DISTRICT SURVEY REPORT
OF
MALDA

(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)

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PREPARED BY
Department of Industry, Commerce & Enterprises
Government of West Bengal

GOVERNMENT OF WEST BENGAL
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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 - Kilometre

LISS - Linear Imaging Self-Scanning Sensor

LOI - Letter of Intent

LULC - Land Use Land Cover

m^2 - 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 $3/4^{th}$ 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:

The district of Malda, once the capital of Gour Empire, lies to the southern fringe of North Bengal. The district Malda lies between 25°32'08" North and 24°40'20" North Latitude and in between 88°28'10" East & 87°45'50" East longitude. To the south is Murshidabad district, to the north are Uttar Dinajpur district and Dakshin Dinajpur district, to the east is the international border of 165.5 km. with Bangladesh and to the west is Santhal Paragonas of Jharkhand and Purnea of Bihar. Malda is called the gateway of North Bengal. It was once the capital of Gour-Banga with its 3,733 square kilometers (1,441 sq mi) lay of the land classified into Tal, Diara, and Barind.

According to 2011 census, the district encompasses a geographical area of 3733 sq km and has a population of 32, 90, 468 (persons) including 16, 89, 406 (males) and 16,01, 062 (females). The district has a sex ratio of 93.9 females for every 100 males. The major religions in the district (according to census 2001) are Muslim (51.27%) and Hindu (48%) of the total population respectively.

This district lies in near Himalayan foothills. So, the climate is not too much hot. The minimum temperature of the district lies within the range of 10.7° and 26.1° Celsius in the month of January and August respectively and maximum temperature lies within 24.2° and 36.1° in the month of January and April respectively.

The district having different physical and physiographical characteristics is covered by alluvium of two different ages. Older alluvium dominates the Barind region while newer alluvial dominates both Tal and Diara regions. This area comprises with thick sequence of alluvial fan and river valley deposits.

The geological formations of the study area were divided by three tentative ages, Holocene period, early Holocene to Pleistocene period and Pleistocene period. The Malda formation, the Shaugaon formation, Ganga Mahananda formation and the present-day deposits were formed in Holocene period. Baikunthapur formation was formed in early Holocene to Pleistocene period. Barind formation was formed in Pleistocene period. In English-Bazar block vast area was covered by Ganga-Mahananda formation where Manickchak block mainly covered by present day deposit.

The district is so far not exposed to extensive mining activities. The district is currently generating revenue from mining of minor minerals such as sand, gravel and brick-earth. Mining of riverbed sand and gravel should be carried out scientifically and based on statutory guidelines for conservation of land, river channels and sustainable development of the society. Revenue generated in the district of Malda from minor minerals during 2016 to 2021 is Rs. 55.82 lakhs.

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 Malda district, total 49.23 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 their 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 for 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. 25th July, 2018 regarding inclusion of the "Minerals Other than Sand" and format for preparation of the DSR has been specified. Enforcement and 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 Rules, 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 DSR of Malda district 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 Malda District has been prepared as per the guide line of Enforcement and Monitoring Guidelines for Sand Mining (EMGSM) January 2020, Issued by MoEF& CC, Ministry of Environment, Forests & 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.

Preparation of District Survey Report (DSR) of Malda District was awarded to Global Management and Engineering Consultant (GMEC) International vide tender Ref NIT No: MDTC/PM-5/160/1147, Dt: 20.11.2019.

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.

The objectives of the District Survey Report are as following

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.

The District Survey report (DSR) is comprised of secondary data published and endorsed by various departments and websites about geology of the area, mineral resources, climate, topography, land form, forest, rivers, soil, agriculture, road, transportation, irrigation etc. Data on lease and mining activities in the district, revenue etc. are collected and collated from concern district Head Quarter and West Bengal Mineral Development Corporation Limited.

2.1 Statutory Framework

a) Evolution of the Environmental Regulatory Framework:

The below table has mentioned the requirement of District survey report and its year wise modification;

Table 2-1: Requirement of District Survey Report & its year wise modification of Guidelines

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 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) of 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 licence-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 DSRi.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 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

Year	Particulars
	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.

b) Other Guidelines for Sand Mining in India:

i) The West Bengal Minor Minerals Concession Rules, 2016

(1) (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 center 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).

ii) Sustainable Sand Mining Management Guidelines, 2016 (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 aggradations 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 aggradations 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 are 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.

i) 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.

J) Flood discharge capacity of the river could be maintained in areas where there is 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.

k) Alternatively, off-channel or floodplain extraction is recommended to allow rivers to replenish the quantity taken out during mining.

l) 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.

m) 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.

n) 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.

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

iii) 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 aggradations shall be identified. The Leaseholder/ Environmental Clearance holder may be allowed to extract the sand and gravel deposit in these locations to manage aggradations 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 kilometer (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.

l) 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 river bed 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 river bed, 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 is 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 2-1: Steps followed in preparation of DSR

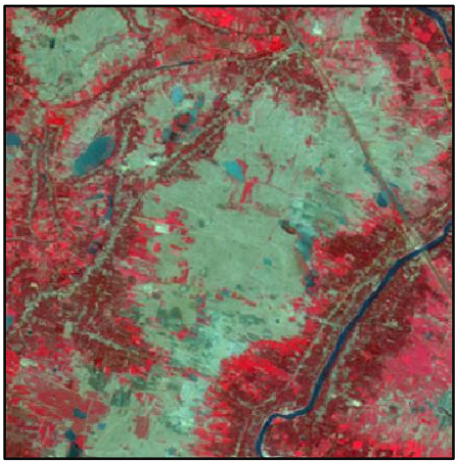
2.2.1 Data source Identification: District Survey Report has been prepared based on the primary data base and secondary data base collated from different sources. It is very critical to identify authentic data sources before collating the data set. The secondary data sources which are used in DSR are mostly government published data based or the published report in reputed journals. District profile has been prepared based on the District Statistical handbook published by West Bengal Government as well as District Census Report, 2011. Potential mineral resources have been described based on GSI or any other govt. agencies work done. Mining lease details and the revenue generated from minor minerals has been prepared based on available data from DL&LRO offices of the district. Satellite image has been used for map preparation related to physiography and land utilization pattern of the district.

2.2.2 Data Analysis and Map preparation: Dataset which are captured during the report preparation, are subjected to detail analysis work. District Survey Report involves the analytical implication of captured dataset to prepare relevant maps. Methodology obtain for map preparation 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 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, Texture, 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 Dark Red color tone, Vegetation Covered Area has been classified.
	**Agricultural Fallow Land** - Based on their Geometrical shape, Yellowish green color toned area has been identified as Agricultural Fallow Land.

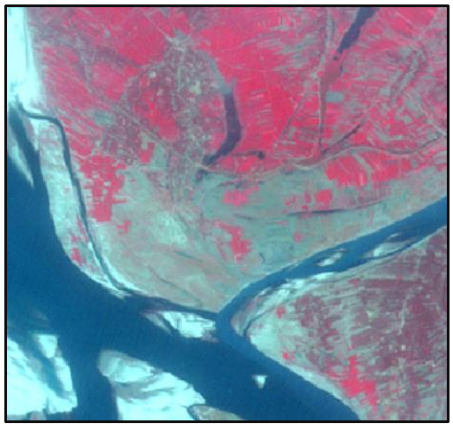
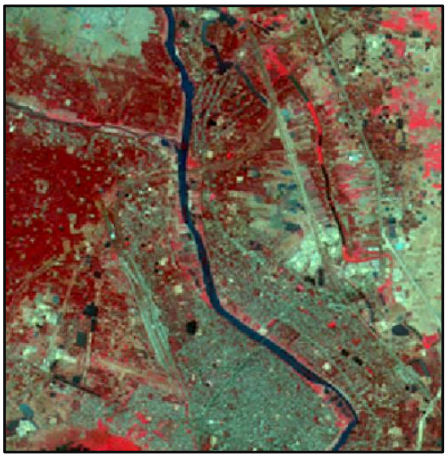
	**Badland Topography**- Area with Non geometrical shape and Yellowish green color tone has been categorized as Bad Land Topography.
	**Settlement** – Area with some geometrical shape in a Linear Pattern including Light Cyan Color tone has been recognized as Settlement Area.
	**Water Bodies** – Area with Blue color has been categorized as Water Bodies.

Figure 2-2: Pictorial Descriptions of Physiography

Geomorphological Map: The major steps of preparing Geomorphological Map is identifying features like – Alluvial Fan, Alluvial Plain, Hilly Region etc. from Satellite Imagery (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.

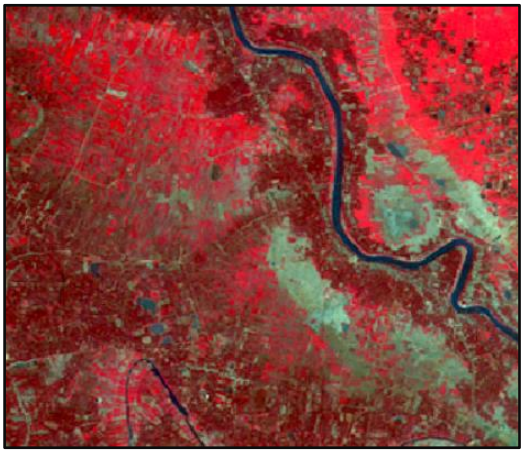
	**Flood Plain** – Floodplains a generally flat area of land next to a river or stream. It stretches from the banks of the river to the outer edges of the valley. For Malda District, Whole region has been classified as Flood Plain Area.

Figure2-3: Pictorial Description of Geomorphic Features

Physiographical Map: 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.

Earthquake Map:

- 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.**
- Data has been geo-referenced using GIS software.

- Digitization of Soil classification zone and superimposed it over District Boundary. **during Sept 2020**
- 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 collected from **ENVIS Centre on Wildlife & Protected Areas during August 2020.**
- Data has been geo-referenced using GIS software.
- Digitization of Wildlife Sanctuary & 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, capturing primary data or field data has also been carried out in 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 from in-stream mining is the removal of more sediment than the system can replenish. It is therefore 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 sand reserve for mining purposes.

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

The district of Malda once the Capital of Gour Empire lies to the Southern fringe of North Bengal. The district of Malda came into existence under the British informally in 1813, obtained the Diwani of the Subah of Bengal, Bihar and Orissa from Emperor Shah lmam in 1765. During the intervening period the district had been parceled out between the districts of Dinajpur, Rajshai (Bangladesh), Murshidabad and Purnea. The newly formed district included in Bhagalpur Division. A treasury was established in 1832 from which the separate existence of the district is usually dated but it was only in 1859 that a Magistrate and collector was placed in charge of the district. The district Malda lies between 25°32'08"N and 24°40'20"N Latitude and in between 88°28'10" E & 87°45'50" E longitude. To the south is Murshidabad district, to the north are Uttar Dinajpur district and Dakshin Dinajpur district, to the east is the international border of 165.5 km. with Bangladesh and to the west is Santhal Paragonas of Jharkhand and Purnea of Bihar. In 1935, the total area of the district was 1,987 sq. miles as per report on the survey and settlement operations. At the time of partition of India, it covered 2,004 sq. miles, but now the area is 1,441.6 sq. miles (3,733sq. km.). Its ranking in respect of area is 11th (eleventh) in the state (https://www.malda.gov.in/index.php/node/27). The location Map of this district has mentioned below figure 3-1.

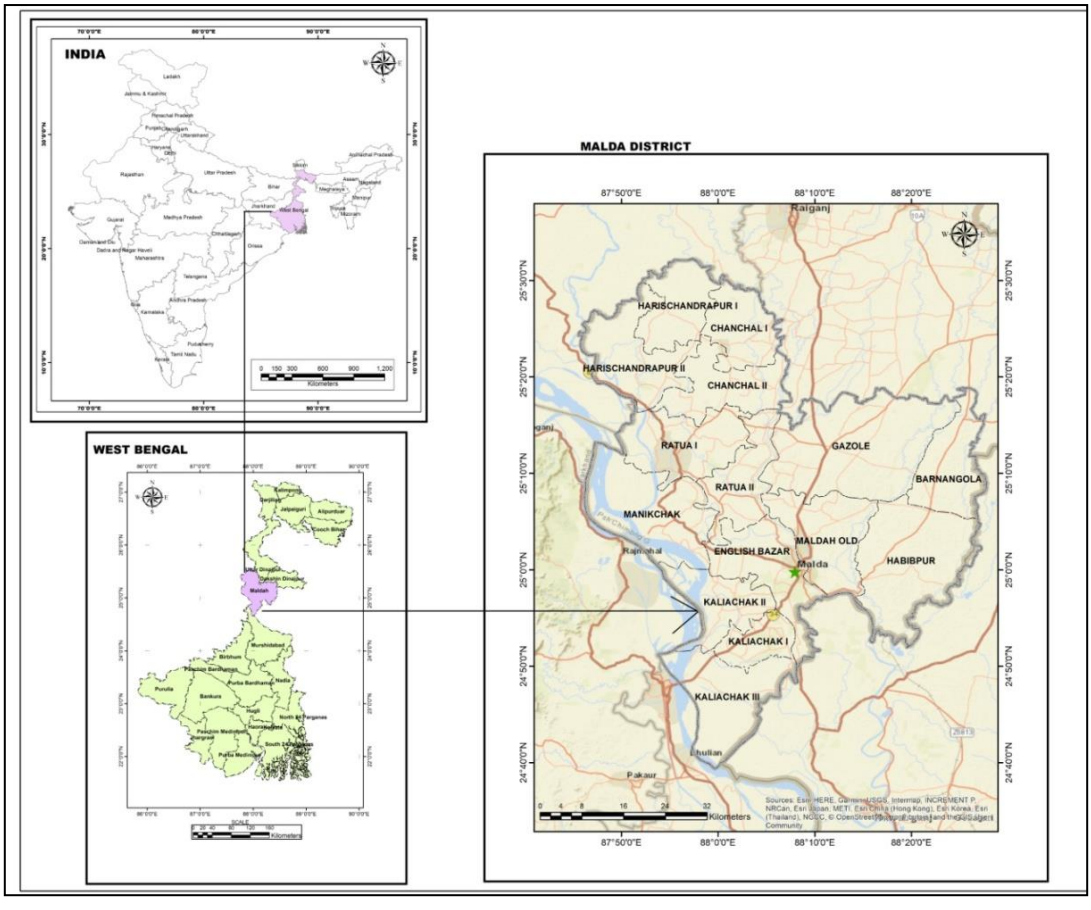


Figure 3-1: Location Map ofMalda
(Source: National Informatics Centre and ESRI Base Map)

The district comprises two subdivisions: Chanchal and MaldaSadar. Chanchal consists of six community development blocks: Chanchal–I, Chanchal–II, Ratua–I, Ratua–II, Harishchandrapur–I and Harishchandrapur–II. MaldaSadar subdivision consists of Old Malda municipality, English Bazar municipality and nine community development blocks: English Bazar, Gazole, Habibpur, and Kaliachak–I, Kaliachak–II, Kaliachak–III, Manickchak, Old Malda and Bamangola. English Bazar is the district headquarters. There are 12 police stations,15 development blocks, 2 municipalities, 146 gram panchayats and 3,701 villages in this district (https://www.malda.gov.in/index.php/node/3).

The below mentioned table has illustrate the area of the district in block wise.

Table 3-1: Sub-division of block Area and Population wise in Malda District

Sub-Division	Headquarter	Police Station	CD Block	Block HQ	Distance from Main HQ (km)	No. of Gram Panchayat	Area (Sq. Km.)-2001
Chanchal Sub-Div.	**Chanchal**	Harishchandrapur	Harishchandrapur-I	Harishchandrapur	21.8	7	171.41
			Harishchandrapur-II	Khanta (Barduari)	20.9	9	217.21
		Chanchal	Chanchal-I	Chanchal	0.85	8	162.14
			Chanchal-II	Malatipur	1.9	7	205.22
		Pukhuria	Ratua-I	Ratua	26	10	230.53
		Ratua	Ratua-II	Pukhuria	37.9	8	173.93
MaldaSadar Sub-Div.	**English Bazar**	Gazole	Gazole	Gazole	29	15	513.65
		Bamangola	Bamangola	Pakuahat	37.6	6	205.91
		Habibpur	Habibpur	Habibpur	22.3	11	396.07
		Malda	Old Malda	Narayanpur	7.3	6	215.66
			Old Malda(M)			-	251.52
		English Bazar & English Bazar Women	English Bazar	Malda	0.45	11	321.77
			English Bazar(M)			-	105.37
		Manickchak	Manickchak	Manickchak	30.3	11	222.73
		Kaliachak	Kaliachak-I	Kaliachak	19.2	14	260.12
			Kaliachak-II	Mothabari	15.9	9	9.00
		Baisnabnagar	Kaliachak-III	Dariapur	32.2	14	13.63
District Total 2011		**12**	**17**	**15**		**146**	**3733**

Source: Census, 2001 & 2011

Malda is called the gateway of North Bengal. It was once the capital of Gour-Banga with its 3,733 square kilometers (1,441 sq mi) lay of the land classified into Tal, Diara, and Barind. To the south Murshidabad district, to the north are North Dinajpur district and South Dinajpur district. To the east is the international border with Bangladesh.

To the west is Santhal Parganas of Jharkhand and Purnea of Bihar. The block map has mentioned below in figure3-2;

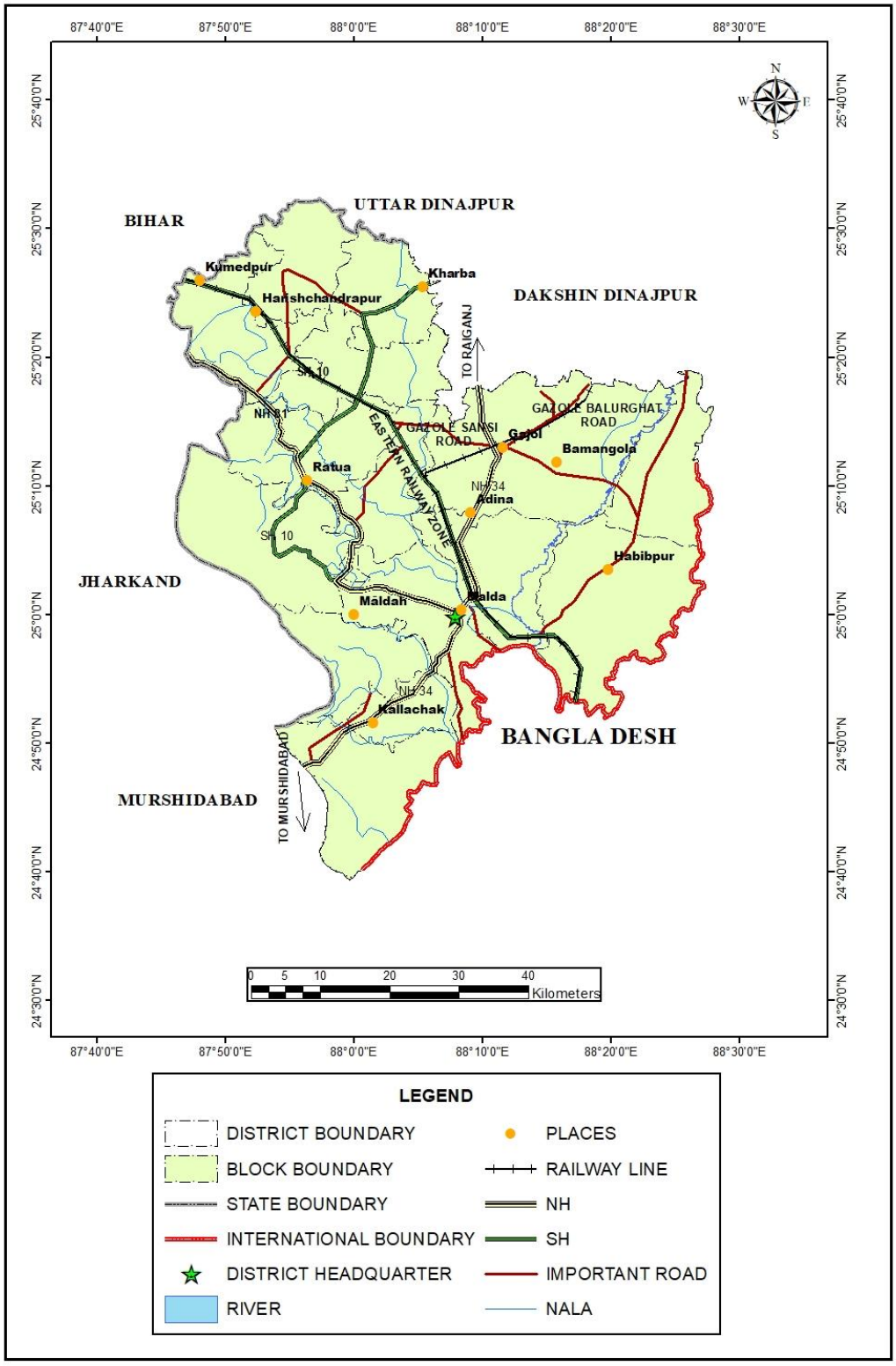


Figure 3-2: Block Map of Malda

(Source: National Informatics Center)

b) Climate Condition

The Climatic characteristic of the district can be considered as one of the explanatory factors for the nature and type of surface water bodies essentially the 'bils' in the district. Reduction in the water quantities during summer months and recharging of water during monsoon and post monsoon months depend to a great extent on the temperature, humidity and precipitation. Rainfall naturally carries slightly more wightage in determining the recharge quantity and quality of water in the bils. The district with its notorious flooding background provides the recharging quantity and quality factors of the bils of the district.

A brief description of the climatic parameters of the district is given below-

The Malda district is significantly under hot and humid monsoonal climate. An oppressive summer season, plentiful rain and humid atmosphere all through the year are the main characteristics of the climate of Malda district. On the basis of temperature variation, rainfall, humidity and winds, the year of the district can be divided into four well defined seasons; namely

1) Hot- Summer Season- March to May,
2) Monsoon Season –June to September,
3) Retreating Monsoon-October to November and
4) Winter Season- December to February,

The Hot Summer Season starts from March and ends in the 1st week of June. This season characterized by a rise in temperature, increases in the amount and frequent rainfall with the advance of the season, decreases in diurnal range of temperature. The total average temperature of this season is around 30˚c, average diurnal range of about 6˚c and average rainfall is 308.7m.m.

The Monsoon Season starts from June and extends up to September. The seasonal characteristic includes weak surface winds, cloudy sky, high humidity and sultry weather. The average rainfall during the season is recorded at 250 cm. Maximum amount of rainfall of the year takes place during this period.

In Retreating Monsoon through there prevails a homogeneous climate in plain nevertheless; a little heterogeneity in climatic conditions within and between different parts of the district in terms of variation in rainfall and range of temperature etc prevails.
The winter season starts from December and ends in February. The main characteristic phenomena of this season is cool weather, frequent morning fog, average monthly temperature above 10˚c and a little amount of rainfall (https://www.imdpune.gov.in/library/public/Climate%20of%20WestBengal.pdf).

c) Rainfall and Humidity

The average annual rainfall is 1326.08 mm from year 2014 – 2018. The maximum rainfall in the area as per IMD data was recorded in the month of June and July followed by August and September (Refer table no. 3-2 and Figure 3-3). The rainfall in winter season is very low in amount.

Table 3-2: Rainfall (in mm) data of Malda from 2104-18

YEAR	Unit	2016	2017	2018	2019	2020	Avg. Rainfall
JAN	mm	16.9	0.9	0	0	8.3	5.22
FEB	mm	0	0	7.6	38.1	35.1	16.16
MAR	mm	2.1	12.4	22.9	3.6	49	18
APR	mm	21.6	94.8	112	77	77.8	76.64
MAY	mm	85.4	110.6	153.6	121.1	137.5	121.64
JUN	mm	157.4	76.5	85.3	98.8	361.9	155.98
JUL	mm	407.3	352.6	230.2	373.5	346.5	342.02
AUG	mm	152.1	580.5	148.9	104	217.4	240.58
SEPT	mm	337.9	200.1	133.4	364.9	317	270.66
OCT	mm	72	143.9	51.2	145.6	52.7	93.08
NOV	mm	0	0	0	0	0	0
DEC	mm	0	5.7	12.3	1.3	0	3.86
Total		1252.7	1578	957.4	1327.9	1603.2	1343.84

Source: India Meteorological Department, Ministry of Earth Sciences

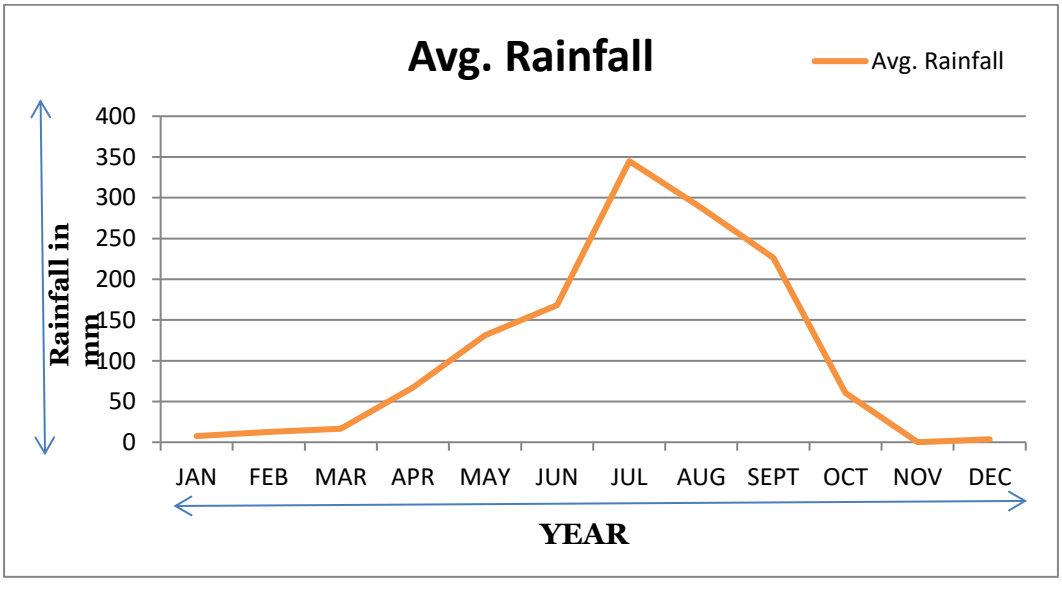


Figure 3-3: Graphical Representation of Rainfall data of year 2016-20

i) Temperature

This district lies in near Himalayan foothills. So, the climate is not too much hot. The minimum temperature of the district lies within the range of 10.7° C and 26.1° C in the month of January and August respectively and maximum temperature lies within 24.2° C and 36.1° C in the month of January and April respectively. Below table3-3; mentioned the temperature variation throughout the year;

Table 3-3: Monthly average temperature (° C) distribution of Malda District:

Year	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Avg. Temperature (°C)	17.4	19.7	25	29.1	30.1	29.7	28.9	28.8	28.8	26.9	21.8	18.7
Min. Temperature (°C)	10.7	12.7	17.3	22.1	24.7	25.8	26.1	26.1	25.8	22.8	15.8	12.2
Max. Temperature (°C)	24.2	26.8	32.7	36.1	35.6	33.6	31.8	31.6	31.8	31	27.9	25.2

(Source:** https://en.climate-data.org/asia/india/west-bengal/malda**)

ii) Relative Humidity, Wind speed & Wind direction

The entire District experiences a high relative humidity that is spread uniformly. Generally, the humidity ranging from 59 - 91% during the monsoons and the relative humidity generally decreases in drier months of March and April are less humid with the relative humidity ranging between 31% - 55%.

The winds over the district are high during Monsoon, the average wind speed in monsoon seasons varies from 11.5 mph to 16.5 mph, and occasionally this wind speed goes over the 20-mph due to depression and local storm. The wind direction in the monsoon season is South- West wind.

d) Topography and Terrain

Malda district is a low-lying plain, through which flows a number of rivers. On the basis of topography and drainage pattern, the district can Physiographycally be divided into three regions i.e. **Tal** (north portion above river Kalindri), **Diara** *(*southern portion below river Kalindri) and **Barind** (eastern part of river Mahananda).

Barind Region:

The 'Barind' tracts have the highest elevation of the district measuring 39.7 meters from the M.S.L. The highest lands are present in Gazole P.S. under this tract. Barind areas extend over a wide area in Malda district. The characteristic feature of this tract is wild undulations of successive ridges and depressions seamed with small water courses in the valleys and are practically devoid of shade except for the village sites and small patches of Sal forest here and there in Habibpur P.S. The ground is baked hard as iron; drinking water is scarce during summers. Except in autumn when it becomes green with winter rice, it remains arid. Of the 11 police stations in Malda, 4 P.S. viz. Old Malda, Gazole, Bamangola and Habibpur are within the tract. Adina, which was once the then capital of Bengal for some time during the Muslim rule is located in Gazole P.S. of this tract and the Barind tract comprises of an area of 1,32,761

hectares. In figure 4-4 the area has demarked in the NW side of the block, where the elevation is quiet higher than other side of the block.

Tal Region:

The Tal region is situated to the west of Mahananda River and north of Kalindri River. It is a low-lying area subjected to inundation with the rise of water level in the Ganges, Mahananda and Kalindri. The construction of flood protection measures has however eased the situation to some extent. The Tal area gradually slopes down towards the south and west and gradually merges with the Diara region. Ratua, Chanchal and Harishchandrapur P.S. are within this region. The total area under Tal tract is 1, 14,100 hectares. In figure 4-4 the North side of the block has demarked this Tal area.

Diara Region:

The 'Diara' consists of a strip roughly 12.87 K.M. in width along the western and southern sides of the district. Its formation is the result of centuries of fluvial action by the Ganges, the old channels of which can still be traced, beginning from the present course of the Bhagirathi River beside Gaur and extending westwards by successive stages. The soil is of light nature with a sandy appearance. English Bazar, Baishnab Nagarar, Kaliachak and Manickchak P.S. are under Diara tract. Total area under this tract is 1, 09,493 hectares.

There are no uplands in the district excepting a few elevated tracts in the district above sea level is 39.7 meters and is situated in Gazole Police Station. But the average elevation range of the district is 30 mts above sea level. And the slope direction of the district is generally forming the north to south. The natural division of the district coincides with that of the administrative division boundaries also. The River Kalindri flowing west to east act as a boundary between the Tal region in the north and Diara in the south. Mahananda up to its confluence with that of the Ganga acts as a boundary between the Tal region in the west and Barind in the east. The administrative boundaries particularly of police station in many cases follow the natural alignment of these rivers. So, the Tal region consists of Ratua, Chanchal and Harishchandrapur P.S., the Barind contains of Old Malda, Gazole, Bamangola & Habibpur P.S. and the Diara region comprises of English Bazar, Manickchak, Kaliachak and Baisnabnagar P.S. Therefore, obtaining of various secondary data related to population, land use etc., have become easier and directly applicable to the natural region as a whole. This indeed is an advantage for the present research work since the administrative divisions coincides with the natural division as referred above.

From the brief description of the topographic characteristics of the district of Malda, it is evident that the topographic configuration in association with the river system, soil characteristics and climatic particularly rainfall characteristics do influence innumerable water bodies, their distribution, areal extension and seasonal fluctuation. Given the slightly undulating topographic character present in the Brind area the surface water regions are expected to the less in numbers, more confined in nature and the seasonal fluctuations are expected to be more also. More over the topographic positivity in association with hydrological supportive characteristics the Tal and Diara regions are the more populous area of the district. In figure 4-4 the Diara region has demarked in south portion of this block. The Physiographic Map has mentioned below in figure 3-4;

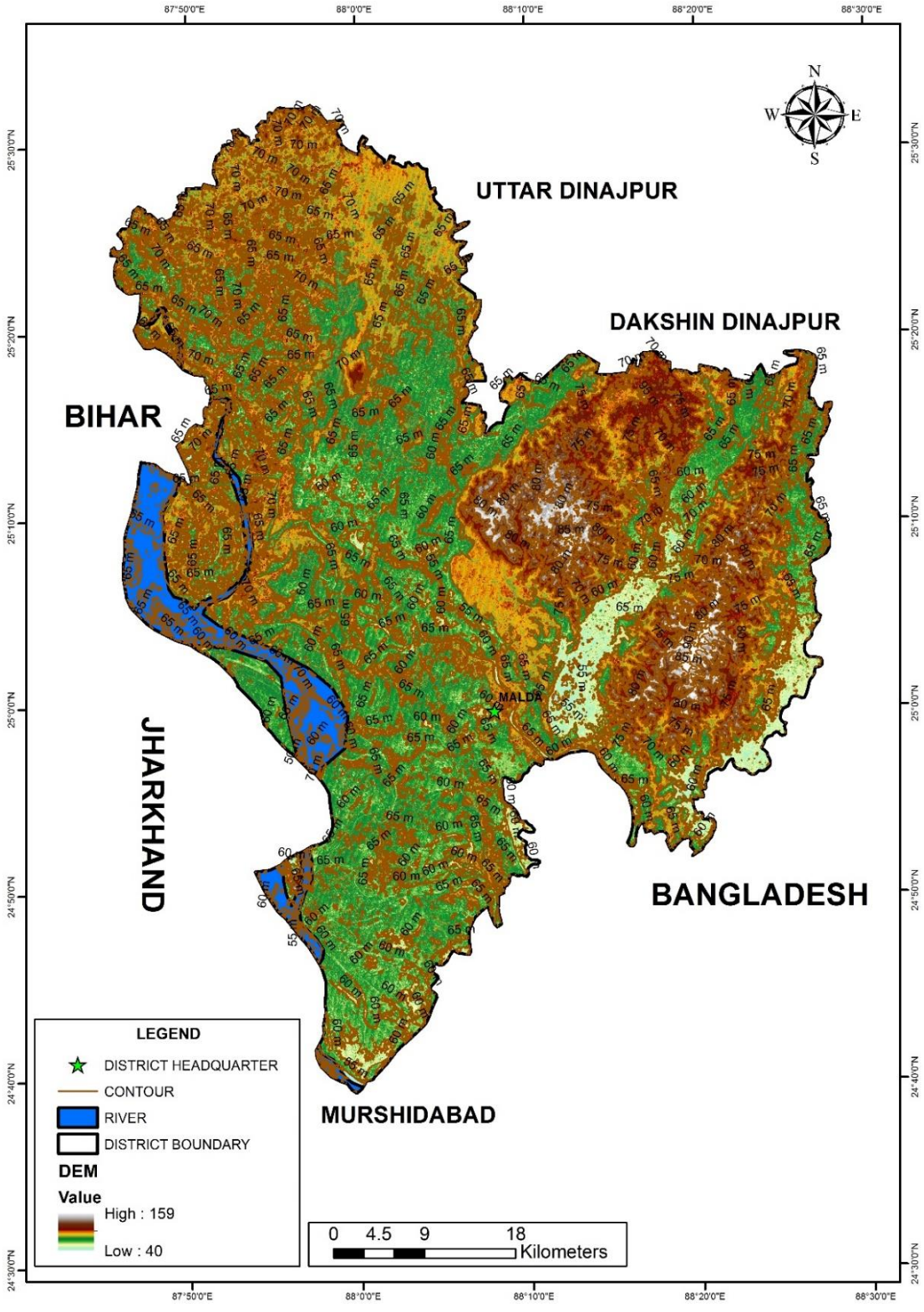


Figure 3-4: Physiography Map of Malda

(Source: Cartosat-1, Bhuvan India)

e) Water Course & Hydrology

Malda region is located in southern edge of the northern para-delta of Bengal region. By virtue of the fact that Malda region provides the final passage of the Ganga River system with its several tributaries having longitudinal alignments originating from the Himalayas and its foot hills in the north the surface hydrological conditions are prominently active in its true sense. In addition to this, as mentioned earlier, the basin between Rajmahal and Garo hills in the Malda district is situated. This set-up does not offer any structural (Geological) or relief (Geomorphological)obstruction against the free play area stage of surface hydrological features. The hydrological activities are evident from the facts that, first, a number of perennial rivers including the Ganga traverse through the district, Secondly, there is a strong evidence of shifting river channel and thirdly, almost the entire district floods keep on occurring almost regularly. So, it is quite natural that among the physical indices of the district hydrological characteristics, particularly surface hydrology features have created distinctive, prominent and permanent imprints.

Beels of the district are one of the products of this active hydrological characteristic of the district. This prominent characteristic in turn has penetrated in some of the explained physical geographical characteristics of the district in one hand and created impression on ethno-socio-cultural mosaic of human life in the district, on the other.

f) Ground Water Development

Ground water table is very significant item with regards to the genesis and properties etc. of the soil. The depth of the water table of any region is bound to various factors such as – physiography, climate, and porosity of substrata water table in the uplands and in the low lands of the district is thus expected to differ considerably. The depth of the ground water table also depends on the distribution of moisture in the various soil horizons. The level of ground water depends to a great extent on the geological conditions too as the height of the water table depends on the underground relief. The relief of the water table changes constantly in relation to the condition of the water balance of soil and ground water. Ground water table is balanced by the amount of rainfall, rate of evaporation, rate of run-off and of the amount that percolates through the soil body. The conditions of ground water table of Malda district, during both summer and rainy season are discussed below,

During summer the water table lies between 7.97 meters to 50.58 meters below the surface over the whole of the district. Major part of the ground water tables lies between 19.98 meters to 39.96 meters from the surface. Water table remains at a greater depth (above 19.98 meters from the surface) in Chanchal, Dakshinsahar, Malda, Sekhpura, Betla etc. In summer water table lies below on an average of 11.97 meters in Kaliachak Police Station and 19.98 meters below the surface in Habibpur Police station. In most of the area water table lies between 6.90 meters to 39.96 meters covering the blocks of English Bazar, Gazole, Chanchal, Ratua, Harishchandrapur-I etc. The depth of the water table from the surface is highest 39.96 meters in Gazole block of Barind area.

During rainy season ground water table is lies between 2.92 meters to 25 meters from the surface. Ground water table of the district lies nearer to the surface of the soil. But it is not continuous all over the district. On the south-west, east and in the middle of the district, water table lies between 3.96 meters to 5.97 meters below the surface. In the northern part of the district water table lies below 3.96 meters and more from the surface. The general water table lies more or less nearer to the surface (

https://indiawris.gov.in/wris/#/groundWater%20(CGWB%20website%20for%20Ground%20water%20data).

The below mentioned table has illustrated the last 23 years Ground water level (1996-2018) of Pre-Monsoon and Post-Monsoon of this district;

Table 3-4: Comparison of Pre-Monsoon and Post Monsoon data from year 1996-2018 in Malda District

Year	Avg. Post Monsoon	Avg. Pre-Monsoon
1996	3.93	7.37
1997	4.01	7.58
1998	2.60	7.27
1999	3.21	7.47
2000	4.61	5.70
2001	3.93	8.18
2002	3.57	8.82
2003	2.59	8.94
2004	3.12	8.11
2005	3.58	6.97
2006	4.33	6.03
2007	3.67	7.18
2008	4.08	6.62
2009	4.00	7.06
2010	4.12	7.30
2011	3.88	7.34
2012	5.31	7.99
2013	3.88	7.85
2014	4.39	6.96
2015	4.70	6.94
2016	4.00	7.25
2017	3.53	5.68
2018	1.02	5.34

Source: Water Resources Information System of India

Also, the figure 3-5, the graphical representation of this data comparison has given below;

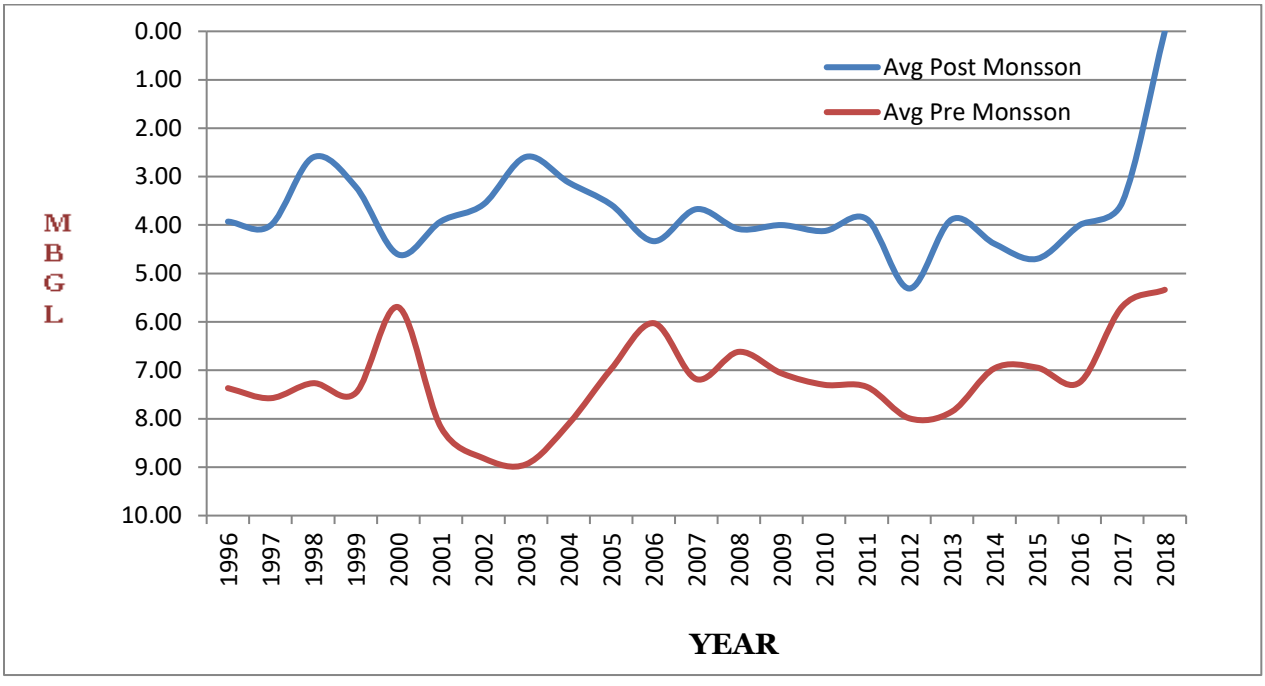
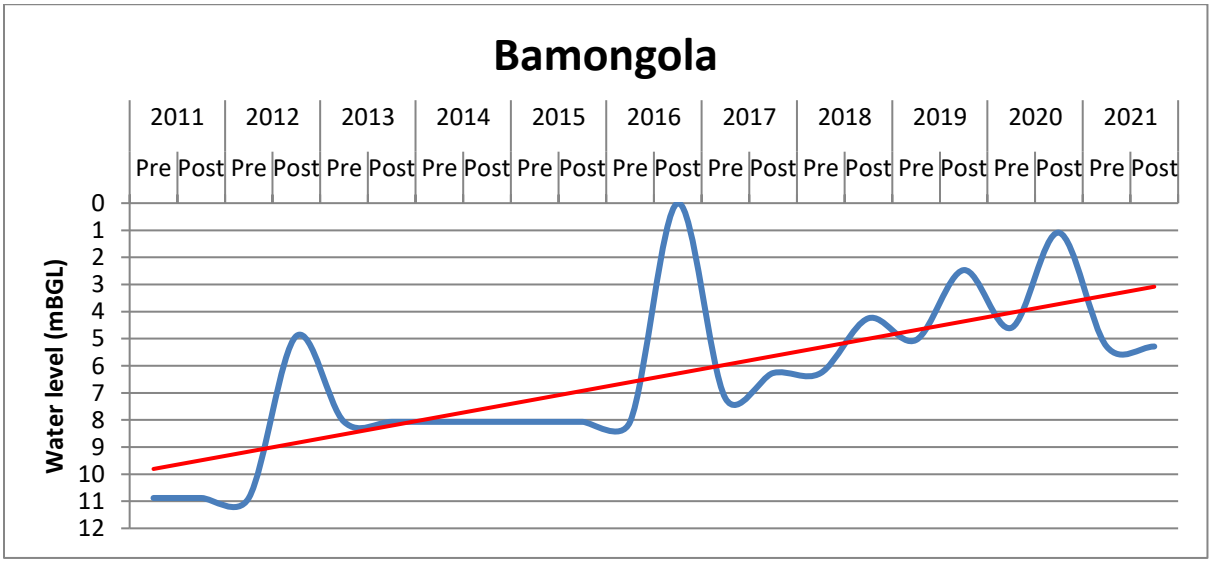
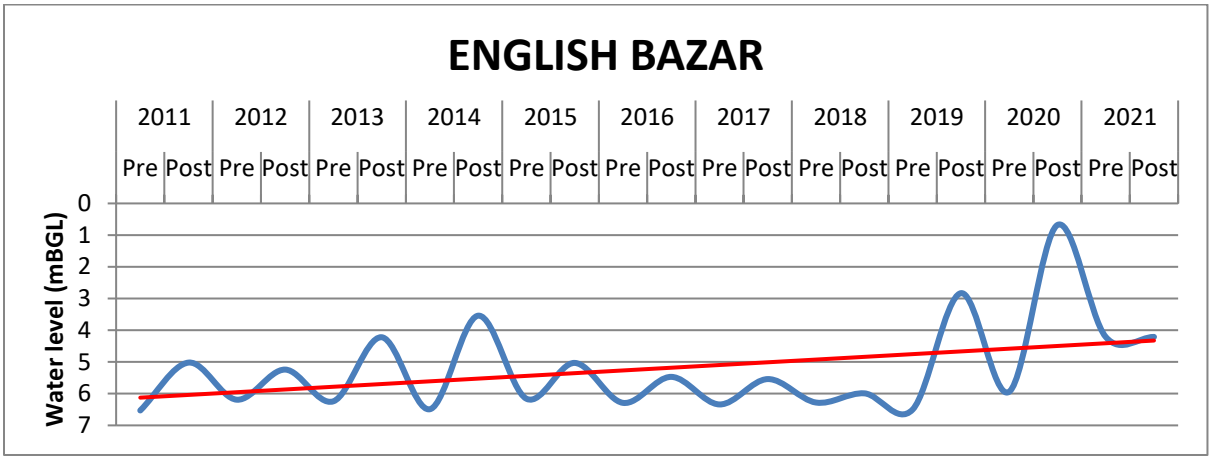
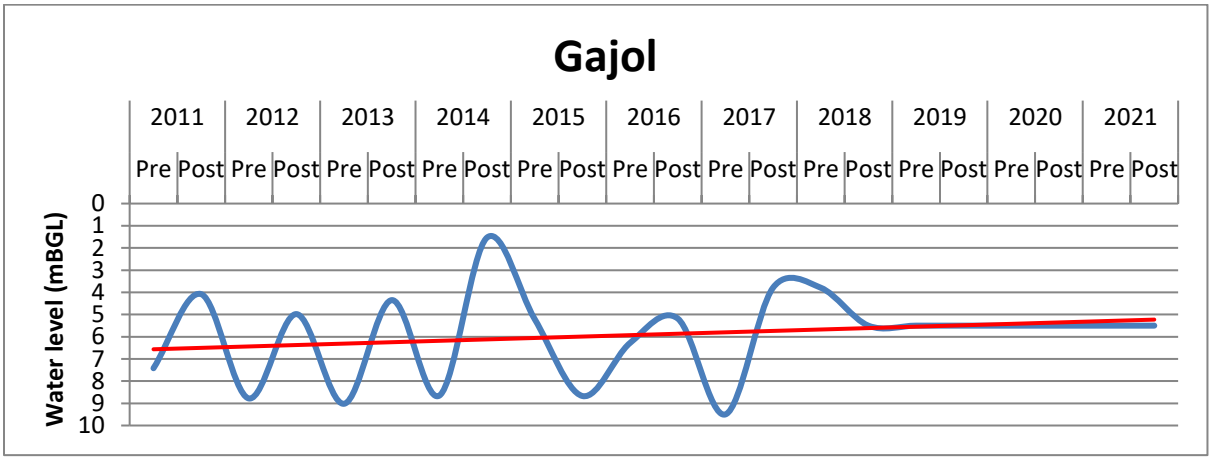


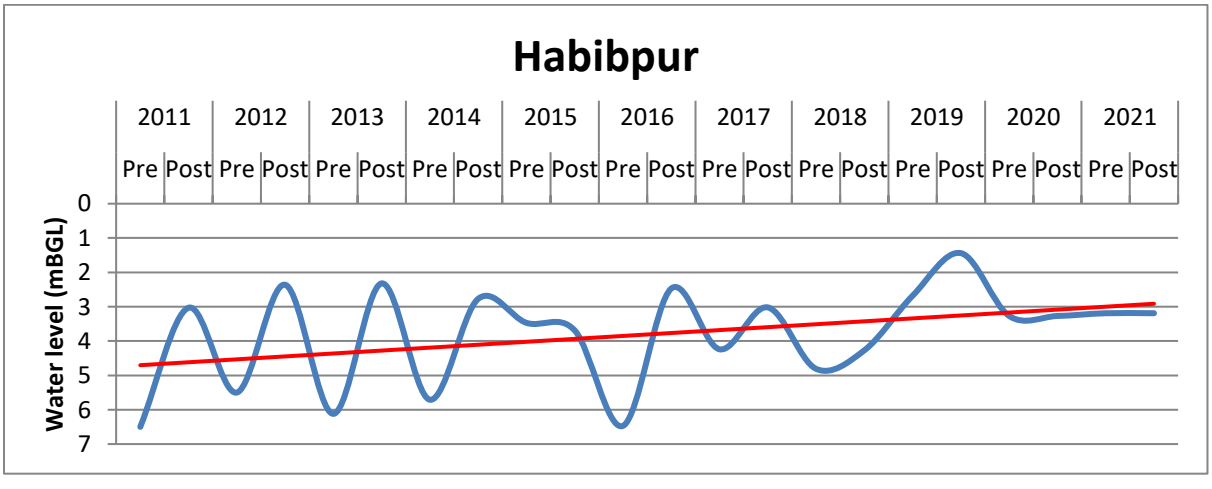
Figure 3-5: Graphical Representation of Ground water data of Malda

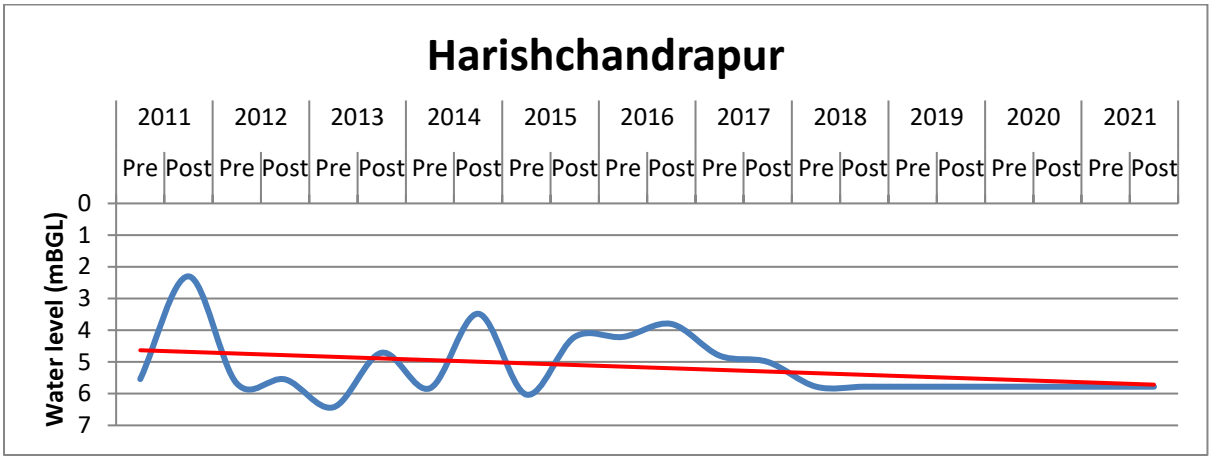
Hydrographs showing variation in water level observed in between 2011 to 2021 in the district is given below.

