral part of the project design and should be in place before project commissioning.
- v. Solar, wind or other Renewable Energy shall be installed to meet electricity generation equivalent to 1% of the demand load or as per the state level/ local building bye-laws requirement, whichever is higher.
- vi. Solar power shall be used for lighting in the apartment to reduce the power load on grid. Separate electric meter shall be installed for solar power. Solar water heating shall be provided to meet 20% of the hot water demand of the commercial and institutional building or as per the requirement of the local building bye-laws, whichever is higher. Residential buildings are also recommended to meet its hot water demand from solar water heaters, as far as possible.

VI. Waste Management

- A certificate from the competent authority handling municipal solid wastes, indicating the existing civic capacities of handling and their adequacy to cater to the M.S.W. generated from project shall be obtained.
- ii. Disposal of muck during construction phase shall not create any adverse effect on the neighboring communities and be disposed taking the necessary precautions for general safety and health aspects of people, only in approved sites with the approval of competent authority.
- Separate wet and dry bins must be provided in each unit and at the ground level for facilitating segregation of waste. Solid waste shall be segregated into wet garbage and inert materials.
- Organic waste compost/ Vermiculture pit/ Organic Waste Converter within the premises with a minimum capacity of 0.3 kg /person/day must be installed.
- All non-biodegradable waste shall be handed over to authorized recyclers for which a written tie up must be done with the authorized recyclers.
- Any hazardous waste generated during construction phase, shall be disposed off as per applicable rules and norms with necessary approvals of the State Pollution Control Board.
- vii. Use of environment friendly materials in bricks, blocks and other construction materials, shall be required for at least 20% of the construction material quantity. These include Fly Ash bricks, hollow bricks, AACs, Fly Ash Lime Gypsum blocks, Compressed earth blocks, and other environment friendly materials.
- viii. Fly ash should be used as building material in the construction as per the provision of Fly Ash Notification of September, 1999 and amended as on 27th August, 2003 and 25th January, 2016. Ready mixed concrete must be used in building construction.
- Any wastes from construction and demolition activities related thereto shall be managed so as to strictly conform to the Construction and Demolition Rules, 2016.
- x. Used CFLs and TFLs should be properly collected and disposed off/sent for recycling as per the prevailing guidelines/ rules of the regulatory authority to avoid mercury contamination.

VII. Water Body Conservation:-

 Existing water body (if any) should not be lined and their embankments should not be cemented. The water body is to be kept in natural conditions without disturbing the ecological habitat.

VIII. Green Cover

- The unit should strictly abide by The West Bengal Trees (Protection and Conservation in Non-Forest Areas) Act, 2006 and subsequent rules. The proponent should undertake plantation of trees over at least 20% of the total area.
- ii. No tree can be felled/transplant unless exigencies demand. Where absolutely necessary, tree felling shall be with prior permission from the concerned regulatory authority. Old trees should be retained based on girth and age regulations as may be prescribed by the Forest Department. Plantations to be ensured

species (cut) to species (planted).

- iii. The proponent should plant at least 710 nos. trees. The landscape planning should include plantation of native species. The species with heavy foliage, broad leaves and wide canopy cover are desirable. Water intensive and/or invasive species should not be used for landscaping. The project proponent should follow plantation plan approved by DFO, 24 Parganas (North) Division vide Memo no. 1829/17-T-9 dated 07.10.2021.
- iv. Where the trees need to be cut with prior permission from the concerned local Authority, compensatory plantation in the ratio of 1:10 (i.e. planting of 10 trees for every 1 tree that is cut) shall be done and maintained. Plantations to be ensured species (cut) to species (planted). Area for green belt development shall be provided as per the details provided in the project document.
- v. Topsoil should be stripped to a depth of 20 cm from the areas proposed for buildings, roads, paved areas, and external services. It should be stockpiled appropriately in designated areas and reapplied during plantation of the proposed vegetation on site.
- vi. Compensatory tree plantation of area approx. 2000 sqm. to be undertaken in WBHIDCO area as proposed.

IX. Transport

- A comprehensive mobility plan, as per MoUD best practices guidelines (URDPFI), shall be prepared to include motorized, non-motorized, public, and private networks. Road should be designed with due consideration for environment, and safety of users. The road system can be designed with these basic criteria.
 - a. Hierarchy of roads with proper segregation of vehicular and pedestrian traffic.
 - b. Traffic calming measures.
 - c. Proper design of entry and exit points.
 - d. Parking norms as per local regulation.
- ii. Vehicles hired for bringing construction material to the site should be in good condition and should have a pollution check certificate and should conform to applicable air and noise emission standards be operated only during non-peak hours.
- iii. A detailed traffic management and traffic decongestion plan shall be drawn up to ensure that the current level of service of the roads within a 05 kms radius of the project is maintained and improved upon after the implementation of the project. This plan should be based on cumulative impact of all development and increased habitation being carried out or proposed to be carried out by the project or other agencies in this 05 Kms radius of the site in different scenarios of space and time and the traffic management plan shall be duly validated and certified by the State Urban Development department and the P.W.D./competent authority for road augmentation and shall also have their consent to the implementation of components of the plan which involve the participation of these departments.

X. Human health issues

- All workers working at the construction site and involved in loading, unloading, carriage of construction material and construction debris or working in any area with dust pollution shall be provided with dust mask.
- ii. For indoor air quality the ventilation provisions as per National Building Code of India.
- Emergency preparedness plan based on the Hazard identification and Risk Assessment (HIRA) and Disaster Management Plan shall be implemented.
- iv. Provision shall be made for the housing of construction labour within the site with all necessary infrastructure and facilities such as fuel for cooking, mobile toilets, mobile STP, safe drinking water, medical health care, crèche etc. The housing may be in the form of temporary structures to be removed after the completion of the project.
- v. Occupational health surveillance of the workers shall be done on a regular basis.
- vi. A First Aid Room shall be provided in the project both during construction and operations of the project.
 XI. Environment Management Plan (EMP)
- i. The project proponent should submit the proposed EMP on a six monthly basis. The Office Memorandum
- issued by the MoEF & CC vide F. No. 22-65/2017-IA.III dated 30.09.2020 should be strictly followed.
 ii. Need based activities for local people is part of the EMP. Details of such activities for expansion project (in addition to the activities for the existing project) is uploaded in the PARIVESH portal by the project proponent.
- iii. The company shall have a well laid down environmental policy duly approved by the Board of Directors.

The environmental policy should prescribe for standard operating procedures to have proper checks and balances and to bring into focus any infringements/deviation/violation of the environmental / forest / wildlife norms /conditions. The company shall have defined system of reporting infringements /deviation / violation of the environmental / forest / wildlife norms / conditions and / or shareholders / stake holders. The copy of the board resolution in this regard shall be submitted to the Regional Office of MoEF&CC along with SEIAA and WBPCB as a part of six-monthly report.

- iv. A separate Environmental Cell both at the project and company head quarter level, with qualified personnel shall be set up under the control of senior Executive, who will directly to the head of the organization.
- v. Action plan for implementing EMP and environmental conditions along with responsibility matrix of the company shall be prepared and shall be duly approved by competent authority. The year wise funds earmarked for environmental protection measures shall be kept in separate account and not to be diverted for any other purpose.
- vi. Year wise progress of implementation of action plan shall be reported to the Regional Office of MoEF&CC along with SEIAA and WBPCB along with the Six Monthly Compliance Report.

XII. Additional condition

1. The project proponent shall develop tree plantation as approved by the DFO.

XIII. Miscellaneous

- i. The environmental clearance accorded shall be valid for a period of 10 years for the proposed project.
- ii. The project proponent shall prominently advertise it at least in two local newspapers of the District or State, of which one shall be in the vernacular language within seven days indicating that the project has been accorded environment clearance and the details of MoEFCC/SEIAA website where it is displayed.
- iii. The copies of the environmental clearance shall be submitted by the project proponents to the Heads of local bodies, Panchayats and Municipal Bodies in addition to the relevant offices of the Government who in turn has to display the same for 30 days from the date of receipt.
- The project proponent shall upload the status of compliance of the stipulated environment clearance conditions, including results of monitored data on their website and update the same on half-yearly basis.
- v. The project proponent shall submit six-monthly reports on the status of the compliance of the stipulated environmental conditions on the website of the Ministry of Environment, Forest and Climate Change at environment clearance portal with a copy to SEIAA and WBPCB.
- vi. The project proponent shall submit the environmental statement for each financial year in Form-V to the concerned State Pollution Control Board as prescribed under the Environment (Protection) Rules, 1986, as amended subsequently and put on the website of the company.
- vii. The project proponent shall inform the Regional Office of the MoEF&CC along with SEIAA and WBPCB, the date of financial closure and final approval of the project by the concerned authorities, commencing the land development work and start of production operation by the project.
- viii. The project authorities must strictly adhere to the stipulations made by the State Pollution Control Board and the State Government.
- The project proponent shall abide by all the commitments and recommendations made in the EIA/EMP report and also that during their presentation to the State Expert Appraisal Committee (SEAC).
- No further expansion or modifications in the plant shall be carried out without prior approval of the SEIAA.
- Concealing factual data or submission of false/fabricated data may result in revocation of this environmental clearance and attract action under the provisions of Environment (Protection) Act, 1986.
- The SEIAA may revoke or suspend the clearance, if implementation of any of the above conditions is not satisfactory.
- xiii. The SEIAA reserves the right to stipulate additional conditions if found necessary. The Company in a time bound manner shall implement these conditions.
- xiv. The Regional Office of the MoEF&CC/SEIAA/WBPCB shall monitor compliance of the stipulated conditions. The project authorities should extend full cooperation to the officer(s) of the Regional Office of MoEF&CC / SEIAA/WBPCB by furnishing the requisite data / information/monitoring reports.
- xv. The above conditions shall be enforced, inter-alia under the provisions of the Water (Prevention & Control of Pollution) Act, 1974, the Air (Prevention & Control of Pollution) Act, 1981, the Environment (Protection) Act, 1986, Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 and the Public Liability Insurance Act, 1991 along with their amendments and Rules and any other

orders passed by the Hon'ble Supreme Court of India / High Courts and any other Court of Law relating to the subject matter.

xvi. Any appeal against this EC shall lie with the National Green Tribunal, if preferred, within a period of 30 days as prescribed under Section 16 of the National Green Tribunal Act, 2010.