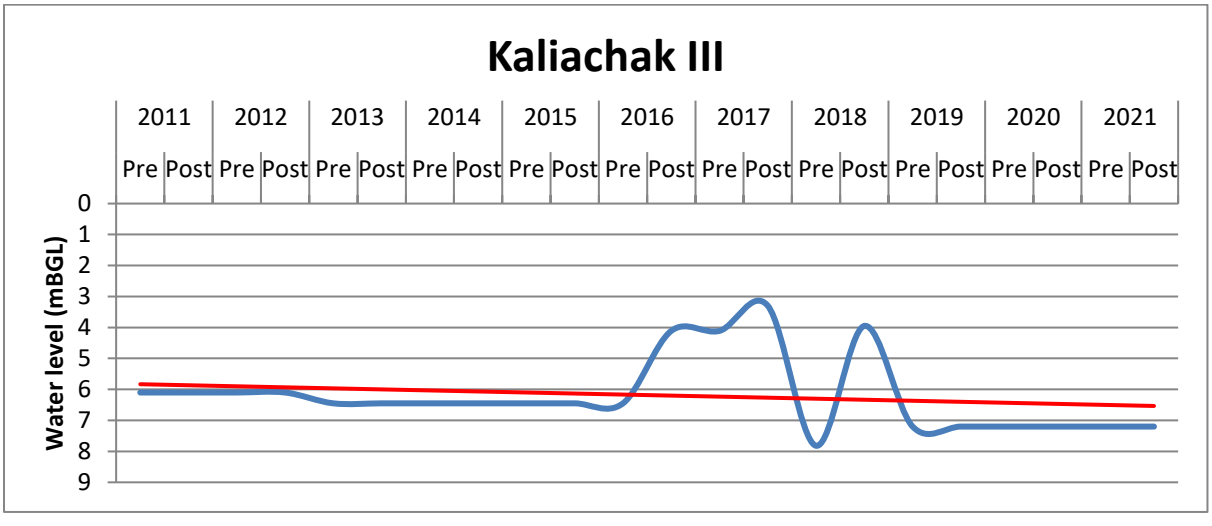


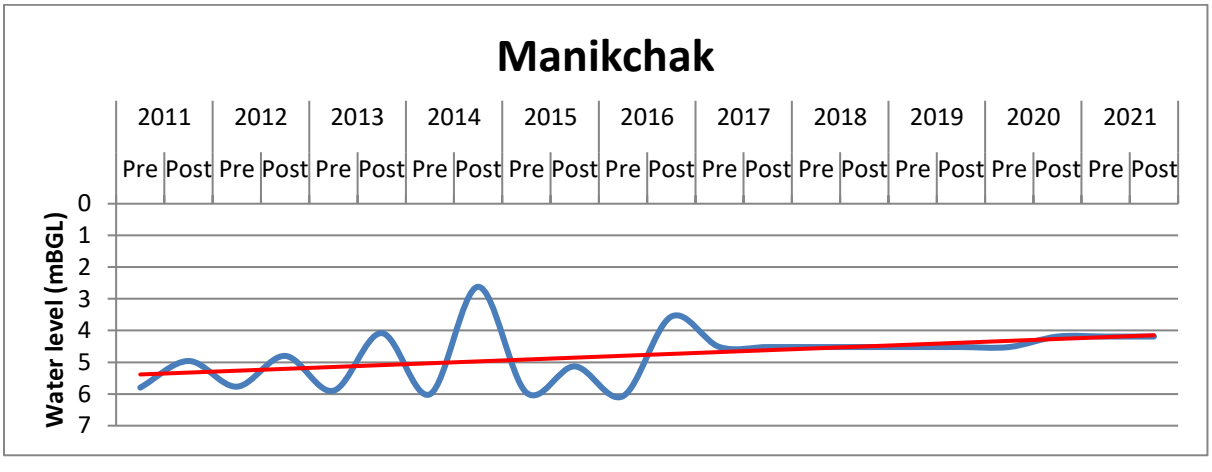

ENGLISH BAZAR
2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021
Pre Post Pre Post Pre Post Pre Post Pre Post Pre Post Pre Post Pre Post Pre Post Pre Post Pre Post
Water level (mBGL)
0 1 2 3 4 5 6 7


Gajol
2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021
Pre Post Pre Post Pre Post Pre Post Pre Post Pre Post Pre Post Pre Post Pre Post Pre Post Pre Post
Water level (mBGL)
0 1 2 3 4 5 6 7 8 9 10


Habibpur
2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021
Pre Post Pre Post Pre Post Pre Post Pre Post Pre Post Pre Post Pre Post Pre Post Pre Post Pre Post
Water level (mBGL)
0 1 2 3 4 5 6 7


Harishchandrapur
2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021
Pre Post Pre Post Pre Post Pre Post Pre Post Pre Post Pre Post Pre Post Pre Post Pre Post Pre Post
Water level (mBGL)
0 1 2 3 4 5 6 7


Kaliachak III
2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021
Pre Post Pre Post Pre Post Pre Post Pre Post Pre Post Pre Post Pre Post Pre Post Pre Post Pre Post
Water level (mBGL)
0 1 2 3 4 5 6 7 8 9


Manikchak
2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021
Pre Post Pre Post Pre Post Pre Post Pre Post Pre Post Pre Post Pre Post Pre Post Pre Post Pre Post
Water level (mBGL)
0 1 2 3 4 5 6 7

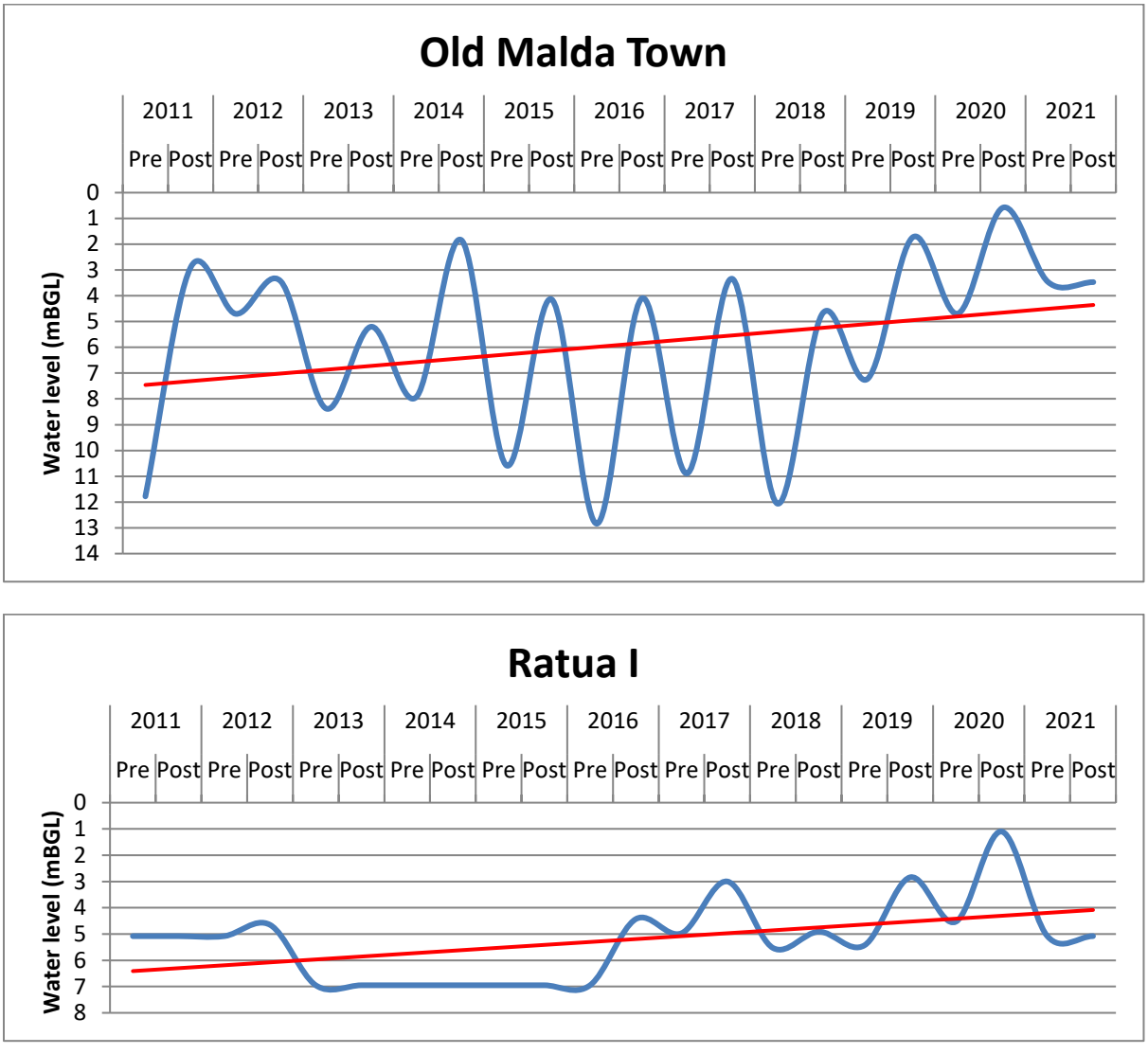


Figure 3-6: Block wise Hydrograph showing variation of waterlevel during 2011 to 2021

g) Drainage System

Rivers in the district constitute an important feature upon its landscape. The earth surface here is washed by the waves of rivers like the Ganga, Mahananda, Fulahar, Kalindri, Tangaon, Punarbhava, Pagla and Bhagirathi. All main rivers of the district are of the Himalayan or sub-Himalayan origin and flows towards south direction. Due to the devastating flood particularly in the Western side of the district, huge amount of life and property, human establishments and agricultural land goes into the Ganga River each year. (Details of Drainage system discussed on 7 chapter).

The following table 3-5 gives a vivid picture of the drainage system within the district of Malda.

Table 3-5: List of Rivers of Malda District

Name of the River	Entry Point to the District	Runs through C.D. Blocks	Length within the District	Branches	End Point
Ganga	Gaduri of Bhutni Char of Manickchak C.D. Block	Kaliachak-II Kaliachak-III Manickchak	172 km.	Fulahar, Bhagirathi, Kalindri	Pardeonapur at Kaliachak-II
Mahananda	Junction of Chanchal-I, Ratua-II and Gazole C.D. Blocks	English Bazar, Old Malda, Habibpur, Gazole	88.6 km.	Kalindri Pagla	Aiho at Habibpur
Punarbhava	North-East portion of Bamangola C.D. Block	Bamangola	64.40 km.	Haria	Eastern border of Bamangola
Tangaon	Junction of Bamangola and Gazole C.D. Blocks	Bamangola, Old Malda, Habibpur Gazole	64.60 km.	ChunakhaliKhal	Mahananda River
Kalindri	Mahaghat of Harishchandrapur-II C.D. Block	Harishchandrapur-II English Bazar, Manickchak, Ratua-I	NA	Fulahar	Mahananda River at Bachamari, Old Malda

Source: District Census Hand Book Malda, Census, 2011

The drainage map of this district has given below and also furnished as **Plate 1**.

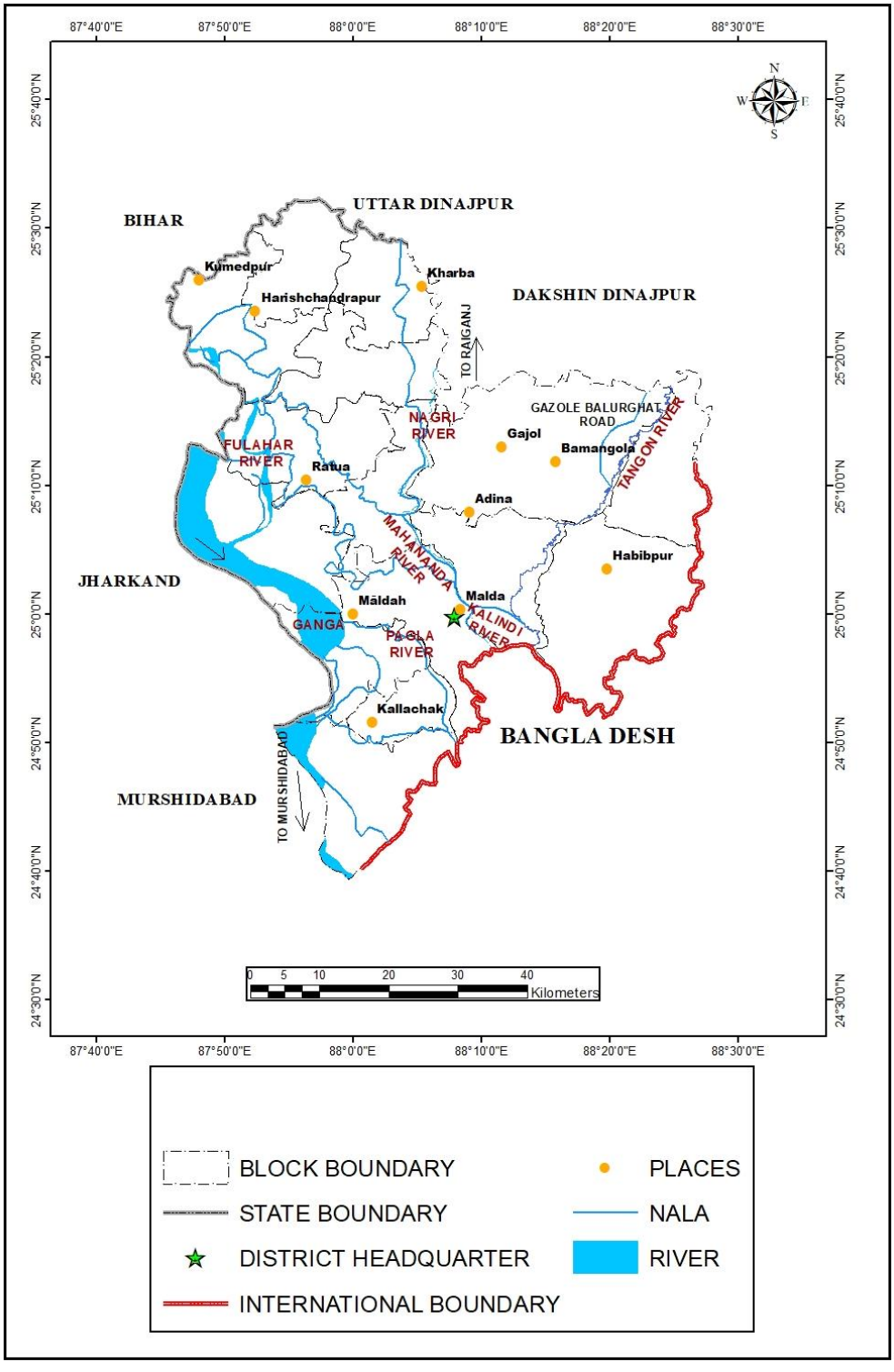


Figure 3-7: Drainage Map of Malda

(Source: National Informatics Center)

h) Demography

According to 2011 census, the district encompasses a geographical area of 3733 sq km and has a population of 32, 90, 468 (persons) including 16, 89, 406 (males) and 16,01, 062 (females). The district has a sex ratio of 93.9 females for every 100 males. The major religions in the district (according to census 2001) are Muslim (51.27%) and Hindu (48%) of the total population respectively. Northern part of the district has dominantly Hindu 53% population; Muslims are 46%. Tribesman and Christian people also live here. Southern Malda is dominated by 59% Muslim population. Sujapur Idgah is one of the largest in India. Hindus are 40% in this part.

The initial provisional data released by census India 2011, shows that density of Malda district for 2011 is 1071 people per sq. km. The average national sex ratio in India is 940 as per latest reports of Census 2011 Directorate. According to Census India, 2011, the Literacy rate of this district is about 61.73% and the population growth rate over the decade 2001-2011 was 21.5%.

Below mentioned table 3.6 shows the block wise Demographic distribution of the district;

Table 3-6: Demographic distribution of Malda District

Sub-Division / C.D.Block	Area (Sq. Km.) (2001)	Total Population			Literacy Rate %	Illiterate %	Percent of population to district population
		Male	Female	Total			
Chanchal Sub-Division	**1160.44**	**553229**	**524872**	**1078101**	**57.68**	**42.32**	**32.76**
Harishchandrapur-I	171.41	83113	79293	162406	52.47	47.53	4.94
Harishchandrapur-II	217.21	102066	95973	198039	54.34	45.66	6.02
Chanchal-I	162.14	89182	85022	174204	65.09	34.91	5.29
Chanchal-II	205.22	84175	81017	165192	57.38	42.62	5.02
Ratua-I	230.53	112396	104960	217356	60.13	39.87	6.61
Ratua-II	173.93	82297	78607	160904	56.19	43.81	4.89
Sadar Sub-Division	**2515.43**	**1E+06**	**1076190**	**2212367**	**63.76**	**36.24**	**67.24**
Gazole	513.65	150303	144412	294715	63.07	36.93	8.96
Bamongola	205.91	65258	61994	127252	68.09	31.91	3.87
Habibpur	396.07	94945	92705	187650	58.81	41.19	5.70
Old Malda	215.66	67587	63668	131255	59.61	40.39	3.99
English Bazar	251.52	116457	109779	226236	63.03	36.97	6.88
Manikchak	321.77	110410	103717	214127	57.77	42.23	6.51
Kaliachak-I	105.37	160064	150871	310935	65.25	34.75	9.45
Kaliachak-II	222.73	108921	102485	211406	64.89	35.11	6.42
Kaliachak-III	260.12	146876	137500	284376	54.16	45.84	8.64
Old Malda(M)	9	32511	30448	62959	75.60	24.40	1.91
English Bazar(M)	13.63	82845	78611	161456	86.46	13.54	4.91
District Total	**3733.00**	**2E+06**	**1601062**	**3290468**	**61.73**	**38.27**	**100**

(Source: Census, 2011)

The below mentioned figure 3-8 depicts the block wise Population of Malda with respect to Male and female counts;

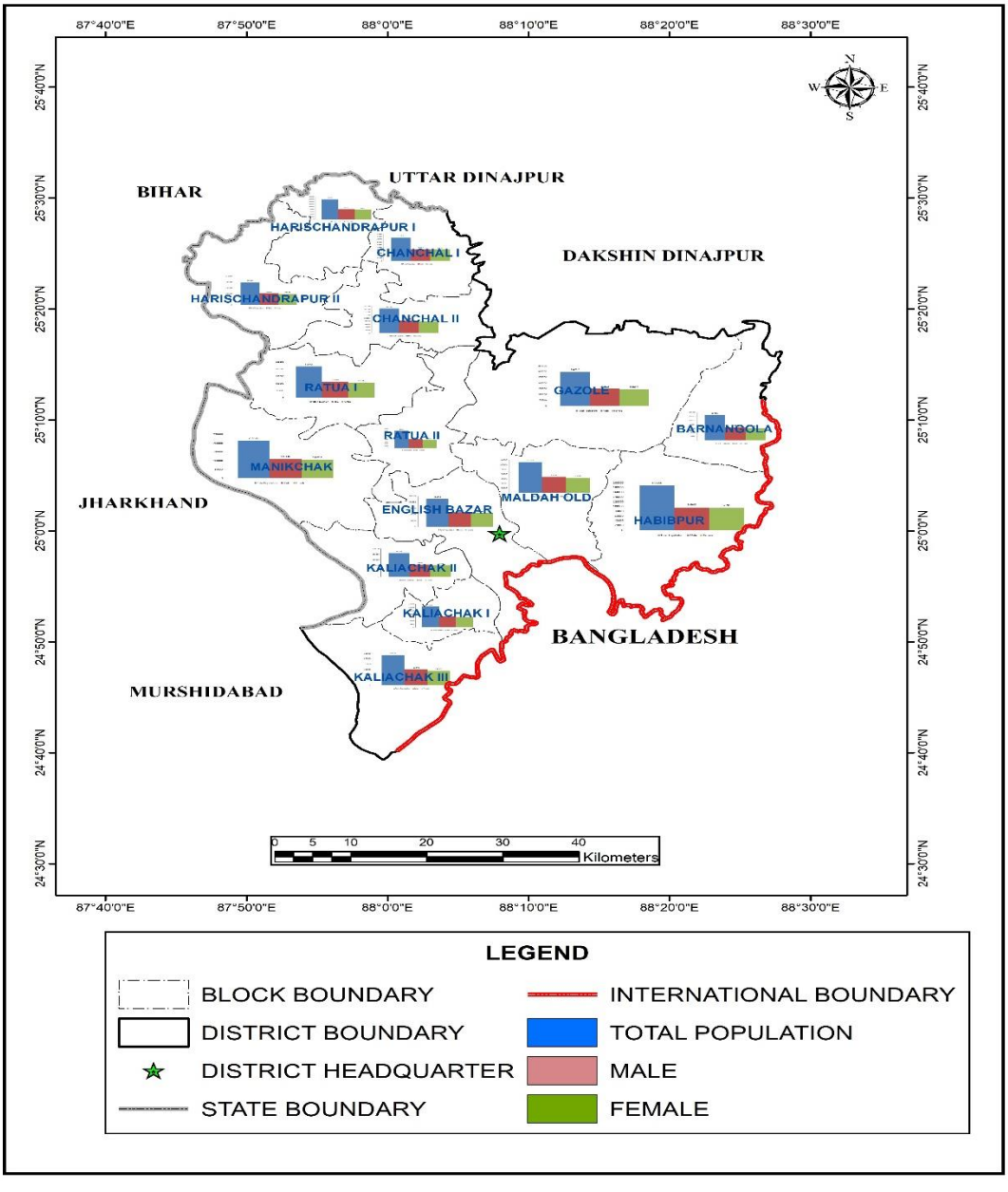


Figure 3-8: Demographic Map of Population in Malda

(Source: Census, 2011)

The below mentioned figure 3-9 depicts the block wise literacy rate of Malda at all the blocks;

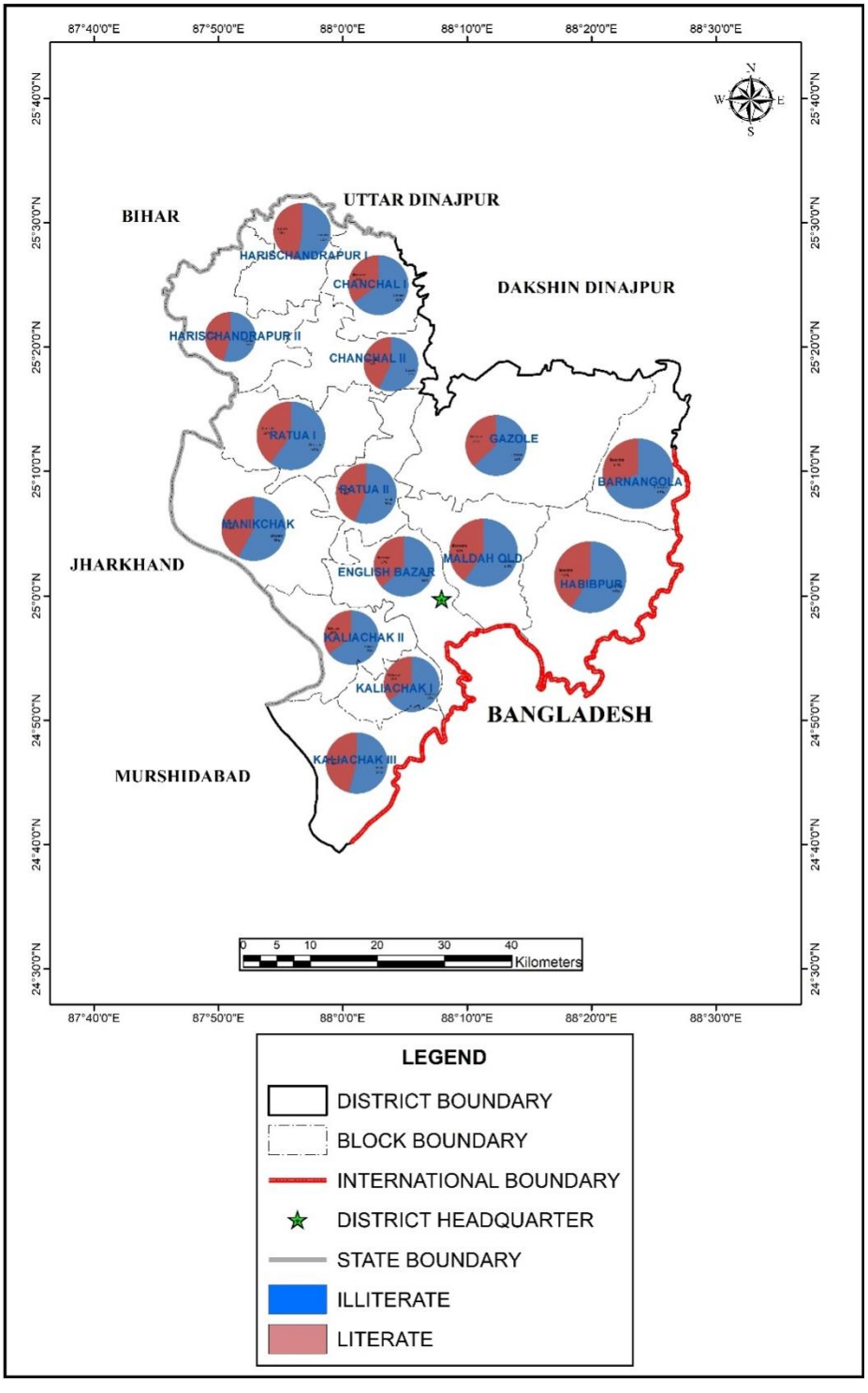


Figure 3-9: Demographic Map of Literacy Rate in Malda

(Source: Census, 2011)

i) Cropping Pattern

Cropping pattern means the proportion of area under various crops at a point of time. It depends on terrain, slope, soils and availability of water for irrigation, use of pesticides, fertilizers and mechanization. In simple word cropping pattern means the production of area under various crops at a point of time. It is dynamic process because no cropping pattern can be said to be ideal for all times to a particular region. It changes over space and time with a view to meet requirements and is governed largely by the physical as well as cultural and technological factors. The change in cropping pattern in a particular span of time clearly indicates the changes that have taken place in the agricultural development. These changes are brought about by socio-economic influence.

A cropping system is kind and sequence of crop grown on a given area of soil over a period of time. It may be regular rotations of different crops in which the crops follow a definite order of appearance on the land or it may consist of only one crop grow year after year on the same area (monoculture). Generally, the cropping pattern adopted by the cultivators should be so flexible as to be based on the following:

I. The crop should not accentuate certain diseases as a result of a fixed continuous rotation

II. The crop should not exhaust on some specific plant nutrients from a particular depth in thesoil.

III. The crop should be fertility building and soil improving.

IV. It should fetch handsome returns to the farmers and should provide the farmer employment and income all year round. Moreover, the crop should ensure the optimum utilization of his resources, particularly, inputs like irrigation water, fertilizers, insecticides, equipment and power (Singh, 1986). Shift in cropping pattern is perceptible incite second phase of Green revolution. The major shift has been found in food grains production. The coarse grains are like maize, bajra, barley, gram and even oilseed comprised a little proportion. There have been phenomenal declines in favor of wheat and rice.

A developed agricultural economy is characterized by a balanced cropping pattern. In other words, in such an economy hectares of land use for different crops should bear a close relationship with their relative importance. Cropping patterns of a region are the extent to which the arable land under different agricultural activities can be put to use. Cereal consists of two crops i.e. rice and wheat. A perusal of the Table 4-7 reveals that cereals accounts for the largest proportion of total cropped area in Malda district. This is mainly due to the fact that the climatic and soil condition of the district is much favorable for cereals cultivation. Among cereals rice is the staple food item of all the people of the district.

Table 3-7: Block wise Cropping Pattern of Malda district (2010-11)

Blocks	Cereals		Pulses		Oilseeds		Cash Crops	
	Area	%	Area	%	Area	%	Area	%
Harishchandrapur-I	19725	74.39	1197	4.51	1997	7.53	3595	13.56
Harishchandrapur-II	26679	82.55	1218	3.77	3476	10.76	944	2.92

Blocks	Cereals		Pulses		Oilseeds		Cash Crops	
	Area	%	Area	%	Area	%	Area	%
Chanchal-I	21806	77.44	631	2.24	1885	6.69	3838	13.63
Chanchal-II	24039	83.07	599	2.07	2753	9.51	1548	5.35
Ratua-I	15995	80.82	763	3.86	805	4.07	2229	11.26
Ratua-II	14924	70.83	1783	8.46	1969	9.34	2395	11.37
Gazole	8743	51.75	1067	6.32	5348	31.65	1738	10.29
Bamongola	12581	79.82	60	0.38	2541	16.12	579	3.67
Habibpur	26387	85.21	150	0.48	4120	13.3	310	1
Old Malda	7884	79.7	71	0.72	862	8.71	1075	10.87
English Bazar	7846	77.98	1594	15.84	470	4.67	152	1.51
Manikchak	9937	65.63	3518	23.23	258	1.7	1429	9.44
Kaliachak-I	3030	64.01	119	2.51	548	11.58	1037	21.91
Kaliachak-II	2214	64.47	171	4.98	561	16.34	488	14.21
Kaliachak-III	13652	62.98	3230	14.9	3098	14.29	1698	7.83
Malda	**215442**	**75.5**	**16171**	**5.67**	**30691**	**10.76**	**23055**	**8.08**

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

Cropping Intensity

The cropping intensity in Malda district was 150 percent in 2000-01, which has increased to 183 percent in 2010-11 which is a sign of healthy agricultural economy. But there are significant variations across the district.

High Cropping Intensity:

During 2000-01, high cropping intensity has registered only in five blocks namely, Harishchandrapur-I, Chanchal-I, Chanchal-II, Ratua-II and Kaliachak-I.During 2010-11, high cropping intensity has noticed in five blocks namely, Harishchandrapur-I, Harishchandrapur-II, Chanchal-I, Chanchal-II, and Ratua-II. It is because of favorable irrigation facility, extent of new farm technology, climatic and edaphic condition for cultivation of crops.

Medium Cropping Intensity:

There are five blocks, reported under medium cropping intensity i.e.Kaliachak-II, Kaliachak-III, Manickchak, Harishchandrapur-II and English Bazar during the year 2000-01. Whereas, there are five blocks come under the category of medium cropping intensity on 2010-11, these blocks are Ratua-I, English Bazar, Kaliachak-I, Kaliachak-II and Kaliachak-III.

Low Cropping Intensity:

Five blocks which report low cropping intensity during 2000-01. These are Ratua-I, Gazole, Bamangola, Habibpur and English Bazar. During 2010-11, there are five blocks namely;Gazole, Bamangola, Habibpur, Old Malda and Manickchak have low level of cropping intensity.

Below table mentioned major farming system with compare to land situation;

Table 3-8: Cropping Intensity in Malda District

Blocks	2001	2011	Growth Rate (%)
Harishchandrapur-I	199	257	29.15
Harishchandrapur-II	171	240	40.35
Chanchal-I	197	282	43.15
Chanchal-II	186	242	30.11
Ratua-I	132	204	54.55
Ratua-II	173	243	40.46
Gazole	127	148	16.54
Bamangola	142	153	7.75
Habibpur	121	123	1.65
Old Malda	143	153	6.99
English Bazar	116	164	41.38
Manickchak	153	148	-3.27
Kaliachak-I	181	161	-11.05
Kaliachak-II	159	172	8.18
Kaliachak-III	162	221	36.42
Malda	**150**	**183**	**22**

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

j) Land Form and Seismicity

The study area is found to be affected by the seismo-tectonic activity. Eastern Gangetic plain is neo-tectonically active as evidenced by occurrence of several major (1883, 1897, 1934 and 1988) and minor earthquakes in this region. Due to the great earthquake of 12thJune 1897, with its epicenter on the Shilong plateau cracks up to a mile length and upto a few feet in width opened all-over low-lying lands, in Malda district. Spouting of sand and water were also observed. The earthquake of 1934 (intensity about 8.4 Richter scale) had its epicenter in the Madhubari area and is thought to have occurred due to movements along a fracture zone between Motihari and Purnea (Dunn et.al, 1939). The maximum intensity reached in 1988 Bihar - Nepal earthquake was 9 in modified Mercalli (MM) scale over an area northeast of Madhubari, Bihar (G.S.I., 1933). The river basin in the region is subsiding at a rate of 1 m per 1000 years. (Agarwal and Bhoj, 1992). The entire north Indian plate is subjected to NNE - SSW directed

(approximately N-S) compression that resulted from post coalitional northward under thrusting of the Indian plate, (Bilham, R. 1950). the structural map, contour map of the basement and cross-sections showing Neogene - Quaternary formations suggests a regional tilt from east to west along the Malda-Kishanganj fault, which got accentuated in the recent past due to reactivation along the faults / lineaments resulting west word migration of the river. On 21st September 2009 (Monday, 18.01, I.S.T.) an earthquake measuring 6.3 on the Richter scale recorded parts of Assam and other north-eastern states of India. The epicenter was plotted in Munggar in Bhutan, which is located along India-Bhutan border, 125 Km northwest of Guwahati. The tremors were felt in Malda district approximately 2.26 P.M but no major damage was reported in this area. Calculate the energy of earthquakes from,

Log_{10} E = 4.4 + 1.5 Ms

(For earthquake less than 5.0 magnitudes)

Log_{10} E = 5.24+1.44 Ms

(For earthquake greater than 5.0 magnitudes)

Where, E = energy of the earthquake in Jules,

Ms = surface wave magnitude (lowrie, 2007).

Southern part of North Bengal and the western part of the Darjeeling Himalaya along with foothills come within Zone IV of seismic zoning Map of India, where as west, central and North-East part lying in the Zone III.

The brief Description of Seismic zoning;

Zone - V

Zone 5 covers the areas with the highest risks zone that suffers earthquakes of intensity MSK IX or greater. The IS code assigns zone factor of 0.36 for Zone 5. Structural designers use this factor for earthquake resistant design of structures in Zone V. The zone factor of 0.36 is indicative of effective (zero periods) level earthquake in this zone. It is referred to as the Very High Damage Risk Zone. The region of Kashmir, the Western and Central Himalayas, North and Middle Bihar, the North-East Indian region, the Rann of Kutch and the Andaman and Nicobar group of islands fall in this zone.

Generally, the areas having trap rock or basaltic rock are prone to earthquakes.

Zone - IV

This zone is called the High Damage Risk Zone and covers areas liable to MSK VIII. The IS code assigns zone factor of 0.24 for Zone 4 Jammu and Kashmir, Ladakh, Himachal Pradesh, Uttarakand, Sikkim, the parts of Indo-Gangetic plains (North Punjab, Chandigarh, Western Uttar Pradesh, Terai, North Bengal, Sundarbans) and the capital of the country Delhi fall in Zone 4. In Maharashtra, the Patan area (Koynanagar) is also in zone no-IV. In Bihar the northern part of the state like Raxaul, near the border of India and Nepal, is also in zone no-IV.

Zone - III

This zone Comprises of Kerala, Goa, Lakshadweep islands, remaining parts of Uttar Pradesh, Gujarat and West Bengal, parts of Punjab, Rajasthan, Madhya Pradesh, Bihar, Jharkhand, Chhattisgarh, Maharashtra, Odisha, Andhra Pradesh, Tamil Nadu and Karnataka.

Zone – II

This region is liable to MSK VI or less and is classified as the Low Damage Risk Zone. The IS code assigns zone factor of 0.10 (maximum horizontal acceleration that can be experienced by a structure in this zone is 10% of gravitational acceleration) for Zone II.

Zone – I

Since the current division of India into earthquake hazard zones does not use Zone 1, no area of India is classed as Zone I.

The below table mentioned the seismic zone sustain on comprising to earthquake intensity;

Table 3-9: Seismic zone with intensity of earthquake

Seismic Zone	Intensity on M.M Scale
Zone-II (Low-Intensity Zone)	6 (or less)
Zone-III (Moderate Intensity Zone)	7
Zone-IV (Severe Intensity Zone)	8
Zone-V (Very Severe Intensity Zone)	9 (and above)

This district belongs to seismic zone IV because early mentioned that this area has faced some serious earthquake. So, based on that matter Malda has categorized in seismic zone IV. Below mentioned figure 3-10 has described the Earth quake map of the study district;

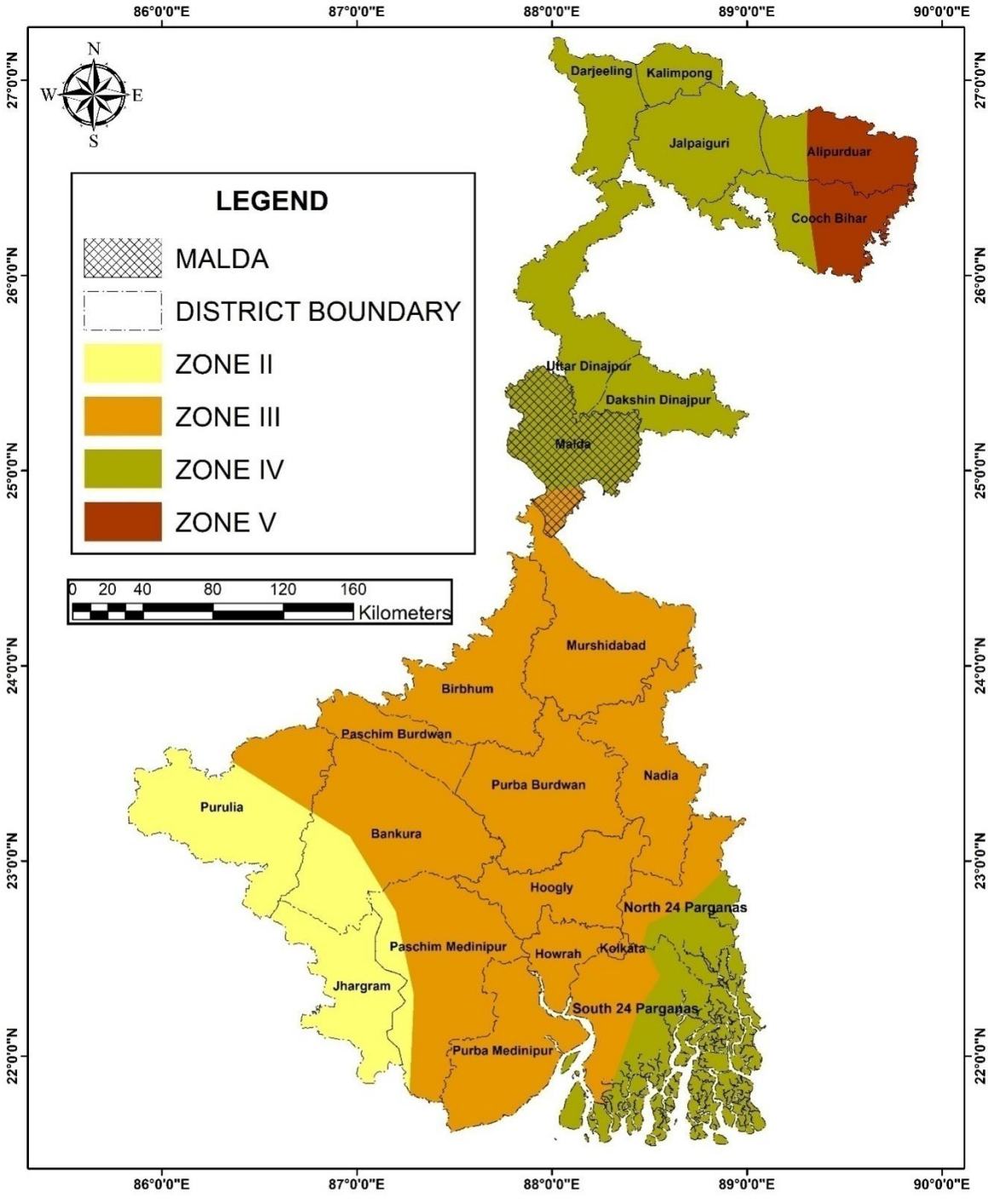


Figure 3-10: Seismic zonation map of West Bengal, highlighting Malda district position

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

k) Flora

This district of Malda is world famous for mango fruit. Other fruits like jackfruits, custard apple, mulberry, peach, gooseberry, wood apple, betel nut and coconut are also available. Among the jungle trees babool, wild palm, pepul, acacia, burged, tamarisk, sisoo, sagoon, toon, gamar, arjun, bamboo, simul are noteworthy.

Some hydro plankton also found in the wetland of this district. Some of hydrophytes are common in all wetlands of three geographical regions i.e. Tal, Barind&Diara regions. Common hydrophytes like kulakhara, Thankuni, Hingcha, Kuchuripana, Susnisak, Kalmisak, Bara pana, Gima, Saluk etc. are found all through the wetlans. From human point of view, these common hydrophytes play vital role to support the local people needs e.g. economically (salable product) as well as food value purpose (individual consumptive). Hydrophytes like kulakhara, thankuni, hingcha, gima, kalmisak are also used for medicinal purpose by the villagers.

On the other hand, a hydrophyte '***Makhna'*** is cultivated only in Tal region wetlands of the district. This particular very high protein and economical plant is very much effective to the local people for their economic needs. 'Sola', 'Pani-phal', are mainly grown in Chaklabeel of Tal region of the district. The reasons of these areal difference may be micro-ecological and beyond the perview of the present research. But from the above descriptive information it is evident that the phyto-geographical components available in the bils ecosystem are more or less uniform interms of their variety.

l) Fauna

Wild animals were abundant till the first quarter of the nineteenth century. Among them Rhinoceros, Tiger, *Samber*, Leopard, *Bara Singha* deer, Spotted Deer, Antelope, Wild Cat, Wild Buffaloes, Hyena, Wolf, Wild-Cats were found. Among amphibious reptiles the snub-nosed crocodiles were found in large number in the Tangan and Punarbhava river and Gharial in the Ganga River. But due to the over-increasing pressure of population most of the wild animals of late suffered extinction in Maldah and shifted their habitat further north.

Like the floral life, in this district the aqua life also very important. Many types of wetland birds and fishes have been seen. The details of these have given below;

Table 3-10: Diversity of Fishes, Malda District

SL No	LOCALNAME	SCIENTIFIC NAME	SL No.	LOCALNAME	SCIENTIFIC NAME
1	Air	***Mystusseenghala***	13	Chanda	***Ambassisnama***
2	Chela	***Chela bacaila***	14	Ranga chanda	***Ambassisranga***
3	Boal	***Wallagoniaattu***	15	Koi	***Anabas testudineus***
4	Danrika	***Esomusdanrica***	16	Veda	***Badisbadis***
5	Darkina	***Rasbora daniconius***	17	Chunakhalisa	***Trichogasterchuna***
6	Puti	***Burbusphutunio***	18	Khalisa	***Trichogasterfasciata***
7	Swarna puti	***Burbussarana***	19	Chang	***Ophicephalusgachua***

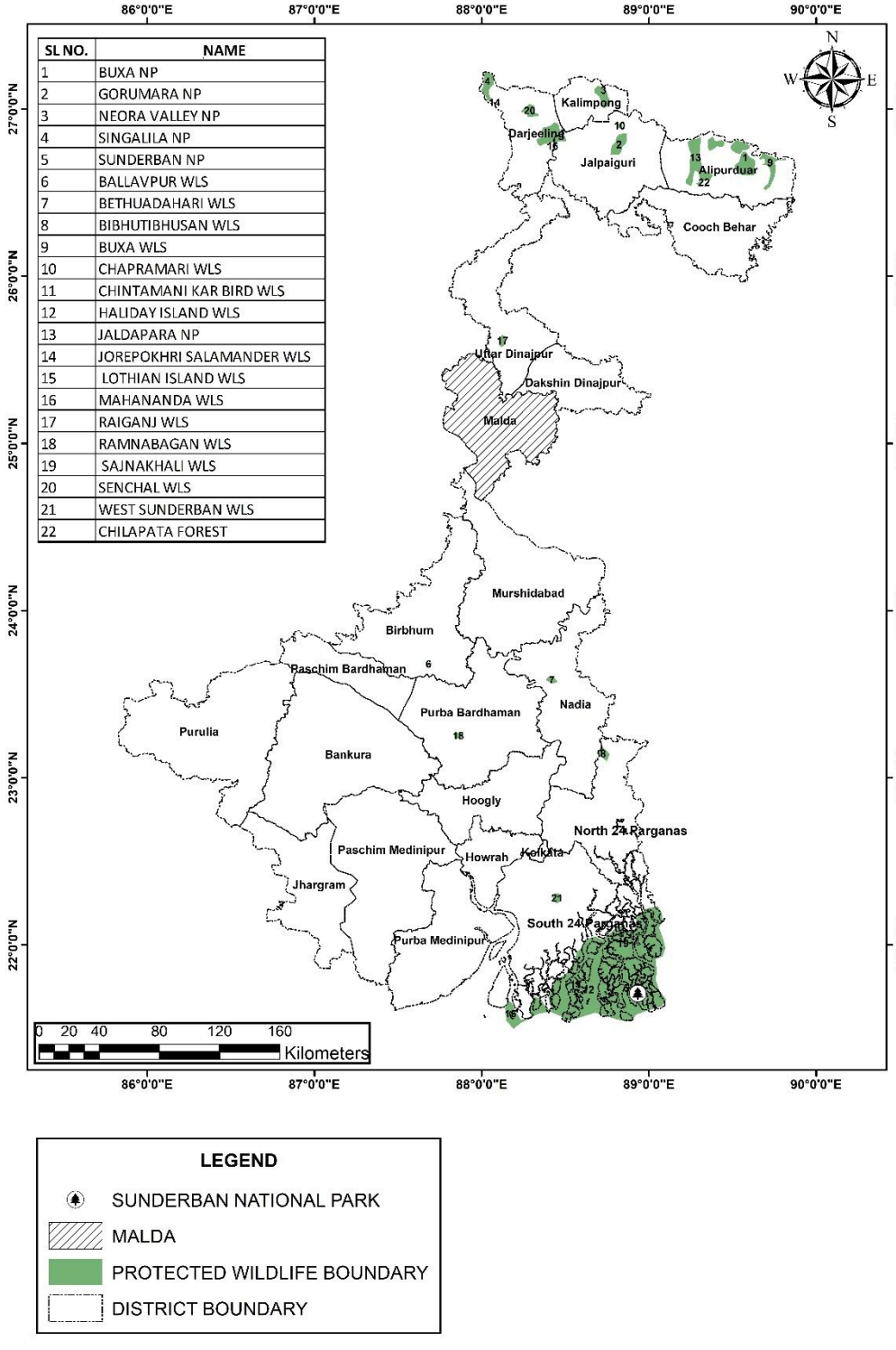
SL No	LOCALNAME	SCIENTIFIC NAME	SL No.	LOCALNAME	SCIENTIFIC NAME
8	Tit punti	***Barbusticto***	20	Gajar	***Ophicephalusmarulius***
9	Mrigal	***Cirrhinamrigala***	21	Lata	***Ophicephalus punctatus***
10	Magur	***Clariusbatrachus***	22	Dud chang	***Ophicephalusstewartii***
11	Singhi	***Heteropneustesfossilis***	23	Shole	***Ophicephalusstriatus***
12	Tengra	***Mystuscavasius***	24	Kunche	***Amphipnouscuchia***

Table 3-11: Diversity of Birds in Malda District

SL. NO.	NAME	SCIENTIFIC NAME	HABITAT	ABUNDANCE	STATUS
1	Lesser Whistling-duck	Dendrocygnajavanica	Wetland	Common	Resident Breeding
2	Greylag Goose	Anseranser	Wetland	Fairly common	Winter Visitor
3	Cotton pygmy-goose	Nettapuscoromandelianus	Wetland	Common	Winter Visitor
4	Common kingfisher	Alcedoatthis	Wetland	Common	Resident Breeding
5	Stork-billed kingfisher	Halcyon capensis	Wetland	Common	Resident Breeding
6	Pied kingfisher	Cerylerudis	Wetland	Common	Resident
7	Common sandpiper	Actitishypoleucos	Wetland	Common	Winter Visitor
8	Little stint	Calidris minuta	Wetland	Common	Winter Visitor
9	Little ringed plover	Charadrius dubius	Wetland	Common	Winter Visitor
10	Red-wattled lapwing	Vanellus indicus	Wetland, Agricultural Land	Common	Resident
11	Brown-headed gull	Larus brunnicephalus	W	Common	Winter Visitor
12	Osprey	Pandion haliaetus	W	Common	Winter Visitor
13	Grey Heron	Ardea cinerea	W	Common	Resident
14	Great egret egret	Casmerodius albus	W	Common	Resident

SL. NO.	NAME	SCIENTIFIC NAME	HABITAT	ABUNDANCE	STATUS
15	Intermediate	Mesophoyx intermedia	W	Common	Resident
16	Indian pond heron	Ardeolagrayii	W	Common	Resident Breeding

The below mentioned figure 3-11 has illustrated the map of wildlife of Malda;



SL NO.	NAME
1	BUXA NP
2	GORUMARA NP
3	NEORA VALLEY NP
4	SINGALILA NP
5	SUNDERBAN NP
6	BALLAVPUR WLS
7	BETHUADAHARI WLS
8	BIBHUTIBHUSAN WLS
9	BUXA WLS
10	CHAPRAMARI WLS
11	CHINTAMANI KAR BIRD WLS
12	HALIDAY ISLAND WLS
13	JALDAPARA NP
14	JOREPOKHRI SALAMANDER WLS
15	LOTHIAN ISLAND WLS
16	MAHANANDA WLS
17	RAIGANJ WLS
18	RAMNABAGAN WLS
19	SAJNAKHALI WLS
20	SENCHAL WLS
21	WEST SUNDERBAN WLS
22	CHILAPATA FOREST

Figure 3-6: Wildlife Map of West Bengal, highlighting Malda district location
***(Source:** http://wiienvis.nic.in/)*

4. Physiography of the district

a) General Landforms

The district is situated on the western part of the alluvial filled gap between the Rajmahal hills on the west and Garo hills on the east. The entire area in the district is covered by alluvium of two different ages (e.g. Pleistocene and Tertiary) displaying different physical and physiographic characteristics. East of the Mahananda which bisect the district roughly along a north-south line older (Pleistocene Period) alluvial are found. This portion known as Barind region is usually made up of massive, argillaceous beds of a pale reddish-brown hue. Disseminated this formation occur kankar and pisolitic ferruginous concretions. On the other hand, the recent alluvium (tertiary period) is found in the western part of the district. This alluvium is typically dark, loosely compacted with a high water and organic material content. It is also consisting of sandy clay, sand and fine slit. A part of the Tal region on the west of Mahananda up to the Kalindri has the same formation. Given the geological set-up of Malda region there is no apparent relation between the underlying rock structure and its properties (the reason is simple). The continuing bed rock between Rajmahal and Garo hills is overlain by several layers of alluvium with huge depth. The only direct expression of geological properties in a feeble degree can be seen only the Barind tract. Malda region is located in the para-delta with strong past references of deltaic hydrological activities and substantial recent activities in terms of shifting river channels, bank erosion, dereliction of river etc. and these have some relation with that of the Beel formation in the district. The massive basin characteristics of Malda region therefore provides a freehand to the oscillating river course characteristics which in turn is considered as one of the reasons for formation of bils in this region.

b) Soil and Rock Pattern

The pedological characteristics of the district do not have a very strong explanatory characteristic so far as the thematic spreads of the present research work. However, the bils or water body areas partly act as depositional areas as follow up of surface runoff and resultant structural change over of soil horizon. Broadly speaking except that of Barind region the entire district possesses a strong active alluvial characteristic and the beels areas are no exception. But since the bils' areas contain some kind of static hydrological condition the scope of depositional activities leading to creation of specific soil characteristic that take place. The overlying introduction of newer soil ingredients as product of the surface runoff is expected to create a pedagogical composition that becomes a part of the abotic components in the bils ecosystem. The district having different physical and physiographical characteristics is covered by alluvium of two different ages. Older alluvium dominates the Barind region while newer alluvial dominate both Tal and Diara regions. So, the soils of the district are locally classified as below;

A) The Soils of Barind Area
B) The Soils of Tal Area
C) The Soils of Diara Area

Soils of Barind Area- Barind Soils are usually made up of massive argillaceous beds of a pale reddish brown colour. It is composed of stiff clay, containing iron and lime and become extremely hard in the cold weather.

Soils of Tal Area- The Soils of Tal region are clay loam to sandy loam in texture. These soils are light loam called 'Do-ash'. It is a later alluvial formation and consists of an admixture of clay and sand.

Soils of Diara Area – The Soils of Diara region are relatively new one and most fertile. These soils are admixture of sand and clay.

But according to the National Bureau of Soil Survey and Land use Planning (WBSS & LUP) map of soil occurrences in West Bengal, the District of Malda possesses 14 categories of soil. These occurrences are shown in the Fig. 5-2. In the following table 5-1 the number codes of the soils of Malda area given with their respective brief description highlighting soil depth, texture, drainage, slope, erosion, salinity etc. of the dominant and associated subdominant mapped soils.

The table no. 4-1 has illustrated the soil description in this district;

Table 4-1: Description of Soil type of Malda District

MAP SYMBOL	DESCRIPTION
ACTIVE ALLUVIAL PLAIN (AaA) (Flood plain soil)	
W011	Very deep, moderately well drained, fine loamy soils occurring on level to nearly level active alluvial plain with loamy surface and moderate flooding associated with very deep, imperfectly drained, fine soils
W014	Very deep, imperfectly drained, fine soils occurring on level to nearly level active alluvial plain with loamy surface and moderate flooding associated with very deep, moderately well drained, fine loamy soils
W015	Very deep, moderately well drained, coarse loamy soils occurring on very gently sloping active alluvial plain with loamy surface associated with very deep, imperfectly drained, fine loamy soils
W016	Very deep, moderately well drained, fine silty soils occurring on very gently sloping active alluvial plain with loamy surface and moderate erosion associated with very deep, moderately well drained, fine loamy soils
RECENT ALLUVIAL PLAIN (AaB) (Most recent soil)	
W017	Very deep, well drained, coarse loamy soils occurring on level to nearly level recent alluvial plain with loamy surface associated with very deep, imperfectly drained, fine loamy soils
W019	Very deep, imperfectly drained, fine loamy soils occurring on level to nearly level recent alluvial plain with loamy surface and moderate flooding associated with very deep, imperfectly drained, coarse loamy soils
W021	Very deep, poorly drained, fine soils occurring on level to nearly level recent alluvial plain with clayey surface and moderate flooding associated with very deep, imperfectly drained, fine loamy soils
W024	Very deep, imperfectly drained, fine loamy soils occurring on very gently sloping recent alluvial plain with loamy surface and moderate erosion associated with very deep, imperfectly drained, fine loamy soils
W027	Very deep, moderately well drained, fine loamy soils occurring on level to nearly level recent alluvial plain with loamy surface associated with very deep, imperfectly drained, fine loamy soils

MAP SYMBOL	DESCRIPTION
W029	Very deep, poorly drained, fine loamy soils occurring on level to nearly level recent alluvial plain with loamy surface associated with very deep, poorly drained, fine soils
W030	Very deep, moderately well drained, coarse loamy soils occurring on level to nearly level recent alluvial plain
OLD ALLUVIAL PLAIN (AaC) (Sub- recent soil)	
W033	Very deep, imperfectly drained, fine loamy soils occurring on level to nearly level old alluvial plain with loamy surface associated with very deep, moderately well drained, fine loamy soils
W034	Very deep, imperfectly drained, fine loamy soils occurring on level to nearly level old alluvial plain with loamy surface associated with very deep, imperfectly drained, fine loamy soils
W035	Very deep, imperfectly drained, fine loamy soils occurring on level to nearly level old alluvial plain with loamy surface and moderate flooding associated with very deep, poorly drained, coarse loamy soils

According to NBSS&LUP the entire state of West Bengal has been divided into several agro-ecological sub regions. The district of Malda falls within the sub region 'Hot moist sub humid (Bengal basin)' unit which stretches from North Dinajpur in the north to north of Gangetic Delta of South 24 Paragonas and coastal sandy soil area of south-eastern part of Midnapur covering entire portions of Malda, Murshidabad, Nadia, Hooghly, Howrah and North 24 Paragonas. It covers eastern parts of Birbhum, Bankura, Bardwan and Midnapur districts, thereby constituting the most extensive sub-region within the state.

This agro-ecological sub-region comprises the Ganga Plain (Bengal Basin) and eastward continuation of Indo-Gangetic Alluvial Plain. The sub region occupies an area of 4.93 m. hectares representing 55.7% of the total geographical area of the state. The soils have been developed in the alluvium laid by Ganga and its tributaries and sub tributaries. These soils are greatly variable in their morphological, physical and chemical properties depending upon the geomorphic situations, moisture regime and degree of profile development.

The below mentioned figure 4-1 has described the soilmap in Malda;

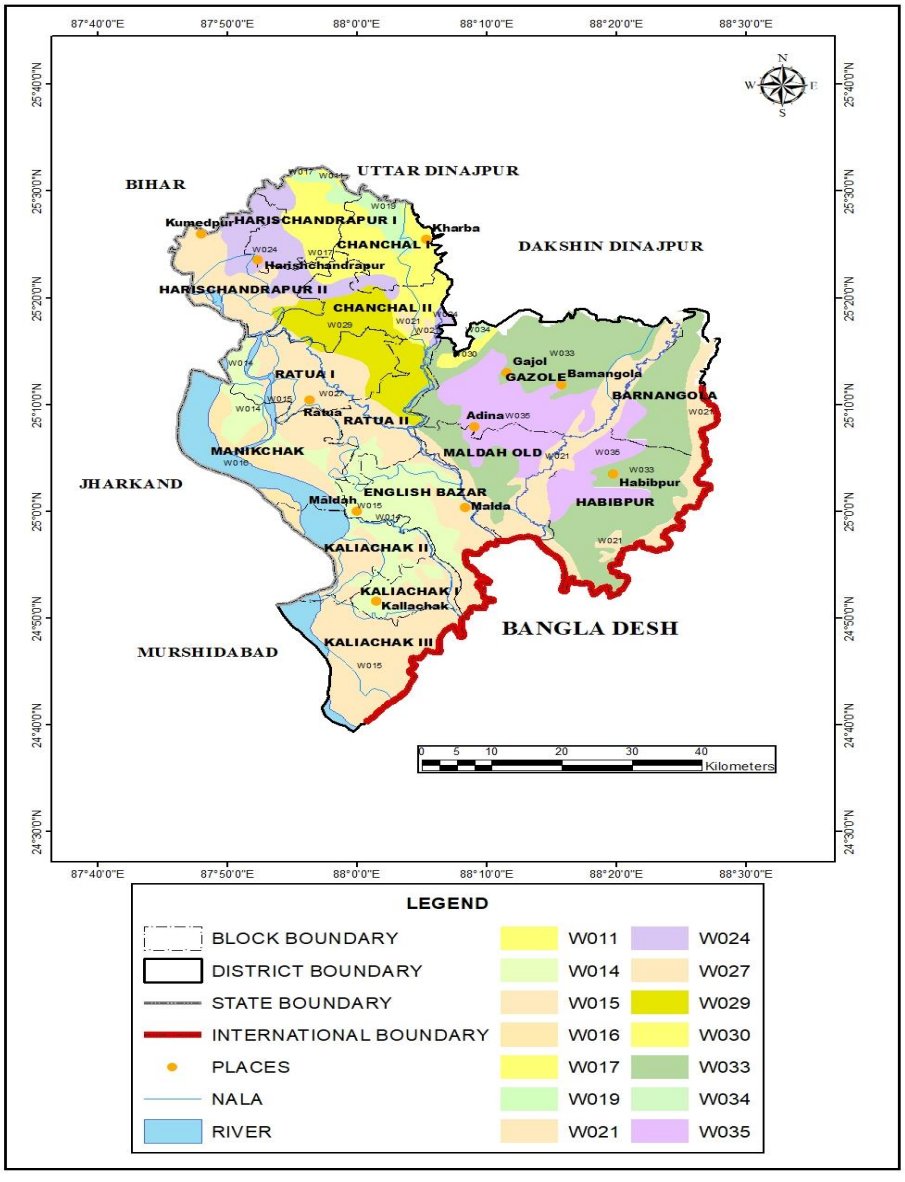


Figure 4-1: Soil Map of Malda
(Source: *https://esdac.jrc.ec.europa.eu/content/west-bengal-soils-sheet-2**)***

c) Different geomorphologic units

Primary geomorphological unit of this area is River flood plain. The Geomorphological map shows 90% of the district is covered with river flood plain. Badland topography is characteristic of this River flood plain. Badland topography is a type of topography with deep vertical ravines due to vertical erosion caused by river.

The below mentioned Figure no. 4-2 has illustrated the Geomorphology Map of Malda.

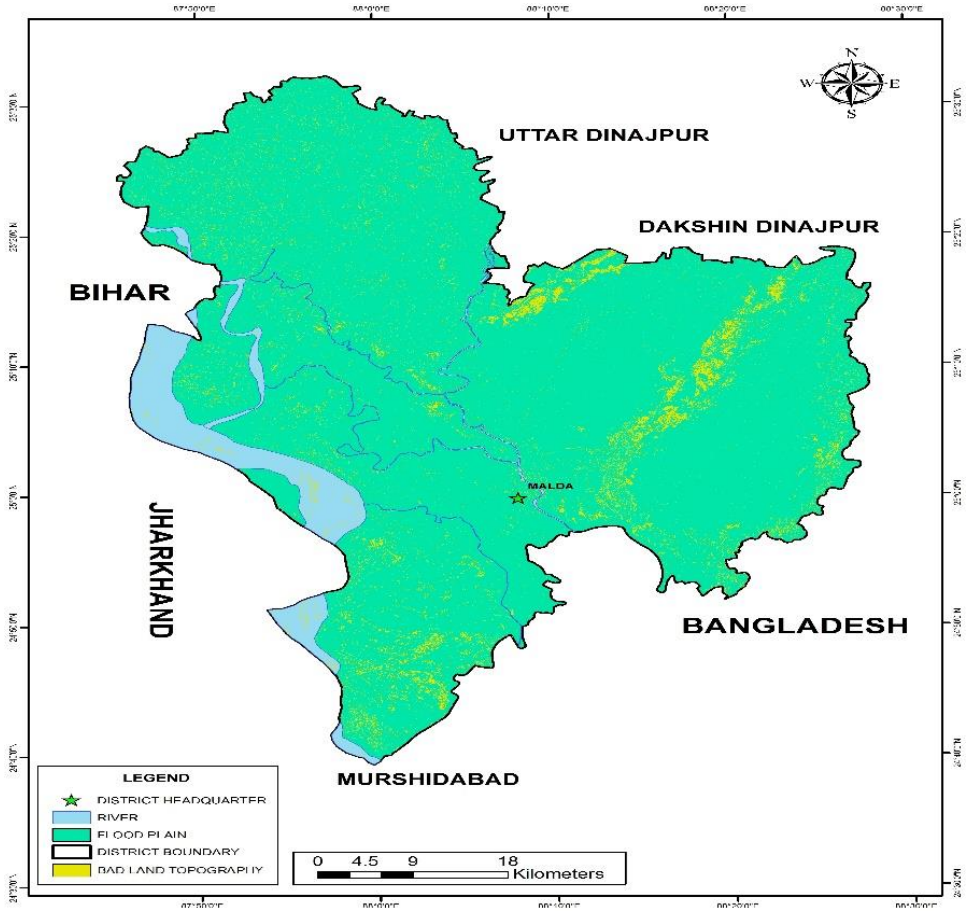


Figure 4-2: Geomorphological Map of Malda
(Source: Resource sat-1&2 – Liss-3, Bhuvan India)

5. Land use pattern of the district

The nature of land use of an area reflects the socio-economic development of people under different physio-cultural milieu. The term land use may broadly be defined as putting up a piece of land into productive purpose. But man's dependence on land in a variety of ways has created tremendous pressure on land leading to its variety of ways has created tremendous pressure on land leading to its diversified use and considerable overuses. Land use is a function of four variables land, water, air and man. Each play in its own role in comprising its life history. Land constitutes its body, water runs through its veins like blood, air gives it oxygen and man act as the dynamic actor to reflect its types, pattern and distribution. In fact, man the user of land is himself the product of atmospheric behavior, hydrological action and lithospheric expressions.

Land varies in altitudes, forms and expressions. Man has played his part on land to portray the different phases of his ties with it. The Homo-sapiens moved from one topography to another to fit his limited wants where climate, flora and fauna are different. Men were not many in number; therefore, their wants were also limited. The use of land likewise was limited. Men multiplied, their wants increased and became complex. The use of land also increased. Methods and technology also changed. Man was making his own map on the face of the earth to portray his link, adaptation, creation and destruction. This cultural map forms the appendix to the natural landscape. Land use primarily relates to public problems, whereas farm management involves private problems as faced by an entrepreneur of a firm, who in this case is farmer. The key to the most important aspect of land use lies in the relation of population to land. Land use particularly is linked with problems initiated in the process of deciding upon and translating into action the optimum use of limited land between the alternative major types of land utilization.

The area under various land use categories in Malda during agricultural years 2009-2010 to 2013-2014 present an interesting pattern. The increase or decrease in area available for cultivation as well as net sown area reveals the level of achievement in the field of agricultural development. In order to follow this progress, the study is carried on under following broad nine-fold land use categories: (1) Forest Area, (2) Area under Non-Agricultural uses, (3) Barren and Uncultivable Land, (4) Permanent Pastures and other Grazing Land, (5) Land under Miscellaneous Tree groves not included in Net Sown Area, (6) Cultivable Waste Land, (7) Fallow Land other than Current Fallow, (8) Current Fallow and (9) Net Sown Area. Table 6.1 reveals that total reporting area was 370.86 thousand hectares in 2009-10 and 2013-14. There is no change area under the forest category during the study period. Area under non-agricultural uses decreased from 88.62 thousand hectares in 2009-10 to 81.25 thousand hectares in 2013-14. It is mainly because the cultivation land growth. Similarly fallow land other than current fallow and current fallow also decreased during this period. The fallow land has gone down due to availability of sufficient water or developing of irrigation facility in various blocks and the district. The net sown area obviously occupies the largest portion, which has been true during all the periods of analysis i.e., 2009-10 and 2013-14.

The below mentioned table 5-1 is describes the classification of Land utilization of this district;

Table 5-1: Classification of Land Utilization Statistics in the district of Malda

Year	2009-10	2010-11	2011-12	2012-13	2013-14
Reporting Area	370.86	370.86	370.86	370.86	370.86
Forest Area	1.68	1.68	1.68	1.68	1.68
Area under non-agricultural use	88.62	90.11	75.28	80.82	81.25
Barren &uncultivable land	-	-	-	-	-
Permanent pastures & other grazing land	-	-	-	-	-
Land under misc. tree groves not included in Net area sown	3.43	3.24	2.93	2.93	2.99
Cultivable waste land	0.09	0.10	0.08	0.09	0.09
Fallow land other than Current fallow	0.33	0.30	0.30	0.30	0.27
Current fallow	60.71	57.45	59.52	53.96	52.42
Net area sown	216.00	217.98	231.07	231.08	232.16

(Unit in Thousand hectares)

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

Below mentioned figure 5-1 has describes the Land use and Land Cover map of Malda;

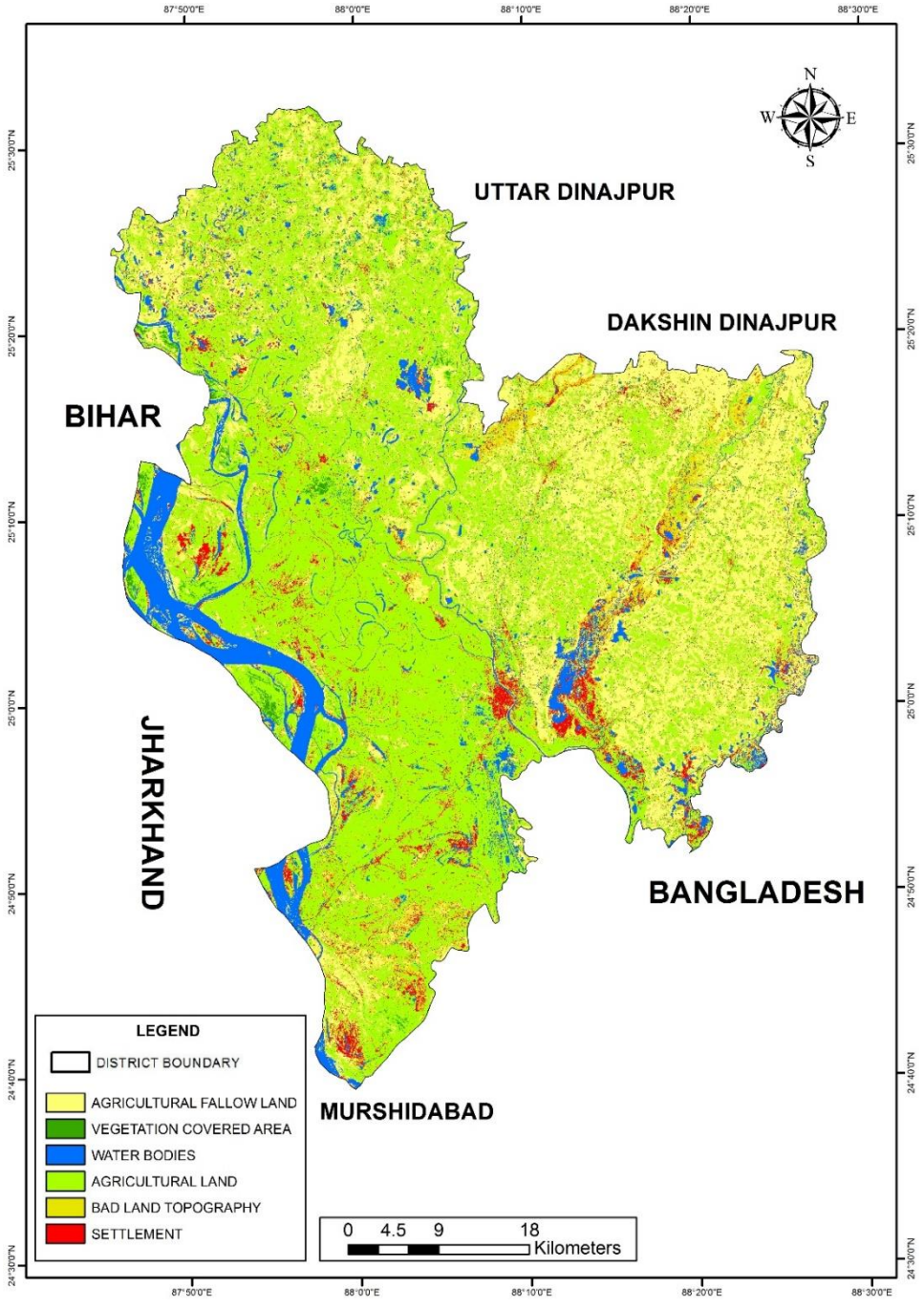


Figure 5-1: Land use and Land cover Map of Malda

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

a) Forest -detail of the area

Natural Vegetation is the first biotic expression of a combination of physical and abiotic in diseases of a region. Therefore, the nature and degree of combination of different physical and geographical parameters are expressed in terms of nature and distribution of vegetation. Since, 'bills' are part of macro physical-geographical system the expression in terms of natural vegetation in the bills areas and the region as a whole should be in concordance with each other. But at the same time, it's quite natural expectation that in spite of this uniformity at the macro scale, the bills areas are expected to project a slightly different physical set-up. This in turn should support vegetation characteristics in the bills areas in a slightly different manner. To be precise, the bills should possess a slightly different vegetal characteristics as a part of its micro-ecosystem in comparison to the non- bills areas and the region as a whole.

As a part of the biotic components of the ecosystem in Malda, flora plays their vital role in human survival and activities. There is an alteration of the bils and village shrubberies with the jungle of the Barind region. Where the ground is not occupied by the usual crops, it is covered by abundant natural vegetation excepting the sandy beds of rivers. Old river beds, ponds, marshy land etc. have a copious vegetation of Vallisneria and other plants. Some portions of Barind area are covered by jungles, which consist chiefly of thorny scrub bush jungles mixed with Pipal, Bat, Simul and Pakur trees and Nepal Bamboos. Species of thorny bamboos are also seen in Pandua areas near villages and embankment areas of Gour thickets or shrubberies, ordinary Neem tree, Jack-fruit tree, Tamarind, Bamboo, Peepul tree and Mango tree are seen in plenty. The soil of the western region of the district is particularly suited to the growth of mulberry and mango, for the production of both Malda has become famous. Though large games were found in plenty in the Malda district, the jungles have now mostly been cleared and their inhabitants exterminated by the Santals and Paharias, who have crossed the Ganges in large number to settle in Barind.

Total forest area in this district is about 1.70 thousand hectares (Directorate of Agriculture (Evaluation), Govt. of W.B.

Table 5-2: Classification of Forest Area in Malda

Item	Unit	2009-10	2010-11	2011-12	2012-13	2013-14
Area by Class of forest	-	-	-	-		
Reserved forest	Hectare	773.95	773.95	773.95	773.95	773.95
Protected forest	"	373.04	373.04	373.04	373.04	373.04
Unclassed state forest	"	556.05	556.05	556.05	556.05	556.05
Khas forest	"	-	-	-	-	-
Vested waste land	"	-	-	-	-	-
Forest owned by corporate bodies	"	-	-	-	-	-

Item	Unit	2009-10	2010-11	2011-12	2012-13	2013-14
Area by Class of forest	_	_	_	_		
Forest owned by private individuals	"	-	-	-	-	-
Forest owned by civil authorities	"	-	-	-	-	-
Total		**1703.04**	**1703.04**	**1703.04**	**1703.04**	**1703.04**

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

Table 5-3: Forest Area, Out-turn of Forest Produce, Revenue and Expenditure of Forest Department from 2009-10 to 2013-14

Item	Unit	2009-10	2010-11	2011-12	2012-13	2013-14
Forest Produce	_	_	_	_		
Timber	Thousand cu. metre	0.460	0.129	0.071	-	0.496
Fuel	"	0.041	0.310	0.012	-	0.066
Pulpwood	"	-	-	-	-	-
Pole	Number	107	-	-	-	-
Post	"	-	-	-	-	-
Revenue & Expenditure	_					
Revenue	Rs. in thousand	10882	1682	17761	15088	8284
Expenditure	"	34705	38644	38111	7905	7721

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

b) Agriculture & Irrigation

Agriculture

People of Malda are primarily dependent on agriculture as the land is very much fertile. The main crops of the land of this area are paddy, jute, pulses and mustard. Jute is the main cash crop of the district. Malda is the largest producer of excellent quality of jute in India. There has been a reducing trend in the last few years towards use of land for crop production.

The region is predominated with rice cultivation with a variety of aus, aman and boro. Apart from rice the district has the experience of wheat, jute and sugarcane cultivation. Here, due to its diverse and surplus production of various crops like Jute, Potato, Ginger, Spices etc. the district has a strong base for agro based and horticulture- based industry. Periodic markets in rural areas have the potentiality to carry on marketing transaction of agricultural and horticultural produce which give the impetus for more production to farmers. So it is imperative to highlight the large agricultural potentials of the district and data regarding the area which is occupied under different principle crops has been given below. As some periodic markets operating in the region operate as a cattle market along with general commodities so it is also urgent to show the livestock status of the region.

Table 5-4: Production of Principal Crops (Thousand Tones) in the district of Malda

Crops		2009-10	2010-11	2011-12	2012-13	2013-14
Foodgrains :						
1.	**Rice**	**614.5**	**630.5**	**612.0**	**644.6**	**704.4**
	Aus	11.8	5.5	8.5	5.5	6.1
	Aman	378.5	379.5	386.1	412.6	462.1
	Boro	224.2	245.5	217.4	226.5	236.2
2.	Wheat	129.4	144.0	131.8	125.1	131.7
3.	Barley	1.4	2.1	1.9	2.0	1.9
4.	Maize	19.9	20.2	29.4	40.3	42.7
5.	Other Cereals	-	-	-	-	-
	Total Cereals	**765.2**	**796.8**	**775.1**	**812.0**	**880.7**
6.	Gram	4.8	2.4	3.8	4.7	3.6
7.	Tur	0.1	0.1	(b)	(b)	(b)
8.	Other Pulses	18.9	13.9	14.3	18.0	17.9
	Total Pulses	**23.8**	**16.4**	**18.1**	**22.7**	**21.5**
Total Food grains		**789.0**	**813.2**	**793.2**	**834.7**	**902.2**
Oil Seeds :						
1.	Rapeseed & Mustard	38.4	31.8	36.6	35.8	38.3
2.	Linseed	0.1	0.1	(b)	(b)	0.1
3.	Other Oil seeds	0.2	0.4	0.3	0.5	0.7
Total Oil seeds		**38.7**	**32.3**	**36.9**	**36.3**	**39.1**
Fibers* :						
1.	Jute	307.8	255.6	313.2	394.6	396.1
2.	Mesta	2.2	5.1	4.8	4.7	4.4
3.	Other Fibres	-	-	-	-	-
Total Fibers		**310.0**	**260.7**	**318.0**	**399.3**	**400.5**

Crops		2009-10	2010-11	2011-12	2012-13	2013-14
Miscellaneous crops :						
1.	Sugarcane	212.8	221.0	253.9	216.5	210.2
2.	Potato	151.8	146.8	147.0	176.8	164.7
3.	Tobacco	0.1	0.1	0.1	0.1	-
4.	Tea	-	-	-	-	-
5.	Chilies (dry)	2.8	2.8	2.8	2.8	2.9
6.	Ginger	0.4	0.4	0.4	0.4	0.6
Total Miscellaneous crops		**367.9**	**371.1**	**404.2**	**396.6**	**378.4**

Sources: http://wbpspm.gov.in/publications/District%20Statistical%20Handbook

The yield rate of the principal crops in this district is given below;

Table 5-5: Yield rate of the principal crops in this district of Malda from 2009-10 to 2013-14

Crops		2009-10	2010-11	2011-12	2012-13	2013-14
Food grains :						
1.	**Rice**	**2834**	**3140**	**2986**	**3105**	**3544**
	Aus	2031	1600	2317	1781	1943
	Aman	2647	2859	2671	2833	3407
	Boro	3296	3802	3835	3847	3935
2.	Wheat	2938	3027	3030	2784	2944
3.	Barley	1132	1378	1467	1419	1419
4.	Maize	2314	2299	2164	1979	2630
5.	Other Cereals	-	-	-	-	-
	Total Cereals	**2827**	**3081**	**2944**	**2960**	**3373**
6.	Gram	1464	1074	1113	1446	1132
7.	Tur	1100	1094	448	1359	1286
8.	Other Pulses	1089	976	907	1016	967
	Total Pulses	**1149**	**989**	**943**	**1083**	**992**
Total Food grains		**2707**	**2955**	**2808**	**2827**	**3191**
Oil Seeds :						
1.	Rapeseed & Mustard	1174	1047	1128	1062	1087
2.	Linseed	663	623	726	493	682
3.	Other Oil seeds	677	629	767	933	916
Total Oil seeds		**1166**	**1035**	**1123**	**1059**	**1081**
Fibers * :						

Crops		2009-10	2010-11	2011-12	2012-13	2013-14
1.	Jute	16.9	14.2	14.6	16.6	16.1
2.	Mesta	13.2	11.9	7.6	8.3	7.8
3.	Other Fibers	-	-	-	-	-
Total Fibers		**16.9**	**14.1**	**14.4**	**16.4**	**15.9**
Miscellaneous crops :						
1.	Sugarcane	98701	98925	116395	104567	102366
2.	Potato	34382	29153	38048	36077	32175
3.	Tobacco	657	656	650	658	-
4.	Tea	-	-	-	-	-
5.	Chilies (dry)	1102	1105	1085	1086	1116
6.	Ginger	1593	1641	1642	1660	2162
Total Miscellaneous crops		**38726**	**36029**	**44418**	**39652**	**37694**

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

From the upper mentioned tale, it clear that the main revenue generates coming in this district is from the agriculture. The principal crops are Rice, Wheat, Jute, Mastered, Potato, Maize, and Sugarcane. These all-agricultural crops are the revenue generated crops in Malda. Maximum families in this district are depending upon the agriculture.

Irrigation

Irrigation refers to the artificial supply of water by different means to the plants. In Malda district major means of irrigation are tank, river lifting, deep tube well and shallow tube well. A variation in the irrigation system at the block level is observed in the Table 6.6. Tank irrigation is under practice only in five blocks (i.e. Chanchal-I, Gazole, Bamangola, Habibpur and Old Malda). Deep tube well irrigation is completely absent in the Bamangola block. Only 0.82 percent and 0.93 percent to total irrigated area is under the deep tube well irrigation system in Habibpur and Harishchandrapur-II blocks respectively, while highest area i.e., 15.57 percent has been recorded in English Bazar block followed by Kaliachak-II block (13.24 percent). Three blocks of the study area i.e., Kaliachak-III, Harishchandrapur-II and Harishchandrapur-I are highly dependent on shallow tube well accounting 90.54 percent, 88.89 percent and 80.13 percent of irrigated area under it. Again, it is revealed from the present analysis that, highest percentage of area under irrigation to the net cropped area (irrigation intensity) has been recorded in Chanchal-I block i.e., 71.19 percent, followed by Harishchandrapur-I (67.88 percent) and Harishchandrapur-II (66.51 percent) blocks, whereas only 24.17 percent in Kaliachak-II block followed by Manickchak block (26.25 percent).

The details of irrigation in the district of Malda for the period 2009-10 to 2013-14, is shown hereunder table;

Table 5-6: Area ((Thousand Hectors) Irrigated by different sources in the district of Malda

Year	Area irrigated by									
	Govt. Canal	Tank	HDTW	MDTW	LDTW	STW	RLI	ODW	Others	Total
2009-10	-	1.333	6.568	0.450	0.886	82.813	9.423	-	24.990	126.463
2010-11	-	1.323	6.606	0.459	0.903	83.003	9.471	-	24.999	126.764
2011-12	-	1.391	6.570	0.468	1.248	83.242	9.596	-	25.029	127.544
2012-13	-	1.389	6.585	0.477	1.256	83.275	9.606	-	25.032	127.620
2013-14	-	1.393	6.590	0.489	1.354	83.306	9.614	-	25.037	127.783

Sources: http://wbpspm.gov.in/publications/District%20Statistical%20Handbook

Table 5-7: Sources of Irrigation in the district of Malda (Number)

Year	Tank	HDTW	MDTW	LDTW	STW	RLI	ODW	Others
2009-10	255	326	39	145	33459	483	-	446
2010-11	255	326	39	145	33515	483	-	446
2011-12	255	326	39	192	33595	483	-	446
2012-13	255	326	39	192	33602	483	-	446
2013-14	255	326	39	204	33616	483	-	446

Sources: http://wbpspm.gov.in/publications/District%20Statistical%20Handbook

c) Horticulture

Horticulture crops, fruits and vegetables are an important food supplement to the human diet as they provide the essential vitamins and mineral fibers required for maintaining health. Malda district is ideally suited to a wide variety of soil conditions for growing a large variety of fruit and vegetable production in the district. Mango is the major crop in the district. Most of the fruit and vegetable are seasonal crops and are perishable in nature. In a favorable season there is a good market for chilly, ginger, different fruits and other seasonal vegetables. The surplus cannot is stored for the sale in the off season because insufficient cold storage can't store such large amount of perishable items. Thus, the cultivation does not get the best price for their produce and have to sell their produce on the available rate, which they get from the local middle man in the district. The sale is further hampered because the marketing channel is not proper. At times there is complete loss to the farmers growing fruit and vegetables.

The major fruits and vegetable grown in the district of Malda for the period 2009-10 to 2013-14, is shown hereunder table;

Table 5-8: Area and Production of Fruits in the district of Malda

Name of Fruits	Area (Thousand hectares)					Production (Thousand tonnes)				
	2009-10	2010-11	2011-12	2012-13	2013-14	2009-10	2010-11	2011-12	2012-13	2013-14
Fruits:										
Mango	27.00	27.40	27.60	28.50	28.70	180.00	196.00	221.00	257.00	200.00
Banana	0.80	0.81	0.91	1.01	1.09	14.50	14.80	16.49	18.30	19.75
Pineapple	-	-	0.03	0.04	0.05	0.08	0.08	0.60	0.74	1.20
Papaya	0.24	0.24	0.25	0.26	0.27	7.80	7.86	8.07	7.39	8.55
Guava	0.43	0.43	0.44	0.45	0.45	7.25	7.26	7.47	7.62	7.63
Jackfruit	0.38	0.38	0.39	0.40	0.41	4.50	4.50	4.68	4.90	5.03
Litchi	1.00	1.00	1.09	1.18	1.20	9.00	9.40	8.50	12.24	15.00
Mandarin Orange	-	-	-	-	-	-	-	-	-	-
Other Citrus	0.20	0.21	0.22	0.27	0.29	1.80	1.80	1.93	2.46	2.65
Sapota	0.24	0.24	0.25	0.25	0.25	2.80	2.80	2.86	2.94	2.95
Others	0.23	0.23	0.22	0.24	0.25	1.40	1.40	1.44	1.29	1.50
Total	**30.52**	**30.94**	**31.40**	**32.60**	**32.96**	**229.13**	**245.90**	**273.04**	**314.88**	**264.26**

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

Table 5-9: Area and Production of Vegetables in the district of Malda

Name of Vegetable	Area (Thousand hectares)					Production (Thousand tonnes)				
	2009-10	2010-11	2011-12	2012-13	2013-14	2009-10	2010-11	2011-12	2012-13	2013-14
Vegetables										
Tomato	2.65	2.68	2.80	2.85	2.94	36.35	37.82	38.42	39.16	40.32
Cabbage	4.20	4.26	4.35	4.42	4.50	115.40	117.02	119.44	123.74	126.04
Cauliflower	3.51	3.55	3.70	3.80	3.85	101.13	102.46	106.63	109.54	111.68
Peas	0.85	0.87	0.89	0.89	0.92	4.20	4.33	4.38	4.40	4.54
Brinjal	11.92	10.36	12.39	12.49	12.52	204.97	181.77	214.35	215.27	210.80
Onion	1.46	1.48	1.51	1.58	1.62	16.10	16.54	16.67	17.66	19.30
Cucurbits	9.81	9.95	10.38	10.44	10.45	97.91	101.25	97.05	100.30	100.39
Ladies Finger	3.07	3.11	3.16	3.16	3.19	34.08	35.00	34.73	35.99	36.48
Radish	2.23	0.39	2.33	2.38	2.41	24.50	4.66	26.57	27.11	26.52
Others	16.99	29.33	15.99	15.51	15.53	74.96	125.60	77.36	74.28	74.86
Total	**56.69**	**65.98**	**57.50**	**57.52**	**57.93**	**709.60**	**726.45**	**735.60**	**747.45**	**750.93**

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

Table 5-10: Area and Production of Flowers in the district of Malda

Name of Flowers	Area/'000 hectares					Production/'000 Mt				
	2009-10	2010-11	2011-12	2012-13	2013-14	2009-10	2010-11	2011-12	2012-13	2013-14
Rose	-	-	-	-	-	-	-	-	-	-
Chrysanthemum	-	-	-	-	-	-	-	-	-	-
Gladiolus	0.003	0.004	0.006	0.007	0.008	0.042	0.018	0.072	0.085	0.099
Tuberose	0.003	0.003	0.009	0.009	0.010	0.042	0.042	0.130	0.132	0.150
Marigold	0.050	0.050	0.060	0.064	0.066	0.400	0.400	0.479	0.490	0.507
Jasmine	-	-	-	-	-	-	-	-	-	-
Seasonal Flower	0.004	1.018	0.004	0.005	0.005	0.006	1.393	0.007	0.009	0.009
Misc. Flower	0.028	0.028	0.028	0.030	0.031	0.030	0.039	0.042	0.046	0.046

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

A short note on Mango production of the district:

Mango is undoubtedly the best-known product of the district having national and international fame. A range of delectable table fruit, ranging from the famous *langra*to the *himasagar, amrapali, laxmanbhog, gopalbhog*and*fazli*mango varieties grows in the district. From the above table 6.8 it is seen that out of 32.96 thousand hectares of area under fruit production, 28.70 thousand hectares of area produces mango. Mangoes grown in the district become available for processing between the months of May and August, starting from early varieties such as the *himsagar*and*laxmanbhog*to late varieties such as the *gopalbhog*. Thus, once an orchard has been planted and has matured, mango cultivation becomes a highly seasonal activity, with the activity period spanning just four months of the year. As the district's economy is largely dependent on production and trading of mango, storage and transportation facility has improved a lot.

Most regions of Malda district, barring the Barind, are climatically well suited to the cultivation of mangoes. Along with Old Malda C.D. Block, the Diara region C.D. Blocks of Manickchak and English Bazar constitute the traditional growing area for mangoes in Malda district, together accounting for 57 per cent of the total mango area and the mangoes produced by the district. From this core area, mango cultivation has spread southwards to the other Diara region C.D. Blocks of Kaliachak-I and II, followed by the C.D. Blocks of Ratua-I, Ratua-II and Chanchal-I in the Tal region. While the share of theDiara region in total mango area and production has come down as a result, the six C.D. Blocks in the Tal region together now account for just over 28 per cent of area and production of mangoes in Malda. Old Malda is the only Barind region C.D. Block that grows mangoes to a significant degree. The other Barind region C.D. Blocks of Gajol, Bamangola and Habibpur together contribute only about 2 per cent of the total mango area and production in the district. Since mangoes are already grown on a

wide scale in the Diara region, future extension of mango cultivation in Malda district is likely to occur in the Tal region rather than the Barind region due to its climatic advantages. Such trends are already visible in the growth of mango area and production in many C.D. Blocks of Tal region.

d) Mining

The Malda district is absolutely free from any types of major mineral deposits. The district is having minor mineral occurrences. Mining of sand, gravel from the river-bed and Brick-earth are main source of revenue of the district.

6. Geology of the district

The Malda district of West Bengal is located at the mouth of Bengal delta within the western half of the Garo-Rajmohal Gap. The district is completely blanketed by Quaternary sediment. Geomorphologically the district is situated at the head of a conjugate fan of the Mahananda and Tista Rivers, which flow respectively to the west and the east of the area and are joint by a number of distributaries. All the Rivers merge into the Ganga- Brahmaputra Delta to the south. The south western part of the district is affected by the Ganga fluvial regime, the deposits of which spread west ward from the southern margin of the Barind uplands up to the present Ganga River. The low land region covered by the flood plain deposits, viz. the Shaugaon - Ganga-Mahananda and Jalpaiguri - Malda formation is devoid of soil cover in contrast to the Baikunthapur flood plain deposits which is characterized by inception.

The oldest deposits, the Barind formation is exposed at higher level in the eastern part of the district as brick red clays with a high concentration of nodular ferricret softened by weathering. The Barind formation is also seen in sections at various levels being overlapped by the latter Baikunthapur / Lalgarh formation of the Rarh region of south Bengal. Rill, gully and wind erosion have played a major role in reworking and re-depositing of Barind formation. The Baikunthapur formation consisting of thick clay, sand and silt occurs in the eastern and central part of the district. They also consist of thick clay deposits besides sand and silt horizons. Its oxidized, greenish grey colored capping contains high concentration of calcareous nodules besides a few reworked iron nodules. The presence of calcretised-kankar classed in the older Baikunthapur formation indicate short annual weight spells followed by long dry spells. The Malda formation of the Mahananda-Tista fluvial regime covers the eastern and central part of the district. It generally overlaps the Baikunthapur formation.

The Shaugaon formation comprising sand, silt and clay deposits is observed to flank the major and minor rivers of the district. It merges with the deposits of the Ganga-Mahananda formation in the Ganga fluvial regime. That has a larger spread in the western and southern part of the district where it overlaps the older deposits.

The present-day deposits occur along the course and banks of the presently active channels. They consist of loose, unconsolidated sand, silt and clay. The areas other than the present-day flood plain although generally inactive become dynamic in parts during very high floods. Water logging of the ancient back swamps is an increasing hazard of the districts. The instability of the terrain is witnessed by the antecedent nature of the rivers like Tangaon, Chirramati and Atrai and also the slope reversal as indicated by the upland surface which demonstrates northerly tilt of the area. Techtonic upheaval along with an inversion of relief has resulted in the creation of uplands. This area at present remains dry and barren for most of the year and has a low ground water table in contrast to the reach agricultural lands of the low areas adjacent to it.

Geological Formations

The geological units of the study area were divided by three tentative ages, Holocene period, early Holocene to Pleistocene period and Pleistocene period. The Malda formation, the Shaugaon formation, Ganga Mahananda formation and the present-day deposits were formed in Holocene period. Baikunthapur formation was formed in early Holocene to Pleistocene period. Barind formation was formed in Pleistocene period. In English-Bazar block vast area was covered by Ganga-Mahananda formation where Manickchak block mainly covered by present day deposit.

Shaugaon formation was found in Ratua-II block and Old-Malda block very frequently. Baikunthapur formation is found north-western portion of the Old-Malda block and Barind formation is found northeastern portion of the Old-Malda block.

English-Bazar block contains some of the youngest as well as the oldest exposures of Quaternary sediments within the Tista-Mahananda interfluves. To the west the younger deposits interfinger with deposits of the Kosi and the Ganga Rivers while to the east, the older deposits spread laterally into Bangladesh. The older deposits are overlapped by the younger deposits of the Mahananda - Tista regime in the north. The district is completely blanketed by Quaternary sediments. The younger deposits merge with the deltaic sediments of the Bengal basin South wards, while the older deposits terminate abruptly with a relatively higher slope defining a northwest – southeast trending lineament. The spread of the Ganga deposits to the south of the uplands is marked by numerous paleo channels and active channels, viz. the Kalindri, the Bhagirathi.

Table 6-1: Geological formation of Malda District

Sl.No.	Lithostratigraphic Unit	Depositional Environment	Surficial lithology	Geomorphology	Age
1	Malda Formation (Shaogaon Formation)	Alluvial valley and deltaic plain (flood plains)	(a) Medium sand (b) Fine sand-silt (c) Silty clay	Newer Alluvium	Present day – Late Holocene
2	Shansi Formation (Baikunthapur/Paskura Formation)	Delta flank fan (marginal fan and valley fills)	Silty clay with occasional fine sand		Late – Middle Holocene

Sl.No.	Lithostratigraphic Unit	Depositional Environment	Surficial lithology	Geomorphology	Age
3	Barind Formation (Chalsa / Sijua Formation)	Delta flank fan (upper part)	Fine micaceous clay with ferrugenous sand	Older Alluvium	Early Holocene – Late Pleistocene

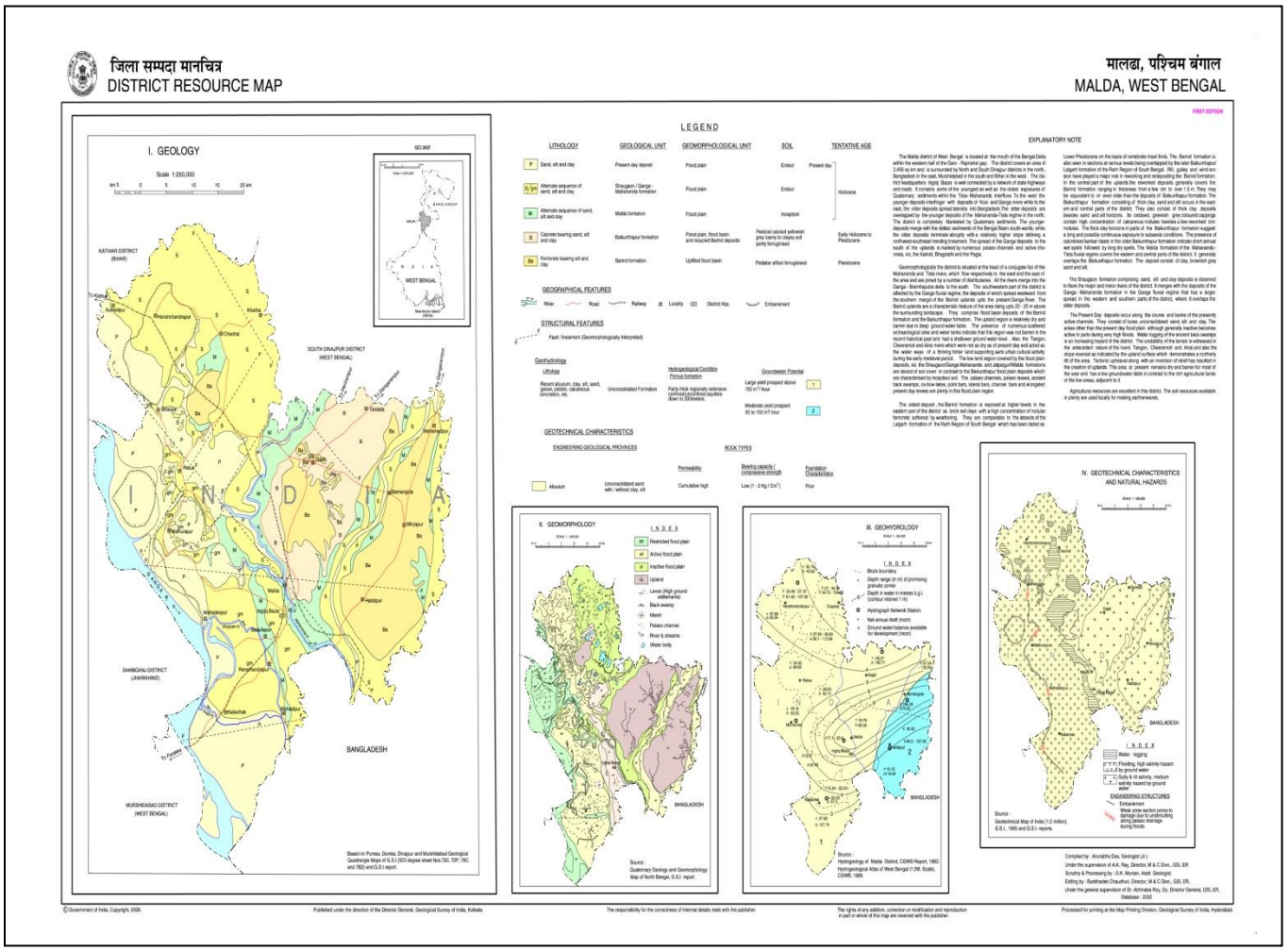


Figure 6-1: Geological Map of Malda

Source: GSI, 2008

7. Mineral Wealth

7.1 Overview of mineral resources

Occurrence of major minerals in the district is not established so far. Main mineable mineral of the district is sand and Gravel from the riverbed and Brick-earth from some appropriate, suitable locations

7.2 Details of Resource

A) Sand and other River bed minerals

i) Drainage System

Rivers in the district constitute an important feature upon its landscape. The earth surface here is washed by the waves of rivers like the Ganga, Mahananda, Fulahar, Kalindri, Tangaon, Punarbhava, Pagla and Bhagirathi. All main rivers of the district are of the Himalayan or sub-Himalayan origin and flows towards south direction. Due to the devastating flood particularly in the Western side of the district, huge amount of life and property, human establishments and agricultural land goes into the Ganga River each year

Ganga

River Ganga flows through the western part of the district and acts as a natural division between Jharkhand and Malda district. The Ganga first touches the district as it sweeps round to the south of the Rajmahal hills and leaves the district at Khejuria near Farakka Barrage.

During the last few years, the tendency has been for the river to continue gradually the westward movement. Alluvium and diluvium had occurred constantly as a result of the continual changes in the course of the river. The position of the Ganges was therefore, very similar in Rennell'stime (1764- 1773) to what it is today. Buchanan Hamilton noted in 1810 that the general course of the river Ganges was away from plains of Malda. At the time of the revenue survey, Rajmahal was on the bank of the river but in 1870 the river took an eastward move leaving Rajmahal at its west and almost threatened to cut into the river Kalindri, as a result of which a good amount of erosion took place in the Malda Bank. But at present time the river has been flowing through channel.

Mahananda

River Mahananda first touches the district at its extreme north point near the tri-junction point of the P.S. of Chanchal, Ratua and Gajol and leaves the district at the southernmost point and falls into the river Ganges. The main channel of river Mahananda in Malda district is fairly deep and alluvium &diluvium processes are going on gradually. River Mahananda runs for about 88.6 km in this district and divided the district into two nearly equal

portions. During the last century few changes have been taken place in its course. But in between the dates of Rennell's map and revenue survey a very great change took place. In Renells time, the river ran from Swarupganj down to what is now the channel known as the Mora Mahananda along the western boundary of Kharba P.S., instead of along the eastern boundary as at present.

River Kalindri

The river Kalindri is taken as an off-shoot of eastern branch of the Ganges. It enters into the district near Miaghat of Harishchandrapur-II. In the Tal region, the river Kalindri receives four tributaries, namely Kalkos, Kankar, Kos and Baromasia. These four small tributaries of Kalindri drain the excess water of Tal region and meet river Kalindri. After then, the river Kalindri is flowing mainly in south- eastern direction and meets river Mahananda. The alteration in the course of river Kalindri is still now going on. The present bed has being in places at some distance from the position of the river at the time of revenue survey.

Tangaon and Punarbhava

These two are very similar river systems. Both are narrow system, muddy and tortuous courses. Both are also the tributaries of the river Mahananda. The Tangaon forms the boundary between Gazole and Bamangola Block. The Tangaon appears to have shifted its course at various periods. Due to shifting of course, a branch of named Mara Tangaon, flows several Kilometers through the police station of Gazole and join the mother course in Bamangola.

The total linear length of all the rivers in the district of Malda runs up to 172 km and thus the district possesses an ample scope for surface water utilization. At the same time the presence of large number of extensive 'beels' 'Jheels' and 'Dhaps', as the local term of naturally stored surface water areas or part of abandoned river channels with the presence of intermittent water bodies, also provide considerable support to the augmentation possibility of surface water utilization. The beels throughout the district are the direct or indirect result of fluvial action and are not due to earth subsidence. The direct result of fluvial action may be seen in the Tangaon and Punarbhava valleys, which contain a chain of beels stretching northwards to the border of South Dinajpur district. From the appearance of these valleys, it can be surmised that they were originally courses of very long rivers than the present streams. The largest is BeelAhore in the Tangaon valley covering an area of nearly two square miles. The same river action is found in the marshy tract between the Mahananda River and the main road from English Bazar to Gour. In Diara tract also beels are due to depressions left by the Ganges. The district is also dotted with numerous tanks, large and small. There are approximately 30,000 tanks in the district, of which about 11,000 tanks are being utilized or utilizable for irrigation purposes.

a) Drainage System with description of main rivers

Table 7-1: Drainage system with description of Main Rivers

Sl.No.	Name of the River	Area drained (Sq.km)	% Area drained in the district
1	Ganga	19055.09	20.98
2	Fulahar	2163.98	36.53
3	Nagri	359.39	30.02
4	Mahananda	586.28	71.39
5	Kalindri	351.57	56.97
6	Tangaon	299.59	71.05

b) Salient Features of important rivers and streams

Table 7-2: Salient Features of important rivers and streams

Sl.No.	Name of the River or Stream	Total Length in the District (in Km)	Place of origin	Altitude at Origin
1	Ganga	20.98	Gangotri Glacier, Gaumukh	3892 m
2	Fulahar	36.53	Tributary of Ganga	-
3	Nagri	30.02	Tributary of Mahananda	-
4	Mahananda	71.39	Paglajhora Falls on Mahaldiram Hill near Chimli, east of Kurseong in Darjeeling district	2100 m
5	Kalindri	56.97	Tributary of Mahananda	-
6	Tangaon	71.05	Jalpaiguri	89

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 Malda District is furnished below.

Table No. 7.3: Place of Origin of important rivers and streams

Name of the River or Stream	Place of origin
Ganga	Gangotri Glacier, Gaumukh
Fulahar	Tributary of Ganga
Nagri	Tributary of Mahananda
Mahananda	Paglajhora Falls on Mahaldiram Hill near Chimli, east of Kurseong in Darjeeling district
Kalindri	Tributary of Mahananda
Tangaon	Jalpaiguri

ii) Catchment Area

The Malda district is mainly drained by the Ganga, Mahananda, Kalindri, Nagri, Fulahar River. These rivers and its tributary rivers are forming the main catchment area.

iii) General profile of river stream

Relative disposition of rivers in Malda district along with the distribution of the section lines are shown in Figure 7.1. River profile has been studied along the cross-section lines (Figure 7.2 to 7.5) 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.

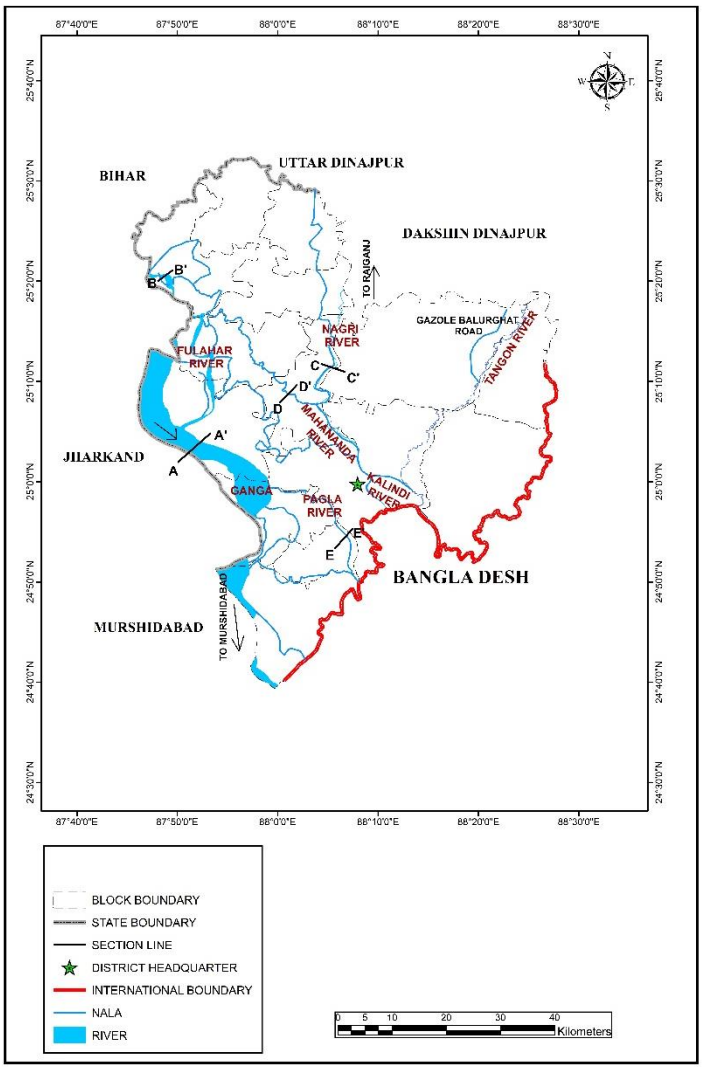


Figure 7-1: Plan showing the major rivers along with the distribution of Section Lines, Malda District, West Bengal

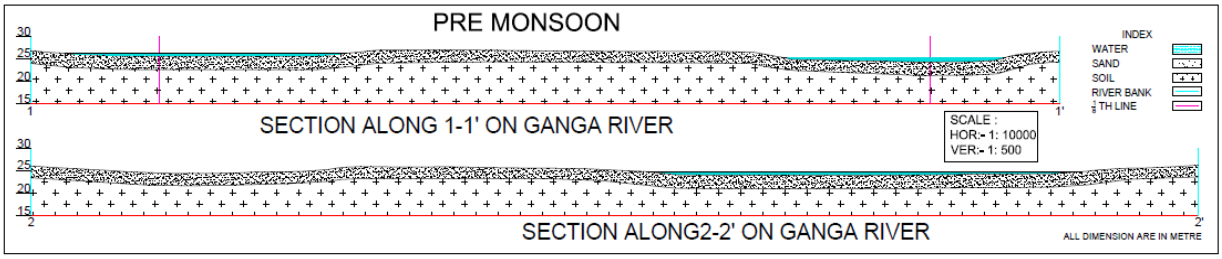


Figure 7-2: Cross section along Ganga River in pre monsoon period

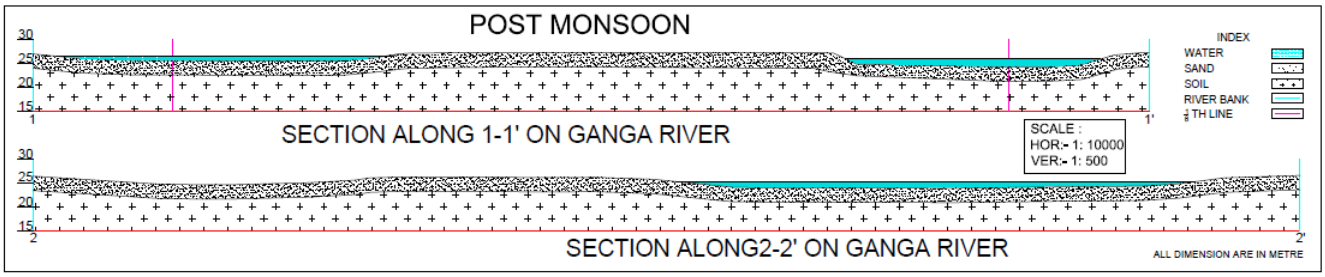


Figure 7-3: Cross section along Ganga River in post monsoon period

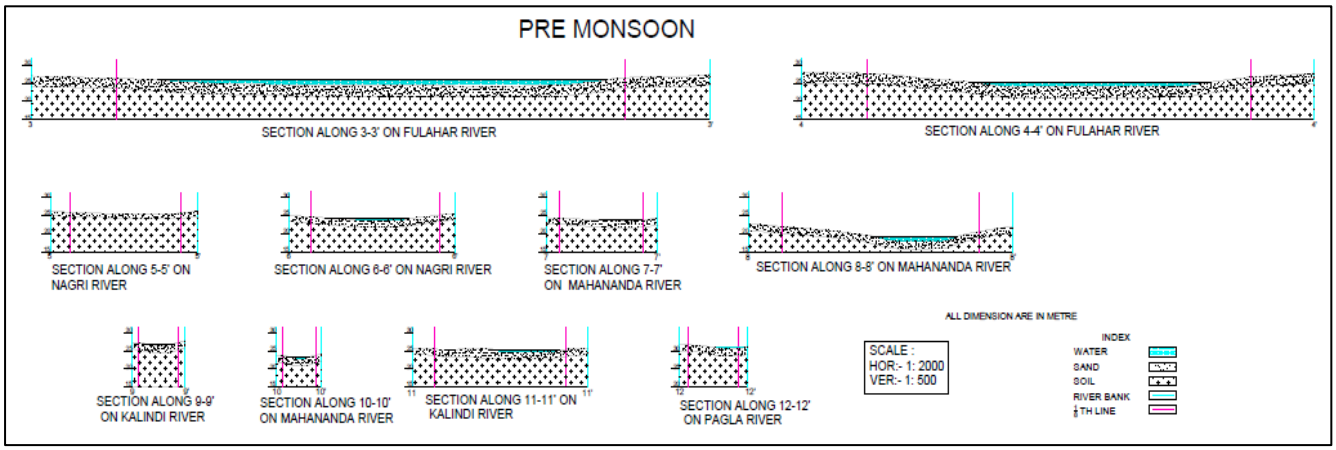


Figure 7-4: Cross section of Rivers of Malda District in pre monsoon period

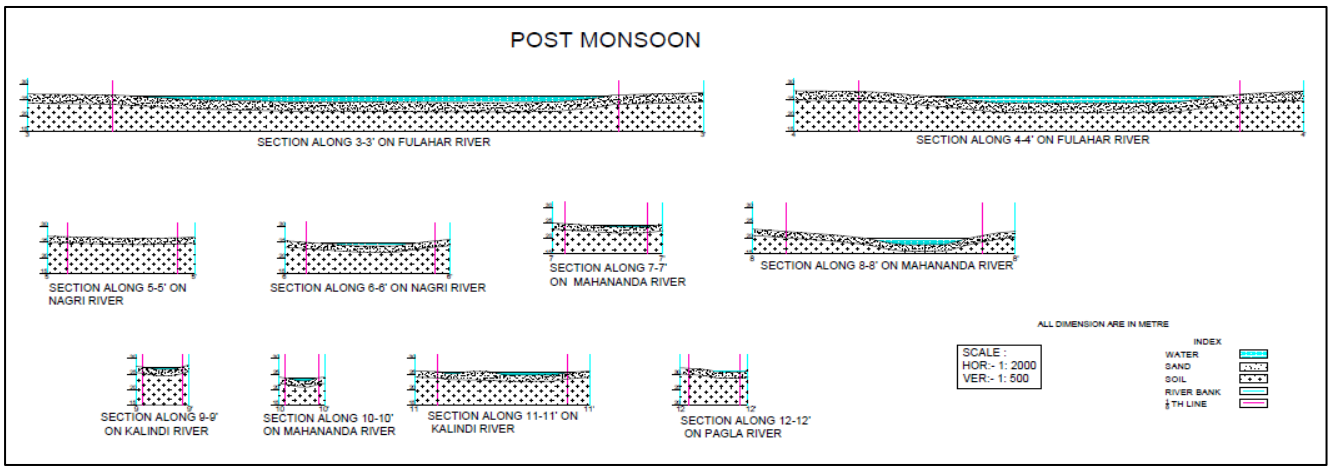


Figure 7-5: Cross section of Rivers of Malda District in post monsoon period

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 are transported by either bedload or suspended load. In case of bedload, when there is insufficient bed shear stress and fluid turbulence is insufficient to keep the sediment moving, the grains looses horizontal movement and rapidly come to rest. In case of suspended load the grains travel 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 whereas 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 composed 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 load 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.

V(A). Replenishment Study based on field investigation:

Sedimentation in any river is dependent on sediment yield and sediment yield 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 calculated by using Dickens, Jarvis and Rational formula at 25, 50 and 100 years return period. The estimation of bed load transport 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 collation was carried out during May- June (2020) for all the river ghats on continuous basis for pre monsoon period and October- November (2020) for all the river ghats on continuous basis for post monsoon period. 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 derive the size frequency analysis.

- **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 this annual replenishment report:
  - ✓ Elevation levels of the different sand ghats and sand bar's 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 extents of the catchment areas, which crossed the district and state boundaries.
- **Estimation of annual sand deposition:**

The major sand producing river of the Malda district is Ganga, Mahananda, Nagri, Kalindri and Fulahar rivers. Planning has been done for systematic sand mining in the rivers.

From the satellite imagery study in the pre monsoon period, altogether 54 sand bars are identified in Malda district

In the post monsoon period, altogether 56 sand bars are identified in Malda district

For calculating the area of sand bars, following categorization of land within the channel area have been adopted:

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 period for different rivers in Malda district is given in Table 7.4 and details of each sand bars along with their sand resources in pre monsoon and post monsoon periods are provided in Annexure 2. Maps showing distribution of sand bars on rivers of the Malda district during pre and post monsoon are depicted in Plate 2A and Plate 2B respectively.

Table7-4*:* Sediment Load comparison between Pre & Post Monsoon periods for different rivers of Malda district

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 (%)
Ganga	18	19	69.84	70.53	0.69	0.98
Fulahar	18	18	9.50	9.51	0.01	0.11
Mahananda	4	4	0.59	0.70	0.11	18.47
Nagri	12	13	0.94	0.98	0.04	3.95
Kalindri	2	2	0.18	0.32	0.14	79.99
Total =	**54**	**56**	**81.05**	**82.04**	**0.99**	**1.22**

Thus, in Malda district about 0.99 million cum of sand has been found as an incremental volume increase when compared between pre and post monsoon sand reserve data. Percentage of difference comes to about 101.22% which is replenishment and aggradation rate for the year.

A Long-term Satellite imagery study has also been carried out for sand producing rivers of Malda District to analyse the changes in river course. A representative map, showing long-term (from 1985-2010-to 2021) erosion-accretion areas on both the banks of Ganga River has been prepared and furnished as Plate No. 5A and 5B. 5B Map shows changes in river channel through erosion and it shows narrowing of width of river courses by almost 650m from 2001 to 2021.

V (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 difference between the depth 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.

Table No. 7-5: Replenishment rate of the district

Location	River Name	Area	Surface RL	Thickness	Volume	After mining floor RL	Surface RL	Thickness	Volume	Difference in RL	Replenishment Rate
		m2	m	m	cum	m	m	m	cum	m	%
Gangarampur	Kalindri	43900.00	28.00	2.80	122920.00	25.20	27.89	2.69	118249.04	0.11	96.20
Kaltapara	Mahananda	9900.00	18.00	3.00	29700.00	15.00	17.88	2.88	28512.00	0.12	96.00
Raipur	Mahananda	14800.00	20.00	2.90	42920.00	17.10	19.89	2.79	41289.04	0.11	96.20
Jagannathpur	Nagri	4000.00	30.00	2.95	11800.00	27.05	29.88	2.83	11339.80	0.12	96.10
Hossainpur	Nagri	26800.00	24.00	3.00	80400.00	21.00	23.89	2.89	77425.20	0.11	96.30
Maharajpur	Nagri	7200.00	26.00	2.80	20160.00	23.20	25.90	2.70	19414.08	0.10	96.30
Chakbahadurpur	Ganga	39900.00	21.00	3.00	119700.00	18.00	20.88	2.88	114912.00	0.12	96.00

Therefore, the average replenishment rate for the year 2020 comes to about 96.16%.