5. Proposal No. :- SIA/WB/NCP/72819/2018 File No- EN/T-II-1/012/2018

Proposed expansion of Residential Complex by at 33A, Canal South Road, Kolkata – 700 015, KMC Ward No. 57, PO – Beliaghata, PS – Tangra, West Bengal by M/s. Springcity Buildcon LLP & Others.

Type- EC

INTRODUCTION

The proponent made online application vide proposal no. SIA/WB/NCP/72819/2018 dated 07 Mar 2018 along with copies of EIA/EMP seeking environment clearance under the provisions of the EIA Notification, 2006 for the above mentioned project. The proposed project activity is listed at SL.No. 8(a) Building and Construction projects under Category "B2" of EIA Notification 2006 and the proposal is appraised at State level.

Earlier the project had obtained EC vide no. 2705/EN/T-II-I/007/2015 dated 07.12.2016 in the name of M/s. Nishant Fiscal Services Pvt. Ltd. & Ors. for a built up area of 1,03,624.34 sq.m. from SEIAA, WB.

The project had received stipulated conditions for environmental clearance for expansion project vide Memo No. 1954/EN/T-II-1/012/2018 dated 10.08.2018 for a built-up area of 113283.96 sq.m. and land area of 38,709.81 sq.m (as per U.L.C.) and 29,481.034 sq.m (as per Survey).

The project was placed in the 67th meeting of SEIAA held on 12.07.2022 and it was observed that some documents required to be uploaded in the PARIVESH Portal. The project proponent uploaded documents on 03.08.2022.

PROJECT DETAILS

The project of M/s SPRINGCITY BUILDCON LLP AND OTHERS located in as follows :

	Sta	te of the pr	oject							
S. No.		1.56	State			District	Tehsil		Village	
(1.) West Bengal			and the second	K	olkata	Kolkata	- Speak 16			
1	4. 1	Project con	figurat	ion/prod	luct deta	ils				
S. No.	configuration/product		Quanti	ty Unit	Other Unit	Mode of Transport/Transmission of Product		Other Mode of Transport		
			19 Storied		No. (MLCP)					
	Ray	w Material	Requir	ement d	etails		11.5	N. N		
S. No.	Item	Quantity per annum	Unit	Other Unit	Source	Mode of Transport/Transmission of Product		Other Mode of Transport	Distance of Source from Project Site(Kilometers)	
						NIL				

力主	Det	ails of Prev	ious T	oR					di kalah
S. No.	Item	Quantity	Unit	Other Unit	Source	Mode of Transport/Transmission of Product		Other Mode of Transport	Distance of Source from Project Site(Kilometers)
						NIL	-		a second
1.	2.	Expansi	ion De	tails :			100		
S.	F	Product/Activity (Capacity / Area)		Quan				194	Other Helt
No.	(F	rom	To	Unit		Other Unit

DELIBERATION IN SEIAA

SEIAA considered the submission made by the project proponent vide their letter No. NIL dated 03.08.2022 uploaded on 03.08.2022 and accepted the same.

RECOMMENDATIONS OF SEIAA

The application for EC is approved based on the KMC Building Permit No. 2016070060 dated 05.04.2021.

Conclusion

Recommended

S.No		Conditions									
	L	Statutory compliance:									
	i.	The project proponent shall obtain all necessary clearance/ permission from all relevant agencies including town planning authority before commencement of work. All the construction shall be done in accordance with the local building byelaws.									
	ii.	The approval of the Competent Authority shall be obtained for structural safety of building due to earthquakes, adequacy of firefighting equipment etc. as per National Building Code including protection measures from lightening etc.									
	iii.	The project proponent shall obtain forest clearance under the provisions of Fores (Conservation) Act, 1986, in case of the diversion of forest land for non-forest purpose involved in the project.									
(1)	iv.	The project proponent shall obtain clearance from the National Board for Wildlife, i applicable.									
	v.	The project proponent shall obtain Consent to Establish / Operate under the provisions of Ai (Prevention & Control of Pollution) Act, 1981 and the Water (Prevention & Control o Pollution) Act, 1974 from the concerned State Pollution Control Board/ Committee.									
	vi.	The project proponent shall obtain the necessary permission for drawl of ground water /surface water required for the project from the competent authority.									
	vii.	A certificate of adequacy of available power from the agency supplying power to the project along with the load allowed for the project should be obtained.									
	viii.	All other statutory clearances such as the approvals for storage of diesel from Chie Controller of Explosives, Fire Department, Civil Aviation Department shall be obtained, as									

- applicable, by project proponents from the respective competent authorities.
- The provisions of the Solid Waste (Management) Rules, 2016, e-Waste (Management) Rules, 2016, and the Plastics Waste (Management) Rules, 2016 shall be followed.
- The project proponent shall follow the ECBC/ECBC-R prescribed by Bureau of Energy Efficiency, Ministry of Power strictly.
- xi. The project proponent should strictly comply with the guidelines for High Rise Buildings, issued by MoEF, Gol vide No. 21-270/2008-IA.III dated 07.02.2012.
- xii. The project proponent shall comply with the EMP as proposed in terms of Office Memorandum issued by the MoEF & CC vide F. No. 22-65/2017-1A.III dated 30.09.2020.