V (C). Replenishment estimation based on an 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 depend 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.

Catchment Yield can be estimated using following formula:

Catchment Yield (m^3) =Catchment area (m^2) × Runoff coefficient (%) × Rainfall (m)

The runoff generated from the watershed is analyzed using Strange's Tables method 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 characleris1ics. Catchments are classified as good, average and bad according to the relative magnitudes of yield they give. 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 Stange established runoff coefficient table as given below:

Table No. 7-6: Runoff coefficient of the catchment based on Strange's table

Total monsoon rainfall (mm)	Runoff coefficient (%)			Total monsoon rainfall (mm)	Runoff coefficient (%)		
	Good catchment	Average catchment	Bad catchment		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
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

Total monsoon rainfall (mm)	Runoff coefficient (%)			Total monsoon rainfall (mm)	Runoff coefficient (%)		
	Good catchment	Average catchment	Bad catchment		Good catchment	Average catchment	Bad catchment
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

(Source: Subramanya, 2008)

Rainfall returns 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)**,**

$$Q = CA^{3/4}$$

Where: Q is Maximum flood discharge (m^3/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 (m^3/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)**,**

Q = CIA

Where: Q is Maximum flood discharge (m^3/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.

$$C_t = C_s G_s \left(d_{50}/h\right) \left(V/U_*\right)^{n'} \left[\left(F_{gr}/A_1\right) - 1\right]^{m}$$

The dimensionless particle d_{gr} is calculated by:

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

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

$$F_{gr} = \left(U \times n'/\sqrt{(G_s-1) g\, d_{50}}\right) \times \left(V/(5.66 \log(10h/d_{50}))\right)^{1-n'}$$

Where,

A_1 = Critical particle mobility factor
C_s = Concentration coefficient in the sediment transport function
C_t = Total sediment concentration
d_{50} = Median grainsize

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:

Meyer-Peter's equation (Ponce, 1989) is based on experimental work carried out at Federal Institute of Technology, Zurich. Mayer-Peter gave a dimensionless equation based, for the first time, on rational laws. Mayer- Peter equations giving an empirical correlation 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. η' = (1/24) x d1/6 where d is the median size (d_{50}) 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 d_{50} and d_{60}.

τ0= Unit tractive force produced by flowing water i.e. γwRS. Truly speaking, its value should be taken as the unit tractive force produced by the flowing water on bed = 0.97γwRS. 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 occurr 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 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 (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 inches:

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

For run off more than 2 inches:

$(Q > 2\ in):\ S= 1958 \times (e^{-0.055\times Q}) \times [1.43-0.26\ Log\ (A)]$

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 as drainage area increases. As drainage area increases, average land slopes usually decrease; 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 rain- fall 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 rain- fall.

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:

Geomorphologically 90% of the district is covered with river flood plain. The district is situated on the western part of the alluvial filled gap between the Rajmahal hills on the west and Garo hills on the east. The entire area in the district is covered by alluvium of two different ages (e.g. Pleistocene and Tertiary) displaying different physical and physiographic characteristics.

The Malda district is mainly drained by the Ganga, Mahananda, Kalindri, Nagri, Fulahar and Tangaon 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 1524mm 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 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 -Boltan formula also says that actual sediments yield from individual drainage basins may vary 10-fold or even 100-fold from computed yields. Since the district river basin comprises of 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 No. 7-7: Replenishment parameter estimated for each river in the district

Estimation parameter	Ganga	Fulahar	Mahananda	Nagri	Kalindri
Catchment Area (m^2)	415970000	542680000	756970000	132940000	233370000
Annual Rainfall (m) (in 2020)	1.603	1.603	1.603	1.603	1.603
Strange Runoff coefficient (%)	45%	45%	45%	45%	45%
Annual Run-off (m) (in 2020)	0.35266	0.35266	0.35266	0.35266	0.35266
Catchment Yield (m^3)	300059960	391462218	546040309.5	95896269	168341450
Peak Flood Discharge (m^3/sec)	34952460.51	42666705.31	54763380.26	14856722.17	22657657.92
Flow depth d (m)	0.8	0.4	0.6	0.3	0.3
Channel width b (m)	553.18	120.78	23.34	24.27	50.44
Mean velocity v (m/s)	0.1	0.05	0.08	0.04	0.04

Estimation parameter	Ganga	Fulahar	Mahananda	Nagri	Kalindri
Channel slope S_0 (m/m)	0.011	0.007	0.009	0.006	0.005
Sediment Yield (Tons/year)	7625.28	9599.28	12780.93	2803.47	4603.97
Estimated Annual Replenishment (in million m3)	0.14280	0.17976	0.23934	0.05250	0.08622

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 7.6.

Table No. 7-8: Year-wise sedimentation rate (tons/sq km/yr) for last 5 years of each river

Year	Ganga	Fulahar	Mahananda	Nagri	Kalindri
2016	39.11	37.74	36.03	45	42.09
2017	19.48	18.79	17.94	22.41	20.96
2018	74.19	71.58	68.33	85.34	79.84
2019	33.25	32.09	30.63	38.25	35.78
2020	18.33	17.69	16.88	21.09	19.73

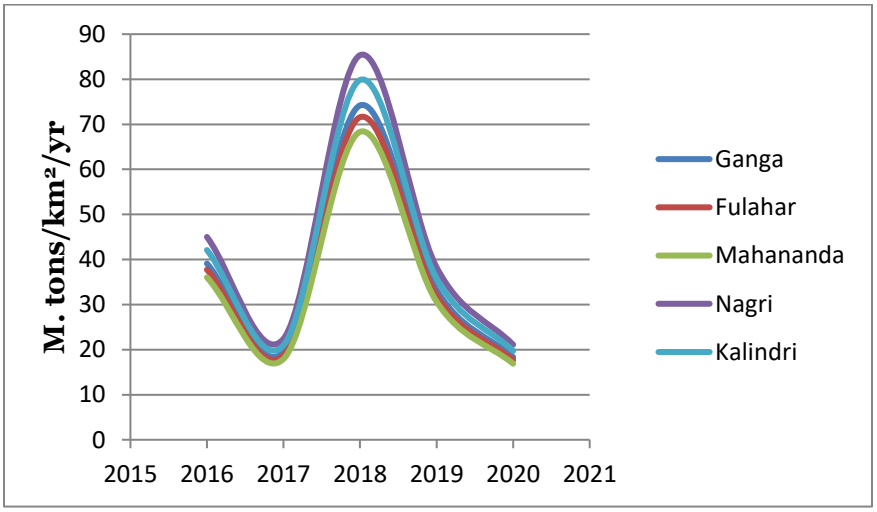


Figure No.7.6: Graphical representation of year-wise sedimentation rate

The estimation of sedimentation 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.

Table No.7-9: River wise replenishment rate estimation based on empirical formula

Location	River Name	Lease Area	Surface RL Before mining	Mine out Thickness	Mine out Volume	Annual Rainfall -2020	Estimated Replenished Volume as per Dendy-Bolton	Replenishment Rate
		m2	m	m	cum	m	cum	%
Gangarampur	Kalindri	43900.00	28.00	2.80	122920.00	1.60	86044.00	70.00
Kaltapara	Mahananda	9900.00	18.00	3.00	29700.00		21384.00	72.00
Raipur	Mahananda	14800.00	20.00	2.90	42920.00		32190.00	75.00
Jagannathpur	Nagri	4000.00	30.00	2.95	11800.00		8024.00	68.00
Hossainpur	Nagri	26800.00	24.00	3.00	80400.00		55476.00	69.00
Maharajpur	Nagri	7200.00	26.00	2.80	20160.00		14515.20	72.00
Chakbahadurpur	Ganga	39900.00	21.00	3.00	119700.00		83790.00	70.00

Illustration of Replenishment Estimation is given in Table 7.10.

Table No. 7-10: Illustration of replenishment rate calculation based on 3 methods

Based on Satellite imagery		**Based on field investigation**		**Based on empirical formula**	
Particulars	Estimation	Particulars	Estimation	Particulars	Estimation
		River Name	Nagri	River Name	Nagri
River	Nagri	Location	Jagannathpur	Location	Jagannathpur
Total Pre-monsoon Sand Bar Area	470016 (sq.m)	Mining Area	4000 (Sq.m)	Lease Area	4000 (Sq.m)
Average Pre monsoon Thickness	2 (m)	Pre monsoon RL	30 (m)	Surface RL Before mining	30 (m)
Total Sand Volume	0.94 (Mcum)	Sand Thickness	2.95 (m)	Mine out Thickness	2.95 (m)
Total Post-monsoon Sand Bar Area	444175 (sq.m)	Volume excavated (Cum)	11800 (Cum)	Mine out Volume (Cum)	11800 (Cum)
Average Post-monsoon Thickness	2.2 (m)	Post monsoon RL	29.88 (m)	Drainage area for lease block	0.001 (Sq.km)
Total Sand Volume	0.98 (M.cum)	Thickness	2.83 (m)	Monsoon Rainfall-2020	1.6 (m)

Based on Satellite imagery		**Based on field investigation**		**Based on empirical formula**	
Pre and Post monsoon Volume Difference	0.04 (M.cum)	Volume deposited (Cum)	11339 (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)	8024 (Cum)
Replenishment and Aggradation %	104%	Replenishment Rate	96.1%	Replenishment Rate	68%

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 No 7-11: Comparison of replenishment study

Replenishment Study Method	**Kalindri**	**Mahananda**	**Nagri**	**Ganga**
Estimated Annual Replenishment based on Satellite imageries **(*)**	118%	119%	104%	101%
Estimated Annual Replenishment based on field investigation	96.2%	96.1%	96.23%	96%
Estimated Annual Replenishment based on empirical formula	70%	73.5%	69.67%	70%

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

vi) Total potential of minor mineral in the river bed

The major sand producing rivers of the Malda district are Ganga, Mahananda, Kalindri, Nagri and Fulahar rivers. The total potential of minor mineral in the riverbed is 49.23 Mcum.

B. Geological studies

i) Lithology of the catchment area

The overall rock type of the catchment area is mainly consisting of medium to fine grained sandstone, silty clay and fine micaceous clay with ferruginous sand.

ii) Tectonics and structural behavior of rocks

The district falls under the Seismic Zone IV and V, indicating very prone to the earthquakes. Western part of the district falls under Zone IV and eastern part in Zone V. However, no major earth quake event has been recorded with its epicenter in the district. Many earthquake shocks experienced in the district have been recorded

C. Climate Factors

i) Intensity of rainfall

The average annual rainfall is 1326.08 mm from year 2016 – 2020. The maximum rainfall in the area as per IMD data was recorded in the month of June and July followed by August and September. The rainfall in winter season is very low in amount.

ii) Climate zone

The Malda district is significantly under hot and humid monsoonal climate. An oppressive summer season, plentiful rain and humid atmosphere all through the year are the main characteristics of the climate of Malda district. On the basis of temperature variation, rainfall, humidity and winds, the year of the district can be divided into four well defined seasons; namely

1) Hot- Summer Season- March to May,
2) Monsoon Season – June to September,
3) Retreating Monsoon-October to November and
4) Winter Season- December to February,

iii) Temperature variation

This district lies in near Himalayan foothills. So, the climate is not too much hot. The minimum temperature of the district lies within the range of 10.7°C and 26.1° C in the month of January and August respectively and maximum temperature lies within 24.2°C and 36.1°C in the month of January and April respectively.

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.

Table No 7-12: River wise thickness of sand bar considered mineable

River Name	Considered Thickness (m)
Ganga	3
Fulahar	2.5
Mahananda	3
Nagri	2.2
Kalindri	1.6

Based on geomorphology, geology, climate and mineable thickness of sand bar the annual deposition of riverbed minerals (sand and gravel) 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 ¼th 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.

Table 7-13: Annual deposition of Riverbed minerals

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 Sq.m)	Mineable mineral potential (in Mcum) (60% of total mineral potential
1	Ganga	58.54	42500.00	553.18	23510094.38	42.32
2	Fulahar	57.50	31500.00	120.78	3804610.71	5.71
3	Mahananda	14.29	10000.00	23.34	233402.77	0.42
4	Nagri	59.98	18300.00	24.27	444175.50	0.59
5	Kalindri	7.08	4000.00	50.44	201767.76	0.19

iii) Riverbed Mineral Potential

Sand: Huge quantity of quality sands and silts are found to occur in part of Mahananda, Ganga, Nagri and Fulahar rivers. Smaller patches are also available locally in the other smaller rivers as well. The rivers in the districts are filled by 70% of silt and 30% of sand only.

Table 7-14: Resources of Potential Riverbed Mineral

Boulder/Pebbles/Gravel (Cubic meter)	Silt (Cubic meter)	Sand (Cubic meter)	Total Mineable, Mineral Potential (Cubic meter)
0.00	34.46	14.77	**49.23**

iv) Riverbed Mineral Potential Zones

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.

Table No.7-15: Potential Zone of Riverbed Mineral

Sl No	Rivers or Streams	Location of potential zones						Area within prohibited zone as per rule 3 of WBMMC Rules, 2016 (in sqm)
		Administrative Block	Mouza	JL Nos	ZONE	Co-ordinates		
						LATITUDE	LONGITUDE	
1	GANGA RIVER	MANIKCHAK	KESAEPUR(002), NAOBARARJAIGIR(007),HIRANANDAPUR(012), BAGDUKRA(015), DAKSHIN CHANDIPUR(019), PASCHIM NARAYANPUR(021), NARAYANPUR(022), DHARAMPUR(073), MIRPUR(088)	002, 007, 012, 015, 019, 021, 022, 073, 088	ZONE 1	25°13'8.314"N	87°46'2.696"E	4385434.09
						24°59'40.113"N	87°56'56.83"E	
		KALIACHAK III	CHAKBAHADURPUR(040), DEBIDASPUR(192), PAR DEONAPUR(193), PAR PARANPARA(194), JIOLMARI(196), PAR LALPUR(197),	040, 192, 193, 194, 196, 197, 199, 200	ZONE 2	24°48'25.045"N	87°56'17.176"E	494896.89
						24°39'22.586"N	88°0'5.694"E	

Sl No	Rivers or Streams	Location of potential zones						Area within prohibited zone as per rule 3 of WBMMC Rules, 2016 (in sqm)
		Administrative Block	Mouza PAR ANANTAPUR(199), PAR SHIBPUR(200)	JL Nos	ZONE	Co-ordinates		
						LATITUDE	LONGITUDE	
2	FULAHAR RIVER	HARISCHANDRAPUR II	DAULAT NAGAR(161),BHALUKA(175)	161, 175	ZONE 3	25°20'45.1"N 25°16'23.935"N	87°47'9.412"E 87°52'40.603"E	269800.03
		RATUA I	BAJITPUR(012), DWITIYA BALUPUR(008), SURAJPUR(023), MOHANPUR(027)	012, 008, 023, 027	ZONE 4	25°16'24.172"N 25°10'6.64"N	87°51'20.21"E 87°53'34.334"E	306348.70
		MANIKCHAK	MAHABBATPUR(031), GHASIGAON(027)	031, 027	ZONE 5	25°10'8.052"N 25°5'32.287"N	87°52'51.261"E 87°50'55.395"E	60684.91
3	MAHANANDA RIVER	ENGLISH BAZAR	JATALPUR(054), , RAIPUR(096)	054, 096	ZONE 6	25°2'6.626"N 24°57'59.39"N	88°7'57.97"E 88°10'17.627"E	2245.91
4	NAGRI RIVER	CHANCHAL II	KHANPUR(191),MADHAIHAT(193), HOSENPUR(192), BAHARBAD(187)	191, 193, 192, 187	ZONE 7	25°19'13.904"N 25°16'41.401"N	88°7'9.729"E 88°5'43.141"E	39417.22
		RATUA II	GOBINDAPUR(079), MAGURAKHOD(081), BARAIL(082)	079, 081, 082	ZONE 8	25°16'40.888"N 25°13'26.085"N	88°6'13.107"E 88°4'49.284"E	22027.65
		RATUA II	MAHARAJPUR(091), RANGMATIA (093)	091, 093	ZONE 9	25°11'26.413"N 25°9'20.883"N	88°5'41.991"E 88°3'35.231"E	10246.92
5	KALINDRI RIVER	ENGLISH BAZAR	GANGARAMPUR(039), DAIBAKIPUR(036)	039, 036	ZONE 10	25°3'55.875"N 25°3'36.773"N	88°3'45.552"E 88°6'1.957"E	39861.36

NO MINING ZONE:

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. 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 Kalindri of Malda district is given below.

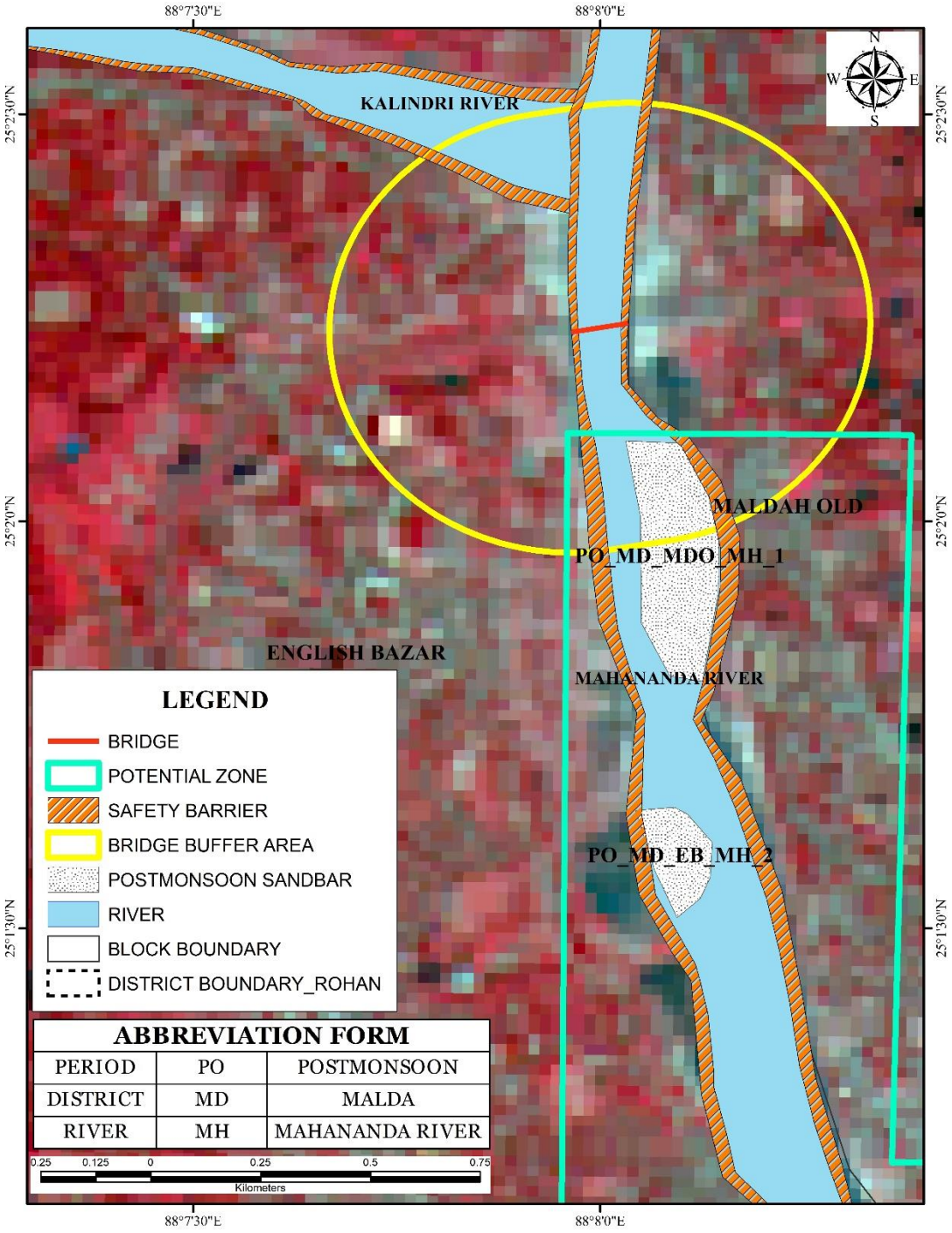


Figure 7.7: A representative map showing no-mining zone demarcated on Kalindri River

Table No 7-16: No mining zone in the district

Sl. No.	River Name	Block Name	No mining area (in Sq.m.)
1	GANGA RIVER	MANIKCHAK	4385434.09
		KALIACHAK III	494896.89
2	FULAHAR RIVER	HARISCHANDRAPUR II	269800.03
		RATUA I	306348.70
		MANIKCHAK	60684.91
3	MAHANANDA RIVER	ENGLISH BAZAR	2245.91
4	NAGRI RIVER	CHANCHAL II	39417.22
		RATUA II	22027.65
		RATUA II	10246.92
5	KALINDRI RIVER	ENGLISH BAZAR	39861.36

B) In-situ Minerals

I. Mineral Reserve

Mineral resources of the district are still not well established, the major mineral like coal, iron, copper, zinc and others has not traced out in this district.

II. Mineral Potential

The mineral potential of this district is very less.

Table 7-17: In-situ Minerals Occurrences

Name of mineral	Name of associated minerals, if any	Host rock of mineralization	Area of mineralization	Depth of mineralization	Whether virgin or partially excavated	Name of land (whether free for mining/forest/agricultural	Mineral reserve (approximate) mentioning grade	Location of potential mineralized zones				Area within prohibited zone as per rule 3(7) of WBMMC Rules, 2016	Infrastructure available near the mineralized zone
								Administrative Block	Mouza	Plot No.s	Co-ordinates		
Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil				Nil	Nil

7.3 Exploration Requirement of the district

The occurrences of sand in riverbed are mostly observed in the river Kalindri, Mahananda, Fulahar, Nagri and Ganga and other small rivers. This report also recommends to undertake detail exploration (G1 & 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.

8. Overview of mining activity in the district

a) General overview

The district is not very rich in mineral resources and there are no large mines in the district. However, collection of sand, Soil and Brick Earth from the river-bed are the minor mineral sources. These materials are primarily utilized for construction purpose. As per the present practice, mining is done by manual method with tools and tackles.

b) List of existing mining leases of the districts

Details of mining leases of the district is furnished below.

Table 8-1: Details of mining leases of the districts

ID	Block	Mouza	JL No	River	Road	Plot No	Area in Hectares	Latitude	Longitude	Bidder Name	Date of Issuance of Environmental Clearance (E.C.)	Date of Execution of Lease Deed	Lease Agreement Start Date (date of effect)	Lease Agreement Expiry Date	Quantum of Sand Extraction permissible as per Mining Plan (tonnes)	Reasons for non-execution of lease deed
400/SB 2021	English Bazar (M)	KALTAPARA	62	Mahananda	Metal/Black top/Pitch/Pucca Road	40 BATA 517	0.4	25° 1' 12.11"N	88° 1' 11.87"E	MATIUR RAHMAN	4/17/2017	2/10/2017	4/17/2017	10-Feb-22	137350.081	
413/SB 2021	ENGLISHBAZAR	PURAPARA	65	Mahananda	Metal/Black top/Pitch/Pucca Road	3069	2.16	25° 0' 26.50"N	88° 9' 11.90"E	AJIT SINGH	4/17/2017	4/20/2017	4/20/2017	20-Apr-22	741696.921	
431/SB 2021	Old Malda (M)	MOULPUR	103	Mahananda	Metal/Black top/Pitch/Pucca Road	382	0.88	25° 1' 40.66"N	88° 8' 7.42"E	IMRAN KHAN	4/17/2017	2/9/2017	2/9/2017	9-Feb-22	38897.893	
442/SB 2021	KALIACHAK-3	LAKSHMIPUR	36	Ganga-Padma	Metal/Black top/Pitch/Pucca Road	3520, 3524, 3522, 3563, 3589, 3590	2.023	24° 47' 4.25"N	87° 57' 42.60"E	MOJAMEL SEIKH	2/22/2017	2/9/2017	2/22/2017	8-Feb-22	76580.227	
482/SB 2021	KALIACHAK-3	CHAK BAHADURPUR	40	Ganga-Padma	Kachha Road	1503 to 1506, 1508 to 1523, 1526 to 1541	3.998	24° 46' 45.40"N	87° 57' 4.35"E	FUL KUMAR SAHA	2/22/2017	2/7/2017	2/22/2017	6-Feb-22	157050.243	
669/SB 2021	CHANCHAL-1	RATORE	30	Mahananda	Kachha Road	254	0.36	25° 28' 56.22"N	88° 4' 24.64"E	MAJMUL HAQUE	2/22/2017	2/6/2017	2/22/2017	5-Feb-22	7390.6	
652/SB 2021	CHANCHAL-1	JAGANNATHPUR	194	Mahananda	Kachha Road	79	0.4	25° 29' 40.32"N	88° 4' 17.08"E	ABDUL RAHIM	2/22/2017	2/6/2017	2/22/2017	5-Feb-22	7455.429	
697/SB 2021	CHANCHAL-2	HOSSAINPUR	192	Mahananda	Kachha Road	1, 351, 551	2.86	25° 18' 4.09"N	88° 6' 33.40"E	OBAIDUR RAHMAN	2/22/2017	2/2/2017	2/22/2017	1-Feb-22	5032.415	

ID	Block	Mouza	JL No	River	Road	Plot No	Area in Hectares	Latitude	Longitude	Bidder Name	Date of Issuance of Environmental Clearance (E.C.)	Date of Execution of Lease Deed	Lease Agreement Start Date (date of effect)	Lease Agreement Expiry Date	Quantum of Sand Extraction permissible as per Mining Plan (tonnes)	Reasons for non-execution of lease deed
1448/SB2021	ENGLISHBAZAR	SHAILPUR	45	Kalindri	Kachha Road	1495/1528	0.57	25° 3' 47.39"N	88° 3' 46.86"E	MD SELIM	4/17/2017	3/21/2017	4/17/2017	21-Mar-22	5558.991	
1462/SB2021	ENGLISHBAZAR	RAIPUR	96	Mahananda	Kachha Road	553, 554	1.48	24° 57' 56.40"N	88° 10' 13.95"E	PRADIP ARORA	4/17/2017	6/8/2019	6/8/2019	8-Jun-24	14383.44	
1471/SB2021	OLD MALDA	SAHAPUR MIDDLE	110	Mahananda	Kachha Road	396	4.38	24° 59' 28.56"N	88° 8' 53.27"E	HINDUSTHAN CONSTRUCTION CO LTD	4/17/2017	11/16/2017	11/16/2017	15-Nov-22	135170.178	
1491/SB2021	GAZOLE	JIGIN	20	Mahananda	Kachha Road	126	1.2	25° 19' 10.30"N	88° 9' 6.76"E	PAWAN ARORA					0	EC Awaiting
1497/SB2021	RATUA - 2	RAJAPUR 2	92	Mahananda	Kachha Road	1770	2.48	25° 9' 46.55"N	88° 3' 55.26"E	PRADIP ARORA					0	EC Awaiting
1495/SB2021	RATUA - 2	RAJAPUR 1	92	Mahananda	Kachha Road	940	1.71	25° 9' 36.72"N	88° 3' 37.24"E	PRADIP ARORA					0	EC Awaiting
1498/SB2021	OLD MALDA	BALARAMPUR	1	Mahananda	Kachha Road	2002	0.405	25° 7' 36.01"N	88° 3' 57.27"E	PRADIP ARORA					0	EC Awaiting
1499/SB2021	RATUA - 2	TEKNA	81	Mahananda	Kachha Road	957/1593	0.44	25° 15' 4.10"N	88° 5' 10.64"E	SAFIKUL ISLAM					0	EC Awaiting
1501/SB2021	RATUA - 2	PUKHURIA	144	Mahananda	Kachha Road	5640	0.8	25° 7' 57.86"N	88° 2' 13.96"E	ABHINNA MINING PVT LTD					0	EC Awaiting
1502/SB2021	CHANCHAL-2	KHANPUR	191	Mahananda	Kachha Road	3330/3149	1.2	25° 17' 20.10"N	88° 6' 2.90"E	Adyamaa Tradelink Pvt Ltd					0	EC Awaiting
384/SB2021	ENGLISHBAZAR	GANGARAMPUR	208	Kalindri	Kachha Road	208	4.4	25° 3' 51.13"N	88° 3' 38.95"E	MANGAL SK	2/22/2017	1/30/2017	2/22/2017	30-Jan-22	154132.901	
673/SB2021	CHANCHAL-1	SHAKTIHAR	43	Mahananda	Kachha Road	453, 664, 689, 692	0.54	25° 25' 45.43"N	88° 5' 49.22"E	GOPAL SAHA	4/17/2017	4/26/2017	4/26/2017	25-Apr-17	5348.46	
1420/SB2021	RATUA - 2	CHATORBARAIL	82	Mahananda	Kachha Road	2202	0.72	25° 13' 24.20"N	88° 4' 58.98"E	ABDUL KASHIR	3/21/2018	4/17/2018	4/17/2018	16-Apr-23	8513.44	
1426/SB2021	RATUA - 2	MAHARAJPUR	91	Mahananda	Kachha Road	1307	0.72	25° 11' 24.24"N	88° 5' 13.19"E	ABHINNA MINING PVT LTD	4/17/2017	5/10/2019	5/10/2019	9-May-24	6997.339	
1457/SB2021	ENGLISHBAZAR	NIMAISARAI	53	Mahananda	Kachha Road	402	2.96	25° 2' 4.51"N	88° 7' 59.10"E	ABHINNA MINING PVT LTD	4/17/2017	5/10/2019	5/10/2019	10-May-19	28766.881	

ID	Block	Mouza	JL No	River	Road	Plot No	Area in Hectares	Latitude	Longitude	Bidder Name	Date of Issuance of Environmental Clearance (E.C.)	Date of Execution of Lease Deed	Lease Agreement Start Date (date of effect)	Lease Agreement Expiry Date	Quantum of Sand Extraction permissible as per Mining Plan (tonnes)	Reasons for non-execution of lease deed
1466/SB2021	OLD MALDA	SAHAPUR NORTH	110	Mahananda	Kachha Road	396	3.43	24° 59' 35.82"N	88° 8' 54.26"E	HINDUSTHAN CONSTRUCTION CO LTD	4/17/2017	11/16/2017	11/16/2017	15-Nov-22	138602.917	
1472/SB2021	OLD MALDA	SAHAPUR SOUTH	110	Mahananda	Kachha Road	396	4.16	24° 59' 28.51"N	88° 8' 53.25"E	HINDUSTHAN CONSTRUCTION CO LTD	4/17/2017	11/16/2017	11/16/2017	15-Nov-22	106969.206	
1486/SB2021	ENGLISHBAZAR	DAIBIKIPUR	36	Kalindri	Kachha Road	1	4.4	25° 3' 38.85"N	88° 5' 18.96"E	ABHINNA MINING PVT LTD					0	EC Awaiting

c) Detail of production of sand and other minerals during last three years

Details of production of last 3 years are furnished below.

Table 8-2: Detail of production of sand and other minerals during last three years

Sl. No.	Year	Name of mineral	Total Production (in cft)	Total Production (in cum)
1	2017-2018	Sand	1308000	37038.09
2	2018-2019	Sand	810500	22950.59
3	2019-2020	Sand	617000	17471.33

Conversion factor: 1cum=35.315 cft

(Source: Directorate of Mines and Minerals)

9. Details of revenue generated from mineral sector during last five years

Revenue generations of last five years are furnished below.

Table 9-1: District revenue generation from Mineral sector (in Rs.)

Year	Royalty collected for sand
2016-17	747450
2017-18	1987250
2018-19	1055045
2019-20	991000
2020-21	801900

(Source: Directorate of Mines and Minerals)

10. Transport (Railway, road)

Emphasize on local transport infrastructure from mineral transport point of view, Malda district is well connected with other cities and towns of West Bengal and neighborhood states by road and rail transport.

10.1 Rail Transport

The main railway station is Malda Town in Malda district. Malda Town railway station is a railway station on the Howrah-New Jalpaiguri line under Malda railway division of Eastern Railway zone. It serves the city of Malda in the Indian state of West Bengal. It is one of the largest as well as busiest railway stations of Eastern India. Indian railways upgrade this station with modern facilities.Malda Town railway station is amongst the top hundred booking stations of Indian Railways.One of the reasons for it being a busy station is that every train that passes through the station stops here since it is the meeting point of two railway zones (i.e. The Eastern Railway and the Northeast Frontier Railway). To the north of the station starts the Northeast Frontier Railway and to the south starts the Eastern Railway. More than 10 express trains from Malda to Kolkata are available for reaching Kolkata and a link superfast express train Brahmaputra is available for going to New Delhi. Also, some passenger trains and intercity express are available for transportation mode within the district.

10.2 Road Transport

Malda is well connected with the rest of the State through National Highways, State Highways and Railways. NH-34 passes through the heart of the district.Malda is 364 km from State capital Kolkata (Calcutta) by National Highway No. 12/NH-34. The distance from Malda to Raiganj is 72 km and Silliguri is 230 km respectively. National highway 81 is also going through within this district. State highway 10 is running throughout this district. Transport system mainly depends on Govt. Bus Service & Private Bus service. The town is well connected to major towns like - Kolkata, Durgapur, Asansol, Sainthia, Burdwan, Raijanj, Balurghat, Jalpaiguri, Siliguri, Katwa, etc. through roadway.

The transportation map is furnished below as Figure10-1. 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.

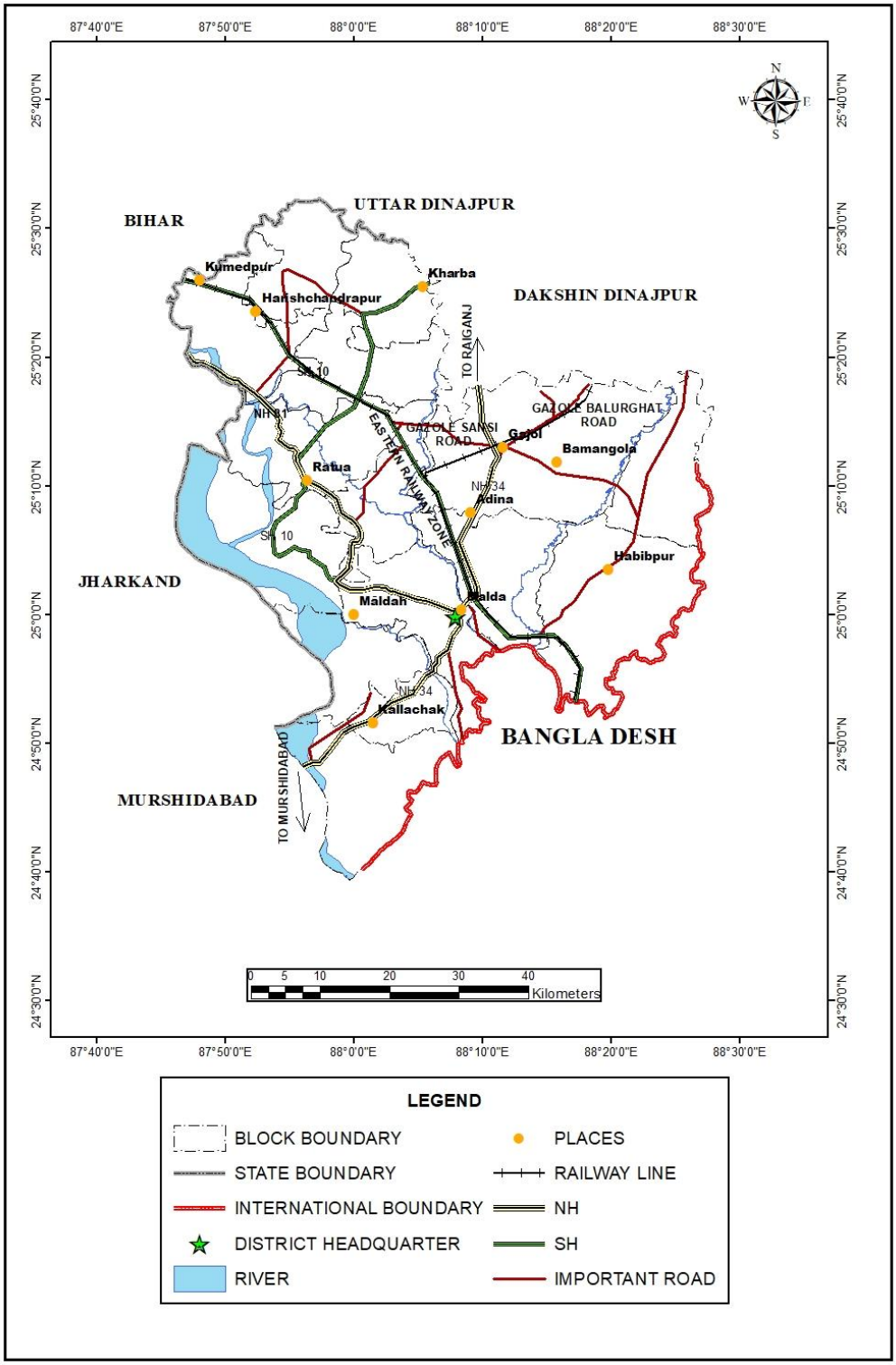


Figure 10-1: Transportation Map of Malda
(Source: National Informatics Centre)

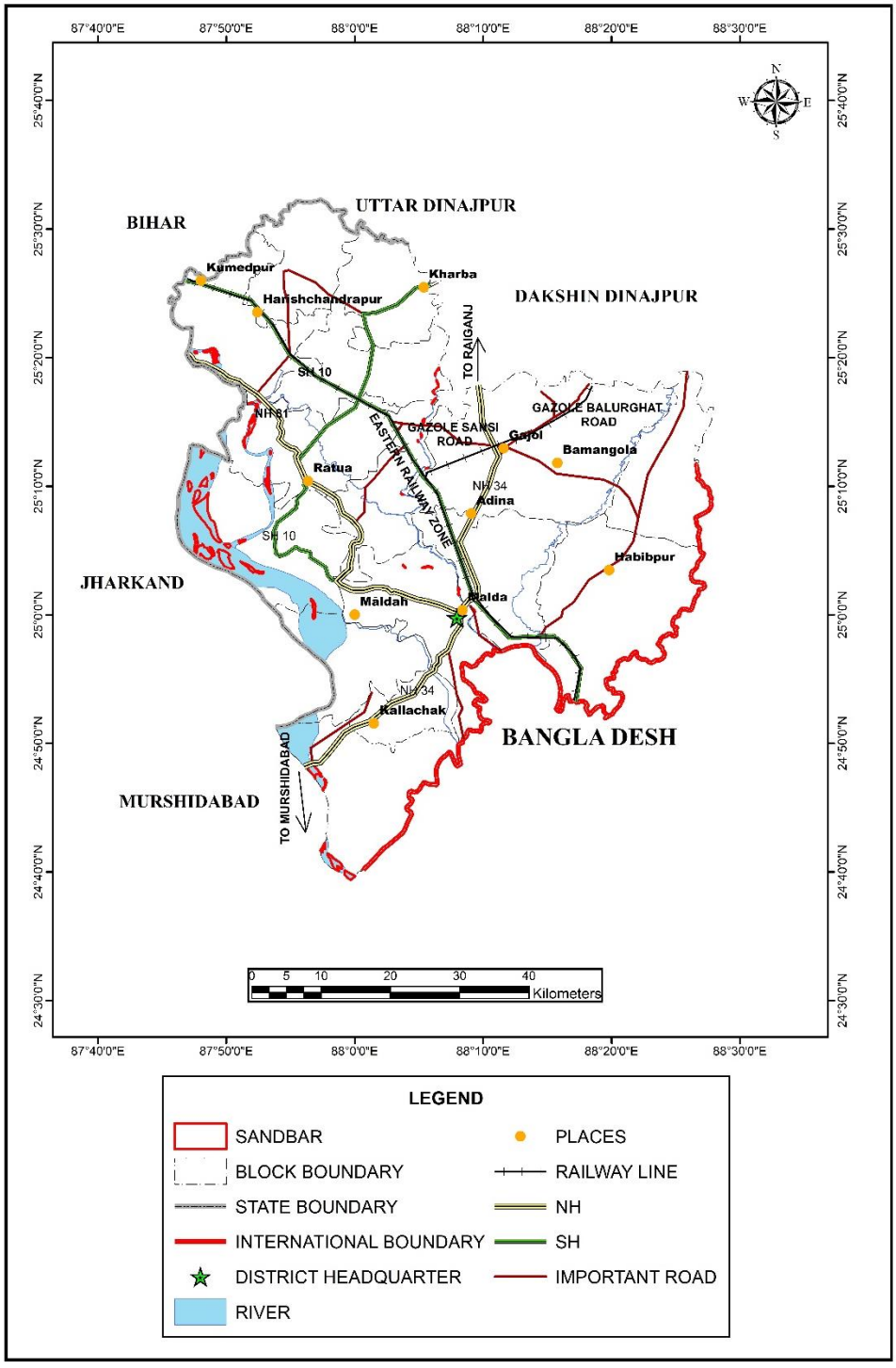


Figure 10.2: Map showing approach road to potential sand bars

(Source: National Informatics Centre)

11. Remedial measure to mitigate the impact of mining

11.1Environmental Sensitivity

The Malda area represents a unique geo- environmental setup. The form of environmental degradation is quite extensive particularly the extraction of forest produces, mining and agriculture are also taken into account. As human population expands, 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, nature has started reacting sharply to the accumulated human guilt. Soil erosion and its conservation play an important role.

The adverse effect of this unscientific mining is removal of soil cover, formation of gullies and badlands; siltation of river beds leading to frequent floods, endangering the lives and properties of local inhabitants.

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 led to unsustainable sand mining process resulting in illegal mining.

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

Removal or extraction of too much sand from rivers leads to erosion shrinking of river banks. Deltas can recede due to sand mining. These destructive effects of sand mining ultimately result 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. By 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 tables and frequently leads to destruction of bridges and channelization structures (Source: Wiejaczka2018).

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 lose.

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 and 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) has 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 gravel / 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.;

g) 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 carry out up to 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 risk 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 truck should be brought to a lower level so that the loading operation suits to 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 liscence.

13.2.2 Measures 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 mines 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 for Malda district has been prepared as per Ministry of Environment, Forests & Climate Change (MoEF& CC) guidelines. This report will guide the systematic and scientific mining of major and minor mineral of the district. Report highlighted the district profile with respect to its geographical position, its area of extent, soil characteristic, land use patter, physiography of the district and mineral potentiality.

The Malda District is holding mineral potentiality with respect to minor minerals. Minor minerals are mining actively in the state, mainly sand, soil, brick earth and earth from river beds.

It has been observed during the preparation of district survey report that Malda district do not have any in-situ minor mineral occurrences as per the till date studies being carried out by various authorities and agencies.

Geomorphologically 90% of the district is covered with river flood plain. The entire area in the district is covered by alluvium of two different ages (e.g. Pleistocene and Tertiary) displaying different physical and physiographic characteristics.

The Malda district is mainly drained by the Ganga, Mahananda, Kalindri, Nagri, Fulahar and Tangaon river. These rivers and its tributary rivers are forming the main catchment area.

The riverbeds are enriched with sand and silt, percentage of larger grains (gravels and boulders) is very less.

The district is generating considerable revenue from mining of minor minerals such as riverbed sand deposits. Revenue generated in the district from minor minerals during 2016 to 2021 is Rs. 55.83 lakhs.

14.1 Conclusion:

1. The rivers are enriched with gravels and boulders along with sand where the percentage of larger grains (gravels and boulders) are much more in the uphill region while percentage of sand is found to be more towards the plains.
2. The replenishment study has been carried out during the preparation of this DSR. Both field-based survey coupled with satellite imagery study and empirical study were carried out to determine the rate of replenishment in each river of the district.
3. 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.

4. It is suggested to have a periodical review along with field data acquisition during pre and post monsoon periods to record the seasonal variance of the sedimentation rate on annual basis and update this DSR in case of any abnormal findings.
5. Field base study shows variation of replenishment from 96.0 to 96.3% in the district and for theoretical replenishment study shows variations from 68% to 75% with an average of 70.1% of replenishment rate in the district.
6. The total potential river bed deposit for the district comes to about 49.23 million cubic meters.

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 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

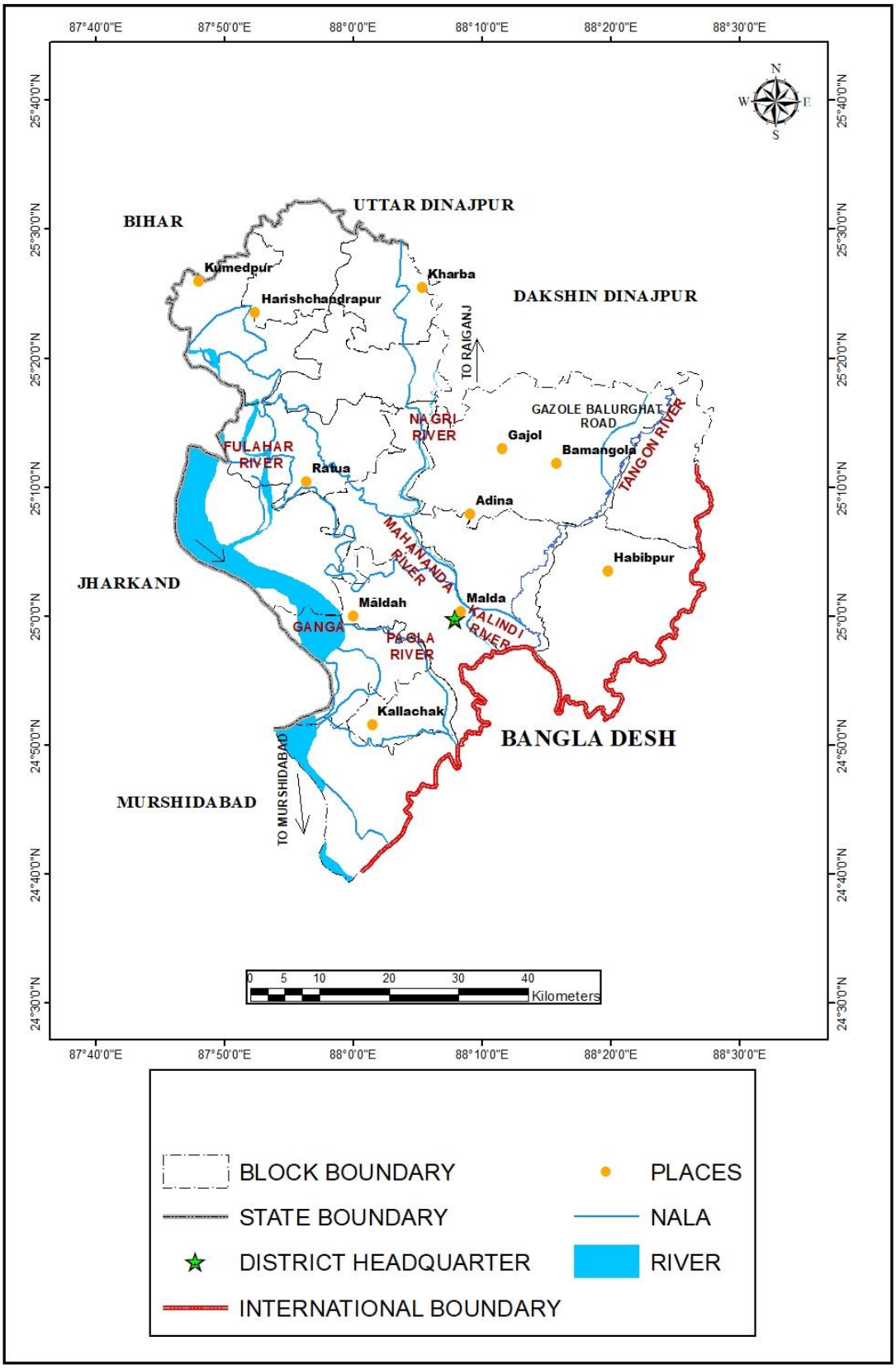
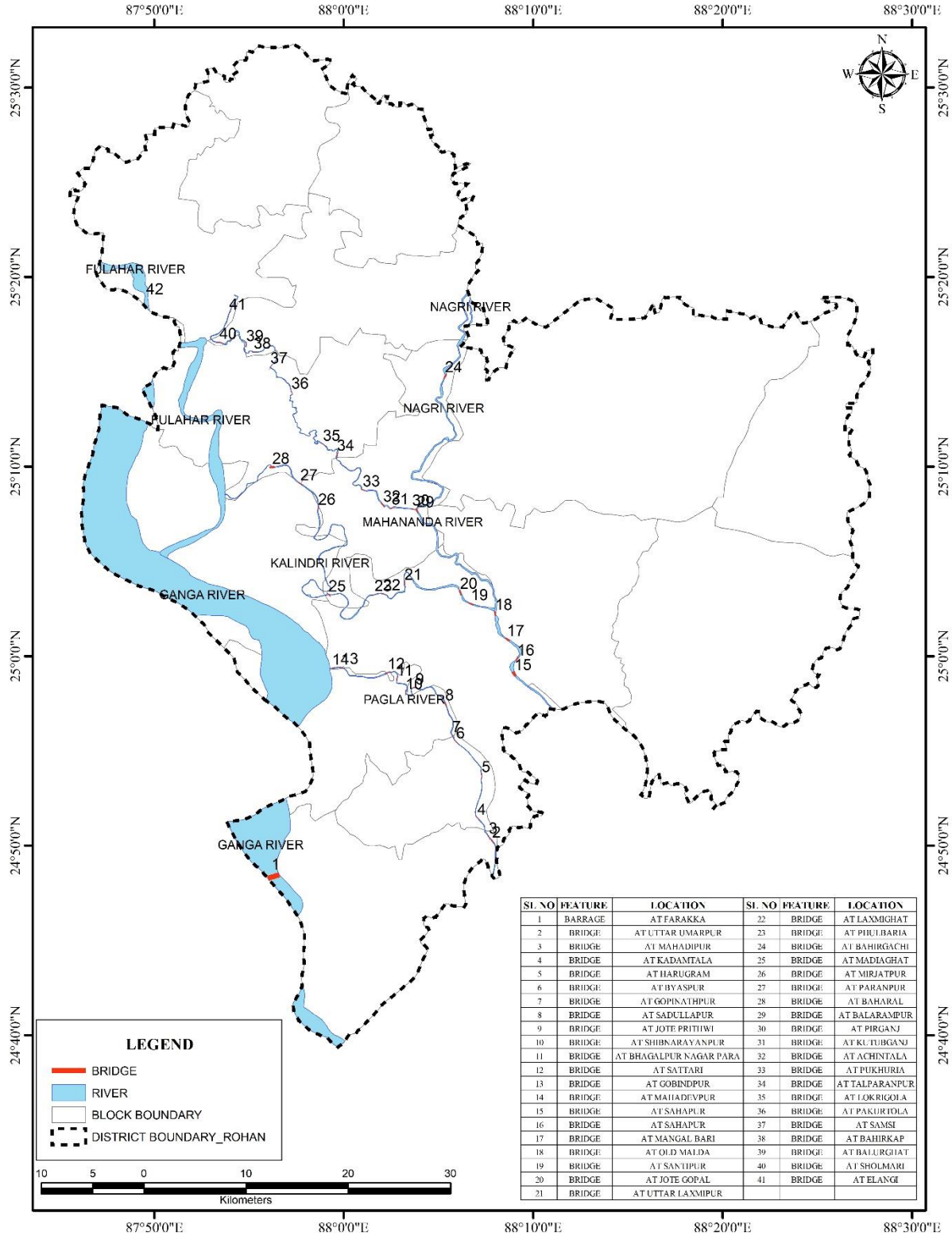


Plate 1A: Drainage Map of the District *(Source: National Informatics Centre -NIC Website, Sept 2020)*



SL NO	FEATURE	LOCATION	SL NO	FEATURE	LOCATION
1	BARRAGE	AT FARAKKA	22	BRIDGE	AT LAXMIGHAT
2	BRIDGE	AT UTTAR UMARPUR	23	BRIDGE	AT PHULBARIA
3	BRIDGE	AT MAHADIPUR	24	BRIDGE	AT BAHIRGACHI
4	BRIDGE	AT KADAMTALA	25	BRIDGE	AT MADIAGHAT
5	BRIDGE	AT HARUGRAM	26	BRIDGE	AT MIRJATPUR
6	BRIDGE	AT BYASPUR	27	BRIDGE	AT PARANPUR
7	BRIDGE	AT GOPINATHPUR	28	BRIDGE	AT BAHARAL
8	BRIDGE	AT SADULLAPUR	29	BRIDGE	AT BALARAMPUR
9	BRIDGE	AT JOTE PRITHWI	30	BRIDGE	AT PIRGANJ
10	BRIDGE	AT SHIBNARAYANPUR	31	BRIDGE	AT KUTUBGANJ
11	BRIDGE	AT BHAGALPUR NAGAR PARA	32	BRIDGE	AT ACHINTALA
12	BRIDGE	AT SATTARI	33	BRIDGE	AT PUKHURIA
13	BRIDGE	AT GOBINDPUR	34	BRIDGE	AT TALPARANPUR
14	BRIDGE	AT MAHADEVPUR	35	BRIDGE	AT LOKRIGOLA
15	BRIDGE	AT SAHAPUR	36	BRIDGE	AT PAKURTOLA
16	BRIDGE	AT SAHAPUR	37	BRIDGE	AT SAMSI
17	BRIDGE	AT MANGAL BARI	38	BRIDGE	AT BAHIRKAP
18	BRIDGE	AT OLD MALDA	39	BRIDGE	AT BALURGHAT
19	BRIDGE	AT SANTIPUR	40	BRIDGE	AT SHOLMARI
20	BRIDGE	AT JOTE GOPAL	41	BRIDGE	AT ELANGI
21	BRIDGE	AT UTTAR LAXMIPUR			

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

PLATE 2A

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

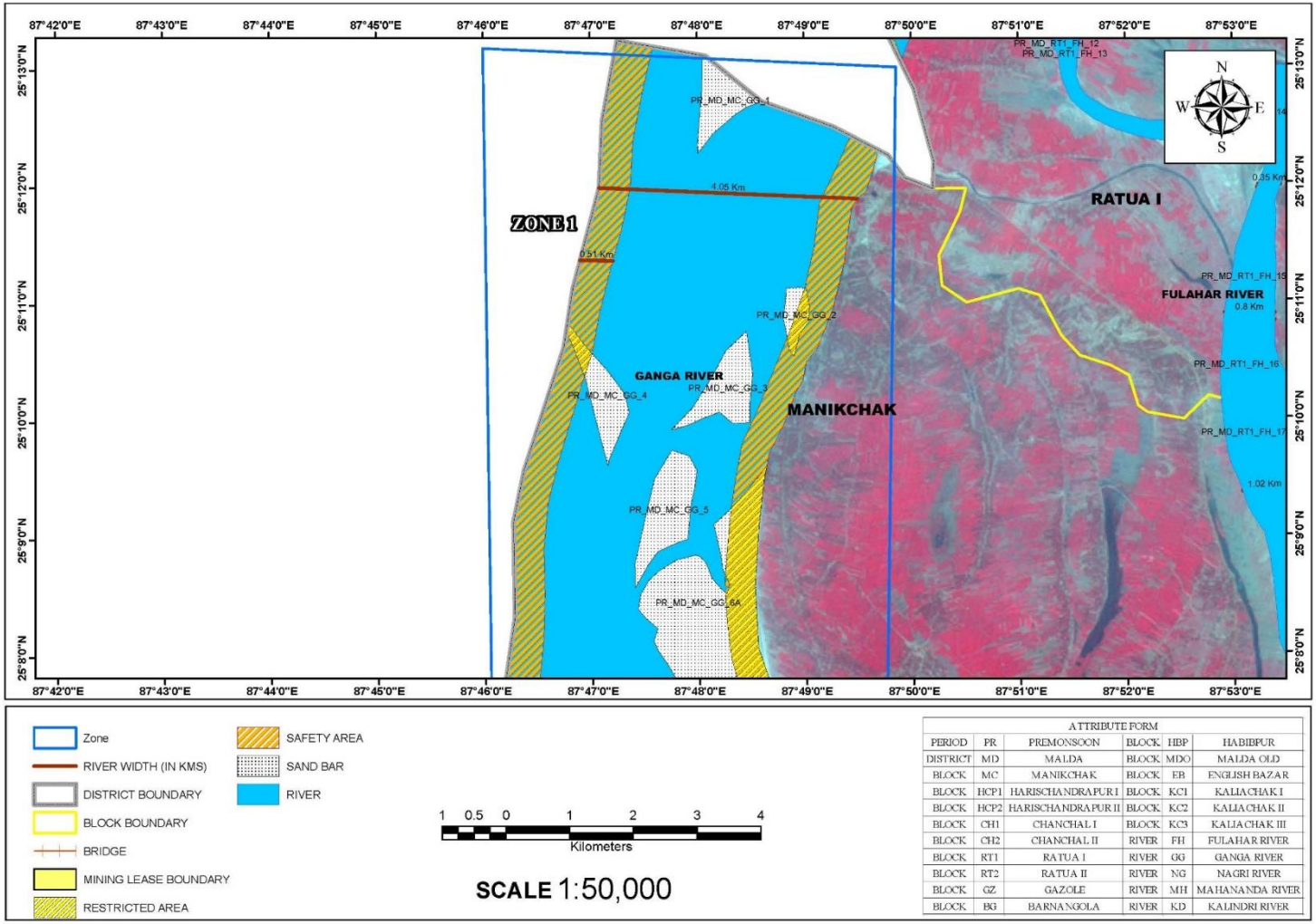
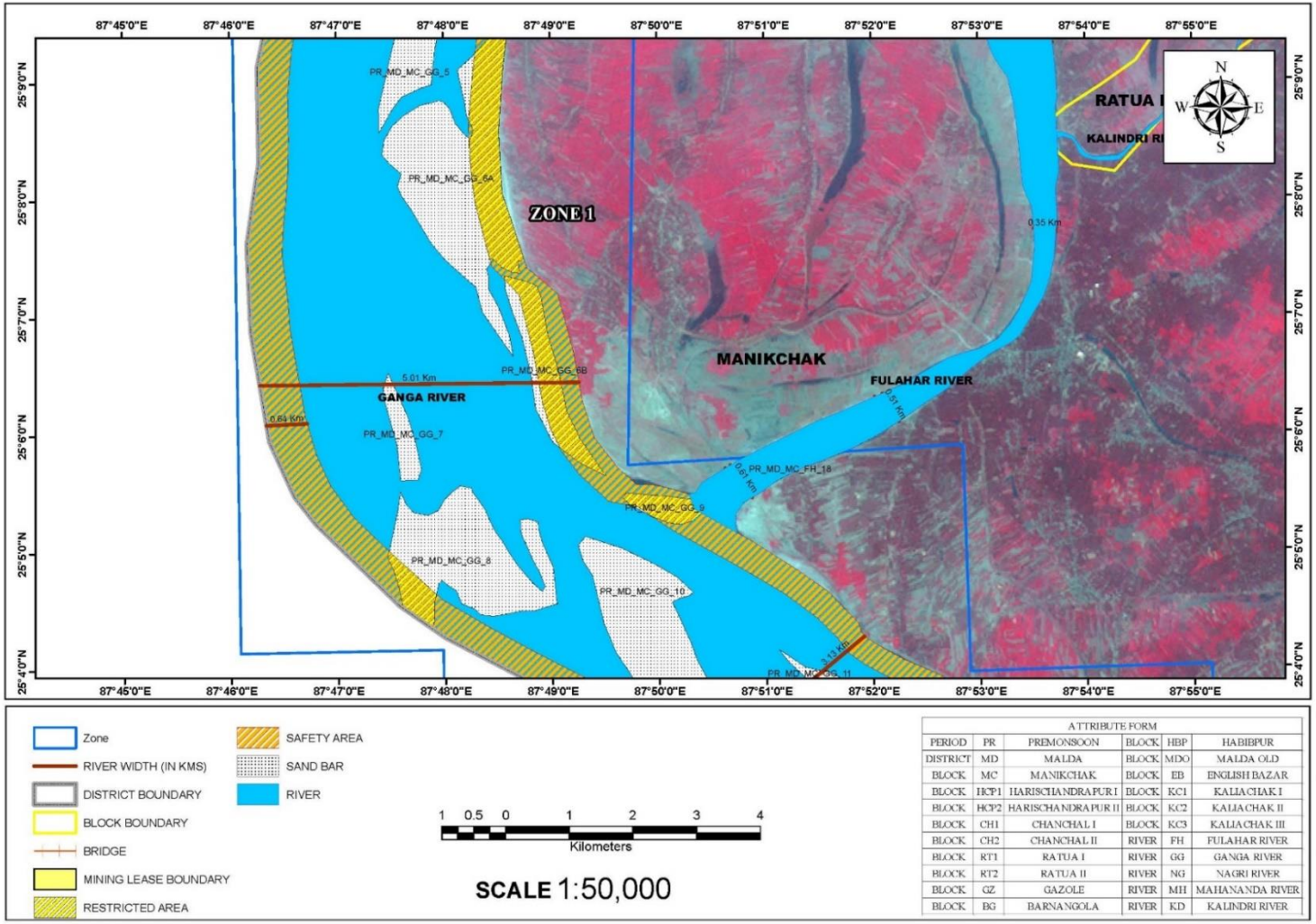


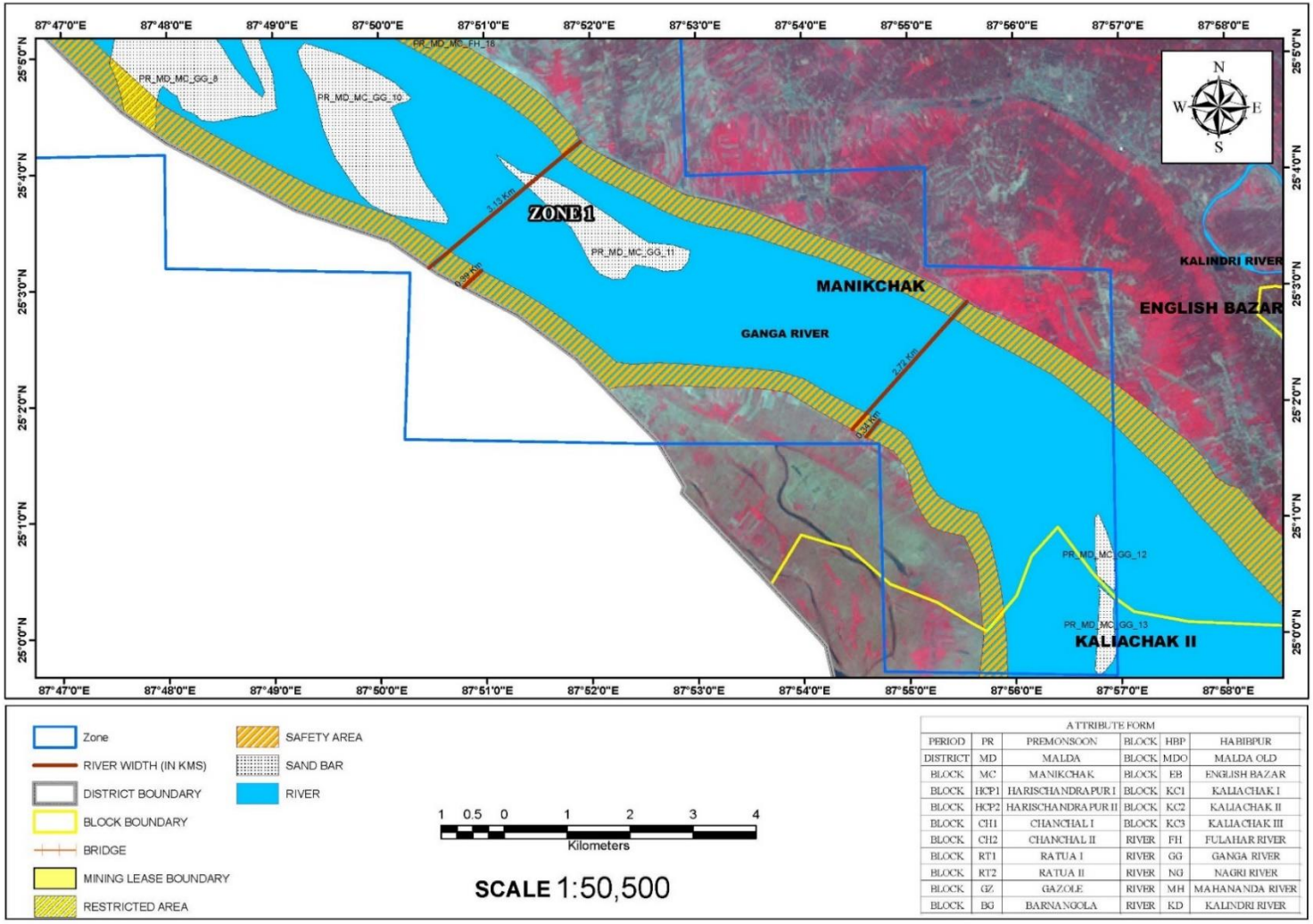
Plate 2A1: Distribution Map of Sand Bars on Rivers During Pre-Monsoon Period of Malda District *(Source: ISRO RESOURCE Sat 2 LISS III Sensor, March 2020)*



ATTRIBUTE FORM

PERIOD	PR	PREMONSOON	BLOCK	HBP	HABIBPUR
DISTRICT	MD	MALDA	BLOCK	MDO	MALDA OLD
BLOCK	MC	MANIKCHAK	BLOCK	EB	ENGLISH BAZAR
BLOCK	HCP1	HARISCHANDRAPUR I	BLOCK	KC1	KALIACHAK I
BLOCK	HCP2	HARISCHANDRAPUR II	BLOCK	KC2	KALIACHAK II
BLOCK	CH1	CHANCHAL I	BLOCK	KC3	KALIACHAK III
BLOCK	CH2	CHANCHAL II	RIVER	FH	FULAHAR RIVER
BLOCK	RT1	RATUA I	RIVER	GG	GANGA RIVER
BLOCK	RT2	RATUA II	RIVER	NG	NAGRI RIVER
BLOCK	GZ	GAZOLE	RIVER	MH	MAHANANDA RIVER
BLOCK	BG	BARNANGOLA	RIVER	KD	KALINDRI RIVER

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



ATTRIBUTE FORM

PERIOD	PR	PREMONSOON	BLOCK	HBP	HABIBPUR
DISTRICT	MD	MALDA	BLOCK	MDO	MALDA OLD
BLOCK	MC	MANIKCHAK	BLOCK	EB	ENGLISH BAZAR
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BLOCK	HCP2	HARISCHANDRAPUR II	BLOCK	KC2	KALIACHAK II
BLOCK	CH1	CHANCHAL I	BLOCK	KC3	KALIACHAK III
BLOCK	CH2	CHANCHAL II	RIVER	FH	FULAHAR RIVER
BLOCK	RT1	RATUA I	RIVER	GG	GANGA RIVER
BLOCK	RT2	RATUA II	RIVER	NG	NAGRI RIVER
BLOCK	GZ	GAZOLE	RIVER	MH	MAHANANDA RIVER
BLOCK	BG	BARNANGOLA	RIVER	KD	KALINDRI RIVER

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

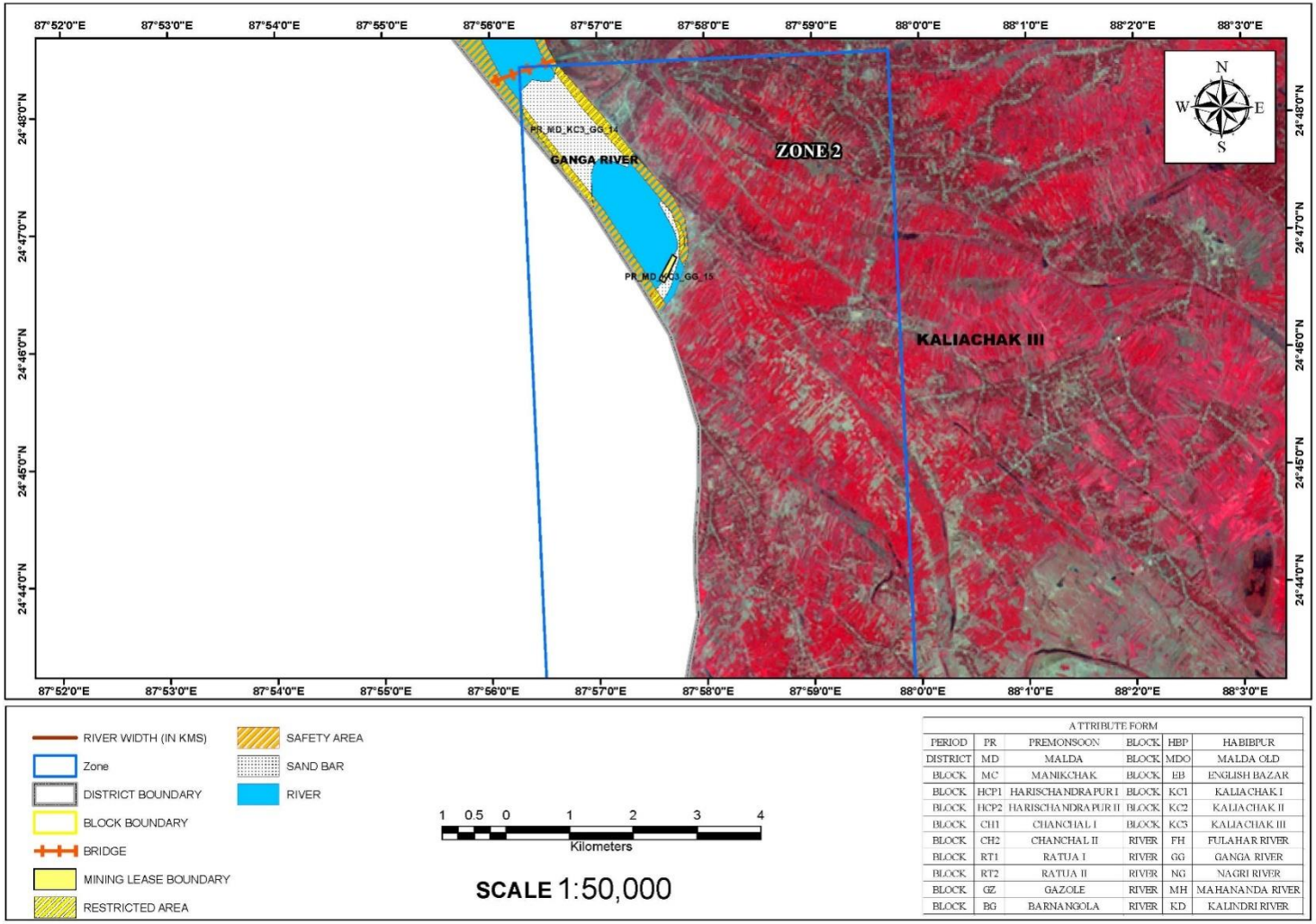
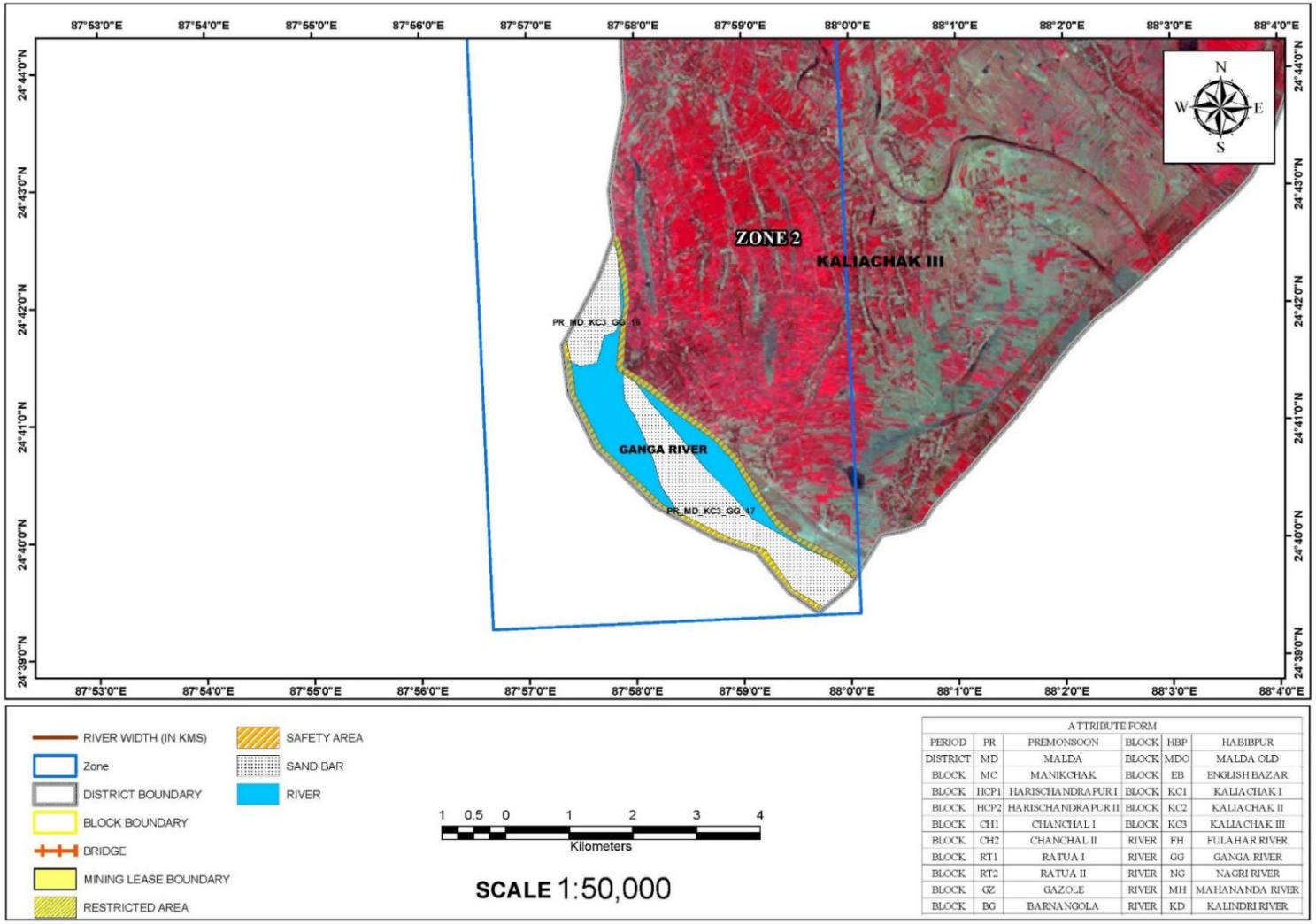


Plate 2A4: Distribution Map of Sand Bars on Rivers During Pre-Monsoon Period of Malda District *(Source: ISRO RESOURCE Sat 2 LISS III Sensor, March 2020)*



ATTRIBUTE FORM

PERIOD	PR	PREMONSOON	BLOCK	HBP	HABIBPUR
DISTRICT	MD	MALDA	BLOCK	MDO	MALDA OLD
BLOCK	MC	MANIKCHAK	BLOCK	EB	ENGLISH BAZAR
BLOCK	HCP1	HARISCHANDRAPUR I	BLOCK	KC1	KALIACHAK I
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BLOCK	CH1	CHANCHAL I	BLOCK	KC3	KALIACHAK III
BLOCK	CH2	CHANCHAL II	RIVER	FH	FULAHAR RIVER
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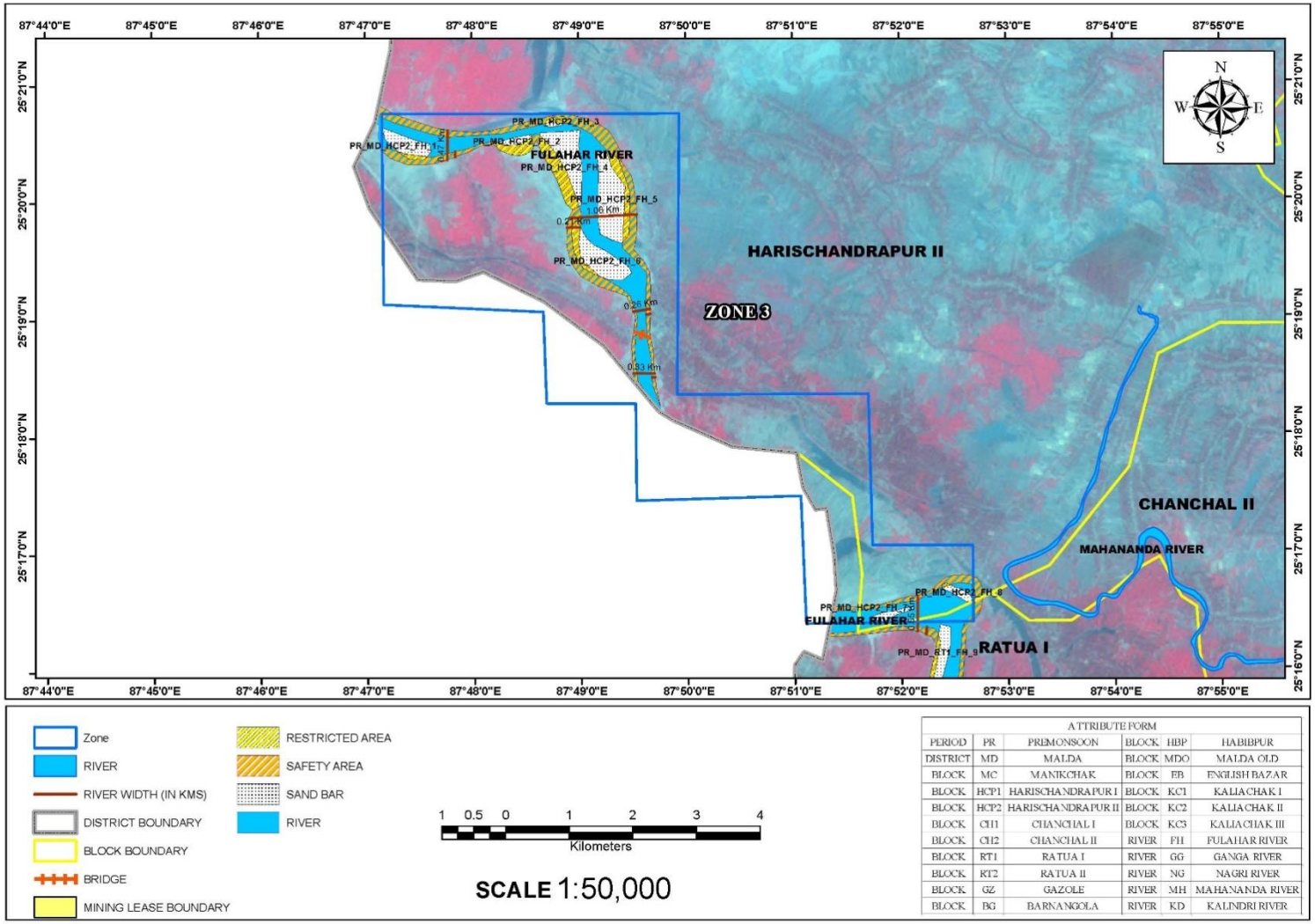
BLOCK	RT2	RATUA II	RIVER	NG	NAGRI RIVER
BLOCK	GZ	GAZOLE	RIVER	MH	MAHANANDA RIVER
BLOCK	BG	BARNANGOLA	RIVER	KD	KALINDRI RIVER

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



ATTRIBUTE FORM

PERIOD	PR	PREMONSOON	BLOCK	HBP	HABIBPUR
DISTRICT	MD	MALDA	BLOCK	MDO	MALDA OLD
BLOCK	MC	MANIKCHAK	BLOCK	EB	ENGLISH BAZAR
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BLOCK	RT2	RATUA II	RIVER	NG	NAGRI RIVER
BLOCK	GZ	GAZOLE	RIVER	MH	MAHANANDA RIVER
BLOCK	BG	BARNANGOLA	RIVER	KD	KALINDRI RIVER

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

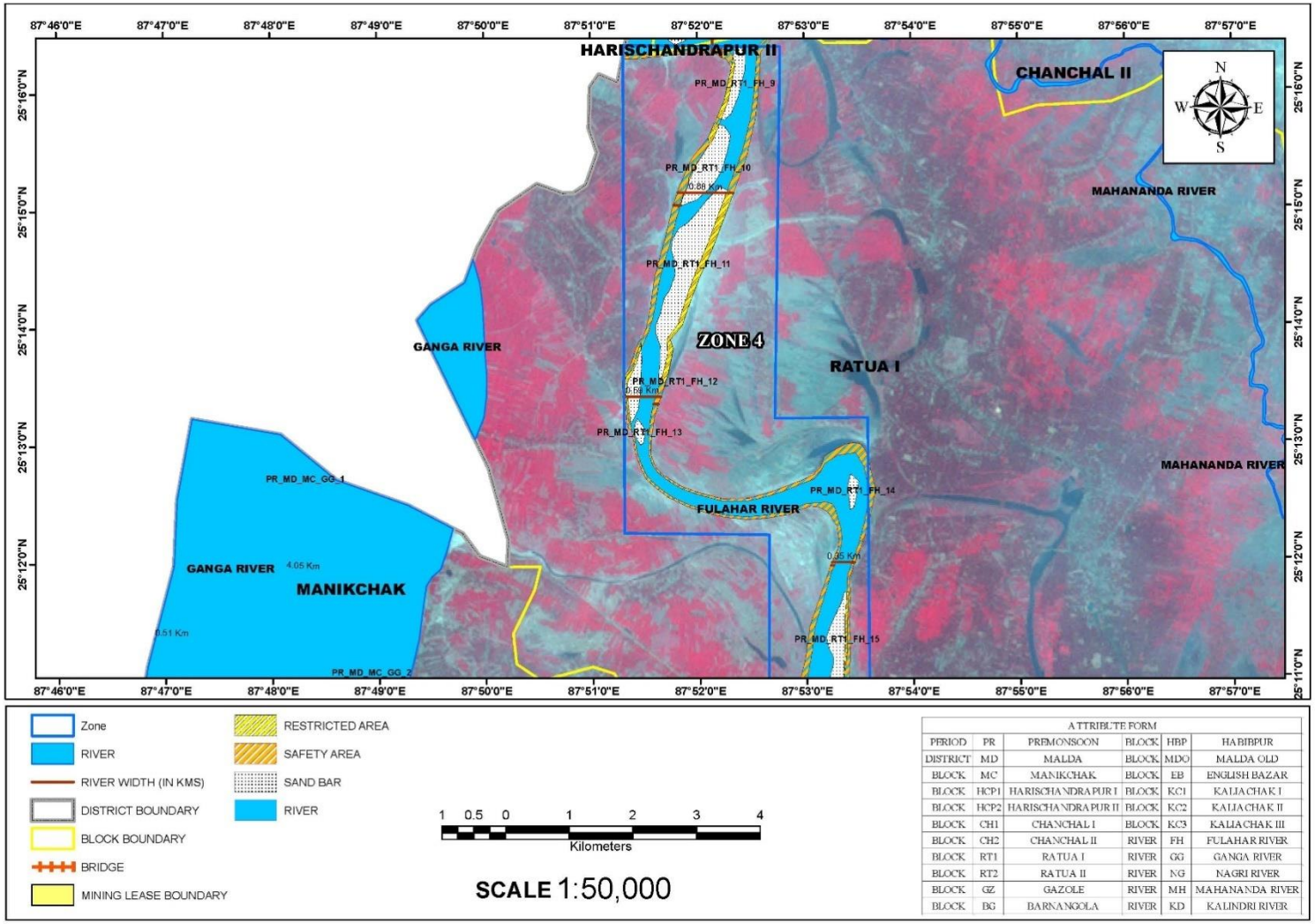
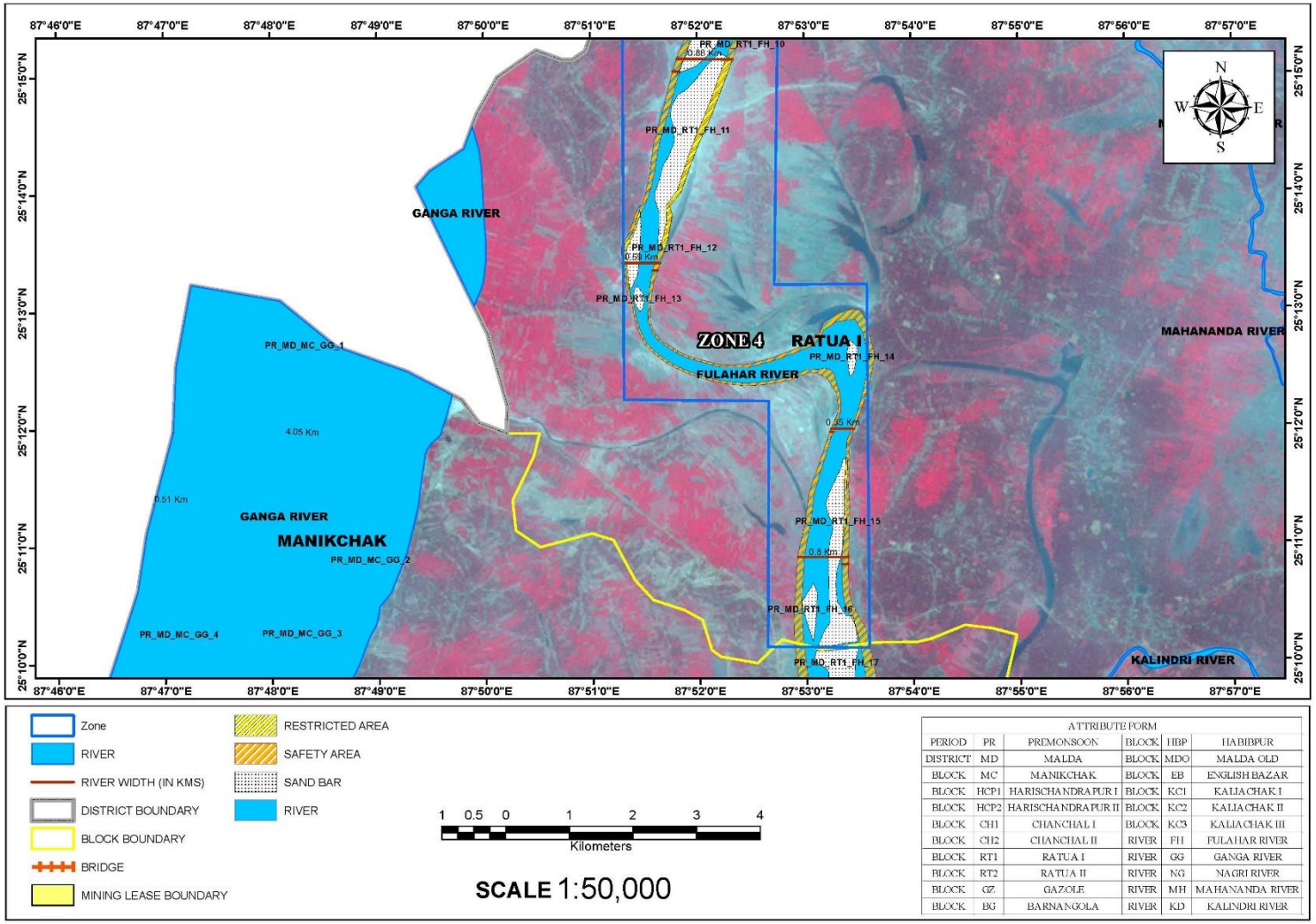


Plate 2A7: Distribution Map of Sand Bars on Rivers During Pre-Monsoon Period of Malda District *(Source: ISRO RESOURCE Sat 2 LISS III Sensor, March 2020)*



ATTRIBUTE FORM

PERIOD	PR	PREMONSOON	BLOCK	HBP	HABIBPUR
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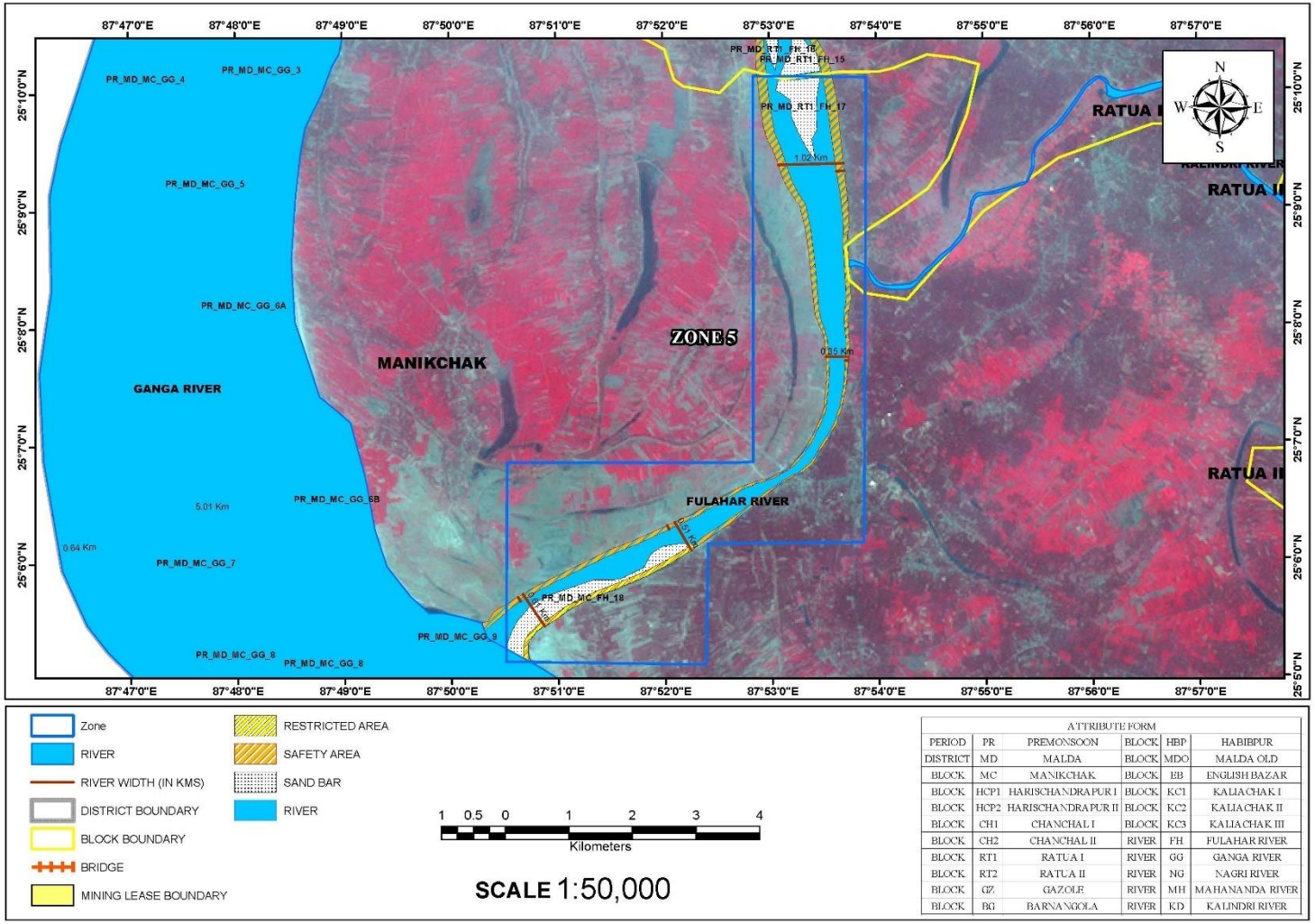
BLOCK	MC	MANIKCHAK	BLOCK	EB	ENGLISH BAZAR
BLOCK	HCP1	HARISCHANDRAPUR I	BLOCK	KC1	KALIACHAK I
BLOCK	HCP2	HARISCHANDRAPUR II	BLOCK	KC2	KALIACHAK II
BLOCK	CH1	CHANCHAL I	BLOCK	KC3	KALIACHAK III
BLOCK	CH2	CHANCHAL II	RIVER	FH	FULAHAR RIVER
BLOCK	RT1	RATUA I	RIVER	GG	GANGA RIVER
BLOCK	RT2	RATUA II	RIVER	NG	NAGRI RIVER
BLOCK	GZ	GAZOLE	RIVER	MH	MAHANANDA RIVER
BLOCK	BG	BARNANGOLA	RIVER	KD	KALINDRI RIVER

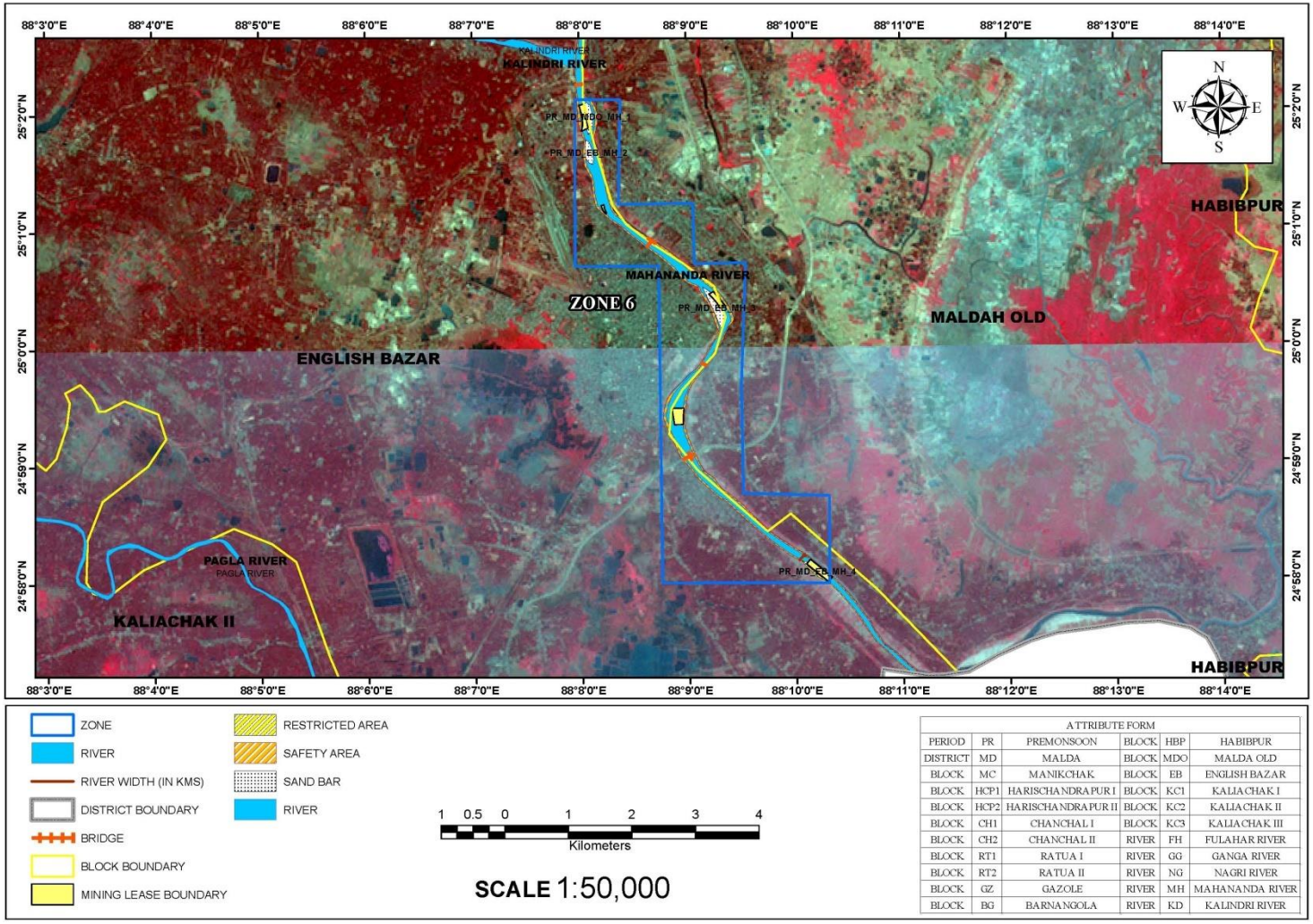
Plate 2A8: Distribution Map of Sand Bars on Rivers During Pre-Monsoon Period of Malda District *(Source: ISRO RESOURCE Sat 2 LISS III Sensor, March 2020)*



ATTRIBUTE FORM

PERIOD	PR	PREMONSOON	BLOCK	HBP	HABIBPUR
DISTRICT	MD	MALDA	BLOCK	MDO	MALDA OLD
BLOCK	MC	MANIKCHAK	BLOCK	EB	ENGLISH BAZAR
BLOCK	HCP1	HARISCHANDRAPUR I	BLOCK	KC1	KALIACHAK I
BLOCK	HCP2	HARISCHANDRAPUR II	BLOCK	KC2	KALIACHAK II
BLOCK	CH1	CHANCHAL I	BLOCK	KC3	KALIACHAK III
BLOCK	CH2	CHANCHAL II	RIVER	FH	FULAHAR RIVER
BLOCK	RT1	RATUA I	RIVER	GG	GANGA RIVER
BLOCK	RT2	RATUA II	RIVER	NG	NAGRI RIVER
BLOCK	GZ	GAZOLE	RIVER	MH	MAHANANDA RIVER
BLOCK	BG	BARNANGOLA	RIVER	KD	KALINDRI RIVER

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



ATTRIBUTE FORM					
PERIOD	PR	PREMONSOON	BLOCK	HBP	HABIBPUR
DISTRICT	MD	MALDA	BLOCK	MDO	MALDA OLD
BLOCK	MC	MANIKCHAK	BLOCK	EB	ENGLISH BAZAR
BLOCK	HCP1	HARISCHANDRAPUR I	BLOCK	KC1	KALIACHAK I
BLOCK	HCP2	HARISCHANDRAPUR II	BLOCK	KC2	KALIACHAK II
BLOCK	CH1	CHANCHAL I	BLOCK	KC3	KALIACHAK III
BLOCK	CH2	CHANCHAL II	RIVER	FH	FULAHAR RIVER
BLOCK	RT1	RATUA I	RIVER	GG	GANGA RIVER
BLOCK	RT2	RATUA II	RIVER	NG	NAGRI RIVER
BLOCK	GZ	GAZOLE	RIVER	MH	MAHANANDA RIVER
BLOCK	BG	BARNANGOLA	RIVER	KD	KALINDRI RIVER

Plate 2A10: Distribution Map of Sand Bars on Rivers During Pre-Monsoon Period of Malda District *(Source: ISRO RESOURCE Sat 2 LISS III Sensor, March 2020)*

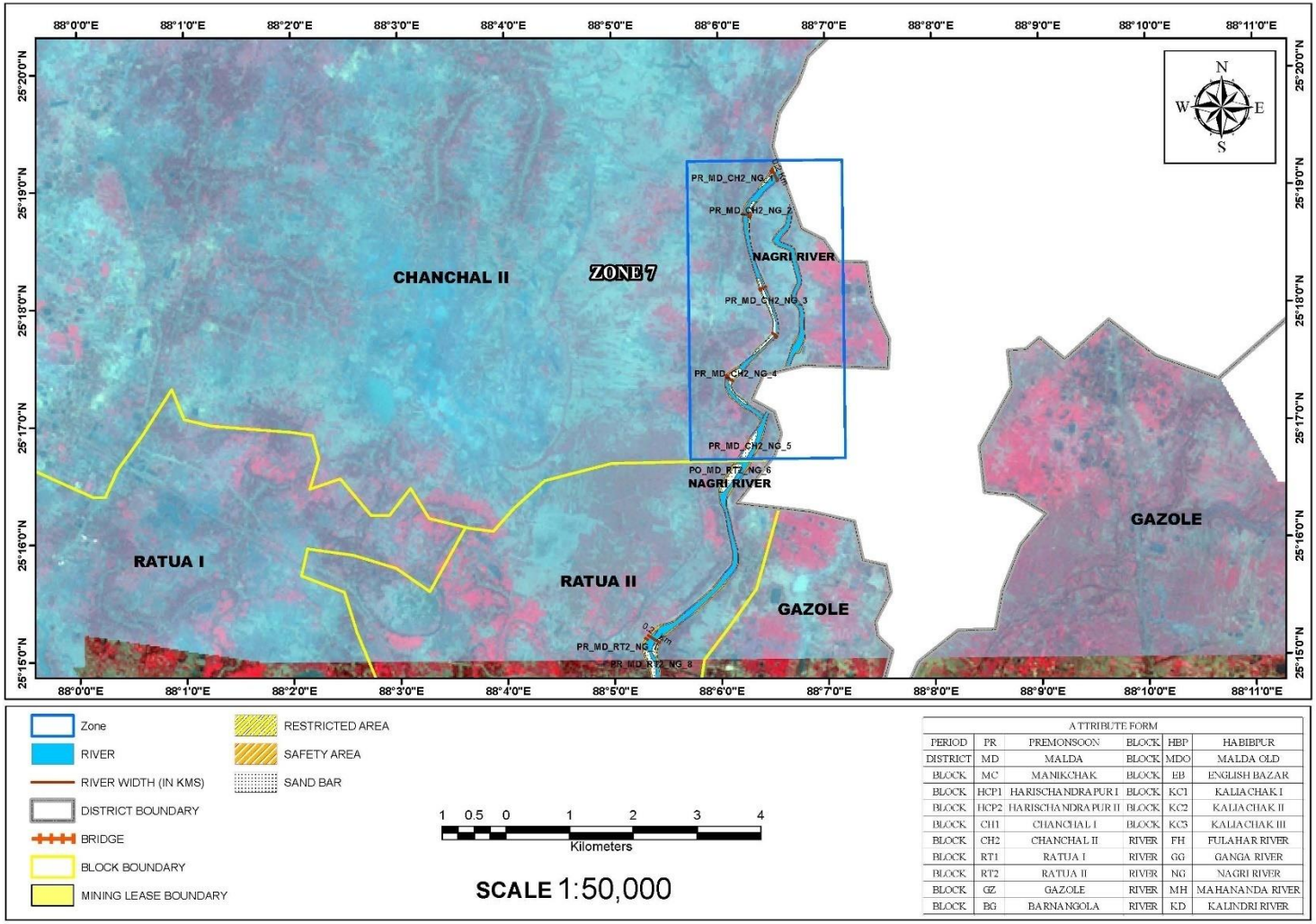
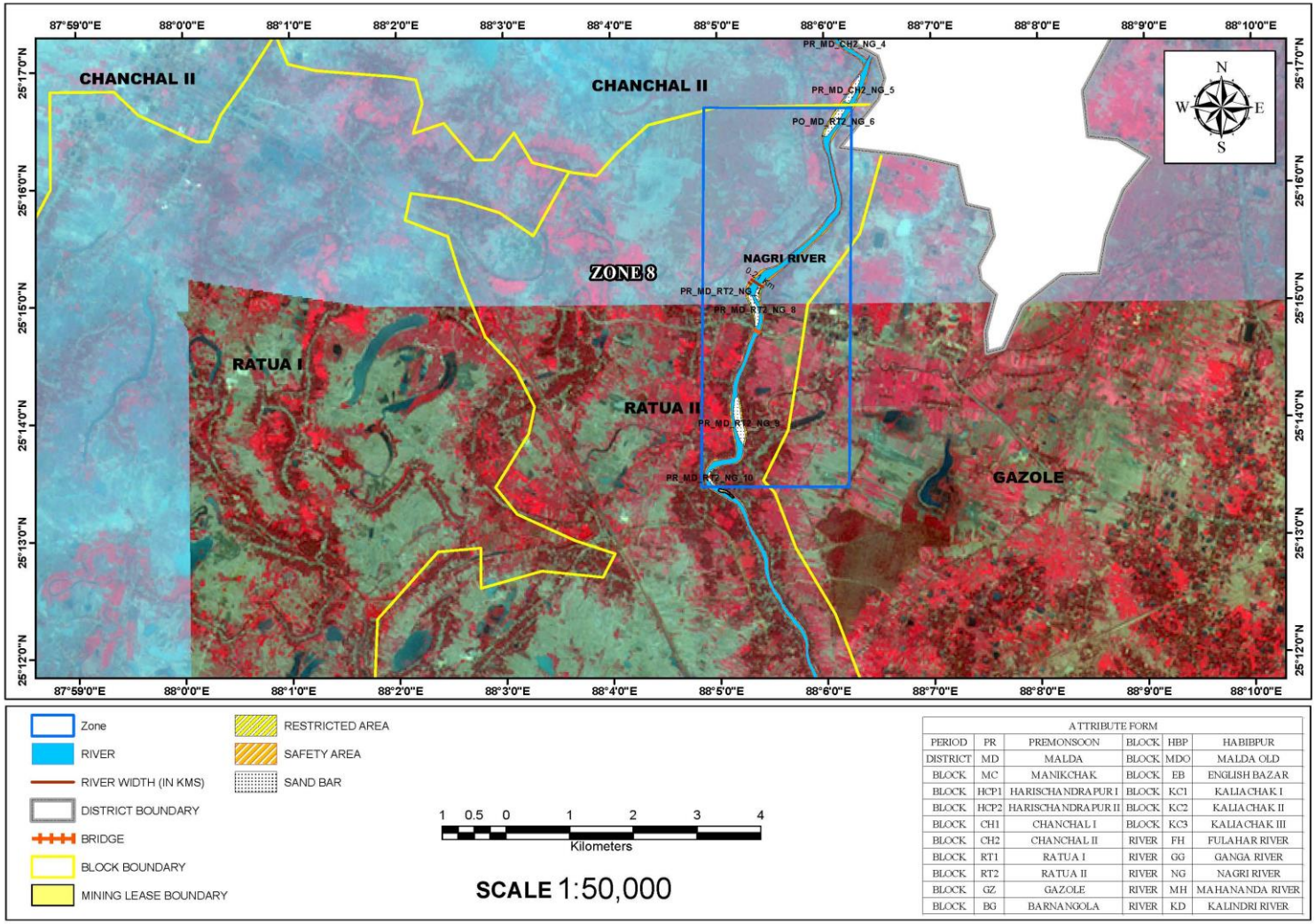


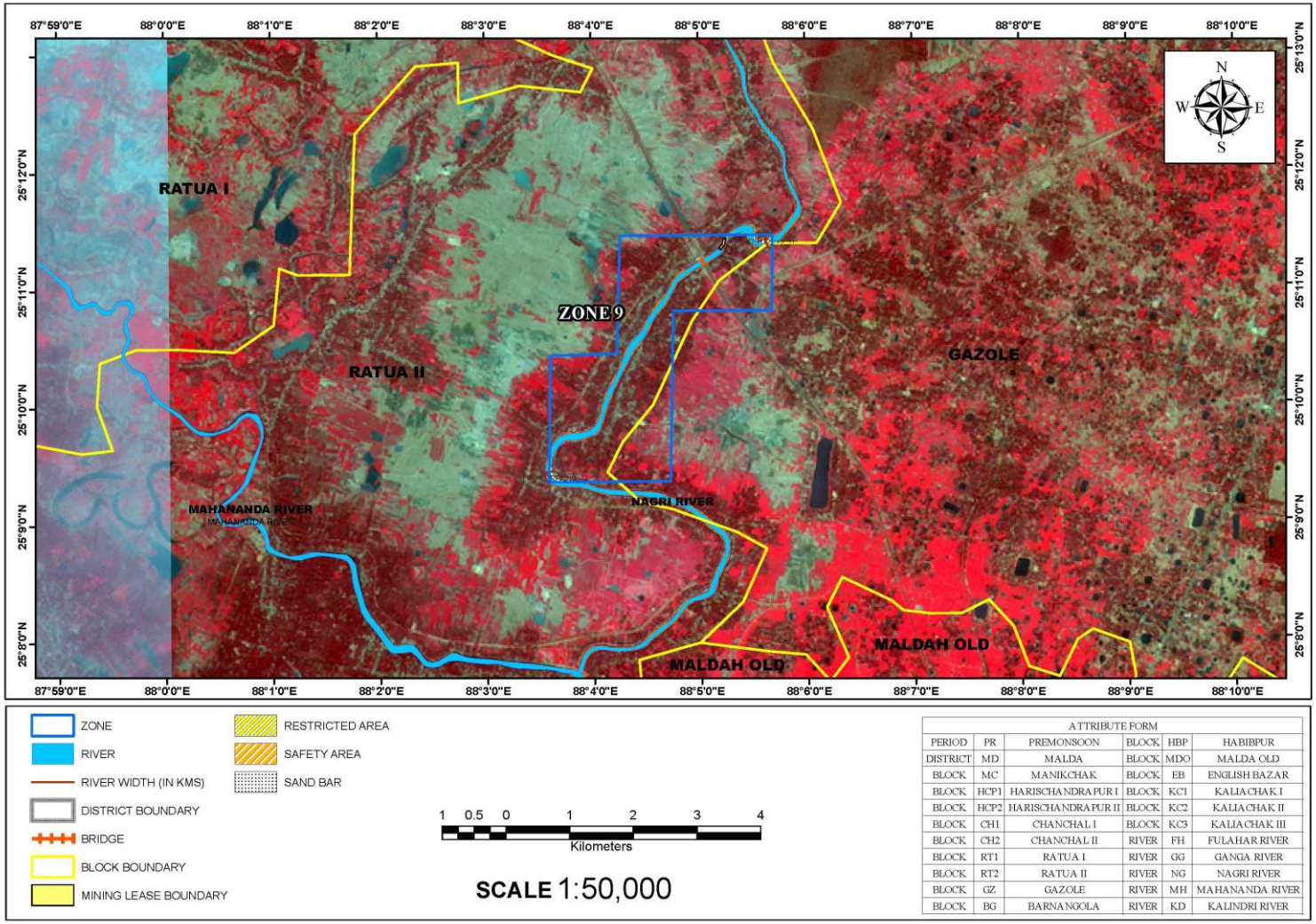
Plate 2A11: Distribution Map of Sand Bars on Rivers During Pre-Monsoon Period of Malda District *(Source: ISRO RESOURCE Sat 2 LISS III Sensor, March 2020)*



ATTRIBUTE FORM

PERIOD	PR	PREMONSOON	BLOCK	HBP	HABIBPUR
DISTRICT	MD	MALDA	BLOCK	MDO	MALDA OLD
BLOCK	MC	MANIKCHAK	BLOCK	EB	ENGLISH BAZAR
BLOCK	HCP1	HARISCHANDRAPUR I	BLOCK	KC1	KALIACHAK I
BLOCK	HCP2	HARISCHANDRAPUR II	BLOCK	KC2	KALIACHAK II
BLOCK	CH1	CHANCHAL I	BLOCK	KC3	KALIACHAK III
BLOCK	CH2	CHANCHAL II	RIVER	FH	FULAHAR RIVER
BLOCK	RT1	RATUA I	RIVER	GG	GANGA RIVER
BLOCK	RT2	RATUA II	RIVER	NG	NAGRI RIVER
BLOCK	GZ	GAZOLE	RIVER	MH	MAHANANDA RIVER
BLOCK	BG	BARNANGOLA	RIVER	KD	KALINDRI RIVER