II. Air quality monitoring and preservation

- Notification GSR 94(E) dated 25.01.2018 of MoEF&CC regarding Mandatory Implementation of Dust Mitigation Measures for Construction and Demolition Activities for projects requiring Environmental Clearance shall be complied with.
- A management plan shall be drawn up and implemented to contain the current exceedance in ambient air quality at the site.
- The project proponent shall install system to carryout Ambient Air Quality monitoring for common/criterion parameters relevant to the main pollutants released (e.g. PM10 and PM25) covering upwind and downwind directions during the construction period.
- iv. Diesel power generating sets proposed as source of backup power should be of enclosed type and conform to rules made under the Environment (Protection) Act, 1986. The height of stack of DG sets should be equal to the height needed for the combined capacity of all proposed DG sets. Use of low sulphur diesel is mandatory. The location of the DG sets may be decided in consultation with State Pollution Control Board.
- v. Construction site shall be adequately barricaded before the construction begins. Dust, smoke & other air pollution prevention measures shall be provided for the building as well as the site. These measures shall include screens for the building under construction, continuous dust/ wind breaking walls all around the site (at least 3 meter height). Plastic/tarpaulin sheet covers shall be provided for vehicles bringing in sand, cement, murram and other construction materials prone to causing dust pollution at the site as well as taking out debris from the site.
- vi. Sand, murram, loose soil, cement, stored on site shall be covered adequately so as to prevent dust pollution.
- vii. Wet jet shall be provided for grinding and stone cutting.
- viii. Unpaved surfaces and loose soil shall be adequately sprinkled with water to suppress dust.
- ix. All construction and demolition debris shall be stored at the site (and not dumped on the roads or open spaces outside) before they are properly disposed. All demolition and construction waste shall be managed as per the provisions of the Construction and Demolition Waste Rules 2016.
- x. The diesel generator sets to be used during construction phase shall be low sulphur diesel type and shall conform to Environmental (Protection) prescribed for air and noise emission standards.
- xi. The gaseous emissions from DG set shall be dispersed through adequate stack height as per CPCB standards. Acoustic enclosure shall be provided to the DG sets to mitigate the noise pollution. Low sulphur diesel shall be used. The location of the DG set and exhaust pipe height shall be as per the provisions of the Central Pollution Control Board (CPCB) norms.

xii. For indoor air quality the ventilation provisions as per National Building Code of India.

III. Water quality monitoring and preservation

i. The natural drainage system should be maintained for ensuring unrestricted flow of water. No construction shall be allowed to obstruct the natural drainage through the site, on wetland and water bodies. Check dams, bio-swales, landscape, and other sustainable urban drainage systems (SUDS) are allowed for maintaining the drainage pattern and to harvest rain water.

- Buildings shall be designed to follow the natural topography as much as possible. Minimum cutting and filling should be done.
- Total fresh water use shall not exceed the proposed requirement as provided in the project details.
- iv. The quantity of fresh water usage, water recycling and rainwater harvesting shall be measured and recorded to monitor the water balance as projected by the project proponent. The record shall be submitted to the Regional Office of Ministry of Environment, Forest and Climate Change (MoEF&CC) along with State Level Environment Impact Assessment Authority (SEIAA) and West Bengal Pollution Control Board (WBPCB) along with six monthly Monitoring reports.
- v. A certificate shall be obtained from the local body supplying water, specifying the total annual water availability with the local authority, the quantity of water already committed, the quantity of water allotted to the project under consideration and the balance water available. This should be specified separately for ground water and surface water sources, ensuring that there is no impact on other users.
- vi. At least 20% of the open spaces as required by the local building bye-laws shall be pervious. Use of Grass pavers, paver blocks with at least 50% opening, landscape etc. would be considered as pervious surface.
- vii. Installation of dual pipe plumbing for supply of recycled water and other for flushing, landscape irrigation, car washing, thermal cooling, conditioning etc. and for supplying fresh water for drinking, cooking and bathing etc. shall to be done.
- viii. Use of water saving devices/ fixtures (viz. low flow flushing systems; use of low flow faucets tap aerators etc.) for water conservation shall be incorporated in the building plan.
- Separation of grey and black water should be done by the use of dual plumbing system. In case of single stack system separate recirculation lines for flushing by giving dual plumbing system be done.
- Water demand during construction should be reduced by use of pre-mixed concrete, curing agents and other best practices referred.
- xi. The local bye-law provisions on rain water harvesting should be followed. If local byelaw provision is not available, adequate provision for storage and recharge should be followed as per the Ministry of Urban Development Model Building Byelaws, 2016. Rain water harvesting recharge pits/storage tanks shall be provided for ground water recharging as per the CGWB norms.
- xii. A rain water harvesting plan needs to be designed where the recharge bores of minimum one recharge bore per 5,000 square meters of built up area and storage capacity of minimum one day of total fresh water requirement shall be provided. In areas where ground water recharge is not feasible, the rain water should be harvested and stored for reuse. The ground water shall not be withdrawn without approval from the Competent Authority.
- xiii. All recharge should be limited to shallow aquifer.
- xiv. No ground water shall be used during construction phase of the project.
- xv. Any ground water dewatering should be properly managed and shall conform to the approvals and the guidelines of the State Water Investigation Directorate (SWID) in the matter. Formal approval shall be taken from the SWID for any ground water abstraction or dewatering.
- xvi. Sewage shall be treated in the STP with tertiary treatment. The treated effluent from STP shall be recycled/re-used for flushing, AC make up water and gardening.
- xvii. No sewage or untreated effluent water would be discharged through storm water drains.
- xviii. Onsite sewage treatment of capacity of treating 100% waste water to be installed. The installation of the Sewage Treatment Plant (STP) shall be certified by an independent expert and a report in this regard shall be submitted to the Regional Office of MoEF&CC along with SEIAA and WBPCB before the project is commissioned for operation. Treated waste water shall be reused on site for landscape, flushing, cooling tower, and other enduses. Excess treated water shall be discharged as per statutory norms notified by