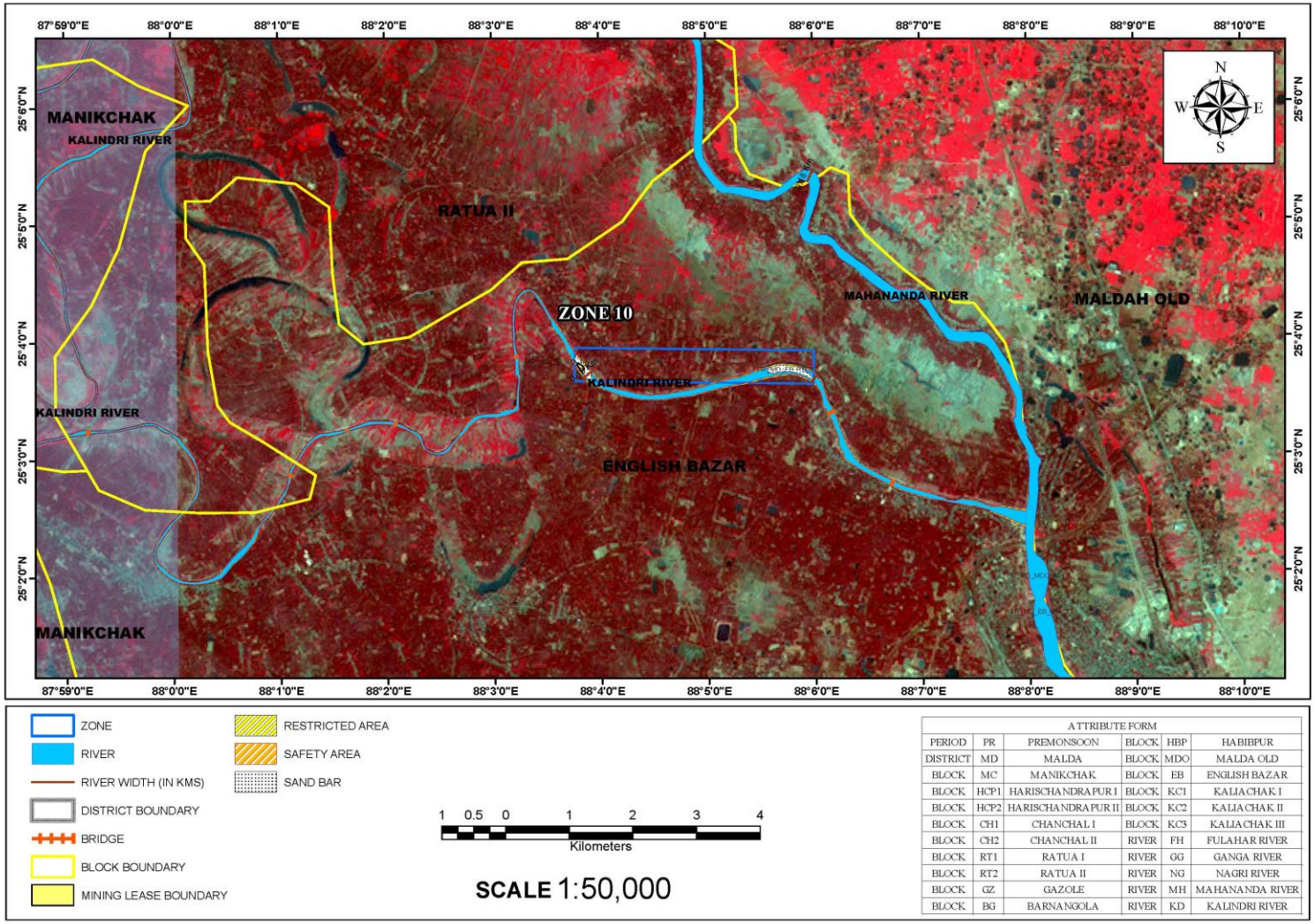
Plate 2A12: Distribution Map of Sand Bars on Rivers During Pre-Monsoon Period of Malda District *(Source: ISRO RESOURCE Sat 2 LISS III Sensor, March 2020)*



ATTRIBUTE FORM

PERIOD	PR	PREMONSOON	BLOCK	HBP	HABIBPUR
DISTRICT	MD	MALDA	BLOCK	MDO	MALDA OLD
BLOCK	MC	MANIKCHAK	BLOCK	EB	ENGLISH BAZAR
BLOCK	HCP1	HARISCHANDRAPUR I	BLOCK	KC1	KALIACHAK I
BLOCK	HCP2	HARISCHANDRAPUR II	BLOCK	KC2	KALIACHAK II
BLOCK	CH1	CHANCHAL I	BLOCK	KC3	KALIACHAK III
BLOCK	CH2	CHANCHAL II	RIVER	FH	FULAHAR RIVER
BLOCK	RT1	RATUA I	RIVER	GG	GANGA RIVER
BLOCK	RT2	RATUA II	RIVER	NG	NAGRI RIVER
BLOCK	GZ	GAZOLE	RIVER	MH	MAHANANDA RIVER
BLOCK	BG	BARNANGOLA	RIVER	KD	KALINDRI RIVER

Plate 2A13: Distribution Map of Sand Bars on Rivers During Pre-Monsoon Period of Malda District *(Source: ISRO RESOURCE Sat 2 LISS III Sensor, March 2020)*



ATTRIBUTE FORM					
PERIOD	PR	PREMONSOON	BLOCK	HBP	HABIBPUR
DISTRICT	MD	MALDA	BLOCK	MDO	MALDA OLD
BLOCK	MC	MANIKCHAK	BLOCK	EB	ENGLISH BAZAR
BLOCK	HCP1	HARISCHANDRAPUR I	BLOCK	KC1	KALIACHAK I
BLOCK	HCP2	HARISCHANDRAPUR II	BLOCK	KC2	KALIACHAK II
BLOCK	CH1	CHANCHAL I	BLOCK	KC3	KALIACHAK III
BLOCK	CH2	CHANCHAL II	RIVER	FH	FULAHAR RIVER
BLOCK	RT1	RATUA I	RIVER	GG	GANGA RIVER
BLOCK	RT2	RATUA II	RIVER	NG	NAGRI RIVER
BLOCK	GZ	GAZOLE	RIVER	MH	MAHANANDA RIVER
BLOCK	BG	BARNANGOLA	RIVER	KD	KALINDRI RIVER

Plate 2A14: Distribution Map of Sand Bars on Rivers During Pre-Monsoon Period of Malda District *(Source: ISRO RESOURCE Sat 2 LISS III Sensor, March 2020)*

PLATE 2B

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

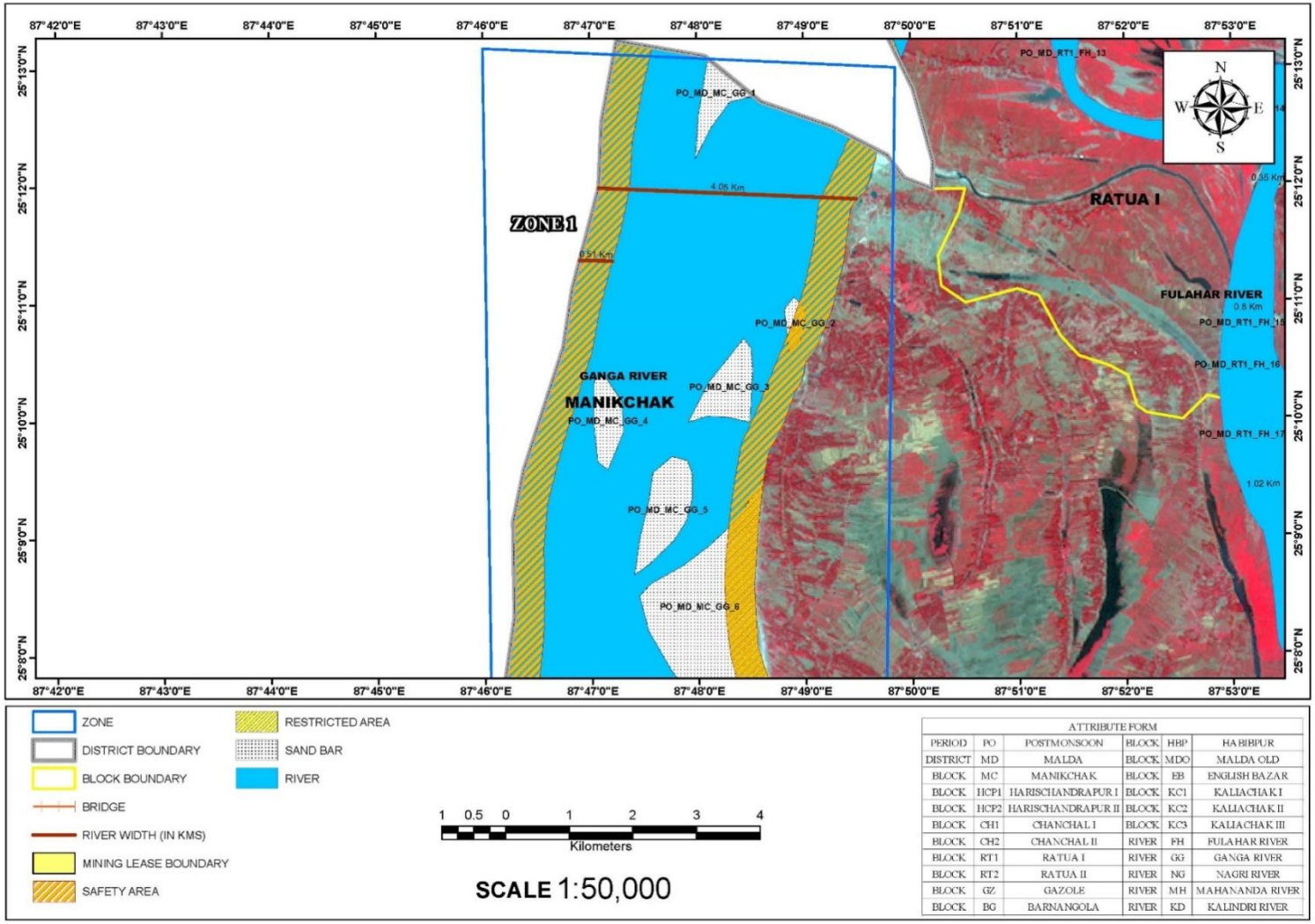
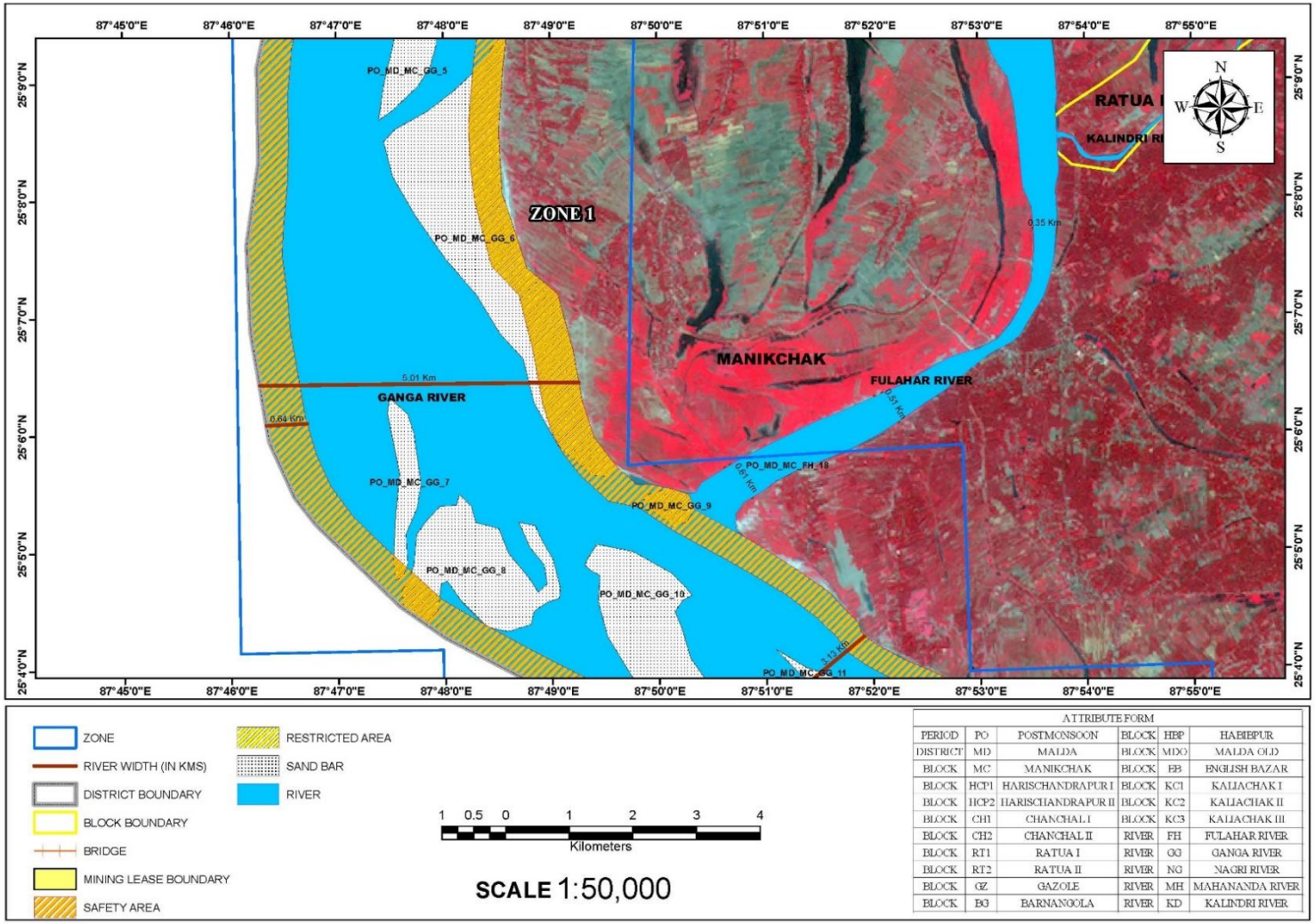


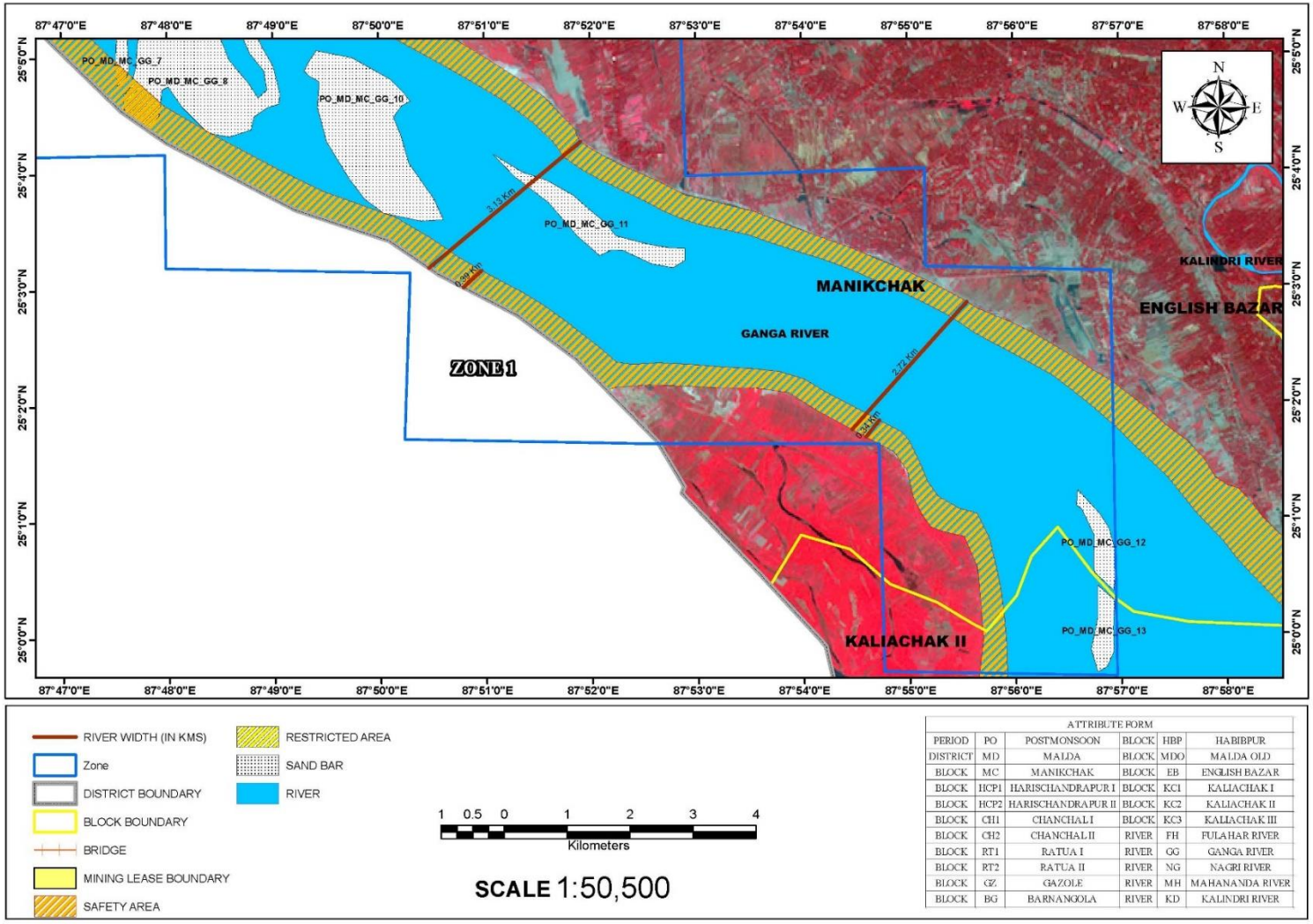
Plate 2B1: Distribution Map of Sand Bars on Rivers During Post-Monsoon Period of Malda District *(Source: ISRO RESOURCE Sat 2 LISS III Sensor, November 2020)*



ATTRIBUTE FORM

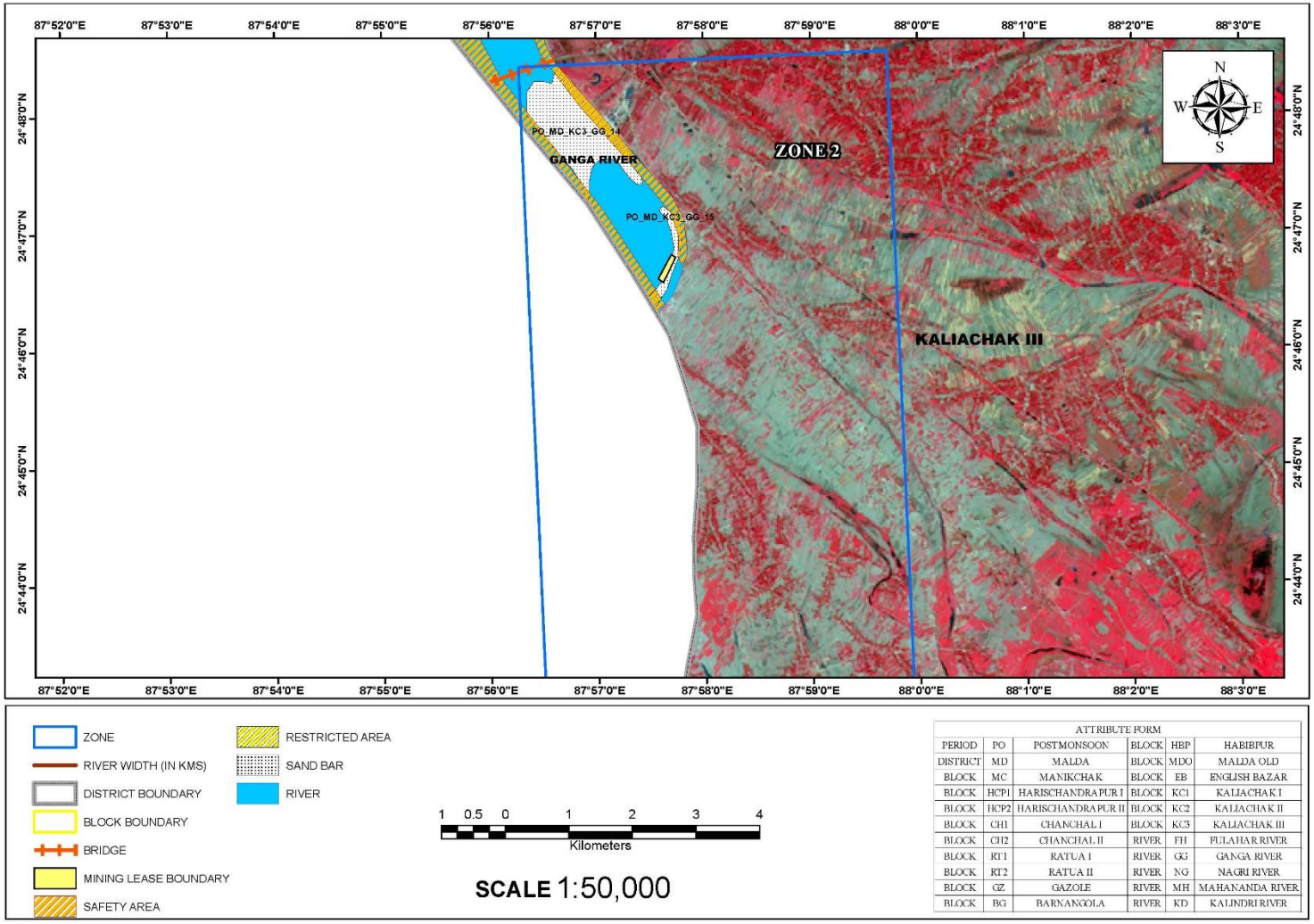
PERIOD	PO	POSTMONSOON	BLOCK	HBP	HABIBPUR
DISTRICT	MD	MALDA	BLOCK	MDO	MALDA OLD
BLOCK	MC	MANIKCHAK	BLOCK	EB	ENGLISH BAZAR
BLOCK	HCP1	HARISCHANDRAPUR I	BLOCK	KC1	KALIACHAK I
BLOCK	HCP2	HARISCHANDRAPUR II	BLOCK	KC2	KALIACHAK II
BLOCK	CH1	CHANCHAL I	BLOCK	KC3	KALIACHAK III
BLOCK	CH2	CHANCHAL II	RIVER	FH	FULAHAR RIVER
BLOCK	RT1	RATUA I	RIVER	GG	GANGA RIVER
BLOCK	RT2	RATUA II	RIVER	NG	NAGRI RIVER
BLOCK	GZ	GAZOLE	RIVER	MH	MAHANANDA RIVER
BLOCK	BG	BARNANGOLA	RIVER	KD	KALINDRI RIVER

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



ATTRIBUTE FORM					
PERIOD	PO	POSTMONSOON	BLOCK	HBP	HABIBPUR
DISTRICT	MD	MALDA	BLOCK	MDO	MALDA OLD
BLOCK	MC	MANIKCHAK	BLOCK	EB	ENGLISH BAZAR
BLOCK	HCP1	HARISCHANDRAPUR I	BLOCK	KC1	KALIACHAK I
BLOCK	HCP2	HARISCHANDRAPUR II	BLOCK	KC2	KALIACHAK II
BLOCK	CH1	CHANCHAL I	BLOCK	KC3	KALIACHAK III
BLOCK	CH2	CHANCHAL II	RIVER	FH	FULAHAR RIVER
BLOCK	RT1	RATUA I	RIVER	GG	GANGA RIVER
BLOCK	RT2	RATUA II	RIVER	NG	NAGRI RIVER
BLOCK	GZ	GAZOLE	RIVER	MH	MAHANANDA RIVER
BLOCK	BG	BARNANGOLA	RIVER	KD	KALINDRI RIVER

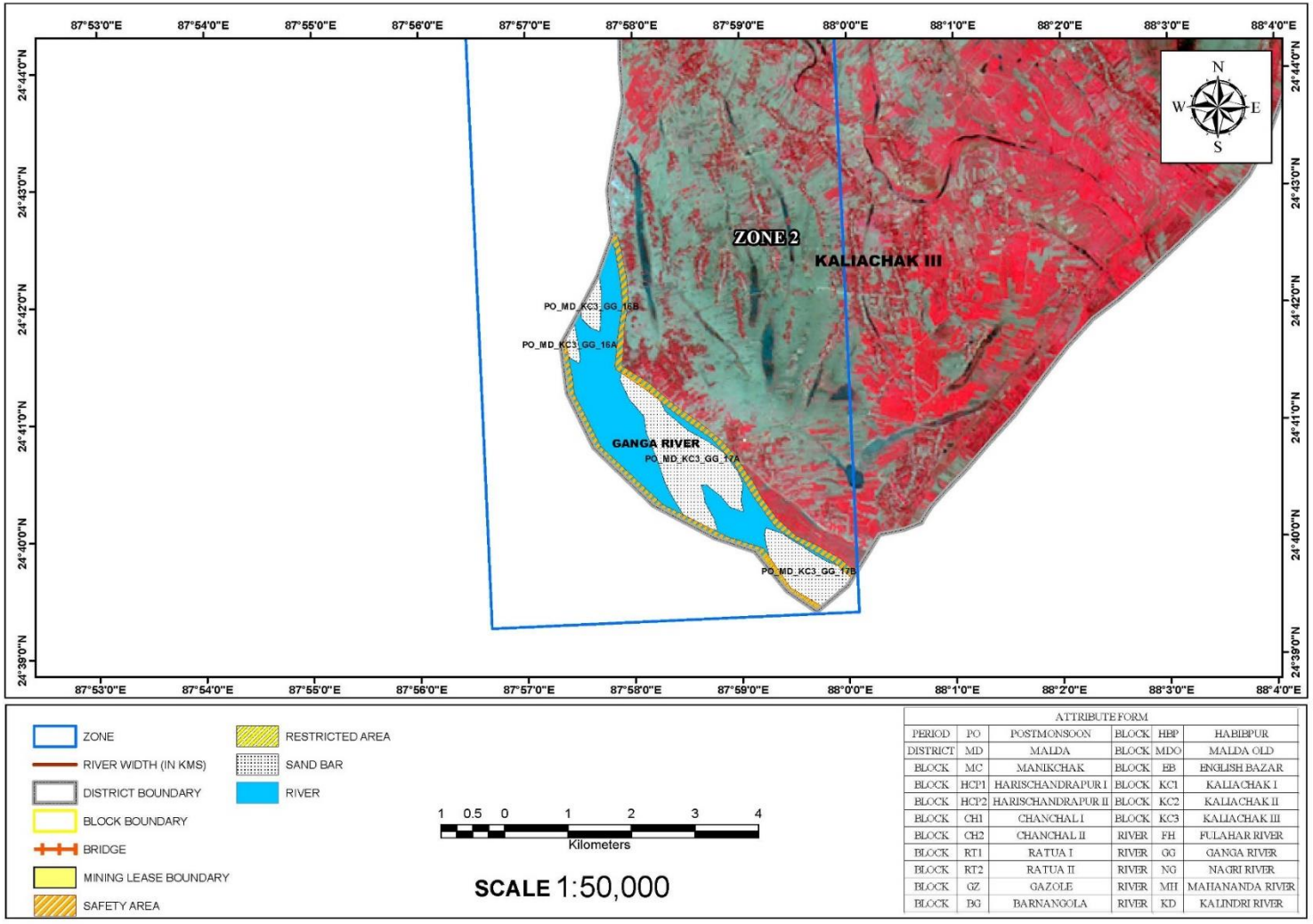
Plate 2B3: Distribution Map of Sand Bars on Rivers During Post-Monsoon Period of Malda District *(Source: ISRO RESOURCE Sat 2 LISS III Sensor, November 2020)*



ATTRIBUTE FORM

PERIOD	PO	POSTMONSOON	BLOCK	HBP	HABIBPUR
DISTRICT	MD	MALDA	BLOCK	MDO	MALDA OLD
BLOCK	MC	MANIKCHAK	BLOCK	EB	ENGLISH BAZAR
BLOCK	HCP1	HARISCHANDRAPUR I	BLOCK	KC1	KALIACHAK I
BLOCK	HCP2	HARISCHANDRAPUR II	BLOCK	KC2	KALIACHAK II
BLOCK	CH1	CHANCHAL I	BLOCK	KC3	KALIACHAK III
BLOCK	CH2	CHANCHAL II	RIVER	FH	FULAHAR RIVER
BLOCK	RT1	RATUA I	RIVER	GG	GANGA RIVER
BLOCK	RT2	RATUA II	RIVER	NG	NAGRI RIVER
BLOCK	GZ	GAZOLE	RIVER	MH	MAHANANDA RIVER
BLOCK	BG	BARNANGOLA	RIVER	KD	KALINDRI RIVER

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



ATTRIBUTE FORM					
PERIOD	PO	POSTMONSOON	BLOCK	HBP	HABIBPUR
DISTRICT	MD	MALDA	BLOCK	MDO	MALDA OLD
BLOCK	MC	MANIKCHAK	BLOCK	EB	ENGLISH BAZAR
BLOCK	HCP1	HARISCHANDRAPUR I	BLOCK	KC1	KALIACHAK I
BLOCK	HCP2	HARISCHANDRAPUR II	BLOCK	KC2	KALIACHAK II
BLOCK	CH1	CHANCHAL I	BLOCK	KC3	KALIACHAK III
BLOCK	CH2	CHANCHAL II	RIVER	FH	FULAHAR RIVER
BLOCK	RT1	RATUA I	RIVER	GG	GANGA RIVER
BLOCK	RT2	RATUA II	RIVER	NG	NAGRI RIVER
BLOCK	GZ	GAZOLE	RIVER	MH	MAHANANDA RIVER
BLOCK	BG	BARNANGOLA	RIVER	KD	KALINDRI RIVER

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

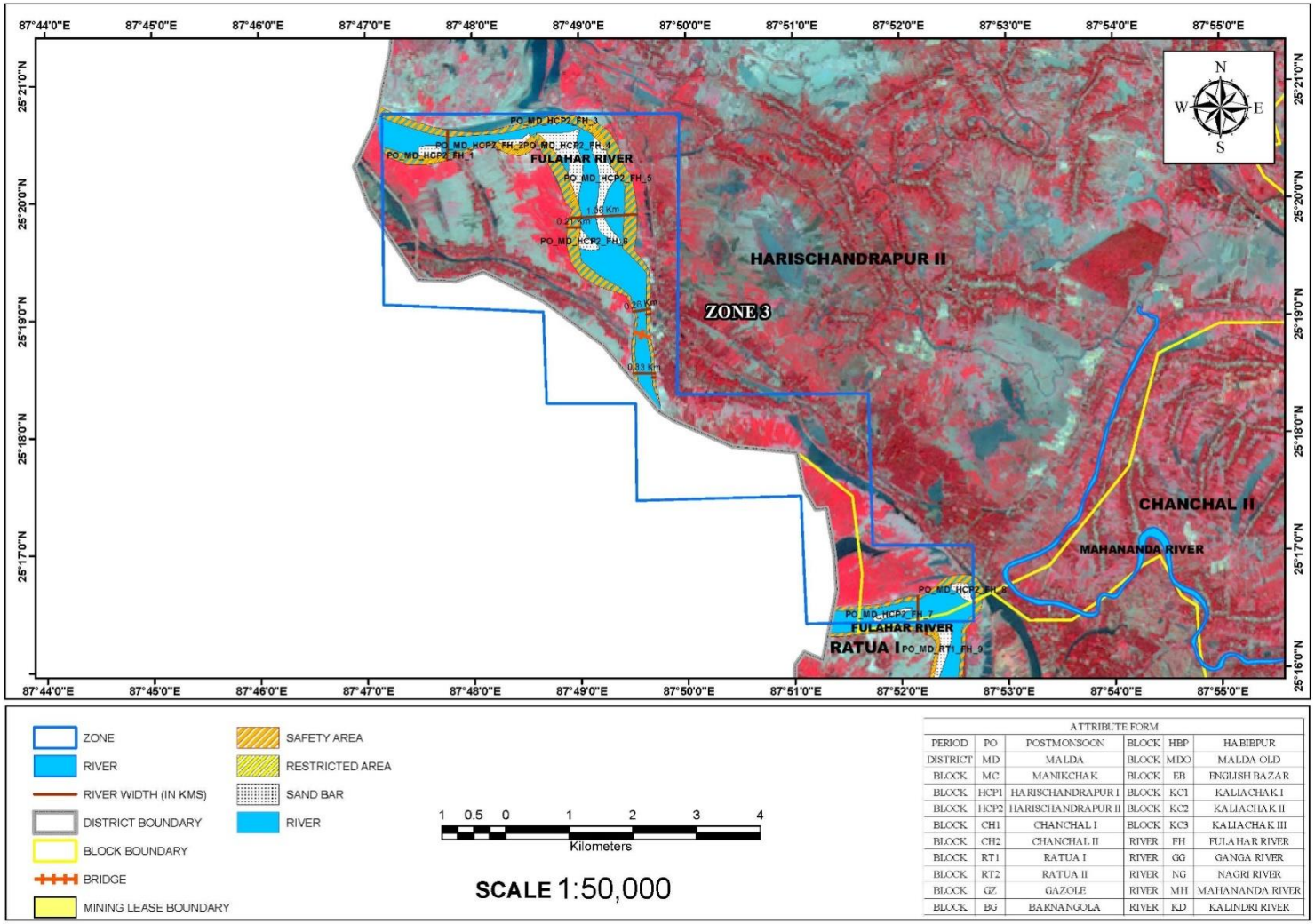


Plate 2B6: Distribution Map of Sand Bars on Rivers During Post-Monsoon Period of Malda District *(Source: ISRO RESOURCE Sat 2 LISS III Sensor, November 2020)*

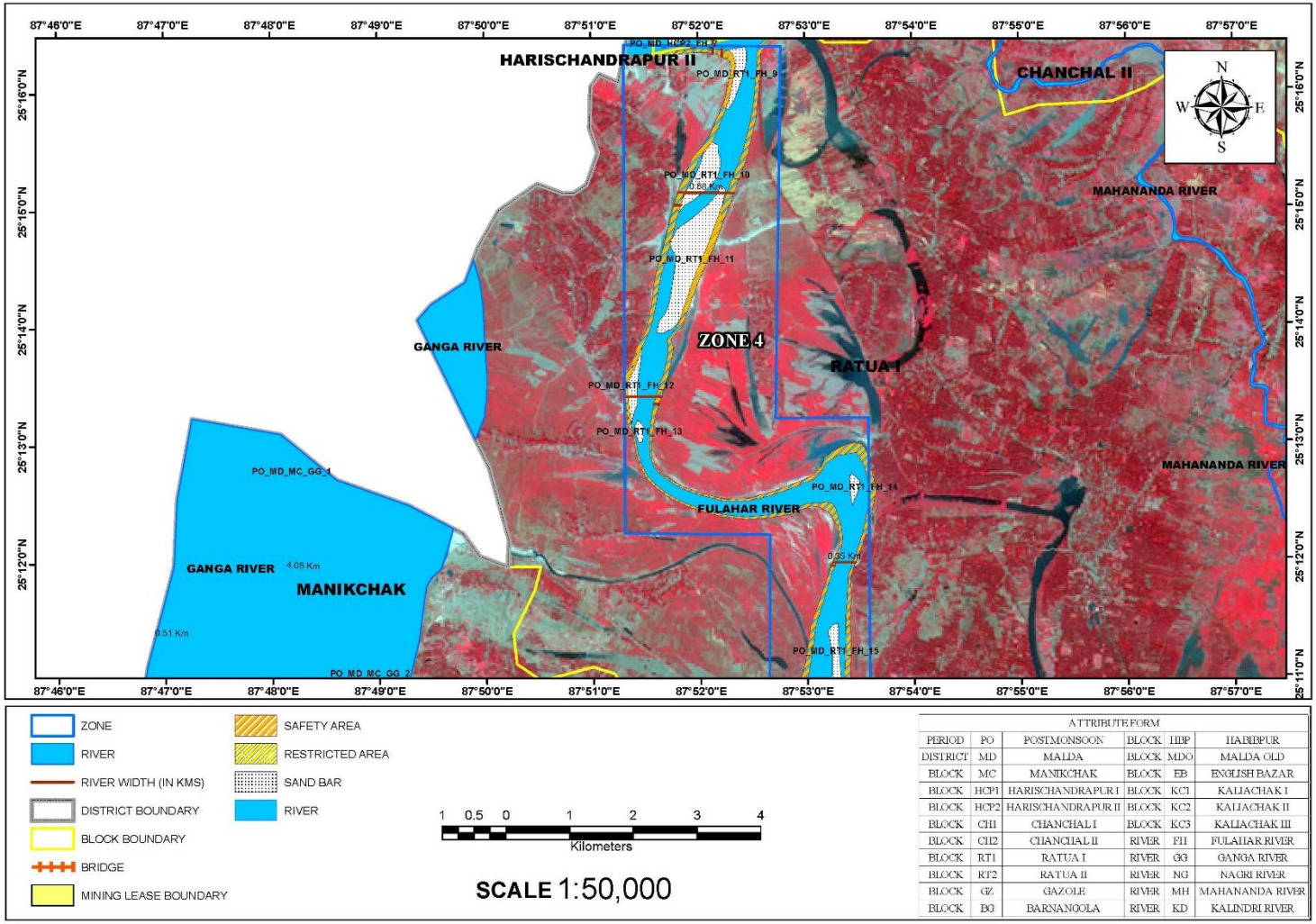


Plate 2B7: Distribution Map of Sand Bars on Rivers During Post-Monsoon Period of Malda District *(Source: ISRO RESOURCE Sat 2 LISS III Sensor, November 2020)*

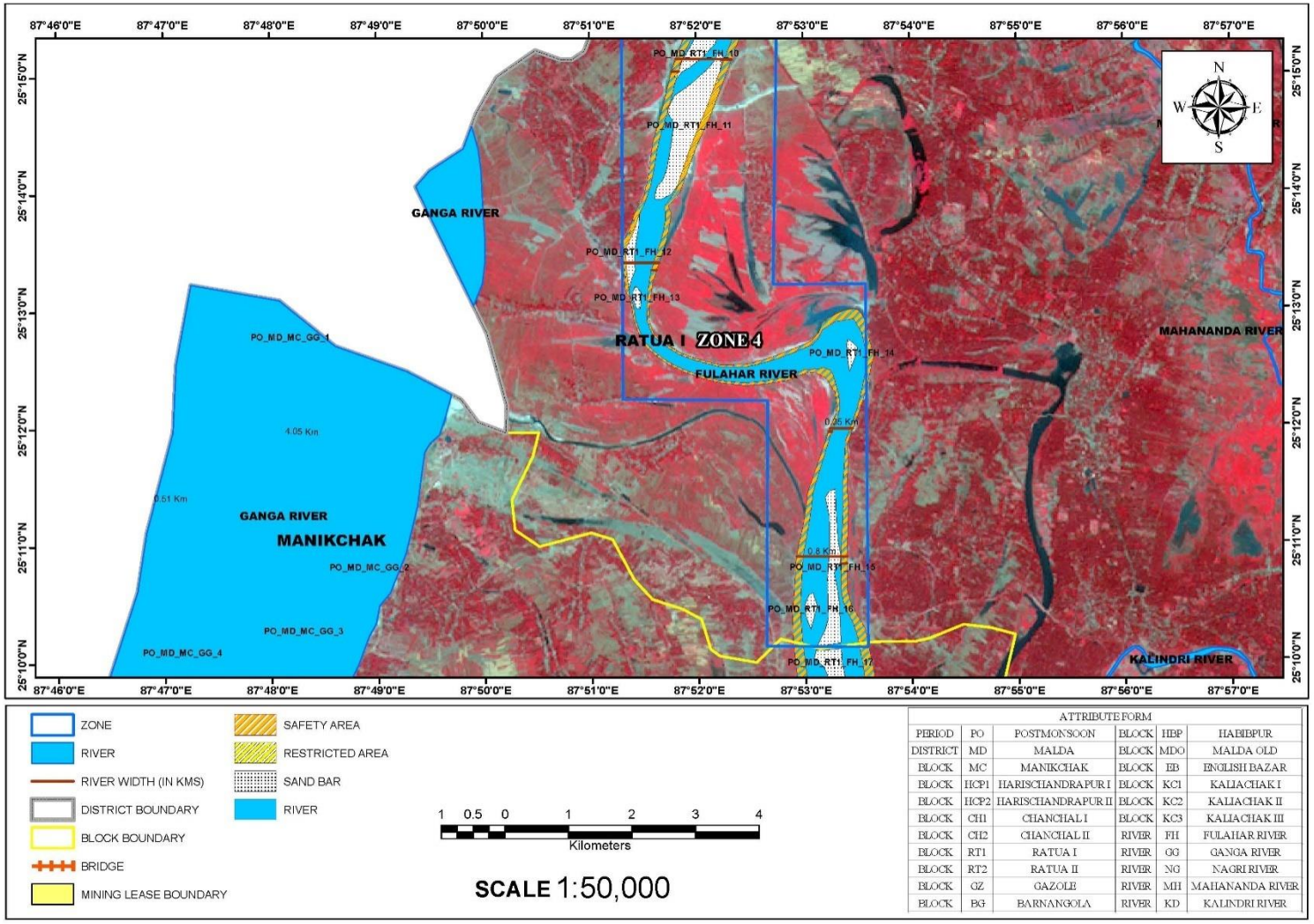
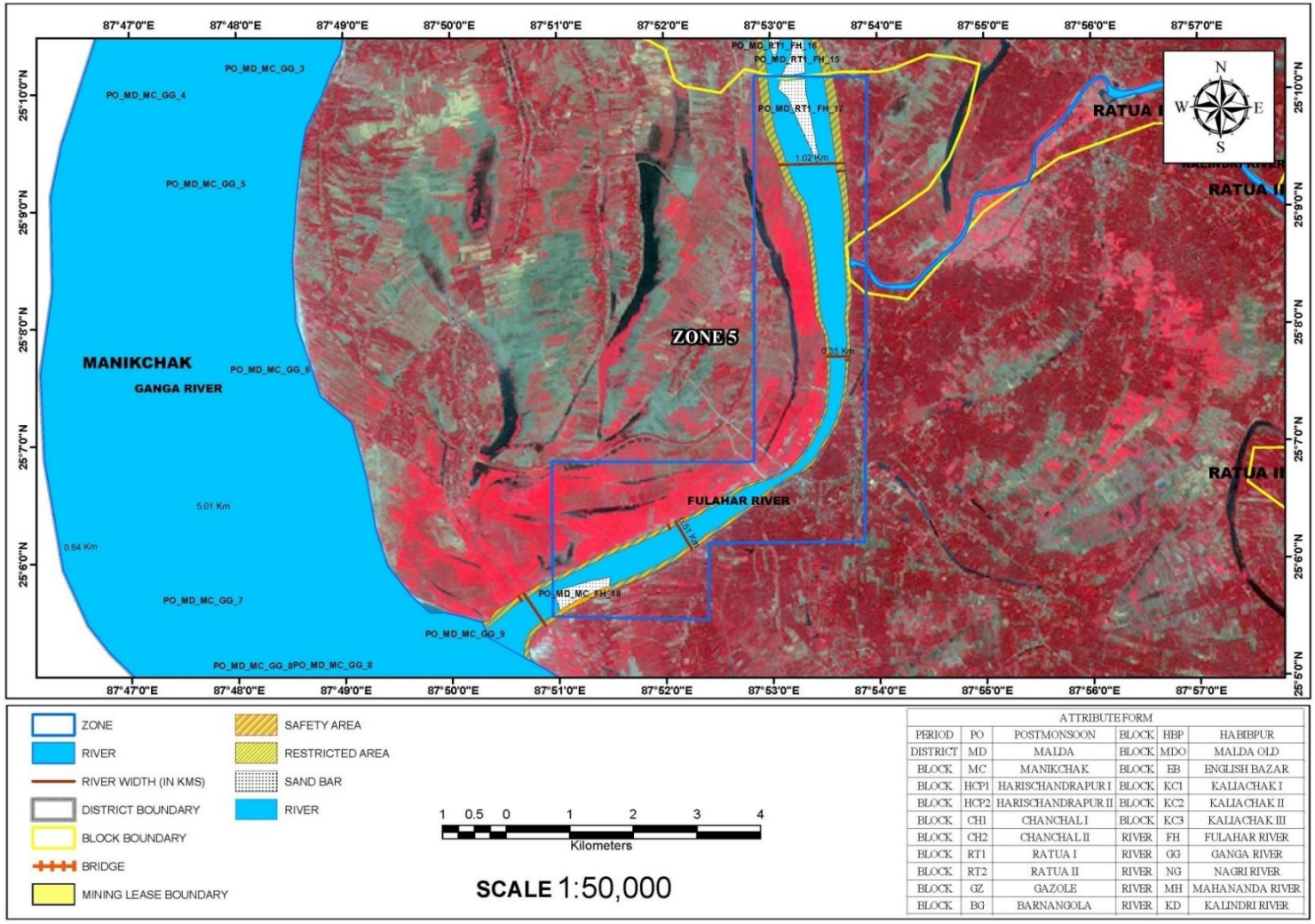


Plate 2B8: Distribution Map of Sand Bars on Rivers During Post-Monsoon Period of Malda District *(Source: ISRO RESOURCE Sat 2 LISS III Sensor, November 2020)*



ATTRIBUTE FORM

PERIOD	PO	POSTMONSOON	BLOCK	HBP	HABIBPUR
DISTRICT	MD	MALDA	BLOCK	MDO	MALDA OLD
BLOCK	MC	MANIKCHAK	BLOCK	EB	ENGLISH BAZAR
BLOCK	HCP1	HARISCHANDRAPUR I	BLOCK	KC1	KALIACHAK I
BLOCK	HCP2	HARISCHANDRAPUR II	BLOCK	KC2	KALIACHAK II
BLOCK	CH1	CHANCHAL I	BLOCK	KC3	KALIACHAK III
BLOCK	CH2	CHANCHAL II	RIVER	FH	FULAHAR RIVER
BLOCK	RT1	RATUA I	RIVER	GG	GANGA RIVER
BLOCK	RT2	RATUA II	RIVER	NG	NAGRI RIVER
BLOCK	GZ	GAZOLE	RIVER	MH	MAHANANDA RIVER
BLOCK	BG	BARNANGOLA	RIVER	KD	KALINDRI RIVER

Plate 2B9: Distribution Map of Sand Bars on Rivers During Post-Monsoon Period of Malda District *(Source: ISRO RESOURCE Sat 2 LISS III Sensor, November 2020)*

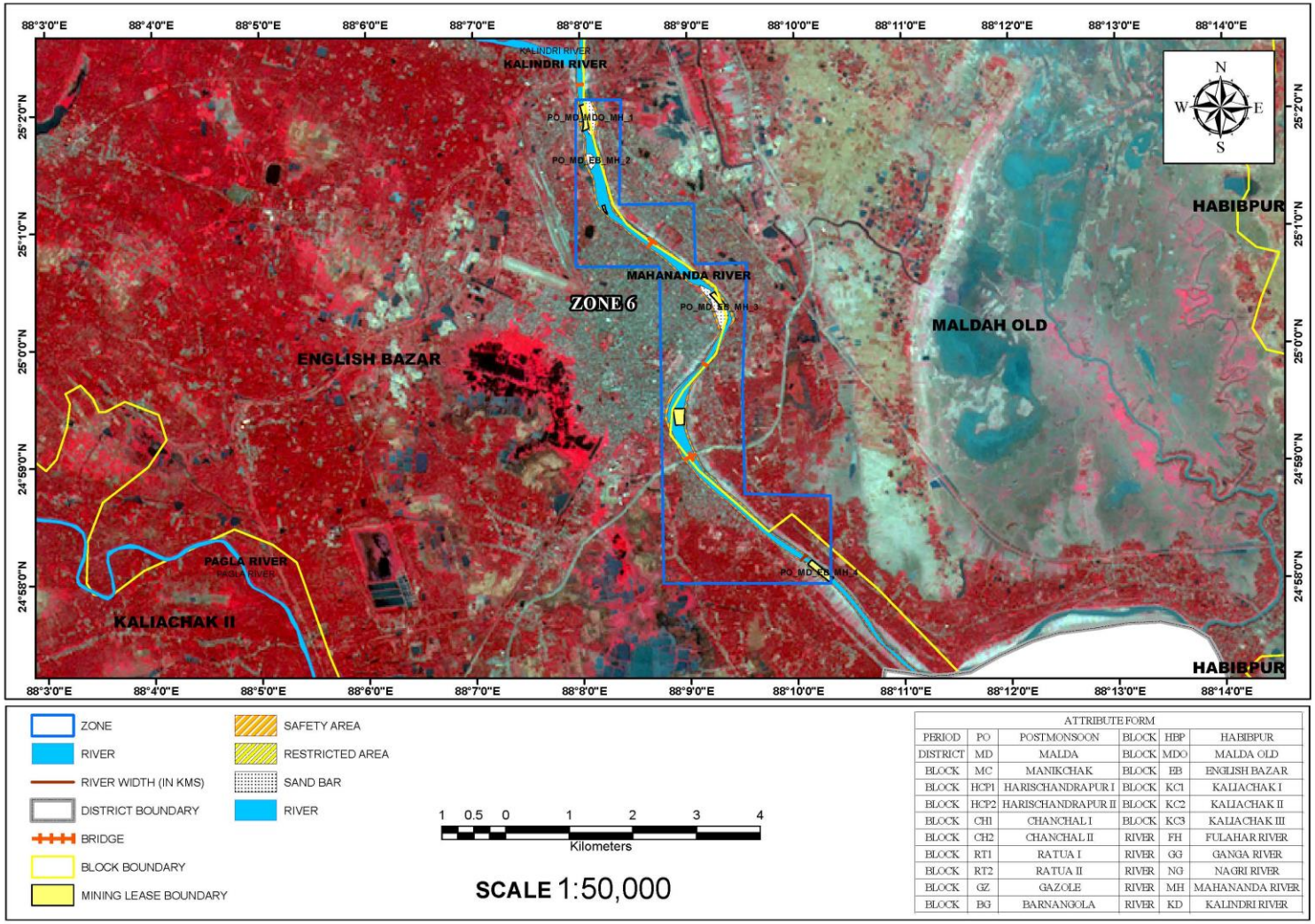
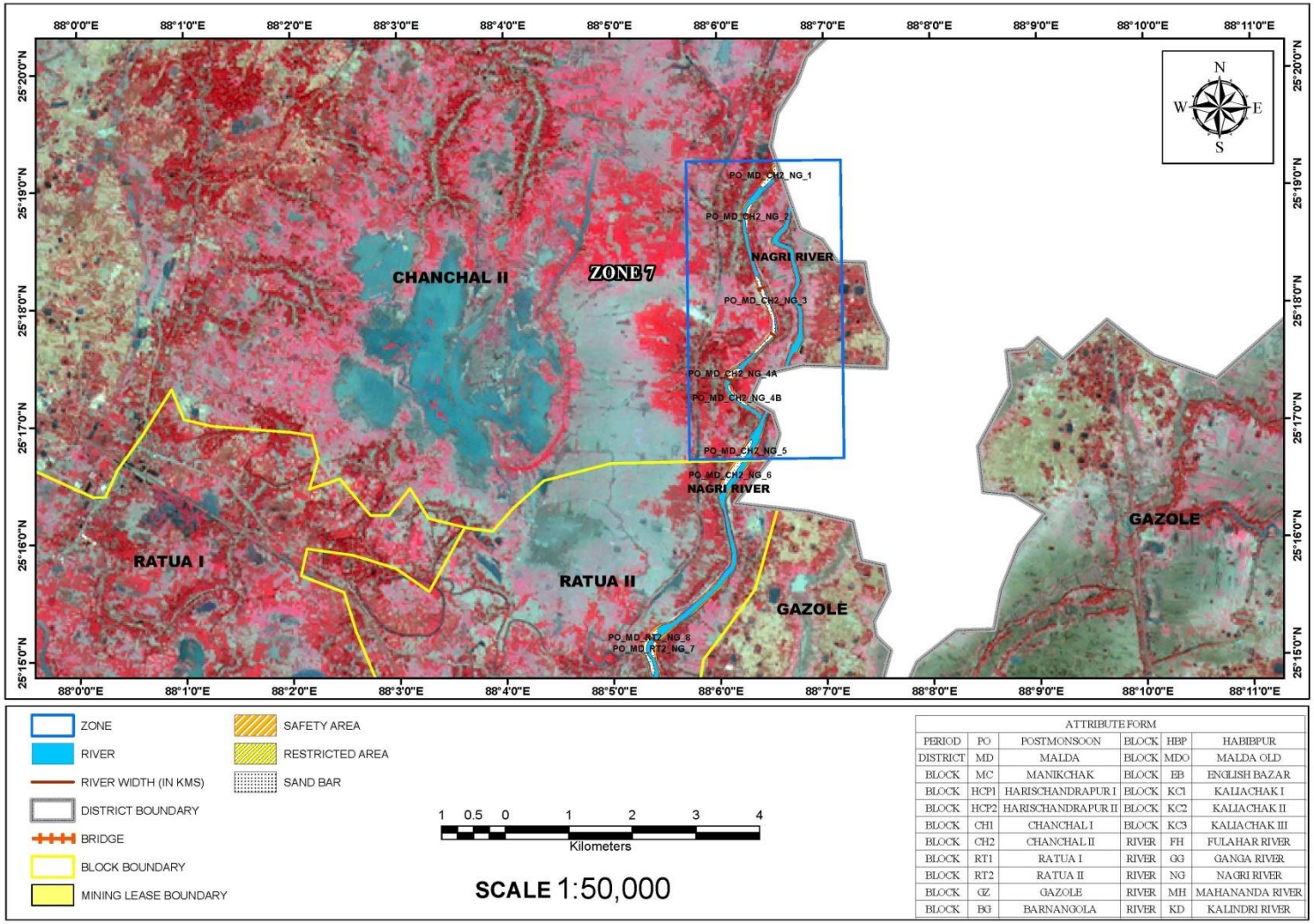


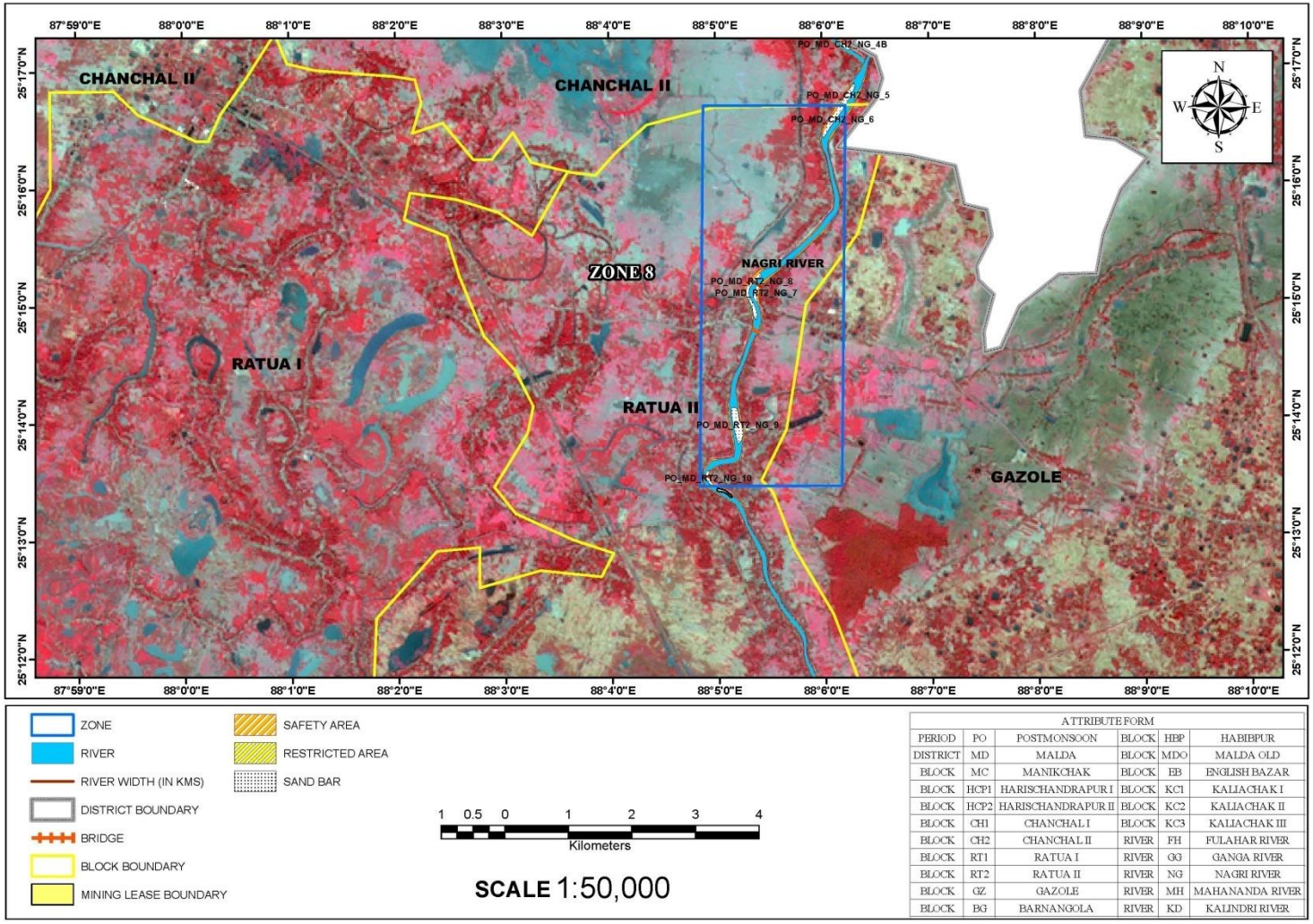
Plate 2B10: Distribution Map of Sand Bars on Rivers During Post-Monsoon Period of Malda District *(Source: ISRO RESOURCE Sat 2 LISS III Sensor, November 2020)*



ATTRIBUTE FORM

PERIOD	PO	POSTMONSOON	BLOCK	HBP	HABIBPUR
DISTRICT	MD	MALDA	BLOCK	MDO	MALDA OLD
BLOCK	MC	MANIKCHAK	BLOCK	EB	ENGLISH BAZAR
BLOCK	HCP1	HARISCHANDRAPUR I	BLOCK	KC1	KALIACHAK I
BLOCK	HCP2	HARISCHANDRAPUR II	BLOCK	KC2	KALIACHAK II
BLOCK	CH1	CHANCHAL I	BLOCK	KC3	KALIACHAK III
BLOCK	CH2	CHANCHAL II	RIVER	FH	FULAHAR RIVER
BLOCK	RT1	RATUA I	RIVER	GG	GANGA RIVER
BLOCK	RT2	RATUA II	RIVER	NG	NAGRI RIVER
BLOCK	GZ	GAZOLE	RIVER	MH	MAHANANDA RIVER
BLOCK	BG	BARNANGOLA	RIVER	KD	KALINDRI RIVER

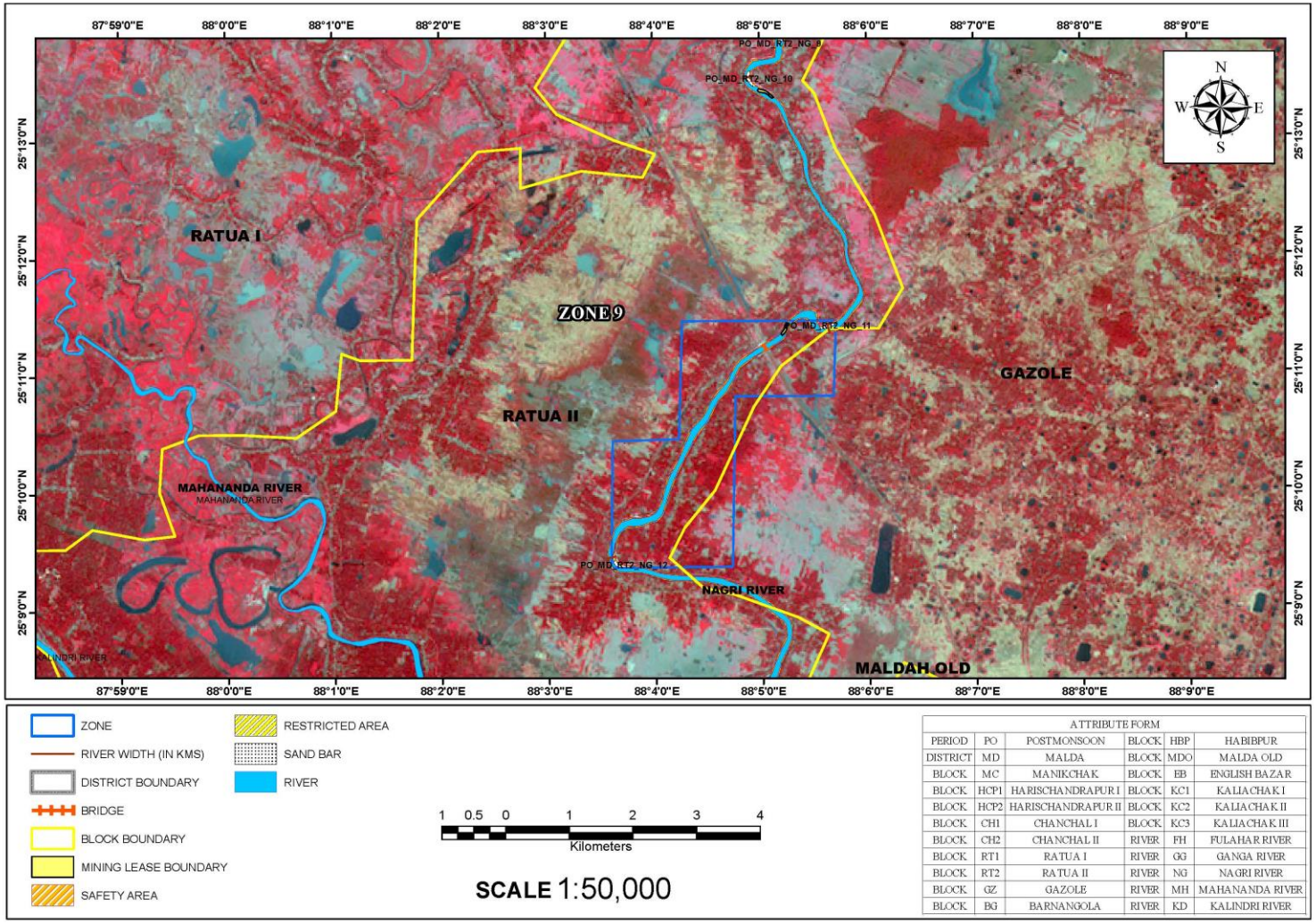
Plate 2B11: Distribution Map of Sand Bars on Rivers During Post-Monsoon Period of Malda District *(Source: ISRO RESOURCE Sat 2 LISS III Sensor, November 2020)*



ATTRIBUTE FORM

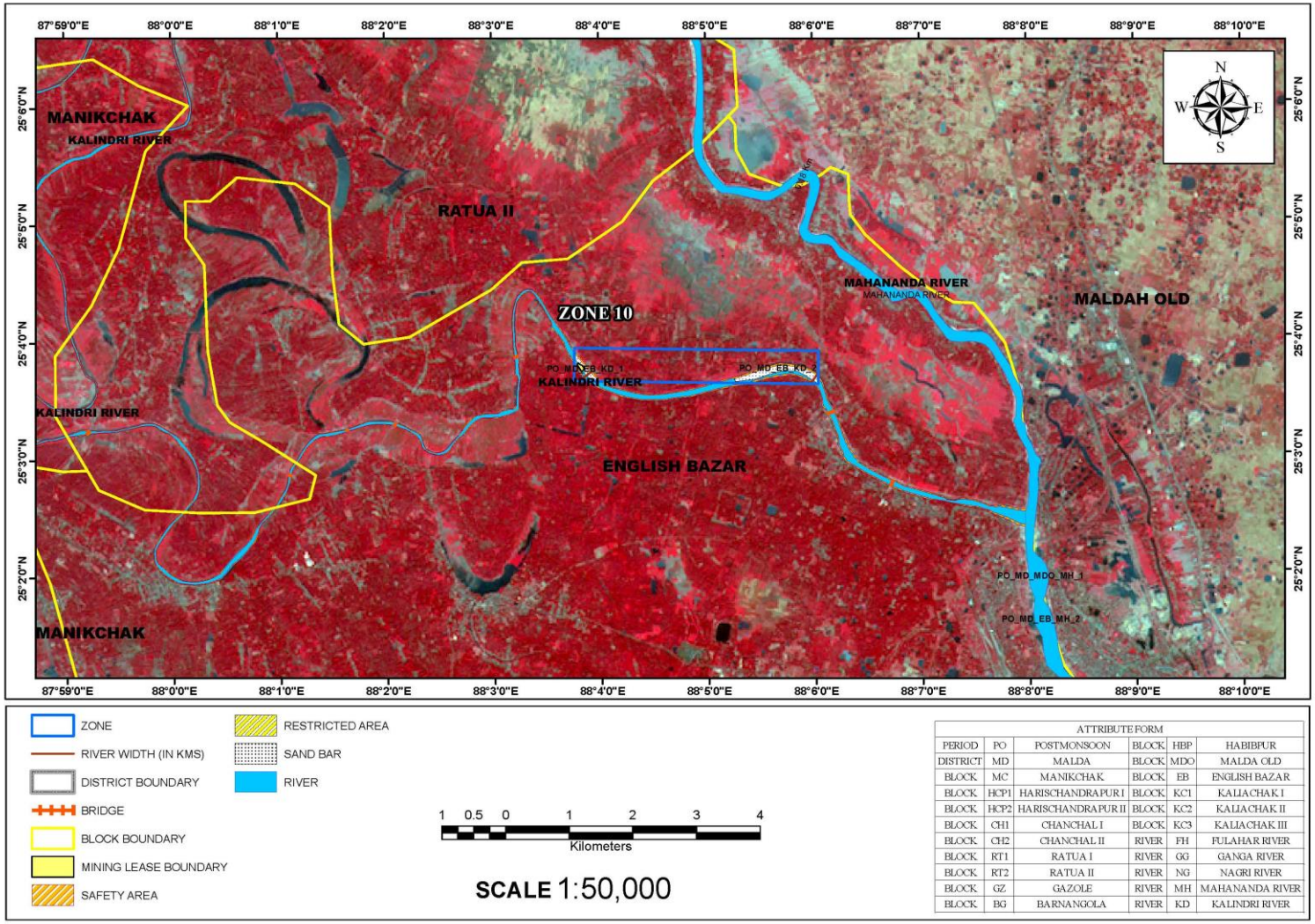
PERIOD	PO	POSTMONSOON	BLOCK	HBP	HABIBPUR
DISTRICT	MD	MALDA	BLOCK	MDO	MALDA OLD
BLOCK	MC	MANIKCHAK	BLOCK	EB	ENGLISH BAZAR
BLOCK	HCP1	HARISCHANDRAPUR I	BLOCK	KC1	KALIACHAK I
BLOCK	HCP2	HARISCHANDRAPUR II	BLOCK	KC2	KALIACHAK II
BLOCK	CH1	CHANCHAL I	BLOCK	KC3	KALIACHAK III
BLOCK	CH2	CHANCHAL II	RIVER	FH	FULAHAR RIVER
BLOCK	RT1	RATUA I	RIVER	GG	GANGA RIVER
BLOCK	RT2	RATUA II	RIVER	NG	NAGRI RIVER
BLOCK	GZ	GAZOLE	RIVER	MH	MAHANANDA RIVER
BLOCK	BG	BARNANGOLA	RIVER	KD	KALINDRI RIVER

Plate 2B12: Distribution Map of Sand Bars on Rivers During Post-Monsoon Period of Malda District *(Source: ISRO RESOURCE Sat 2 LISS III Sensor, November 2020)*



ATTRIBUTE FORM					
PERIOD	PO	POSTMONSOON	BLOCK	HBP	HABIBPUR
DISTRICT	MD	MALDA	BLOCK	MDO	MALDA OLD
BLOCK	MC	MANIKCHAK	BLOCK	EB	ENGLISH BAZAR
BLOCK	HCP1	HARISCHANDRAPUR I	BLOCK	KC1	KALIACHAK I
BLOCK	HCP2	HARISCHANDRAPUR II	BLOCK	KC2	KALIACHAK II
BLOCK	CH1	CHANCHAL I	BLOCK	KC3	KALIACHAK III
BLOCK	CH2	CHANCHAL II	RIVER	FH	FULAHAR RIVER
BLOCK	RT1	RATUA I	RIVER	GG	GANGA RIVER
BLOCK	RT2	RATUA II	RIVER	NG	NAGRI RIVER
BLOCK	GZ	GAZOLE	RIVER	MH	MAHANANDA RIVER
BLOCK	BG	BARNANGOLA	RIVER	KD	KALINDRI RIVER

Plate 2B13: Distribution Map of Sand Bars on Rivers During Post-Monsoon Period of Malda District *(Source: ISRO RESOURCE Sat 2 LISS III Sensor, November 2020)*



ATTRIBUTE FORM					
PERIOD	PO	POSTMONSOON	BLOCK	HBP	HABIBPUR
DISTRICT	MD	MALDA	BLOCK	MDO	MALDA OLD
BLOCK	MC	MANIKCHAK	BLOCK	EB	ENGLISH BAZAR
BLOCK	HCP1	HARISCHANDRAPUR I	BLOCK	KC1	KALIACHAK I
BLOCK	HCP2	HARISCHANDRAPUR II	BLOCK	KC2	KALIACHAK II
BLOCK	CH1	CHANCHAL I	BLOCK	KC3	KALIACHAK III
BLOCK	CH2	CHANCHAL II	RIVER	FH	FULAHAR RIVER
BLOCK	RT1	RATUA I	RIVER	GG	GANGA RIVER
BLOCK	RT2	RATUA II	RIVER	NG	NAGRI RIVER
BLOCK	GZ	GAZOLE	RIVER	MH	MAHANANDA RIVER
BLOCK	BG	BARNANGOLA	RIVER	KD	KALINDRI RIVER

Plate 2B14: Distribution Map of Sand Bars on Rivers During Post-Monsoon Period of Malda District *(Source: ISRO RESOURCE Sat 2 LISS III Sensor, November 2020)*

PLATE 3

WATERSHED MAP OF THE DISTRICT

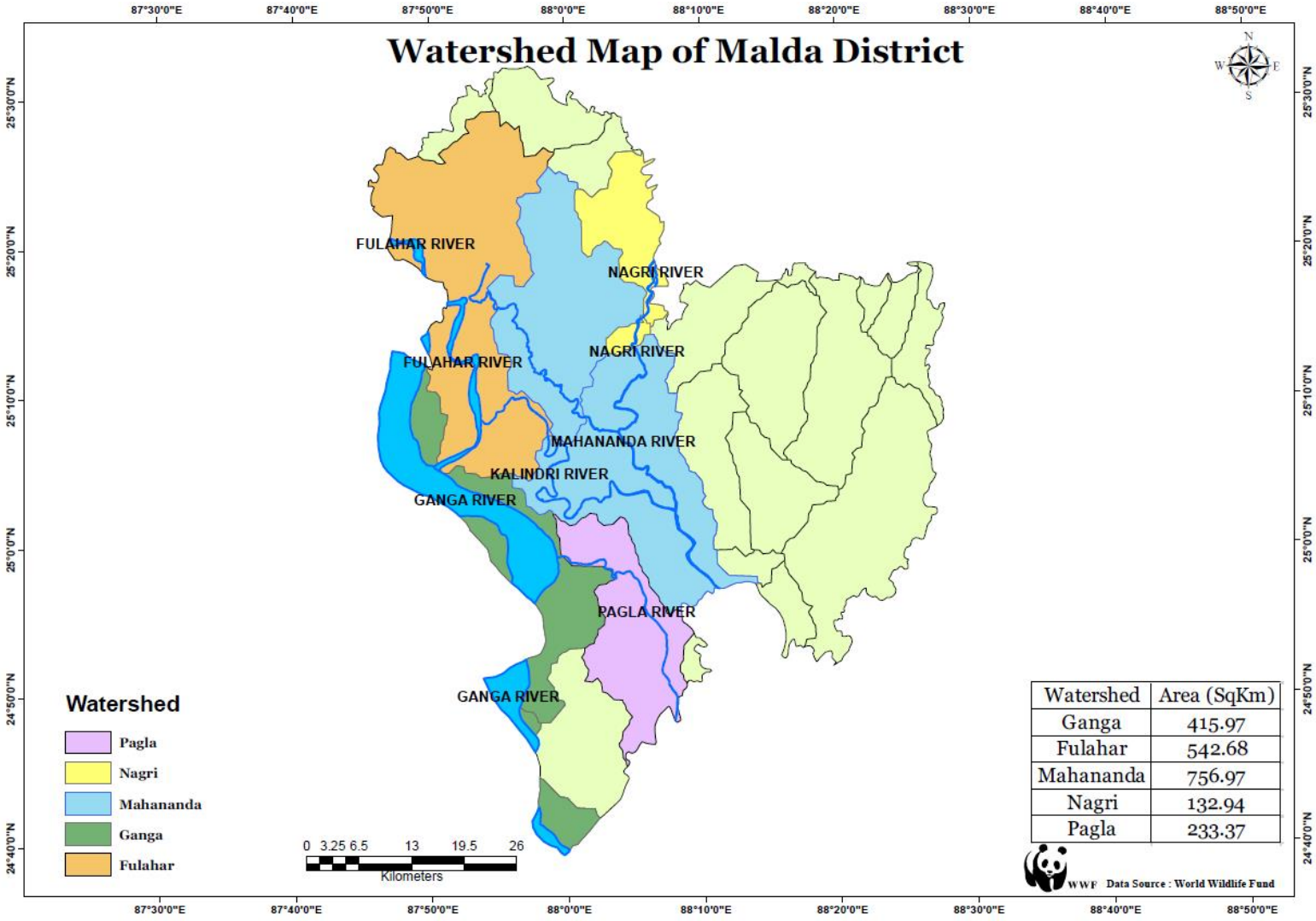


Plate 3A: Watershed Map of Malda District *(Source: World Wild Fund for Nature, September 2020)*

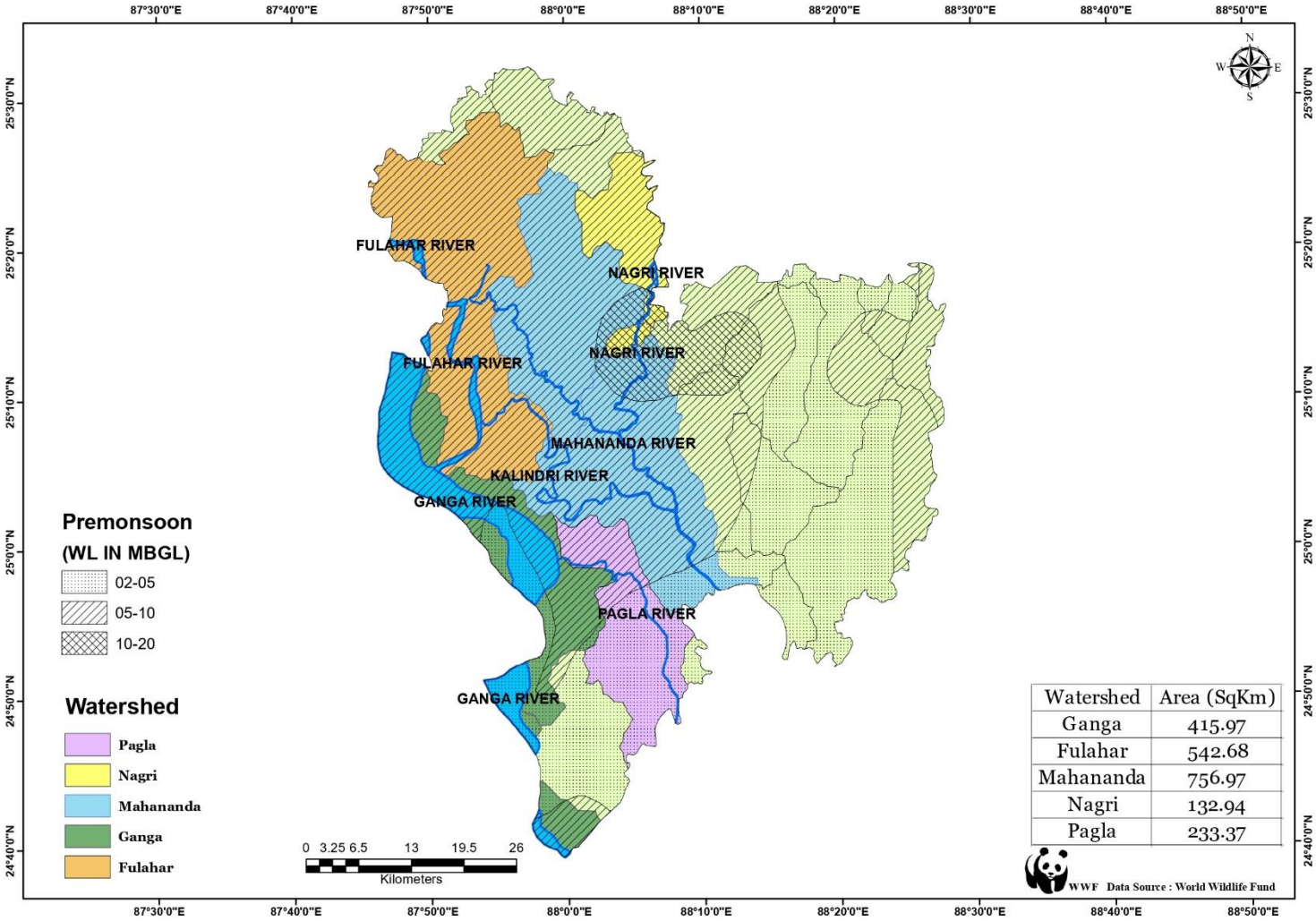


Plate 3B: District Watershed map showing ground water level during Pre-monsoon period *(Source: World Wild Fund for Nature, September 2020)*

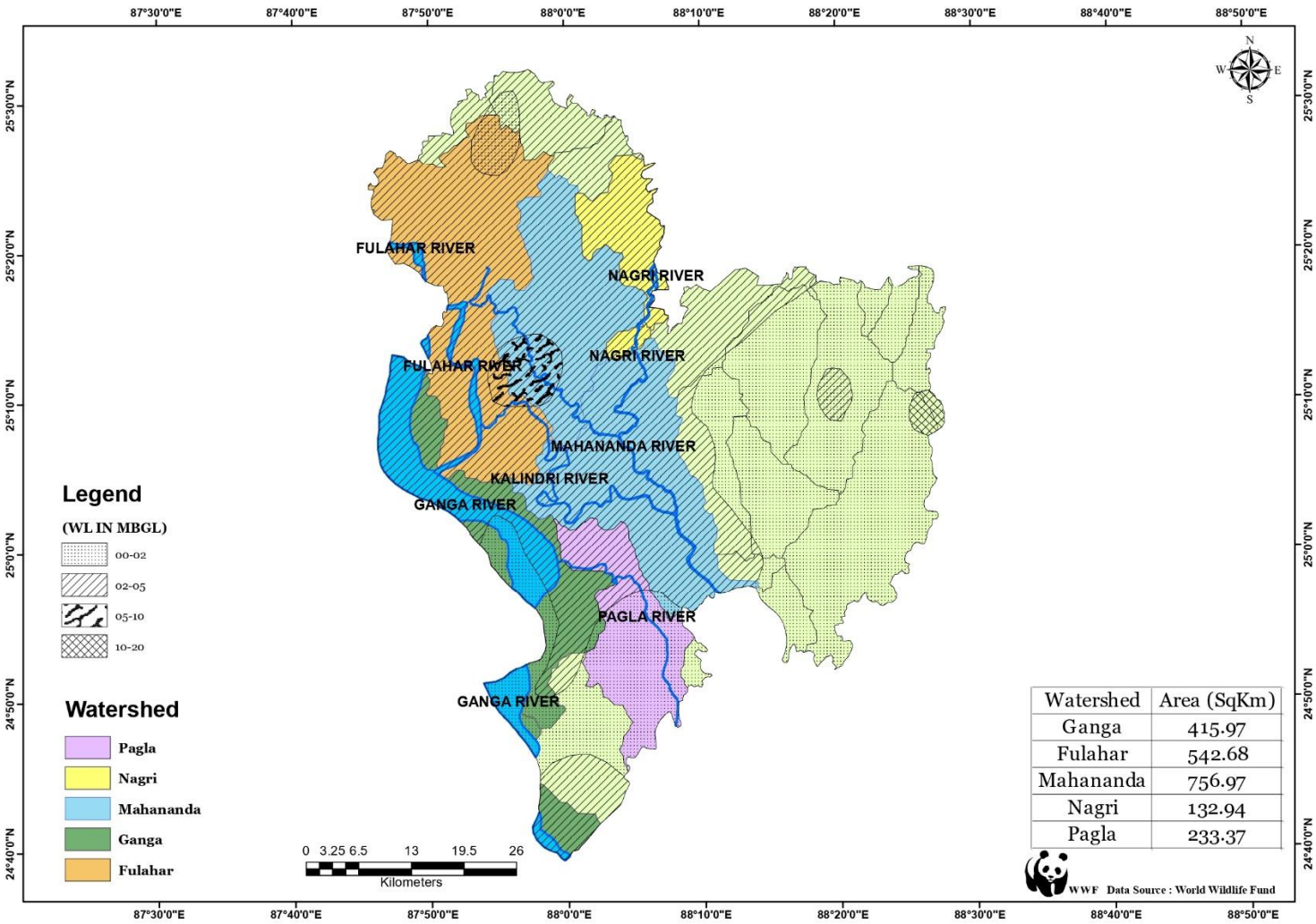


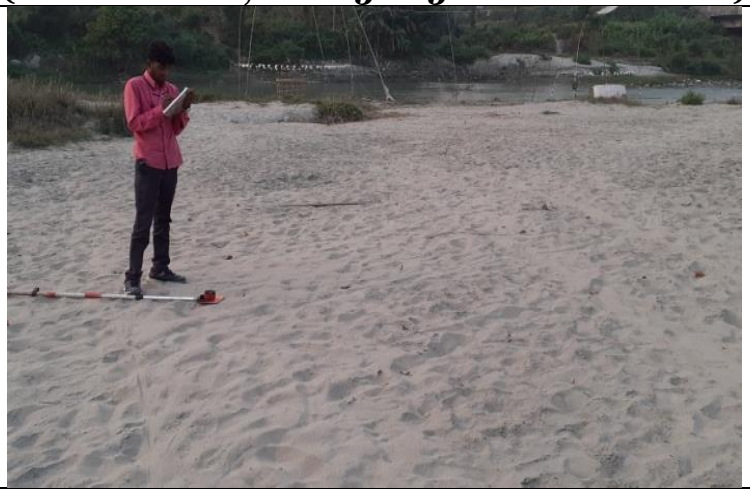
Plate 3C: District Watershed map showing ground water level during Post-monsoon period *(Source: World Wild Fund for Nature, September 2020)*

PLATE 4

FIELD SURVEY PHOTOGRAPHS

4A: Picture of Riverbed deposit of Mahananda River (Date: 10-11-21, Lat: 25° 1' 58" N & 88° 8' 6" E)

4B: Picture of Riverbed deposit of Kalindri River (Date: 10-11-21, Lat: 25° 3' 52" N & Long: 88° 3' 45" E)



4C: Picture of Riverbed deposit of Nagri River (Date: 12-11-21, Lat: 25° 17' 59" N & Long: 88° 6' 27" E)

4D: Picture of Riverbed deposit of Fulahar River (Date: 12-11-21, Lat: 25° 20' 28" N & Long: 87° 48' 43" E)

PLATE 5

LONG TERM EROSION-ACCRETION MAP

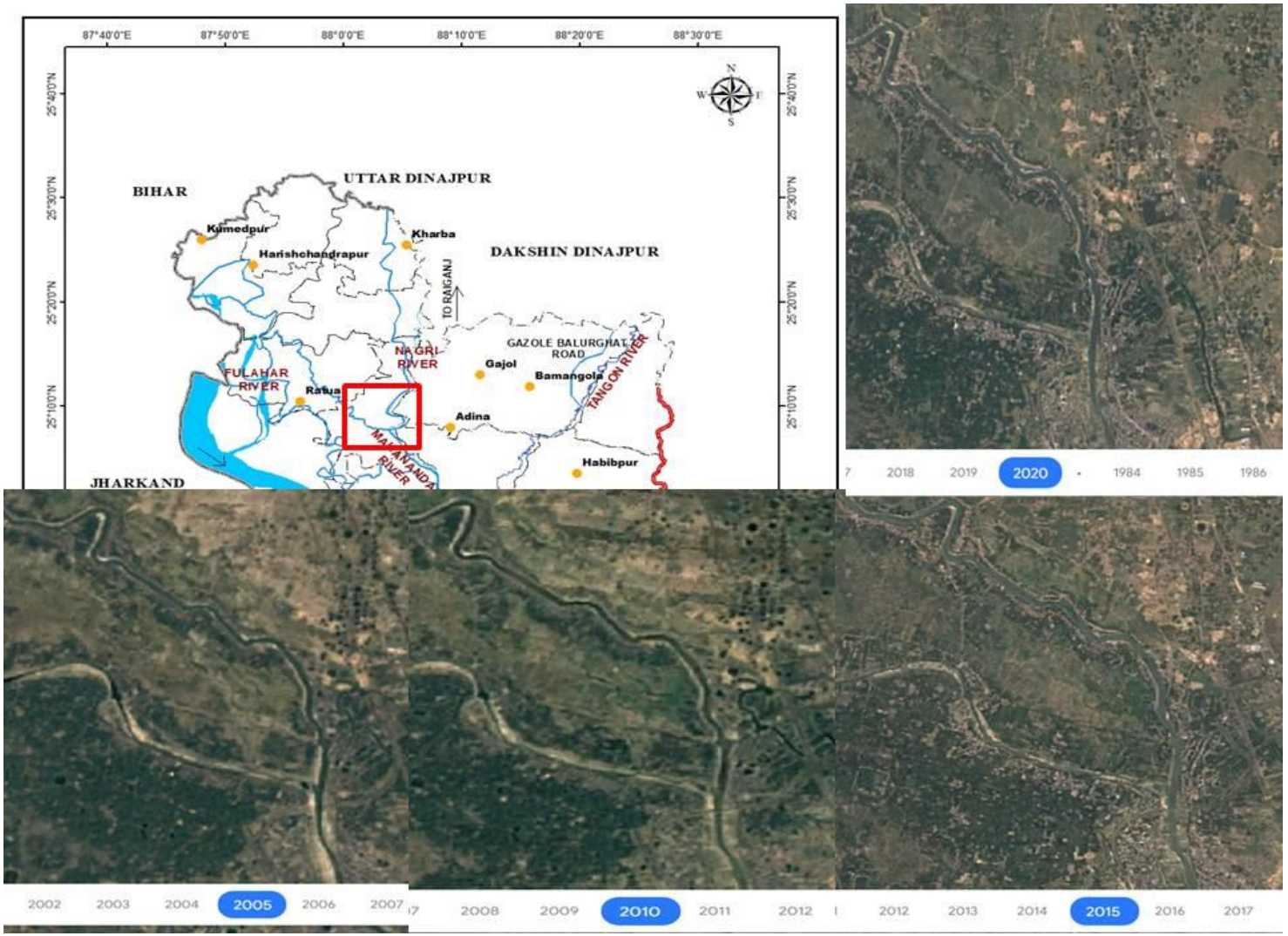


Plate 5A: Long term river course map showing erosion/ accretion along river banks *(Source: ISRO RESOURCE Sat 2 LISS III Sensor)*

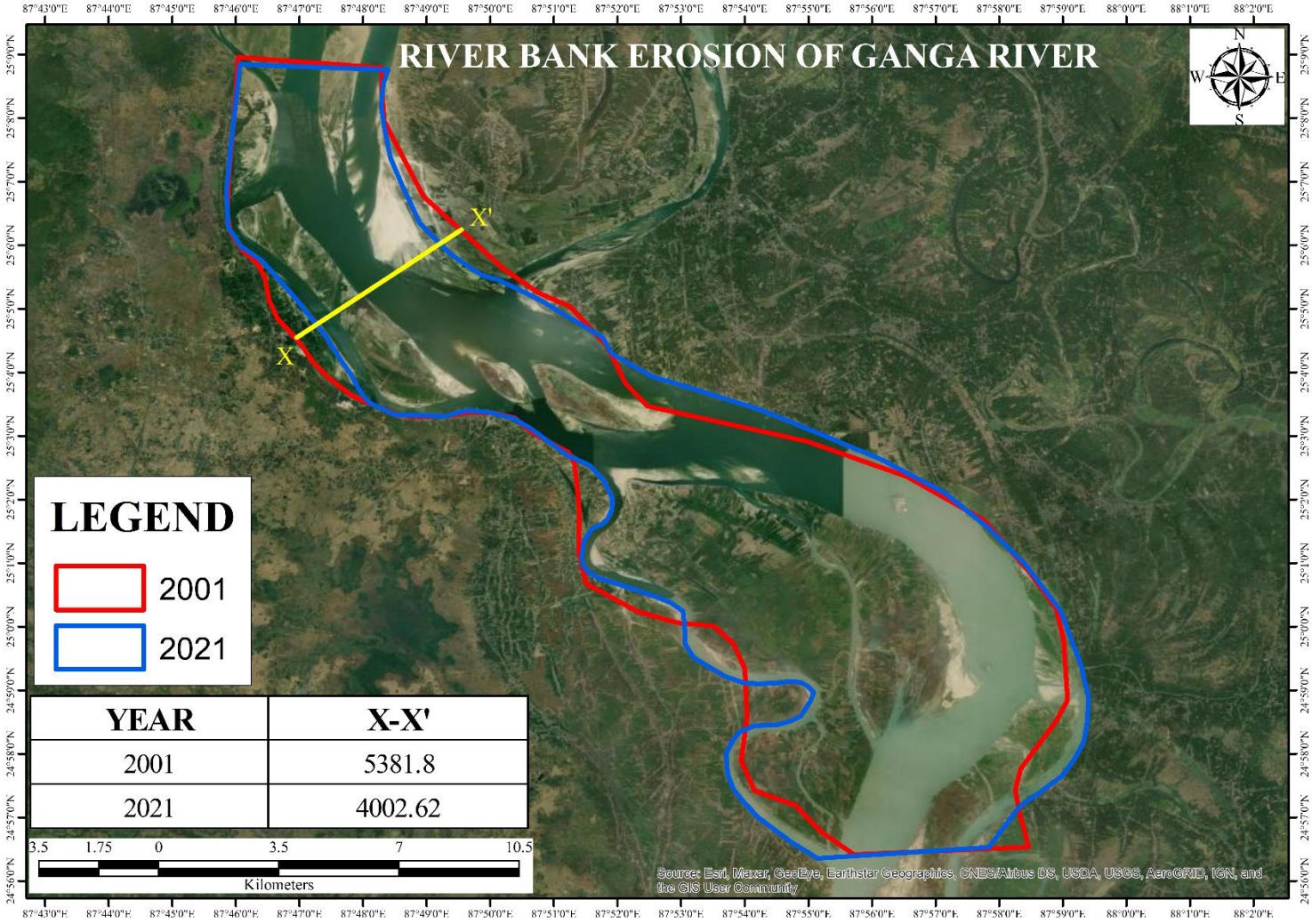


Plate 5B: Map showing long-term (10-year or more) erosion-accretion areas on both the banks of Ganga River, Malda *(Source: ISRO RESOURCE Sat 2 LISS III Sensor)*

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

Sl. 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 66 to 94.
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 92-94.
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.	Complied with and given as Annexure 2.
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 ¾th part of the river, width needs to be identified on a map. Out of the ¾th part area, where there is a deposition/aggradation of the material needs to be identified. The remaining ¼th 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 91 to 92.

Sl. 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 92 to 94.
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 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 92 to 94.
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 compose 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 shall occur. The details of the 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

Particulars	Code	Details	Particulars	Code	Details
PERIOD	PO	POST MONSOON	RIVER	FH	FULAHAR RIVER
PERIOD	PR	PRE MONSOON	RIVER	GG	GANGA RIVER
DISTRICT	MD	MALDA	RIVER	NG	NAGRI RIVER
BLOCK	HCP1	HARISHCHANDRAPUR-I	RIVER	MH	MAHANANDA RIVER
BLOCK	HCP2	HARISHCHANDRAPUR-II	RIVER	KD	KALINDRI RIVER
BLOCK	CH1	CHANCHAL-I	BLOCK	CH2	CHANCHAL-II
BLOCK	RT1	RATUA-I	BLOCK	EB	ENGLISH BAZAR
BLOCK	RT2	RATUA-II	BLOCK	MC	MANICKCHAK
BLOCK	GZ	GAZOLE	BLOCK	KC1	KALIACHAK-I
BLOCK	BG	BAMANGOLA	BLOCK	KC2	KALIACHAK-II
BLOCK	HBP	HABIBPUR	BLOCK	KC3	KALIACHAK-III
BLOCK	MDO	OLD MALDA			

Pre monsoon						Post monsoon					
SL No	Sand Bar_Code	RL (m)	Area in sq.m.	Sand Thickness in m.	Sand Volume in M. Cum	SL No	Sand Bar_Code	RL (m)	Area in sq.m.	Sand Thickness in m.	Sand Volume in M. Cum
Estimation of Sand Resources in Pre monsoon period & Post monsoon period in sand bar regions of Ganga River											
1	PR_MD_MC_GG_1	24.8	659004.6	2.8	1.85	1	PO_MD_MC_GG_1	25	490352.4	3	1.47
2	PR_MD_MC_GG_2	22.8	296686.6	2.8	0.83	2	PO_MD_MC_GG_2	23	188382.4	3	0.57
3	PR_MD_MC_GG_3	22.8	835330.1	2.8	2.34	3	PO_MD_MC_GG_3	23	729840.2	3	2.19
4	PR_MD_MC_GG_4	21.8	714163.5	2.8	2	4	PO_MD_MC_GG_4	22	499259	3	1.5
5	PR_MD_MC_GG_5	24.8	1043966	2.8	2.92	5	PO_MD_MC_GG_5	25	938509.9	3	2.82
6	PR_MD_MC_GG_6A	25.8	4820919	2.8	13.5	6	PO_MD_MC_GG_6	26	7272928	3	21.82
7	PR_MD_MC_GG_6B	2.8	1326474	2.8	3.71						
8	PR_MD_MC_GG_7	21.8	443282.4	2.8	1.24	7	PO_MD_MC_GG_7	22	761846.3	3	2.29
9	PR_MD_MC_GG_8	24.8	3445677	2.8	9.65	8	PO_MD_MC_GG_8	25	2968907	3	8.91
10	PR_MD_MC_GG_9	24.8	363243.4	2.8	1.02	9	PO_MD_MC_GG_9	25	304746.3	3	0.91

Pre monsoon						Post monsoon					
SL No	**Sand Bar_Code**	**RL (m)**	**Area in sq.m.**	**Sand Thickness in m.**	**Sand Volume in M. Cum**	**S L No**	**Sand Bar_Code**	**RL (m)**	**Area in sq.m.**	**Sand Thickness in m.**	**Sand Volume in M. Cum**
11	PR_MD_MC_GG_10	22.8	3146333	2.8	8.81	10	PO_MD_MC_GG_10	23	2951787	3	8.86
12	PR_MD_MC_GG_11	23.8	1567354	2.8	4.39	11	PO_MD_MC_GG_11	24	971440.1	3	2.91
13	PR_MD_MC_GG_12	22.8	256210.5	2.8	0.72	12	PO_MD_MC_GG_12	23	397175.7	3	1.19
14	PR_MD_MC_GG_13	22.8	326911.4	2.8	0.92	13	PO_MD_MC_GG_13	23	337527.3	3	1.01
15	PR_MD_KC3_GG_14	21.8	1702478	2.8	4.77	14	PO_MD_KC3_GG_14	22	1552086	3	4.66
16	PR_MD_KC3_GG_15	23.8	226608.8	2.8	0.63	15	PO_MD_KC3_GG_15	24	215464.3	3	0.65
17	PR_MD_KC3_GG_16	17.8	883719.6	2.8	2.47	16	PO_MD_KC3_GG_16A	18	104611.9	3	0.31
						17	PO_MD_KC3_GG_16B	23	185059.3	3	0.56
18	PR_MD_KC3_GG_17	17.8	2885745	2.8	8.08	18	PO_MD_KC3_GG_17A	18	1705804	3	5.12
						19	PO_MD_KC3_GG_17B	18	934367.1	3	2.8
Estimation of Sand Resources in Pre monsoon period & Post monsoon period in sand bar regions of Fulahar River											
1	PR_MD_HCP2_FH_1	25	194682.8	1.5	0.29	1	PO_MD_HCP2_FH_1	26	92033.7	2.5	0.23
2	PR_MD_HCP2_FH_2	24	137499.8	1.5	0.21	2	PO_MD_HCP2_FH_2	25	137097.7	2.5	0.34
3	PR_MD_HCP2_FH_3	23	39493.54	1.5	0.06	3	PO_MD_HCP2_FH_3	24	17337.08	2.5	0.04
4	PR_MD_HCP2_FH_4	25	550437	1.5	0.83	4	PO_MD_HCP2_FH_4	26	339648.5	2.5	0.85
5	PR_MD_HCP2_FH_5	22	601185.7	1.5	0.9	5	PO_MD_HCP2_FH_5	23	348566.3	2.5	0.87
6	PR_MD_HCP2_FH_6	24	375599.3	1.5	0.56	6	PO_MD_HCP2_FH_6	25	74929.45	2.5	0.19
7	PR_MD_HCP2_FH_7	22	54836.58	1.5	0.08	7	PO_MD_HCP2_FH_7	23	45105.38	2.5	0.11
8	PR_MD_HCP2_FH_8	25	58431.47	1.5	0.09	8	PO_MD_HCP2_FH_8	26	63445.61	2.5	0.16
9	PR_MD_RT1_FH_9	25	239007.1	1.5	0.36	9	PO_MD_RT1_FH_9	26	233629.5	2.5	0.58
10	PR_MD_RT1_FH_10	23	432356.2	1.5	0.65	10	PO_MD_RT1_FH_10	24	273957.8	2.5	0.68
11	PR_MD_RT1_FH_11	24	1201506	1.5	1.8	11	PO_MD_RT1_FH_11	25	938375.7	2.5	2.35
12	PR_MD_RT1_FH_12	23	189450.8	1.5	0.28	12	PO_MD_RT1_FH_12	24	156203.1	2.5	0.39
13	PR_MD_RT1_FH_13	22	46357.06	1.5	0.07	13	PO_MD_RT1_FH_13	23	34014.37	2.5	0.09
14	PR_MD_RT1_FH_14	22	62200.2	1.5	0.09	14	PO_MD_RT1_FH_14	23	48678.59	2.5	0.12
15	PR_MD_RT1_FH_15	24	687452.2	1.5	1.03	15	PO_MD_RT1_FH_15	25	401673.1	2.5	1

Pre monsoon						Post monsoon					
SL No	**Sand Bar_Code**	**RL (m)**	**Area in sq.m.**	**Sand Thickness in m.**	**Sand Volume in M. Cum**	**S L No**	**Sand Bar_Code**	**RL (m)**	**Area in sq.m.**	**Sand Thickness in m.**	**Sand Volume in M. Cum**
16	PR_MD_RT1_FH_16	23	122322.6	1.5	0.18	16	PO_MD_RT1_FH_16	24	65506.82	2.5	0.16
17	PR_MD_RT1_FH_17	23	439247.5	1.5	0.66	17	PO_MD_RT1_FH_17	24	285575.9	2.5	0.71
18	PR_MD_MC_FH_18	24	901955.3	1.5	1.35	18	PO_MD_MC_FH_18	25	248832.1	2.5	0.62
Estimation of Sand Resources in Pre monsoon period & Post monsoon period in sand bar regions of Mahananda River											
1	PR_MD_MDO_MH_1	15.9	51627.02	2.9	0.15	1	PO_MD_MDO_MH_1	16	75313.6	3	0.23
2	PR_MD_EB_MH_2	15.9	34750.48	2.9	0.1	2	PO_MD_EB_MH_2	16	24319.61	3	0.07
3	PR_MD_EB_MH_3	22.9	71654.1	2.9	0.21	3	PO_MD_EB_MH_3	23	104996.4	3	0.31
4	PR_MD_EB_MH_4	19.9	45771.22	2.9	0.13	4	PO_MD_EB_MH_4	20	28773.14	3	0.09
Estimation of Sand Resources in Pre monsoon period & Post monsoon period in sand bar regions of Nagri River											
1	PR_MD_CH2_NG_1	21.8	29470.37	2	0.06	1	PO_MD_CH2_NG_1	22	44847.05	2.2	0.1
2	PR_MD_CH2_NG_2	20.8	20504.6	2	0.04	2	PO_MD_CH2_NG_2	21	23582.99	2.2	0.05
3	PR_MD_CH2_NG_3	19.8	67246.71	2	0.13	3	PO_MD_CH2_NG_3	20	84892.9	2.2	0.19
4	PR_MD_CH2_NG_4	19.8	43977.83	2	0.09	4	PO_MD_CH2_NG_4A	20	19755.58	2.2	0.04
						5	PO_MD_CH2_NG_4B	22	21361.74	2.2	0.05
5	PR_MD_CH2_NG_5	26.8	37344.56	2	0.07	6	PO_MD_CH2_NG_5	27	26115.49	2.2	0.06
6	PO_MD_RT2_NG_6	23.8	60373.14	2	0.12	7	PO_MD_CH2_NG_6	24	46302.77	2.2	0.1
7	PR_MD_RT2_NG_7	23.8	23494.62	2	0.05	8	PO_MD_RT2_NG_7	24	24050.42	2.2	0.05
8	PR_MD_RT2_NG_8	20.8	45005.54	2	0.09	9	PO_MD_RT2_NG_8	21	43419.27	2.2	0.1
9	PR_MD_RT2_NG_9	22.8	91881.71	2	0.18	10	PO_MD_RT2_NG_9	23	60887.61	2.2	0.13
10	PR_MD_RT2_NG_10	25.8	15126.23	2	0.03	11	PO_MD_RT2_NG_10	26	15556.09	2.2	0.03
11	PR_MD_RT2_NG_11	26.8	18218.69	2	0.04	12	PO_MD_RT2_NG_11	27	15063.61	2.2	0.03
12	PR_MD_RT2_NG_12	18.8	17372.12	2	0.03	13	PO_MD_RT2_NG_12	19	18339.98	2.2	0.04
Estimation of Sand Resources in Pre monsoon period & Post monsoon period in sand bar regions of Kalindri River											
1	PR_MD_EB_KD_1	19.9	41785.96	1.5	0.06	1	PO_MD_EB_KD_1	20	45264.94	1.6	0.07
2	PR_MD_EB_KD_2	20.9	77787.13	1.5	0.12	2	PO_MD_EB_KD_2	21	156502.8	1.6	0.25

Annexure 3
Boundary Coordinates of Potential Blocks of Malda District

Abbreviation used in the table as below

Particulars	Code	Details	Particulars	Code	Details
PERIOD	PO	POST MONSOON	RIVER	FH	FULAHAR RIVER
PERIOD	PR	PRE MONSOON	RIVER	GG	GANGA RIVER
DISTRICT	MD	MALDA	RIVER	NG	NAGRI RIVER
BLOCK	HCP1	HARISHCHANDRAPUR-I	RIVER	MH	MAHANANDA RIVER
BLOCK	HCP2	HARISHCHANDRAPUR-II	RIVER	KD	KALINDRI RIVER
BLOCK	CH1	CHANCHAL-I	BLOCK	CH2	CHANCHAL-II
BLOCK	RT1	RATUA-I	BLOCK	EB	ENGLISH BAZAR
BLOCK	RT2	RATUA-II	BLOCK	MC	MANICKCHAK
BLOCK	GZ	GAZOLE	BLOCK	KC1	KALIACHAK-I
BLOCK	BG	BAMANGOLA	BLOCK	KC2	KALIACHAK-II
BLOCK	HBP	HABIBPUR	BLOCK	KC3	KALIACHAK-III
BLOCK	MDO	OLD MALDA			

SANDBAR CODE	POINT_NO	LATITUDE	LONGITUDE
MD_HCP2_FH_1	1	25° 20' 24.042" N	87° 47' 43.331" E
	2	25° 20' 22.721" N	87° 47' 37.097" E
	3	25° 20' 23.530" N	87° 47' 30.792" E
	4	25° 20' 24.625" N	87° 47' 29.689" E
	5	25° 20' 27.851" N	87° 47' 29.592" E
	6	25° 20' 28.900" N	87° 47' 34.331" E
	7	25° 20' 28.868" N	87° 47' 40.365" E
	8	25° 20' 27.242" N	87° 47' 42.721" E
MD_HCP2_FH_2	1	25° 20' 29.116" N	87° 48' 28.552" E
	2	25° 20' 28.674" N	87° 48' 21.356" E
	3	25° 20' 30.200" N	87° 48' 13.723" E
	4	25° 20' 31.259" N	87° 48' 15.283" E
	5	25° 20' 31.945" N	87° 48' 27.355" E
	6	25° 20' 34.716" N	87° 48' 31.869" E
	7	25° 20' 33.410" N	87° 48' 33.504" E
	8	25° 20' 33.015" N	87° 48' 32.743" E
	9	25° 20' 30.827" N	87° 48' 30.229" E
MD_HCP2_FH_4	1	25° 20' 36.170" N	87° 49' 0.629" E
	2	25° 20' 33.596" N	87° 48' 59.429" E
	3	25° 20' 29.730" N	87° 48' 58.693" E
	4	25° 20' 27.472" N	87° 48' 58.678" E
	5	25° 20' 24.236" N	87° 49' 0.549" E
	6	25° 20' 18.851" N	87° 49' 2.287" E
	7	25° 20' 10.361" N	87° 49' 1.520" E

SANDBAR CODE	POINT_NO	LATITUDE	LONGITUDE
	8	25° 20' 2.846" N	87° 48' 59.577" E
	9	25° 19' 58.026" N	87° 48' 59.761" E
	10	25° 19' 58.255" N	87° 48' 59.693" E
	11	25° 20' 12.431" N	87° 48' 54.064" E
	12	25° 20' 13.414" N	87° 48' 53.969" E
	13	25° 20' 21.476" N	87° 48' 54.142" E
	14	25° 20' 23.013" N	87° 48' 48.473" E
	15	25° 20' 23.487" N	87° 48' 47.566" E
	16	25° 20' 28.621" N	87° 48' 43.541" E
	17	25° 20' 33.467" N	87° 48' 38.245" E
	18	25° 20' 34.647" N	87° 48' 35.893" E
	19	25° 20' 34.638" N	87° 48' 35.874" E
	20	25° 20' 34.824" N	87° 48' 35.756" E
	21	25° 20' 34.985" N	87° 48' 41.573" E
	22	25° 20' 34.731" N	87° 48' 48.670" E
	23	25° 20' 35.445" N	87° 48' 55.537" E
	24	25° 20' 36.825" N	87° 48' 58.740" E
MD_HCP2_FH_5	1	25° 19' 38.308" N	87° 49' 23.427" E
	2	25° 19' 37.790" N	87° 49' 19.756" E
	3	25° 19' 39.736" N	87° 49' 17.995" E
	4	25° 19' 42.555" N	87° 49' 13.637" E
	5	25° 19' 45.152" N	87° 49' 10.697" E
	6	25° 19' 51.719" N	87° 49' 9.203" E
	7	25° 19' 56.556" N	87° 49' 9.354" E
	8	25° 20' 1.281" N	87° 49' 10.450" E
	9	25° 20' 10.844" N	87° 49' 11.461" E
	10	25° 20' 17.623" N	87° 49' 10.442" E
	11	25° 20' 23.012" N	87° 49' 7.994" E
	12	25° 20' 26.241" N	87° 49' 7.306" E
	13	25° 20' 29.678" N	87° 49' 8.039" E
	14	25° 20' 33.504" N	87° 49' 8.065" E
	15	25° 20' 26.726" N	87° 49' 15.103" E
	16	25° 20' 25.591" N	87° 49' 15.502" E
	17	25° 20' 20.171" N	87° 49' 16.138" E
	18	25° 20' 17.690" N	87° 49' 17.659" E
	19	25° 20' 16.852" N	87° 49' 18.723" E
	20	25° 20' 13.304" N	87° 49' 21.448" E
	21	25° 20' 10.900" N	87° 49' 20.690" E
	22	25° 20' 9.296" N	87° 49' 19.022" E

SANDBAR CODE	POINT_NO	LATITUDE	LONGITUDE
	23	25° 20' 5.442" N	87° 49' 16.157" E
	24	25° 19' 58.897" N	87° 49' 13.747" E
	25	25° 19' 54.709" N	87° 49' 12.772" E
	26	25° 19' 50.615" N	87° 49' 14.283" E
	27	25° 19' 45.111" N	87° 49' 18.031" E
	28	25° 19' 40.677" N	87° 49' 22.615" E
MD_HCP2_FH_6	1	25° 19' 35.336" N	87° 49' 11.019" E
	2	25° 19' 34.675" N	87° 49' 6.188" E
	3	25° 19' 35.385" N	87° 49' 2.171" E
	4	25° 19' 35.943" N	87° 48' 59.931" E
	5	25° 19' 38.301" N	87° 48' 59.559" E
	6	25° 19' 46.241" N	87° 49' 0.414" E
	7	25° 19' 40.698" N	87° 49' 5.708" E
	8	25° 19' 36.973" N	87° 49' 10.604" E
MD_HCP2_FH_7	1	25° 16' 24.972" N	87° 51' 48.900" E
	2	25° 16' 23.610" N	87° 51' 46.545" E
	3	25° 16' 24.170" N	87° 51' 44.959" E
	4	25° 16' 25.626" N	87° 51' 43.078" E
	5	25° 16' 27.396" N	87° 51' 46.344" E
	6	25° 16' 28.405" N	87° 51' 50.211" E
	7	25° 16' 29.211" N	87° 51' 53.698" E
	8	25° 16' 29.738" N	87° 51' 57.637" E
	9	25° 16' 31.088" N	87° 52' 2.111" E
	10	25° 16' 30.997" N	87° 52' 5.819" E
	11	25° 16' 29.899" N	87° 52' 5.281" E
	12	25° 16' 27.937" N	87° 51' 59.592" E
	13	25° 16' 27.212" N	87° 51' 54.213" E
MD_HCP2_FH_8	1	25° 16' 34.105" N	87° 52' 39.724" E
	2	25° 16' 33.667" N	87° 52' 38.690" E
	3	25° 16' 35.763" N	87° 52' 33.891" E
	4	25° 16' 39.012" N	87° 52' 31.266" E
	5	25° 16' 39.783" N	87° 52' 28.926" E
	6	25° 16' 40.066" N	87° 52' 27.641" E
	7	25° 16' 42.729" N	87° 52' 27.530" E
	8	25° 16' 43.875" N	87° 52' 31.782" E
	9	25° 16' 43.369" N	87° 52' 36.503" E
	10	25° 16' 42.693" N	87° 52' 37.120" E
	11	25° 16' 39.660" N	87° 52' 38.082" E
	12	25° 16' 36.903" N	87° 52' 38.894" E

SANDBAR CODE	POINT_NO	LATITUDE	LONGITUDE
MD_RT1_FH_9	1	25° 15' 55.240" N	87° 52' 20.528" E
	2	25° 15' 50.486" N	87° 52' 17.231" E
	3	25° 15' 51.017" N	87° 52' 15.891" E
	4	25° 15' 53.304" N	87° 52' 16.833" E
	5	25° 15' 56.455" N	87° 52' 17.916" E
	6	25° 15' 59.404" N	87° 52' 18.564" E
	7	25° 16' 2.604" N	87° 52' 19.254" E
	8	25° 16' 5.563" N	87° 52' 19.894" E
	9	25° 16' 8.658" N	87° 52' 20.553" E
	10	25° 16' 12.969" N	87° 52' 21.414" E
	11	25° 16' 17.557" N	87° 52' 20.391" E
	12	25° 16' 20.216" N	87° 52' 18.153" E
	13	25° 16' 21.182" N	87° 52' 18.160" E
	14	25° 16' 22.210" N	87° 52' 26.339" E
	15	25° 16' 20.357" N	87° 52' 27.661" E
	16	25° 16' 15.066" N	87° 52' 27.764" E
	17	25° 16' 7.983" N	87° 52' 25.585" E
	18	25° 15' 59.616" N	87° 52' 22.404" E
MD_RT1_FH_10	1	25° 14' 59.288" N	87° 51' 50.205" E
	2	25° 14' 57.748" N	87° 51' 48.917" E
	3	25° 14' 57.780" N	87° 51' 48.901" E
	4	25° 15' 1.983" N	87° 51' 50.361" E
	5	25° 15' 7.342" N	87° 51' 52.336" E
	6	25° 15' 10.617" N	87° 51' 54.399" E
	7	25° 15' 16.658" N	87° 51' 58.414" E
	8	25° 15' 22.190" N	87° 52' 1.007" E
	9	25° 15' 27.417" N	87° 52' 2.772" E
	10	25° 15' 31.304" N	87° 52' 5.898" E
	11	25° 15' 33.760" N	87° 52' 7.813" E
	12	25° 15' 32.452" N	87° 52' 11.153" E
	13	25° 15' 29.225" N	87° 52' 11.414" E
	14	25° 15' 27.417" N	87° 52' 11.685" E
	15	25° 15' 25.605" N	87° 52' 12.665" E
	16	25° 15' 21.863" N	87° 52' 12.780" E
	17	25° 15' 15.681" N	87° 52' 10.892" E
	18	25° 15' 9.142" N	87° 52' 4.036" E
	19	25° 15' 6.325" N	87° 52' 0.327" E
	20	25° 15' 3.639" N	87° 51' 56.336" E
	21	25° 15' 1.727" N	87° 51' 52.350" E