MoEF&CC. Natural treatment systems shall be promoted.

- xix. Periodical monitoring of water quality of treated sewage shall be conducted. Necessary measures should be made to mitigate the odour problem from STP.
- xx. Sludge from the onsite sewage treatment, including septic tanks, shall be collected, conveyed and disposed as per the Ministry of Urban Development, Central Public Health and Environmental Engineering Organization (CPHEEO) Manual on Sewerage and Sewage Treatment Systems, 2013.

IV. Noise monitoring and prevention

- Ambient noise levels shall conform to residential area/commercial area/industrial area/silence zone both during day and night as per Noise Pollution (Control and Regulation) Rules, 2000. Incremental pollution loads on the ambient air and noise quality shall be closely monitored during construction phase. Adequate measures shall be made to reduce ambient air and noise level during construction phase, so as to conform to the stipulated standards by CPCB / SPCB.
- ii. Noise level survey shall be carried out as per the prescribed guidelines and report in this regard shall be submitted to Regional Office of the MoEF&CC along with SEIAA and WBPCB as a part of six-monthly compliance report.
- Acoustic enclosures for DG sets, noise barriers for ground-run bays, ear plugs for operating
 personnel shall be implemented as mitigation measures for noise impact due to ground
 sources.

V. Energy Conservation measures

- Compliance with the Energy Conservation Building Code (ECBC) of Bureau of Energy Efficiency shall be ensured. Buildings in the States which have notified their own ECBC, shall comply with the State ECBC.
- ii. Outdoor and common area lighting shall be LED.
- iii. Concept of passive solar design that minimize energy consumption in buildings by using design elements, such as building orientation, landscaping, efficient building envelope, appropriate fenestration, increased day lighting design and thermal mass etc. shall be incorporated in the building design. Wall, window, and roof u-values shall be as per ECBC specifications.
- Energy conservation measures like installation of CFLs/ LED for the lighting the area outside the building should be integral part of the project design and should be in place before project commissioning.
- v. Solar, wind or other Renewable Energy shall be installed to meet electricity generation equivalent to 1% of the demand load or as per the state level/ local building bye-laws requirement, whichever is higher.
- vi. Solar power shall be used for lighting in the apartment to reduce the power load on grid. Separate electric meter shall be installed for solar power. Solar water heating shall be provided to meet 20% of the hot water demand of the commercial and institutional building or as per the requirement of the local building bye-laws, whichever is higher. Residential buildings are also recommended to meet its hot water demand from solar water heaters, as far as possible.

VI. Waste Management

- A certificate from the competent authority handling municipal solid wastes, indicating the existing civic capacities of handling and their adequacy to cater to the M.S.W. generated from project shall be obtained.
- ii. Disposal of muck during construction phase shall not create any adverse effect on the neighboring communities and be disposed taking the necessary precautions for general safety and health aspects of people, only in approved sites with the approval of competent authority.
- Separate wet and dry bins must be provided in each unit and at the ground level for facilitating segregation of waste. Solid waste shall be segregated into wet garbage and inert materials.
- iv. Organic waste compost/ Vermiculture pit/ Organic Waste Converter within the premises

with a minimum capacity of 0.3 kg /person/day must be installed.

- v. All non-biodegradable waste shall be handed over to authorized recyclers for which a written tie up must be done with the authorized recyclers.
- vi. Any hazardous waste generated during construction phase, shall be disposed off as per applicable rules and norms with necessary approvals of the State Pollution Control Board.
- vii. Use of environment friendly materials in bricks, blocks and other construction materials, shall be required for at least 20% of the construction material quantity. These include Fly Ash bricks, hollow bricks, AACs, Fly Ash Lime Gypsum blocks, Compressed earth blocks, and other environment friendly materials.
- viii. Fly ash should be used as building material in the construction as per the provision of Fly Ash Notification of September, 1999 and amended as on 27th August, 2003 and 25th January, 2016. Ready mixed concrete must be used in building construction.
- Any wastes from construction and demolition activities related thereto shall be managed so as to strictly conform to the Construction and Demolition Waste Management Rules, 2016.
- x. Used CFLs and TFLs should be properly collected and disposed off/sent for recycling as per the prevailing guidelines/ rules of the regulatory authority to avoid mercury contamination.

VII. Water Body Conservation:-

 Existing water body (if any) should not be lined and their embankments should not be cemented. The water body is to be kept in natural conditions without disturbing the ecological habitat.

VIII. Green Cover

- The unit should strictly abide by The West Bengal Trees (Protection and Conservation in Non-Forest Areas) Act, 2006 and subsequent rules. The proponent should undertake plantation of trees over at least 20% of the total area.
- ii. No tree can be felled/transplanted unless exigencies demand. Where absolutely necessary, tree felling shall be with prior permission from the concerned regulatory authority. Old trees should be retained based on girth and age regulations as may be prescribed by the Forest Department. Plantations to be ensured species (cut) to species (planted).
- iii. The proponent should plant at least 410 nos. trees. The landscape planning should include plantation of native species. The species with heavy foliage, broad leaves and wide canopy cover are desirable. Water intensive and/or invasive species should not be used for landscaping. The project proponent should follow plantation plan approved by DFO, Forest Utilisation Division vide Memo no. 967/13-1 dated 17.08.2021.
- iv. Where the trees need to be cut with prior permission from the concerned Local Authority, compensatory plantation in the ratio of 1:10 (i.e. planting of 10 trees for every 1 tree that is cut) shall be done and maintained. Plantations to be ensured species (cut) to species (planted). Area for green belt development shall be provided as per the details provided in the project document.
- v. Topsoil should be stripped to a depth of 20 cm from the areas proposed for buildings, roads, paved areas, and external services. It should be stockpiled appropriately in designated areas and reapplied during plantation of the proposed vegetation on site.

IX. Transport

1.

- A comprehensive mobility plan, as per MoUD best practices guidelines (URDPFI), shall be prepared to include motorized, non-motorized, public, and private networks. Road should be designed with due consideration for environment, and safety of users. The road system can be designed with these basic criteria.
 - e. Hierarchy of roads with proper segregation of vehicular and pedestrian traffic.
 - f. Traffic calming measures.
 - g. Proper design of entry and exit points.
 - h. Parking norms as per local regulation.
- Vehicles hired for bringing construction material to the site should be in good condition and should have a pollution check certificate and should conform to applicable air and noise

emission standards and to be operated only during non-peak hours.

A detailed traffic management and traffic decongestion plan shall be drawn up to ensure that the current level of service of the roads within a 05 kms radius of the project is maintained and improved upon after the implementation of the project. This plan should be based on cumulative impact of all development and increased habitation being carried out or proposed to be carried out by the project or other agencies in this 05 Kms radius of the site in different scenarios of space and time and the traffic management plan shall be duly validated and certified by the State Urban Development department and the P.W.D./competent authority for road augmentation and shall also have their consent to the implementation of components of the plan which involve the participation of these departments.

X. Human health issues

iii.

- All workers working at the construction site and involved in loading, unloading, carriage of construction material and construction debris or working in any area with dust pollution shall be provided with dust mask.
- ii. For indoor air quality the ventilation provisions as per National Building Code of India.
- Emergency preparedness plan based on the Hazard identification and Risk Assessment (HIRA) and Disaster Management Plan shall be implemented.
- iv. Provision shall be made for the housing of construction labour within the site with all necessary infrastructure and facilities such as fuel for cooking, mobile toilets, mobile STP, safe drinking water, medical health care, crèche etc. The housing may be in the form of temporary structures to be removed after the completion of the project.
- v. Occupational health surveillance of the workers shall be done on a regular basis.
- vi. A First Aid Room shall be provided in the project both during construction and operations of the project.

XI. Environment Management Plan (EMP)

- The project proponent should submit the proposed EMP on a six monthly basis. The Office Memorandum issued by the MoEF & CC vide F. No. 22-65/2017-IA.III dated 30.09.2020 should be strictly followed.
- Need based activities for local people is part of the EMP. Details of such activities for expansion project (in addition to the activities for the existing project) is uploaded in the PARIVESH portal by the project proponent.
- iii. The company shall have a well laid down environmental policy duly approved by the Board of Directors. The environmental policy should prescribe for standard operating procedures to balances have proper checks and and to bring into focus any infringements/deviation/violation of the environmental / forest / wildlife norms /conditions. The company shall have defined system of reporting infringements /deviation / violation of the environmental / forest / wildlife norms / conditions and / or shareholders / stake holders. The copy of the board resolution in this regard shall be submitted to the Regional Office of MoEF&CC along with SEIAA and WBPCB as a part of six-monthly report.
- iv. A separate Environmental Cell both at the project and company head quarter level, with qualified personnel shall be set up under the control of Senior Executive, who will directly report to the head of the organization.
- v. Action plan for implementing EMP and environmental conditions along with responsibility matrix of the company shall be prepared and shall be duly approved by competent authority. The year wise funds earmarked for environmental protection measures shall be kept in separate account and not to be diverted for any other purpose.
- vi. Year wise progress of implementation of action plan shall be reported to the Regional Office of MoEF&CC along with SEIAA and WBPCB along with the Six-Monthly Compliance Report.
- XII. Miscellaneous

- The environmental clearance accorded shall be valid for a period of 10 years for the proposed project.
- ii. The project proponent shall prominently advertise it at least in two local newspapers of the District or State, of which one shall be in the vernacular language within seven days indicating that the project has been accorded environment clearance and the details of MoEFCC/SEIAA website where it is displayed.
- iii. The copies of the environmental clearance shall be submitted by the project proponents to the Heads of local bodies, Panchayats and Municipal Bodies in addition to the relevant offices of the Government who in turn has to display the same for 30 days from the date of receipt.
- iv. The project proponent shall upload the status of compliance of the stipulated environment clearance conditions, including results of monitored data on their website and update the same on half-yearly basis.
- v. The project proponent shall submit six-monthly reports on the status of the compliance of the stipulated environmental conditions on the website of the Ministry of Environment, Forest and Climate Change at environment clearance portal with a copy to SEIAA and WBPCB.
- vi. The project proponent shall submit the environmental statement for each financial year in Form-V to the concerned State Pollution Control Board as prescribed under the Environment (Protection) Rules, 1986, as amended subsequently and put on the website of the company.
- vii. The project proponent shall inform the Regional Office of the MoEF&CC along with SEIAA and WBPCB, the date of financial closure and final approval of the project by the concerned authorities, commencing the land development work and start of production operation by the project.
- viii. The project authorities must strictly adhere to the stipulations made by the State Pollution Control Board and the State Government.
- The project proponent shall abide by all the commitments and recommendations made in the EIA/EMP report and also that during their presentation to the State Expert Appraisal Committee (SEAC).
- No further expansion or modifications in the plant shall be carried out without prior approval of the SEIAA.
- xi. Concealing factual data or submission of false/fabricated data may result in revocation of this environmental clearance and attract action under the provisions of Environment (Protection) Act, 1986.
- xii. The SEIAA may revoke or suspend the clearance, if implementation of any of the above conditions is not satisfactory.
- xiii. The SEIAA reserves the right to stipulate additional conditions if found necessary. The Company in a time bound manner shall implement these conditions.
- xiv. The Regional Office of the MoEF&CC/SEIAA/WBPCB shall monitor compliance of the stipulated conditions. The project authorities should extend full cooperation to the officer(s) of the Regional Office of MoEF&CC / SEIAA/WBPCB by furnishing the requisite data / information/monitoring reports.
- xv. The above conditions shall be enforced, inter-alia under the provisions of the Water (Prevention & Control of Pollution) Act, 1974, the Air (Prevention & Control of Pollution) Act, 1981, the Environment (Protection) Act, 1986, Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 and the Public Liability Insurance Act, 1991 along with their amendments and Rules and any other orders passed by the Hon'ble Supreme Court of India / High Courts and any other Court of Law relating to the subject matter.
- xvi. Any appeal against this EC shall lie with the National Green Tribunal, if preferred, within a period of 30 days as prescribed under Section 16 of the National Green Tribunal Act, 2010.

6. Proposal No. :- SIA/WB/NCP/75645/2018 File No- EN/T-II-1/061/2018

Proposed Residential Building at Premises No.46A/I, Biplabi Barin Ghosh Sarani (Formerly an apportioned portion of premises No. 46A, Biplabi Barin Ghosh Sarani), Kolkata-700067, Type- EC Ward No-14, Borough No -III, P.S.- Maniktala Under KMC, West Bengal by M/s. Swastik Projects Pvt. Ltd.

INTRODUCTION

The proponent made online application vide proposal no. SIA/WB/NCP/75645/2018 dated 16 Jul 2018 along with copies of EIA/EMP seeking environment clearance under the provisions of the EIA Notification, 2006 for the above mentioned project. The proposed project activity is listed at SL.No. 8(a) Building and Construction projects under Category "B2" of EIA Notification 2006 and the proposal is appraised at State level.

Earlier the project had received Environmental Clearance vide No. Memo No. 2176/EN/T-II-1/081/2012 dated 25.09.2017 for a built up area of 27947.489 sq.m. on a land parcel of 9474.00 sq.m. Initially the proposal was for the construction of 01 Residential Block of B+G+12 storied having 188 nos. flats, Thereafter, the project proposal was revised / modified and the proponent applied in prescribed format for environmental clearance and uploaded the application in the PARIVESH portal on 16.07.2018. The project had received stipulated conditions for environmental clearance for the project vide Memo No. 29/EN/T-II-1/061/2018 dated 04.01.2019 for a built-up area of 31636.43 sg.m. and land area of 9474.00 sg.m.

A field inspection of the project site to ascertain the present status of the project was conducted by WBPCB on 11.06.2022. It was reported that no construction work was started.

SEAC recommended Environmental Clearance for the proposed project in cancellation of the earlier EC issued vide No. 2176/EN/T-II-1/081/2012 dated 25.09.2017.

The project was placed in the 70th meeting of SEIAA held on 22.08.2022 and it was observed that some documents required to be uploaded in the PARIVESH Portal. The project proponent uploaded documents on 30.08.2022.

PROJECT DETAILS

The project of M/s SWASTIK PROJECTS PVT. LTD. located in as follows :

	Sta	te of the pr	oject						and the second second
S. N	S. No. State					District	Tehsil	1. S.	Village
(1.) West Bengal				K	olkata	Kolkata			
1	4.	Project con	figurat	ion/pro	duct deta	nils			
S. No.	configuration/product			Quant	ity Uni	t Other Unit	Mode of Transport/Transmission of Product		Other Mode of Transport
	6.43 s	nd Construc qm on a Lan w Material	d Area	of 9474	.00 sqm.	ilt-up area of		1.10	100 30
S. No.	Item	Quantity per annum	Unit	Other Unit	Source	Transport/	de of Fransmission roduct	Other Mode of Transport	Distance of Source from Project Site(Kilometers)
		1		2	-	NIL	10 - 10 - 1		Televier.

DELIBERATION IN SEIAA

SEIAA considered the submission made by the PP vide their letter no. NIL dated 30.08.2022 uploaded on 30.08.2022 and observed that there are 5 title deed uploaded by the PP wherein the total land area adds upto 34682 sqm. All the title deed are bearing the Premises No. as 46A, Biplabi Barin Ghosh Sarani. In all other documents eg. Sanction plan and ULC document, the Premises No. is mentioned as 46A/1, Biplabi Barin Ghosh Sarani and the land area as 9474 sqm. PP needs to submit a clarification (boundary declaration/ any other document) in this regard.

RECOMMENDATIONS OF SEIAA

Therefore, the application for EC is deferred (Additional Information).

Conclusion

Deferred

CONSIDERATION/RECONSIDERATION OF EC PROPOSAL (Extension/Amendment/Corrigendum)

1. Proposal No. :- SIA/WB/IND/278173/2022 File No- EN/ T- II-1/051/ 2014

Extension of validity of Environmental Clearance for the proposed expansion of existing standalone cement grinding unit from 0.6 MTPA to 1.8 MTPA at Village – Madhukunda, P.O-Sunuri, P.S. – Santuri, PIN – 723 121, Dist. – Purulia, West Bengal by M/s. Damodhar Cement Works, ACC Limited Type Of Project : Extension

INTRODUCTION

The proponent made online application vide proposal no. SIA/WB/IND/278173/2022 dated 18.07.2022 seeking extension of validity of Environmental Clearance under the provisions of the EIA Notification, 2006 for the above mentioned proposed project.

The PP had obtained Environmental Clearance for the proposed expansion of existing standalone cement grinding unit from 0.6 MTPA to 1.8 MTPA vide no. 287/EN/T-II1/051/2014 dated 05.02.2016 issued by SEIAA, WB. The validity period of existing EC is upto 04.02.2023.

SEAC recommended that the validity extension of EC may be granted for a period of further 3 (three) years i.e. upto 04.02.2026 as per the EIA Notification, 2006 and its subsequent amendments.

PROJECT DETAILS

The project of M/s DAMODHAR CEMENT WORKS, ACC LIMITED located in

State of the project									
S. No.	State	District	Tehsil						
(1.)	West Bengal	Purulia	Raghunathpur						

The salient features of the project submitted by the project proponent is available at <u>Report</u> under online proposal no. SIA/WB/IND/278173/2022

DELIBERATION IN SEIAA

SEIAA considered the recommendation of SEAC and accepted the same.

RECOMMENDATIONS OF SEIAA

Approved extension of validity of Environmental Clearance.

Conclusion

Recommended

MISCELLANEOUS

 Discussion on draft DSRs of Purba Medinipur, Paschim Medinipur and Purba Bardhaman.

DSRs of Purba Medinipur, Paschim Medinipur and Purba Bardhaman are approved.

 ToR application for the proposed Modification of "Aerotropolis Township" at Andal, Vill.

 Tamla, Dhokinkhanda, Mahira, Khandra, Amloka, Banguli, Durgapur Taluk, District: Paschim Bardhhaman, West Bengal by M/s. Bengal Aerotroplis project Limited.
 Proposal No. SIA/WB/MIS/80933/2022.

Background

Earlier M/s. Bengal Aerotroplis project Limited had obtained EC from SEIAA, WB vide No. EN/2041/T-II-1/025/2009 dated 11.08.2011 for Greenfield Aerotropolis Township (Phase I) at Andal, Vill. – Tamla, Dhokinkhanda, Mahira, Khandra, Amloka, Banguli, Durgapur Taluk, District: Burdwan, West Bengal.

Now the PP has applied for modification of "Aerotropolis Township" at Andal, Vill. – Tamla, Dhokinkhanda, Mahira, Khandra, Amloka, Banguli, Durgapur Taluk, District: Paschim Bardhhaman, West Bengal.

The matter was placed in the 69th meeting of SEIAA held on 10.08.2022 and it was decided to request the project proponent to mention the exact distance of the project area from the municipal limits of Durgapur and also submit Google earth image showing the Lat-Long of the proposed project area along with the municipal limits of Durgapur since the location of the proposed project area appears to be close to Durgapur Municipal Corporation area, which is declared as a 'Severely Polluted Area'.

The project proponent submitted reply vide their letter Ref No. BAPL/DGP/INFRA(PI)/L/MS-SEIAA/22-23/269 dated 29.08.2022 uploaded on 30.08.2022.

SEIAA considered the reply submitted by the PP and in view of the O.M. No. 22-23/2018-IA.III[E115231] dated 05.07.2022 of MoEF&CC, the above project which is categorised as a 'B1' project is transferred to MoEF&CC for further necessary action.