SANDBAR CODE	POINT_NO	LATITUDE	LONGITUDE
MD_RT1_FH_11	1	25° 13' 58.934" N	87° 51' 45.664" E
	2	25° 13' 56.387" N	87° 51' 39.973" E
	3	25° 13' 56.538" N	87° 51' 36.286" E
	4	25° 13' 59.760" N	87° 51' 36.734" E
	5	25° 14' 2.979" N	87° 51' 37.891" E
	6	25° 14' 6.315" N	87° 51' 41.035" E
	7	25° 14' 11.721" N	87° 51' 43.343" E
	8	25° 14' 22.932" N	87° 51' 45.550" E
	9	25° 14' 32.084" N	87° 51' 47.033" E
	10	25° 14' 36.471" N	87° 51' 46.922" E
	11	25° 14' 39.193" N	87° 51' 44.814" E
	12	25° 14' 41.526" N	87° 51' 44.042" E
	13	25° 14' 43.267" N	87° 51' 44.623" E
	14	25° 14' 44.266" N	87° 51' 44.917" E
	15	25° 14' 45.381" N	87° 51' 45.709" E
	16	25° 14' 49.497" N	87° 51' 47.866" E
	17	25° 14' 53.075" N	87° 51' 53.707" E
	18	25° 14' 56.401" N	87° 51' 58.554" E
	19	25° 14' 58.707" N	87° 52' 1.266" E
	20	25° 15' 1.524" N	87° 52' 4.974" E
	21	25° 15' 6.397" N	87° 52' 9.974" E
	22	25° 15' 11.670" N	87° 52' 12.849" E
	23	25° 15' 9.462" N	87° 52' 15.387" E
	24	25° 15' 1.989" N	87° 52' 13.632" E
	25	25° 15' 1.550" N	87° 52' 13.556" E
	26	25° 14' 59.617" N	87° 52' 12.743" E
	27	25° 14' 42.968" N	87° 52' 5.982" E
	28	25° 14' 39.321" N	87° 52' 4.310" E
	29	25° 14' 28.541" N	87° 51' 59.219" E
	30	25° 14' 20.843" N	87° 51' 55.884" E
	31	25° 14' 11.018" N	87° 51' 52.168" E
	32	25° 14' 3.322" N	87° 51' 49.395" E
MD_RT1_FH_12	1	25° 13' 10.133" N	87° 51' 21.682" E
	2	25° 13' 10.133" N	87° 51' 21.625" E
	3	25° 13' 15.174" N	87° 51' 21.013" E
	4	25° 13' 23.210" N	87° 51' 20.100" E
	5	25° 13' 30.842" N	87° 51' 19.754" E
	6	25° 13' 35.199" N	87° 51' 21.941" E
	7	25° 13' 39.415" N	87° 51' 24.186" E

SANDBAR CODE	POINT_NO	LATITUDE	LONGITUDE
	8	25° 13' 44.595" N	87° 51' 26.161" E
	9	25° 13' 49.020" N	87° 51' 27.828" E
	10	25° 13' 43.129" N	87° 51' 27.303" E
	11	25° 13' 28.950" N	87° 51' 24.934" E
	12	25° 13' 19.918" N	87° 51' 25.154" E
	13	25° 13' 15.415" N	87° 51' 22.995" E
MD_RT1_FH_13	1	25° 13' 3.772" N	87° 51' 28.303" E
	2	25° 13' 0.421" N	87° 51' 27.712" E
	3	25° 13' 0.821" N	87° 51' 25.588" E
	4	25° 13' 5.862" N	87° 51' 23.921" E
	5	25° 13' 9.089" N	87° 51' 23.660" E
	6	25° 13' 12.304" N	87° 51' 25.385" E
	7	25° 13' 8.933" N	87° 51' 28.339" E
MD_RT1_FH_14	1	25° 12' 30.689" N	87° 53' 26.630" E
	2	25° 12' 27.729" N	87° 53' 25.332" E
	3	25° 12' 33.670" N	87° 53' 24.383" E
	4	25° 12' 41.672" N	87° 53' 23.874" E
	5	25° 12' 44.378" N	87° 53' 24.461" E
	6	25° 12' 42.685" N	87° 53' 27.001" E
	7	25° 12' 40.088" N	87° 53' 29.819" E
	8	25° 12' 36.350" N	87° 53' 29.224" E
MD_RT1_FH_15	1	25° 10' 7.403" N	87° 53' 8.880" E
	2	25° 10' 7.356" N	87° 53' 6.224" E
	3	25° 10' 16.359" N	87° 53' 11.015" E
	4	25° 10' 22.370" N	87° 53' 12.712" E
	5	25° 10' 41.726" N	87° 53' 12.143" E
	6	25° 10' 58.489" N	87° 53' 13.683" E
	7	25° 11' 13.542" N	87° 53' 13.555" E
	8	25° 11' 23.447" N	87° 53' 11.264" E
	9	25° 11' 26.659" N	87° 53' 13.650" E
	10	25° 11' 27.714" N	87° 53' 16.966" E
	11	25° 11' 17.821" N	87° 53' 17.131" E
	12	25° 11' 2.118" N	87° 53' 18.199" E
	13	25° 10' 53.292" N	87° 53' 19.789" E
	14	25° 10' 49.639" N	87° 53' 19.290" E
	15	25° 10' 44.714" N	87° 53' 15.946" E
	16	25° 10' 37.823" N	87° 53' 17.550" E
	17	25° 10' 29.429" N	87° 53' 18.907" E
	18	25° 10' 17.815" N	87° 53' 19.295" E

SANDBAR CODE	POINT_NO	LATITUDE	LONGITUDE
	19	25° 10' 9.053" N	87° 53' 19.680" E
	20	25° 10' 8.564" N	87° 53' 16.118" E
MD_RT1_FH_16	1	25° 10' 28.147" N	87° 53' 6.383" E
	2	25° 10' 16.041" N	87° 53' 2.799" E
	3	25° 10' 22.336" N	87° 53' 0.103" E
	4	25° 10' 28.189" N	87° 52' 59.295" E
	5	25° 10' 33.593" N	87° 53' 1.791" E
	6	25° 10' 34.612" N	87° 53' 4.067" E
MD_RT1_FH_17	1	25° 10' 6.040" N	87° 53' 19.812" E
	2	25° 9' 59.317" N	87° 53' 20.106" E
	3	25° 9' 44.461" N	87° 53' 23.306" E
	4	25° 9' 27.884" N	87° 53' 26.494" E
	5	25° 9' 23.155" N	87° 53' 26.223" E
	6	25° 9' 43.430" N	87° 53' 15.975" E
	7	25° 9' 56.583" N	87° 53' 9.927" E
	8	25° 10' 0.916" N	87° 53' 4.523" E
	9	25° 10' 5.559" N	87° 53' 5.749" E
	10	25° 10' 5.213" N	87° 53' 8.344" E
MD_MC_FH_18	1	25° 5' 36.574" N	87° 51' 2.988" E
	2	25° 5' 34.692" N	87° 51' 0.101" E
	3	25° 5' 36.487" N	87° 50' 59.874" E
	4	25° 5' 42.523" N	87° 50' 57.318" E
	5	25° 5' 45.728" N	87° 51' 0.882" E
	6	25° 5' 49.935" N	87° 51' 17.205" E
	7	25° 5' 51.803" N	87° 51' 28.790" E
	8	25° 5' 47.183" N	87° 51' 28.069" E
	9	25° 5' 44.694" N	87° 51' 20.461" E
	10	25° 5' 42.009" N	87° 51' 14.452" E
	11	25° 5' 39.529" N	87° 51' 8.904" E
	12	25° 5' 38.635" N	87° 51' 7.067" E
MD_MC_GG_1	1	25° 12' 28.808" N	87° 48' 7.776" E
	2	25° 12' 13.372" N	87° 47' 59.166" E
	3	25° 12' 35.554" N	87° 48' 1.013" E
	4	25° 13' 4.481" N	87° 48' 6.428" E
	5	25° 12' 45.230" N	87° 48' 32.157" E
	6	25° 12' 42.167" N	87° 48' 18.642" E
MD_MC_GG_3	1	25° 10' 25.339" N	87° 48' 30.786" E
	2	25° 9' 58.513" N	87° 48' 28.908" E
	3	25° 10' 1.161" N	87° 48' 16.449" E

SANDBAR CODE	POINT_NO	LATITUDE	LONGITUDE
	4	25° 10' 1.739" N	87° 48' 5.112" E
	5	25° 9' 58.701" N	87° 47' 54.317" E
	6	25° 10' 18.766" N	87° 48' 5.790" E
	7	25° 10' 41.365" N	87° 48' 25.787" E
	8	25° 10' 36.183" N	87° 48' 29.723" E
MD_MC_GG_4	1	25° 9' 53.744" N	87° 47' 17.824" E
	2	25° 9' 34.524" N	87° 47' 9.006" E
	3	25° 9' 38.682" N	87° 47' 3.551" E
	4	25° 9' 59.165" N	87° 47' 1.225" E
	5	25° 10' 21.182" N	87° 47' 1.743" E
	6	25° 10' 22.700" N	87° 47' 7.424" E
	7	25° 10' 9.230" N	87° 47' 17.168" E
MD_MC_GG_5	1	25° 8' 46.054" N	87° 47' 31.732" E
	2	25° 8' 40.936" N	87° 47' 23.761" E
	3	25° 8' 58.983" N	87° 47' 26.712" E
	4	25° 9' 18.566" N	87° 47' 31.942" E
	5	25° 9' 33.004" N	87° 47' 34.303" E
	6	25° 9' 41.203" N	87° 47' 45.130" E
	7	25° 9' 39.093" N	87° 47' 53.623" E
	8	25° 9' 32.369" N	87° 47' 56.414" E
	9	25° 9' 19.468" N	87° 47' 56.330" E
	10	25° 9' 8.132" N	87° 47' 52.854" E
	11	25° 8' 58.364" N	87° 47' 45.986" E
MD_MC_GG_6	1	25° 6' 2.333" N	87° 48' 59.599" E
	2	25° 5' 53.648" N	87° 49' 4.274" E
	3	25° 5' 54.215" N	87° 49' 3.574" E
	4	25° 6' 15.964" N	87° 48' 50.115" E
	5	25° 6' 38.706" N	87° 48' 44.031" E
	6	25° 6' 51.679" N	87° 48' 31.079" E
	7	25° 7' 11.360" N	87° 48' 18.171" E
	8	25° 7' 30.034" N	87° 48' 0.720" E
	9	25° 7' 52.316" N	87° 47' 43.857" E
	10	25° 8' 11.994" N	87° 47' 31.512" E
	11	25° 8' 30.083" N	87° 47' 26.526" E
	12	25° 8' 36.243" N	87° 47' 32.803" E
	13	25° 8' 45.435" N	87° 47' 51.005" E
	14	25° 8' 55.163" N	87° 48' 5.244" E
	15	25° 9' 4.776" N	87° 48' 16.754" E
	16	25° 8' 54.558" N	87° 48' 15.637" E

SANDBAR CODE	POINT_NO	LATITUDE	LONGITUDE
	17	25° 8' 37.500" N	87° 48' 14.186" E
	18	25° 8' 16.349" N	87° 48' 15.251" E
	19	25° 7' 58.735" N	87° 48' 17.605" E
	20	25° 7' 40.578" N	87° 48' 22.677" E
	21	25° 7' 26.071" N	87° 48' 26.884" E
	22	25° 7' 19.708" N	87° 48' 33.570" E
	23	25° 7' 11.370" N	87° 48' 42.074" E
	24	25° 6' 57.071" N	87° 48' 45.794" E
	25	25° 6' 42.802" N	87° 48' 49.745" E
	26	25° 6' 29.347" N	87° 48' 52.352" E
	27	25° 6' 15.670" N	87° 48' 54.999" E
MD_MC_GG_7	1	25° 4' 54.293" N	87° 47' 38.739" E
	2	25° 4' 52.579" N	87° 47' 38.002" E
	3	25° 4' 58.496" N	87° 47' 30.937" E
	4	25° 5' 19.101" N	87° 47' 32.098" E
	5	25° 5' 40.248" N	87° 47' 34.502" E
	6	25° 6' 11.248" N	87° 47' 27.900" E
	7	25° 6' 18.983" N	87° 47' 29.083" E
	8	25° 6' 10.672" N	87° 47' 39.232" E
	9	25° 6' 0.848" N	87° 47' 42.569" E
	10	25° 5' 35.023" N	87° 47' 46.369" E
	11	25° 5' 22.650" N	87° 47' 44.022" E
	12	25° 5' 9.265" N	87° 47' 37.702" E
MD_MC_GG_8	1	25° 4' 46.700" N	87° 48' 46.691" E
	2	25° 4' 39.447" N	87° 48' 51.744" E
	3	25° 4' 43.548" N	87° 48' 56.871" E
	4	25° 4' 53.362" N	87° 48' 55.236" E
	5	25° 5' 2.179" N	87° 48' 47.360" E
	6	25° 5' 15.115" N	87° 48' 41.212" E
	7	25° 5' 13.517" N	87° 48' 50.269" E
	8	25° 5' 5.754" N	87° 48' 54.184" E
	9	25° 4' 55.915" N	87° 49' 0.353" E
	10	25° 4' 41.443" N	87° 49' 4.223" E
	11	25° 4' 36.285" N	87° 49' 3.623" E
	12	25° 4' 34.258" N	87° 48' 56.809" E
	13	25° 4' 29.654" N	87° 48' 49.412" E
	14	25° 4' 22.954" N	87° 48' 47.668" E
	15	25° 4' 19.410" N	87° 48' 35.178" E
	16	25° 4' 21.248" N	87° 48' 24.918" E

SANDBAR CODE	POINT_NO	LATITUDE	LONGITUDE
	17	25° 4' 22.961" N	87° 48' 21.750" E
	18	25° 4' 35.037" N	87° 48' 8.648" E
	19	25° 4' 45.401" N	87° 48' 0.782" E
	20	25° 4' 43.871" N	87° 47' 57.372" E
	21	25° 4' 37.112" N	87° 47' 56.471" E
	22	25° 4' 50.181" N	87° 47' 40.866" E
	23	25° 4' 54.725" N	87° 47' 42.378" E
	24	25° 5' 9.340" N	87° 47' 43.771" E
	25	25° 5' 15.978" N	87° 47' 49.127" E
	26	25° 5' 20.896" N	87° 47' 54.236" E
	27	25° 5' 23.612" N	87° 47' 57.063" E
	28	25° 5' 24.079" N	87° 48' 6.134" E
	29	25° 5' 29.747" N	87° 48' 7.871" E
	30	25° 5' 23.517" N	87° 48' 14.631" E
	31	25° 5' 15.248" N	87° 48' 16.844" E
	32	25° 5' 12.080" N	87° 48' 29.858" E
	33	25° 4' 59.148" N	87° 48' 35.440" E
MD_MC_GG_10	1	25° 3' 35.960" N	87° 50' 36.467" E
	2	25° 3' 35.345" N	87° 50' 23.620" E
	3	25° 3' 39.561" N	87° 50' 2.655" E
	4	25° 3' 39.633" N	87° 50' 2.438" E
	5	25° 3' 46.877" N	87° 49' 51.969" E
	6	25° 3' 57.247" N	87° 49' 43.351" E
	7	25° 4' 16.585" N	87° 49' 30.637" E
	8	25° 4' 34.505" N	87° 49' 25.469" E
	9	25° 4' 43.790" N	87° 49' 26.286" E
	10	25° 4' 47.919" N	87° 49' 26.314" E
	11	25° 4' 50.354" N	87° 49' 21.419" E
	12	25° 4' 53.125" N	87° 49' 18.037" E
	13	25° 4' 56.899" N	87° 49' 19.951" E
	14	25° 5' 3.753" N	87° 49' 24.909" E
	15	25° 4' 59.855" N	87° 49' 45.284" E
	16	25° 4' 48.725" N	87° 50' 6.742" E
	17	25° 4' 41.455" N	87° 50' 14.626" E
	18	25° 4' 37.307" N	87° 50' 17.998" E
	19	25° 4' 34.927" N	87° 50' 13.071" E
	20	25° 4' 29.104" N	87° 50' 8.498" E
	21	25° 4' 19.791" N	87° 50' 12.590" E
	22	25° 4' 5.315" N	87° 50' 17.025" E

SANDBAR CODE	POINT_NO	LATITUDE	LONGITUDE
	23	25° 3' 46.656" N	87° 50' 31.252" E
MD_MC_GG_11	1	25° 3' 20.370" N	87° 52' 53.468" E
	2	25° 3' 14.177" N	87° 52' 53.424" E
	3	25° 3' 10.433" N	87° 52' 46.599" E
	4	25° 3' 12.569" N	87° 52' 34.527" E
	5	25° 3' 19.545" N	87° 52' 18.336" E
	6	25° 3' 19.927" N	87° 52' 11.917" E
	7	25° 3' 16.871" N	87° 52' 5.097" E
	8	25° 3' 27.267" N	87° 51' 52.328" E
	9	25° 3' 44.563" N	87° 51' 36.207" E
	10	25° 3' 57.746" N	87° 51' 17.412" E
	11	25° 4' 9.515" N	87° 51' 5.028" E
	12	25° 4' 0.128" N	87° 51' 21.961" E
	13	25° 3' 56.269" N	87° 51' 34.778" E
	14	25° 3' 48.267" N	87° 51' 50.209" E
	15	25° 3' 40.643" N	87° 51' 59.599" E
	16	25° 3' 33.709" N	87° 52' 8.615" E
	17	25° 3' 27.139" N	87° 52' 14.235" E
	18	25° 3' 24.320" N	87° 52' 25.546" E
	19	25° 3' 22.555" N	87° 52' 33.088" E
	20	25° 3' 20.768" N	87° 52' 44.406" E
MD_MC_GG_12	1	25° 0' 39.226" N	87° 56' 57.359" E
	2	25° 0' 22.380" N	87° 56' 55.341" E
	3	25° 0' 31.670" N	87° 56' 44.628" E
	4	25° 0' 35.870" N	87° 56' 44.118" E
	5	25° 0' 50.661" N	87° 56' 44.609" E
	6	25° 1' 4.468" N	87° 56' 37.541" E
	7	25° 1' 6.552" N	87° 56' 34.536" E
	8	25° 1' 14.460" N	87° 56' 35.351" E
	9	25° 1' 1.995" N	87° 56' 47.717" E
	10	25° 0' 54.393" N	87° 56' 52.944" E
MD_MC_GG_13	1	24° 59' 42.945" N	87° 56' 51.435" E
	2	24° 59' 40.226" N	87° 56' 46.129" E
	3	24° 59' 51.947" N	87° 56' 42.444" E
	4	25° 0' 8.781" N	87° 56' 46.348" E
	5	25° 0' 24.951" N	87° 56' 46.472" E
	6	25° 0' 17.234" N	87° 56' 55.892" E
	7	25° 0' 3.221" N	87° 56' 54.989" E
	8	24° 59' 50.834" N	87° 56' 55.271" E

SANDBAR CODE	POINT_NO	LATITUDE	LONGITUDE
MD_KC3_GG_15	1	24° 46' 30.451" N	87° 57' 32.512" E
	2	24° 46' 34.520" N	87° 57' 36.017" E
	3	24° 46' 39.533" N	87° 57' 39.023" E
	4	24° 46' 44.938" N	87° 57' 41.185" E
	5	24° 46' 51.764" N	87° 57' 43.075" E
	6	24° 47' 0.160" N	87° 57' 41.585" E
	7	24° 47' 7.275" N	87° 57' 38.672" E
	8	24° 47' 10.265" N	87° 57' 35.303" E
	9	24° 47' 11.814" N	87° 57' 35.173" E
	10	24° 47' 13.221" N	87° 57' 37.021" E
	11	24° 47' 10.614" N	87° 57' 41.100" E
	12	24° 47' 5.423" N	87° 57' 45.865" E
	13	24° 46' 58.188" N	87° 57' 47.364" E
	14	24° 46' 54.317" N	87° 57' 47.334" E
	15	24° 46' 46.202" N	87° 57' 45.293" E
	16	24° 46' 37.067" N	87° 57' 41.265" E
	17	24° 46' 30.373" N	87° 57' 38.953" E
	18	24° 46' 26.102" N	87° 57' 35.595" E
MD_KC3_GG_16A	1	24° 41' 32.512" N	87° 57' 29.816" E
	2	24° 41' 30.366" N	87° 57' 29.093" E
	3	24° 41' 33.628" N	87° 57' 23.469" E
	4	24° 41' 33.728" N	87° 57' 23.400" E
	5	24° 41' 43.966" N	87° 57' 21.471" E
	6	24° 41' 51.960" N	87° 57' 26.328" E
	7	24° 41' 41.336" N	87° 57' 28.706" E
MD_KC3_GG_16B	1	24° 41' 52.866" N	87° 57' 41.505" E
	2	24° 41' 46.633" N	87° 57' 40.987" E
	3	24° 41' 48.385" N	87° 57' 36.057" E
	4	24° 41' 53.366" N	87° 57' 30.681" E
	5	24° 41' 58.564" N	87° 57' 30.341" E
	6	24° 42' 5.828" N	87° 57' 34.573" E
	7	24° 42' 15.012" N	87° 57' 39.924" E
	8	24° 42' 16.998" N	87° 57' 40.722" E
	9	24° 42' 6.195" N	87° 57' 42.078" E
MD_KC3_GG_17A	1	24° 40' 28.704" N	87° 59' 0.405" E
	2	24° 40' 24.835" N	87° 59' 0.139" E
	3	24° 40' 19.894" N	87° 58' 59.394" E
	4	24° 40' 13.864" N	87° 59' 0.759" E
	5	24° 40' 16.278" N	87° 58' 53.247" E

SANDBAR CODE	POINT_NO	LATITUDE	LONGITUDE
	6	24° 40' 21.903" N	87° 58' 48.114" E
	7	24° 40' 27.977" N	87° 58' 39.924" E
	8	24° 40' 27.566" N	87° 58' 37.097" E
	9	24° 40' 23.686" N	87° 58' 38.479" E
	10	24° 40' 18.951" N	87° 58' 39.148" E
	11	24° 40' 10.747" N	87° 58' 44.026" E
	12	24° 40' 4.713" N	87° 58' 46.097" E
	13	24° 40' 4.727" N	87° 58' 43.871" E
	14	24° 40' 12.487" N	87° 58' 27.013" E
	15	24° 40' 21.217" N	87° 58' 21.280" E
	16	24° 40' 28.987" N	87° 58' 16.869" E
	17	24° 40' 38.901" N	87° 58' 13.415" E
	18	24° 40' 47.095" N	87° 58' 9.949" E
	19	24° 40' 54.859" N	87° 58' 6.478" E
	20	24° 41' 3.038" N	87° 58' 5.365" E
	21	24° 41' 11.692" N	87° 57' 57.194" E
	22	24° 41' 21.617" N	87° 57' 52.092" E
	23	24° 41' 25.345" N	87° 57' 52.788" E
	24	24° 41' 16.273" N	87° 58' 7.418" E
	25	24° 41' 10.736" N	87° 58' 14.703" E
	26	24° 41' 5.757" N	87° 58' 17.154" E
	27	24° 41' 0.771" N	87° 58' 23.470" E
	28	24° 40' 55.566" N	87° 58' 30.255" E
	29	24° 40' 50.337" N	87° 58' 40.569" E
	30	24° 40' 44.039" N	87° 58' 50.170" E
	31	24° 40' 34.528" N	87° 58' 57.626" E
MD_KC3_GG_17B	1	24° 39' 35.676" N	87° 59' 59.035" E
	2	24° 39' 24.906" N	87° 59' 44.767" E
	3	24° 39' 34.685" N	87° 59' 26.828" E
	4	24° 39' 51.273" N	87° 59' 14.535" E
	5	24° 39' 51.408" N	87° 59' 14.702" E
	6	24° 39' 57.008" N	87° 59' 13.334" E
	7	24° 40' 0.883" N	87° 59' 12.659" E
	8	24° 40' 1.960" N	87° 59' 12.432" E
	9	24° 40' 5.611" N	87° 59' 13.167" E
	10	24° 40' 2.537" N	87° 59' 22.791" E
	11	24° 39' 58.844" N	87° 59' 28.409" E
	12	24° 39' 56.013" N	87° 59' 33.799" E
	13	24° 39' 53.189" N	87° 59' 38.013" E

SANDBAR CODE	POINT_NO	LATITUDE	LONGITUDE
	14	24° 39' 48.183" N	87° 59' 47.151" E
	15	24° 39' 46.195" N	87° 59' 53.105" E
	16	24° 39' 39.388" N	88° 0' 1.578" E
MD_CH2_NG_1	1	25° 19' 0.339" N	88° 6' 26.553" E
	2	25° 19' 0.264" N	88° 6' 23.597" E
	3	25° 19' 2.707" N	88° 6' 25.580" E
	4	25° 19' 2.744" N	88° 6' 25.611" E
	5	25° 19' 2.828" N	88° 6' 25.687" E
	6	25° 19' 6.860" N	88° 6' 29.375" E
	7	25° 19' 6.933" N	88° 6' 29.443" E
	8	25° 19' 9.238" N	88° 6' 31.125" E
	9	25° 19' 10.505" N	88° 6' 32.049" E
	10	25° 19' 12.593" N	88° 6' 33.574" E
	11	25° 19' 8.663" N	88° 6' 35.061" E
	12	25° 19' 6.278" N	88° 6' 32.738" E
	13	25° 19' 3.547" N	88° 6' 29.988" E
MD_CH2_NG_2	1	25° 18' 36.869" N	88° 6' 16.978" E
	2	25° 18' 36.626" N	88° 6' 16.241" E
	3	25° 18' 38.725" N	88° 6' 16.185" E
	4	25° 18' 43.856" N	88° 6' 15.474" E
	5	25° 18' 48.839" N	88° 6' 16.314" E
	6	25° 18' 51.575" N	88° 6' 18.421" E
	7	25° 18' 51.553" N	88° 6' 20.058" E
	8	25° 18' 51.139" N	88° 6' 19.595" E
	9	25° 18' 48.675" N	88° 6' 18.179" E
	10	25° 18' 47.208" N	88° 6' 17.822" E
	11	25° 18' 45.467" N	88° 6' 17.398" E
	12	25° 18' 45.431" N	88° 6' 17.394" E
	13	25° 18' 42.085" N	88° 6' 16.979" E
	14	25° 18' 40.197" N	88° 6' 16.802" E
	15	25° 18' 39.359" N	88° 6' 16.724" E
	16	25° 18' 38.857" N	88° 6' 16.677" E
	17	25° 18' 37.629" N	88° 6' 16.863" E
MD_CH2_NG_3	1	25° 17' 35.362" N	88° 6' 21.022" E
	2	25° 17' 35.270" N	88° 6' 19.166" E
	3	25° 17' 36.942" N	88° 6' 20.650" E
	4	25° 17' 40.333" N	88° 6' 24.580" E
	5	25° 17' 41.758" N	88° 6' 26.136" E
	6	25° 17' 42.931" N	88° 6' 27.417" E

SANDBAR CODE	POINT_NO	LATITUDE	LONGITUDE
	7	25° 17' 43.913" N	88° 6' 28.429" E
	8	25° 17' 45.412" N	88° 6' 29.975" E
	9	25° 17' 47.970" N	88° 6' 30.282" E
	10	25° 17' 48.081" N	88° 6' 30.296" E
	11	25° 17' 51.871" N	88° 6' 30.303" E
	12	25° 17' 52.041" N	88° 6' 30.303" E
	13	25° 17' 52.922" N	88° 6' 30.081" E
	14	25° 17' 56.755" N	88° 6' 28.389" E
	15	25° 17' 59.274" N	88° 6' 27.277" E
	16	25° 18' 1.086" N	88° 6' 26.432" E
	17	25° 18' 6.222" N	88° 6' 24.039" E
	18	25° 18' 7.071" N	88° 6' 23.644" E
	19	25° 18' 9.577" N	88° 6' 22.724" E
	20	25° 18' 13.613" N	88° 6' 21.243" E
	21	25° 18' 14.658" N	88° 6' 20.860" E
	22	25° 18' 14.993" N	88° 6' 22.224" E
	23	25° 18' 13.049" N	88° 6' 23.483" E
	24	25° 18' 8.365" N	88° 6' 25.314" E
	25	25° 18' 2.954" N	88° 6' 27.734" E
	26	25° 17' 59.380" N	88° 6' 29.433" E
	27	25° 17' 55.601" N	88° 6' 31.017" E
	28	25° 17' 53.895" N	88° 6' 31.540" E
	29	25° 17' 52.673" N	88° 6' 31.624" E
	30	25° 17' 50.710" N	88° 6' 31.890" E
	31	25° 17' 48.747" N	88° 6' 32.099" E
	32	25° 17' 44.931" N	88° 6' 31.837" E
	33	25° 17' 42.013" N	88° 6' 28.632" E
	34	25° 17' 40.687" N	88° 6' 26.576" E
	35	25° 17' 38.485" N	88° 6' 24.342" E
MD_CH2_NG_4A	1	25° 17' 22.894" N	88° 6' 7.995" E
	2	25° 17' 21.827" N	88° 6' 5.715" E
	3	25° 17' 23.024" N	88° 6' 4.307" E
	4	25° 17' 24.418" N	88° 6' 4.883" E
	5	25° 17' 24.607" N	88° 6' 4.993" E
	6	25° 17' 26.255" N	88° 6' 7.004" E
	7	25° 17' 27.626" N	88° 6' 9.968" E
	8	25° 17' 27.764" N	88° 6' 12.296" E
	9	25° 17' 26.422" N	88° 6' 12.284" E
	10	25° 17' 24.838" N	88° 6' 10.227" E

SANDBAR CODE	POINT_NO	LATITUDE	LONGITUDE
	11	25° 17' 23.621" N	88° 6' 8.830" E
	12	25° 17' 23.356" N	88° 6' 8.385" E
	13	25° 17' 22.983" N	88° 6' 8.097" E
MD_CH2_NG_4B	1	25° 17' 9.143" N	88° 6' 16.077" E
	2	25° 17' 8.697" N	88° 6' 15.586" E
	3	25° 17' 8.862" N	88° 6' 14.282" E
	4	25° 17' 10.325" N	88° 6' 11.798" E
	5	25° 17' 11.993" N	88° 6' 9.543" E
	6	25° 17' 15.318" N	88° 6' 6.621" E
	7	25° 17' 16.979" N	88° 6' 5.331" E
	8	25° 17' 18.994" N	88° 6' 4.952" E
	9	25° 17' 19.801" N	88° 6' 6.314" E
	10	25° 17' 18.647" N	88° 6' 6.084" E
	11	25° 17' 16.304" N	88° 6' 7.036" E
	12	25° 17' 14.492" N	88° 6' 8.558" E
	13	25° 17' 14.160" N	88° 6' 8.837" E
	14	25° 17' 13.741" N	88° 6' 9.445" E
	15	25° 17' 12.038" N	88° 6' 11.920" E
	16	25° 17' 9.865" N	88° 6' 15.130" E
MD_CH2_NG_5	1	25° 16' 46.288" N	88° 6' 16.675" E
	2	25° 16' 40.997" N	88° 6' 13.705" E
	3	25° 16' 41.524" N	88° 6' 10.364" E
	4	25° 16' 42.510" N	88° 6' 11.080" E
	5	25° 16' 44.123" N	88° 6' 12.253" E
	6	25° 16' 47.451" N	88° 6' 14.408" E
	7	25° 16' 51.761" N	88° 6' 18.025" E
	8	25° 16' 49.821" N	88° 6' 18.717" E
MD_CH2_NG_6	1	25° 16' 30.353" N	88° 6' 5.416" E
	2	25° 16' 23.616" N	88° 6' 0.625" E
	3	25° 16' 25.254" N	88° 5' 59.842" E
	4	25° 16' 26.204" N	88° 6' 0.125" E
	5	25° 16' 30.446" N	88° 6' 2.577" E
	6	25° 16' 32.052" N	88° 6' 3.505" E
	7	25° 16' 38.717" N	88° 6' 8.325" E
	8	25° 16' 38.973" N	88° 6' 8.511" E
	9	25° 16' 40.237" N	88° 6' 9.429" E
	10	25° 16' 39.865" N	88° 6' 13.069" E
MD_RT2_NG_7	1	25° 15' 5.281" N	88° 5' 22.835" E
	2	25° 15' 2.346" N	88° 5' 22.629" E

SANDBAR CODE	POINT_NO	LATITUDE	LONGITUDE
	3	25° 15' 2.373" N	88° 5' 22.449" E
	4	25° 15' 2.423" N	88° 5' 22.063" E
	5	25° 15' 2.465" N	88° 5' 21.676" E
	6	25° 15' 2.500" N	88° 5' 21.288" E
	7	25° 15' 2.527" N	88° 5' 20.900" E
	8	25° 15' 2.545" N	88° 5' 20.538" E
	9	25° 15' 4.111" N	88° 5' 20.122" E
	10	25° 15' 5.568" N	88° 5' 20.892" E
	11	25° 15' 7.924" N	88° 5' 22.047" E
	12	25° 15' 9.203" N	88° 5' 23.619" E
	13	25° 15' 9.763" N	88° 5' 25.249" E
	14	25° 15' 8.564" N	88° 5' 24.335" E
MD_RT2_NG_8	1	25° 15' 2.373" N	88° 5' 17.013" E
	2	25° 15' 2.360" N	88° 5' 16.926" E
	3	25° 15' 2.557" N	88° 5' 16.784" E
	4	25° 15' 4.857" N	88° 5' 16.422" E
	5	25° 15' 6.526" N	88° 5' 16.639" E
	6	25° 15' 7.898" N	88° 5' 16.818" E
	7	25° 15' 12.040" N	88° 5' 20.343" E
	8	25° 15' 14.909" N	88° 5' 23.903" E
	9	25° 15' 14.108" N	88° 5' 24.769" E
	10	25° 15' 12.818" N	88° 5' 24.758" E
	11	25° 15' 11.763" N	88° 5' 22.030" E
	12	25° 15' 10.910" N	88° 5' 21.076" E
	13	25° 15' 8.879" N	88° 5' 19.521" E
	14	25° 15' 6.845" N	88° 5' 18.321" E
	15	25° 15' 4.591" N	88° 5' 17.828" E
	16	25° 15' 2.760" N	88° 5' 18.166" E
	17	25° 15' 2.511" N	88° 5' 18.339" E
	18	25° 15' 2.500" N	88° 5' 18.174" E
	19	25° 15' 2.465" N	88° 5' 17.786" E
	20	25° 15' 2.423" N	88° 5' 17.399" E
MD_RT2_NG_9	1	25° 13' 49.475" N	88° 5' 13.140" E
	2	25° 13' 47.337" N	88° 5' 11.466" E
	3	25° 13' 51.325" N	88° 5' 10.084" E
	4	25° 13' 56.065" N	88° 5' 8.825" E
	5	25° 14' 1.771" N	88° 5' 7.812" E
	6	25° 14' 6.395" N	88° 5' 7.617" E
	7	25° 14' 6.052" N	88° 5' 10.451" E

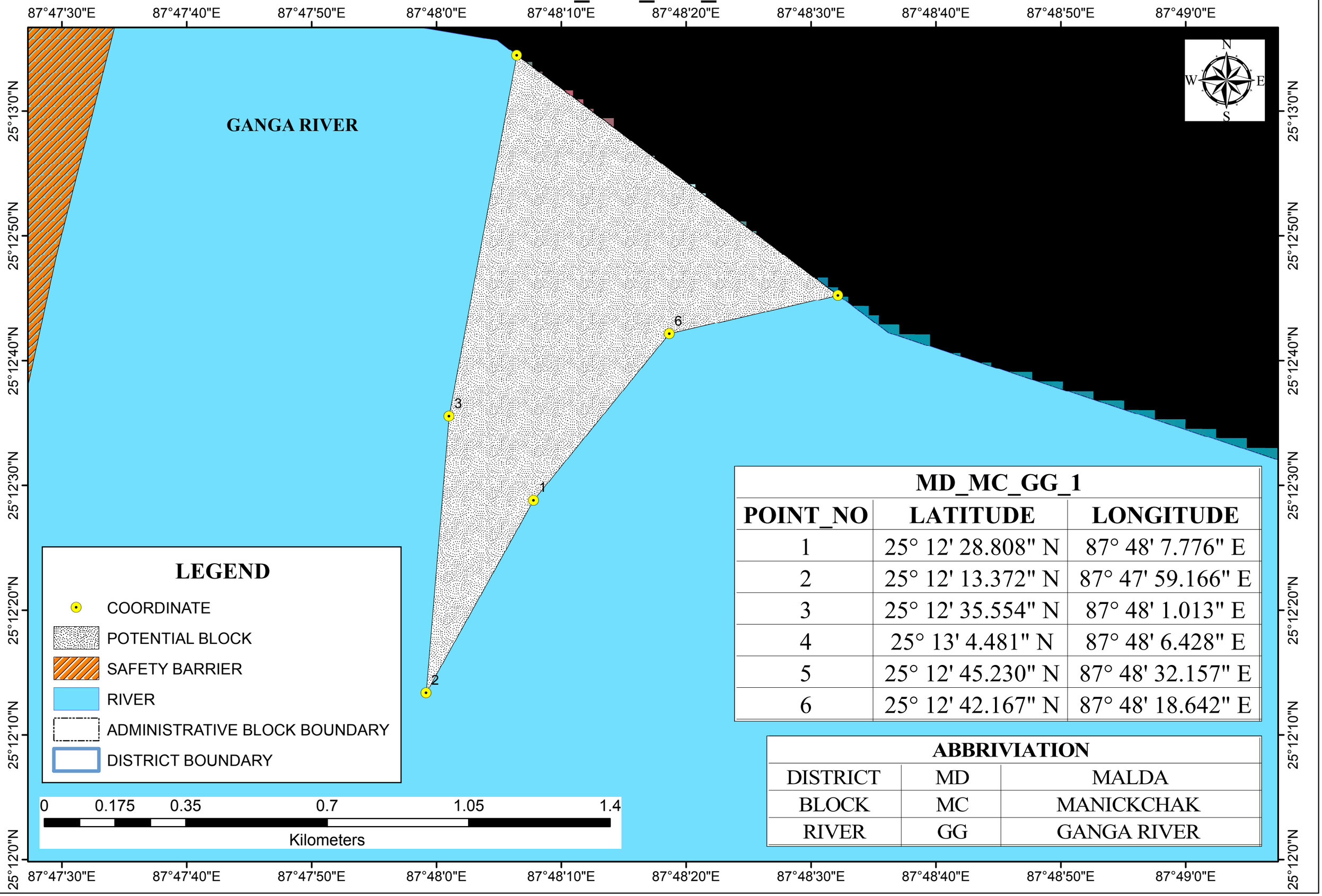
SANDBAR CODE	POINT_NO	LATITUDE	LONGITUDE
	8	25° 14' 4.110" N	88° 5' 11.379" E
	9	25° 14' 0.666" N	88° 5' 11.821" E
	10	25° 13' 57.304" N	88° 5' 13.428" E
	11	25° 13' 56.067" N	88° 5' 13.789" E
	12	25° 13' 52.477" N	88° 5' 14.349" E
MD_RT2_NG_11	1	25° 11' 23.570" N	88° 5' 39.860" E
	2	25° 11' 22.592" N	88° 5' 37.166" E
	3	25° 11' 21.873" N	88° 5' 34.400" E
	4	25° 11' 22.282" N	88° 5' 32.513" E
	5	25° 11' 23.236" N	88° 5' 32.729" E
	6	25° 11' 23.035" N	88° 5' 32.869" E
	7	25° 11' 23.350" N	88° 5' 34.630" E
	8	25° 11' 23.409" N	88° 5' 34.957" E
	9	25° 11' 24.502" N	88° 5' 38.455" E
	10	25° 11' 25.364" N	88° 5' 40.882" E
	11	25° 11' 25.770" N	88° 5' 42.028" E
	12	25° 11' 25.136" N	88° 5' 42.010" E
	13	25° 11' 24.230" N	88° 5' 41.246" E
MD_RT2_NG_12	1	25° 9' 21.712" N	88° 3' 45.802" E
	2	25° 9' 21.053" N	88° 3' 44.180" E
	3	25° 9' 21.195" N	88° 3' 38.870" E
	4	25° 9' 22.484" N	88° 3' 36.594" E
	5	25° 9' 25.775" N	88° 3' 35.772" E
	6	25° 9' 28.337" N	88° 3' 35.926" E
	7	25° 9' 28.543" N	88° 3' 36.350" E
	8	25° 9' 25.039" N	88° 3' 36.956" E
	9	25° 9' 22.912" N	88° 3' 38.574" E
	10	25° 9' 21.748" N	88° 3' 42.722" E
MD_MDO_MH_1	1	25° 1' 54.904" N	88° 8' 8.714" E
	2	25° 1' 48.204" N	88° 8' 7.519" E
	3	25° 1' 48.610" N	88° 8' 5.116" E
	4	25° 1' 52.496" N	88° 8' 3.028" E
	5	25° 1' 58.245" N	88° 8' 2.977" E
	6	25° 1' 58.571" N	88° 8' 5.068" E
	7	25° 1' 58.585" N	88° 8' 5.154" E
	8	25° 1' 58.650" N	88° 8' 5.537" E
	9	25° 1' 58.723" N	88° 8' 5.918" E
	10	25° 1' 58.804" N	88° 8' 6.296" E
	11	25° 1' 58.892" N	88° 8' 6.673" E

SANDBAR CODE	POINT_NO	LATITUDE	LONGITUDE
	12	25° 1' 58.987" N	88° 8' 7.048" E
	13	25° 1' 59.090" N	88° 8' 7.420" E
	14	25° 1' 59.200" N	88° 8' 7.790" E
	15	25° 1' 59.318" N	88° 8' 8.157" E
	16	25° 1' 59.443" N	88° 8' 8.522" E
	17	25° 1' 59.447" N	88° 8' 8.533" E
	18	25° 1' 58.493" N	88° 8' 8.747" E
MD_EB_MH_2	1	25° 1' 32.208" N	88° 8' 7.372" E
	2	25° 1' 30.801" N	88° 8' 5.660" E
	3	25° 1' 34.298" N	88° 8' 3.993" E
	4	25° 1' 35.695" N	88° 8' 3.556" E
	5	25° 1' 38.467" N	88° 8' 3.039" E
	6	25° 1' 38.731" N	88° 8' 3.048" E
	7	25° 1' 38.931" N	88° 8' 5.452" E
	8	25° 1' 38.407" N	88° 8' 6.438" E
	9	25° 1' 36.329" N	88° 8' 8.260" E
	10	25° 1' 33.750" N	88° 8' 8.094" E
MD_EB_MH_3	1	25° 0' 10.749" N	88° 9' 20.807" E
	2	25° 0' 8.319" N	88° 9' 18.095" E
	3	25° 0' 12.382" N	88° 9' 16.532" E
	4	25° 0' 13.472" N	88° 9' 16.162" E
	5	25° 0' 17.899" N	88° 9' 14.561" E
	6	25° 0' 18.409" N	88° 9' 14.243" E
	7	25° 0' 23.588" N	88° 9' 12.291" E
	8	25° 0' 28.143" N	88° 9' 7.502" E
	9	25° 0' 30.065" N	88° 9' 6.605" E
	10	25° 0' 31.375" N	88° 9' 6.276" E
	11	25° 0' 28.750" N	88° 9' 12.056" E
	12	25° 0' 24.319" N	88° 9' 17.819" E
	13	25° 0' 18.613" N	88° 9' 21.589" E
	14	25° 0' 14.610" N	88° 9' 22.117" E
MD_EB_MH_4	1	24° 58' 1.049" N	88° 10' 18.108" E
	2	24° 57' 58.726" N	88° 10' 18.051" E
	3	24° 57' 58.839" N	88° 10' 17.884" E
	4	24° 57' 59.642" N	88° 10' 16.703" E
	5	24° 58' 1.484" N	88° 10' 13.427" E
	6	24° 58' 4.194" N	88° 10' 9.604" E
	7	24° 58' 6.779" N	88° 10' 6.295" E
	8	24° 58' 9.772" N	88° 10' 3.438" E

SANDBAR CODE	POINT_NO	LATITUDE	LONGITUDE
	9	24° 58' 8.799" N	88° 10' 5.915" E
	10	24° 58' 5.659" N	88° 10' 11.500" E
	11	24° 58' 3.176" N	88° 10' 15.581" E
MD_EB_KD_1	1	25° 3' 40.128" N	88° 3' 58.019" E
	2	25° 3' 38.674" N	88° 3' 56.453" E
	3	25° 3' 41.250" N	88° 3' 52.320" E
	4	25° 3' 45.230" N	88° 3' 49.106" E
	5	25° 3' 49.137" N	88° 3' 46.420" E
	6	25° 3' 51.828" N	88° 3' 45.310" E
	7	25° 3' 52.815" N	88° 3' 45.827" E
	8	25° 3' 52.583" N	88° 3' 45.990" E
	9	25° 3' 51.000" N	88° 3' 47.412" E
	10	25° 3' 49.638" N	88° 3' 48.640" E
	11	25° 3' 48.099" N	88° 3' 50.046" E
	12	25° 3' 45.695" N	88° 3' 52.410" E
	13	25° 3' 43.397" N	88° 3' 54.490" E
	14	25° 3' 41.441" N	88° 3' 56.397" E
MD_EB_KD_2	1	25° 3' 44.269" N	88° 5' 54.010" E
	2	25° 3' 43.012" N	88° 5' 58.090" E
	3	25° 3' 41.043" N	88° 6' 1.004" E
	4	25° 3' 39.739" N	88° 6' 2.059" E
	5	25° 3' 38.380" N	88° 6' 1.750" E
	6	25° 3' 36.781" N	88° 6' 1.679" E
	7	25° 3' 40.700" N	88° 5' 55.029" E
	8	25° 3' 43.164" N	88° 5' 49.895" E
	9	25° 3' 43.065" N	88° 5' 42.245" E
	10	25° 3' 41.522" N	88° 5' 34.583" E
	11	25° 3' 39.053" N	88° 5' 26.459" E
	12	25° 3' 37.894" N	88° 5' 15.628" E
	13	25° 3' 39.679" N	88° 5' 15.001" E
	14	25° 3' 40.323" N	88° 5' 18.699" E
	15	25° 3' 41.836" N	88° 5' 23.622" E
	16	25° 3' 43.389" N	88° 5' 28.392" E
	17	25° 3' 44.776" N	88° 5' 33.808" E
	18	25° 3' 45.967" N	88° 5' 39.112" E
	19	25° 3' 46.507" N	88° 5' 40.835" E
	20	25° 3' 46.127" N	88° 5' 44.183" E
	21	25° 3' 45.273" N	88° 5' 49.863" E

Annexure 4
Map showing of Potential Blocks of Malda District

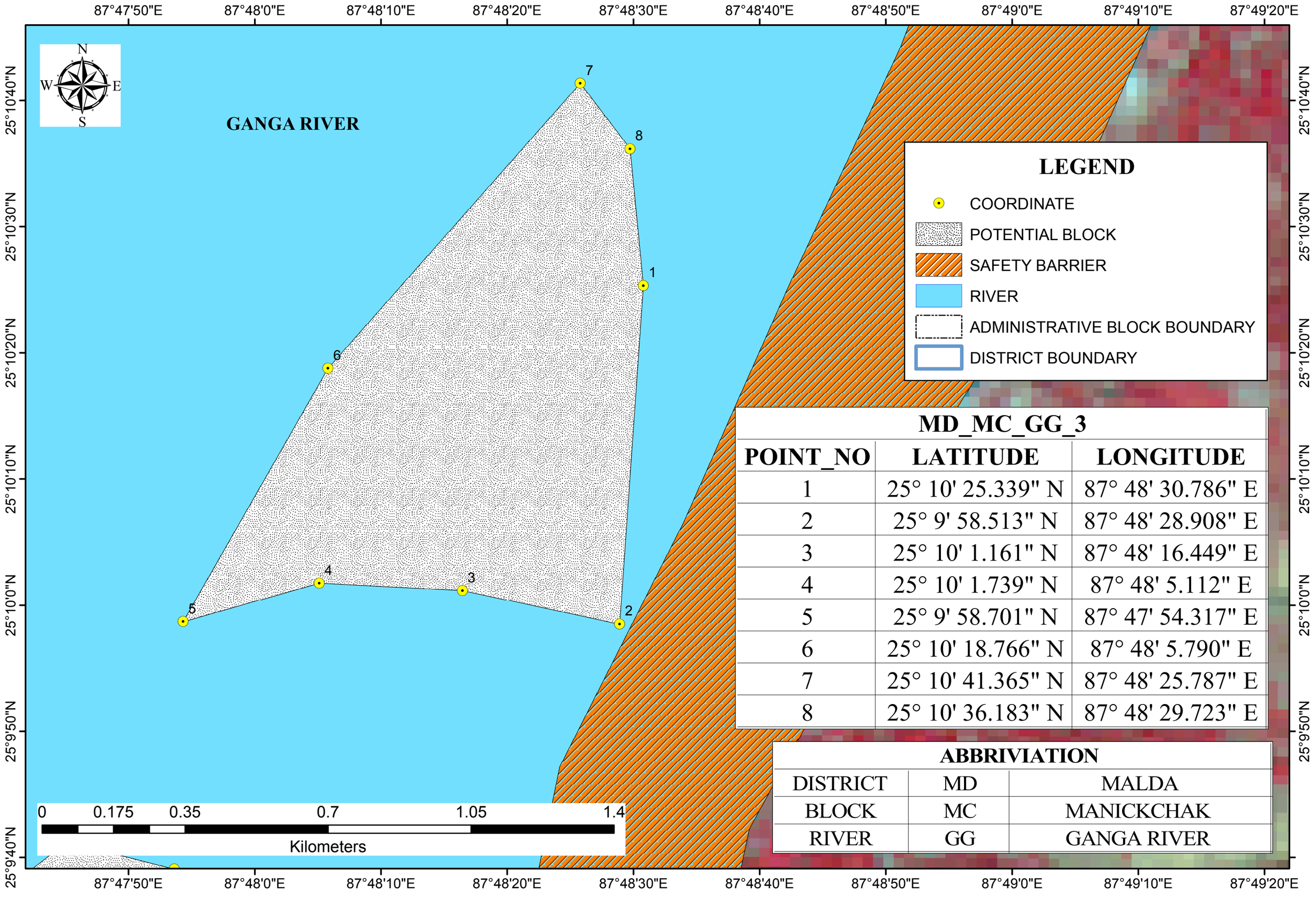
POTENTIAL BLOCK MD_MC_GG_1 OF GANGA RIVER



MD_MC_GG_1		
POINT_NO	**LATITUDE**	**LONGITUDE**
1	25° 12' 28.808" N	87° 48' 7.776" E
2	25° 12' 13.372" N	87° 47' 59.166" E
3	25° 12' 35.554" N	87° 48' 1.013" E
4	25° 13' 4.481" N	87° 48' 6.428" E
5	25° 12' 45.230" N	87° 48' 32.157" E
6	25° 12' 42.167" N	87° 48' 18.642" E

ABBRIVIATION		
DISTRICT	MD	MALDA
BLOCK	MC	MANICKCHAK
RIVER	GG	GANGA RIVER

POTENTIAL BLOCK MD_MC_GG_3 OF GANGA RIVER



LEGEND

- COORDINATE
- POTENTIAL BLOCK
- SAFETY BARRIER
- RIVER
- ADMINISTRATIVE BLOCK BOUNDARY
- DISTRICT BOUNDARY

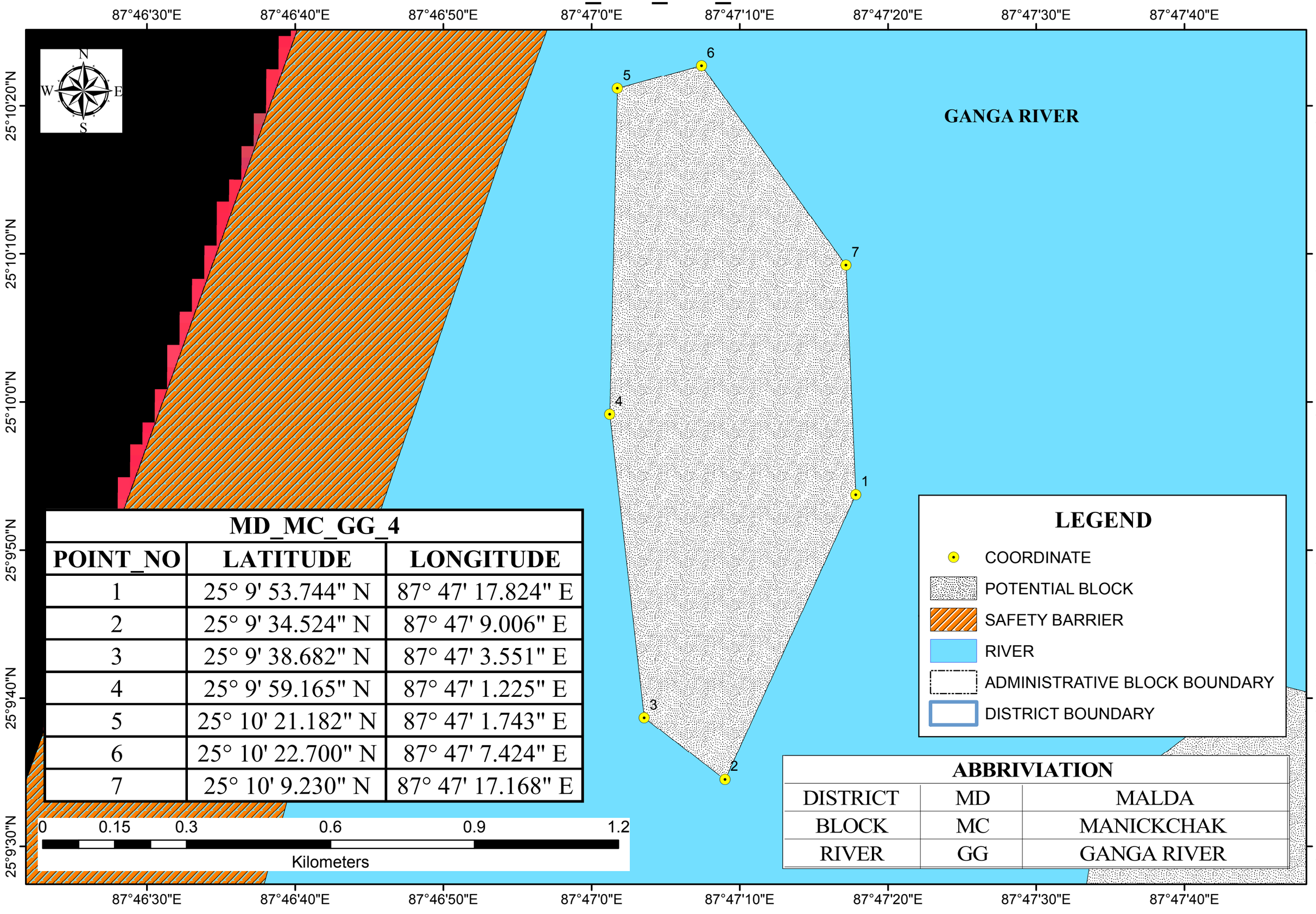
MD_MC_GG_3

POINT_NO	LATITUDE	LONGITUDE
1	25° 10' 25.339" N	87° 48' 30.786" E
2	25° 9' 58.513" N	87° 48' 28.908" E
3	25° 10' 1.161" N	87° 48' 16.449" E
4	25° 10' 1.739" N	87° 48' 5.112" E
5	25° 9' 58.701" N	87° 47' 54.317" E
6	25° 10' 18.766" N	87° 48' 5.790" E
7	25° 10' 41.365" N	87° 48' 25.787" E
8	25° 10' 36.183" N	87° 48' 29.723" E

ABBRIVIATION

DISTRICT	MD	MALDA
BLOCK	MC	MANICKCHAK
RIVER	GG	GANGA RIVER

POTENTIAL BLOCK MD_MC_GG_4 OF GANGA RIVER



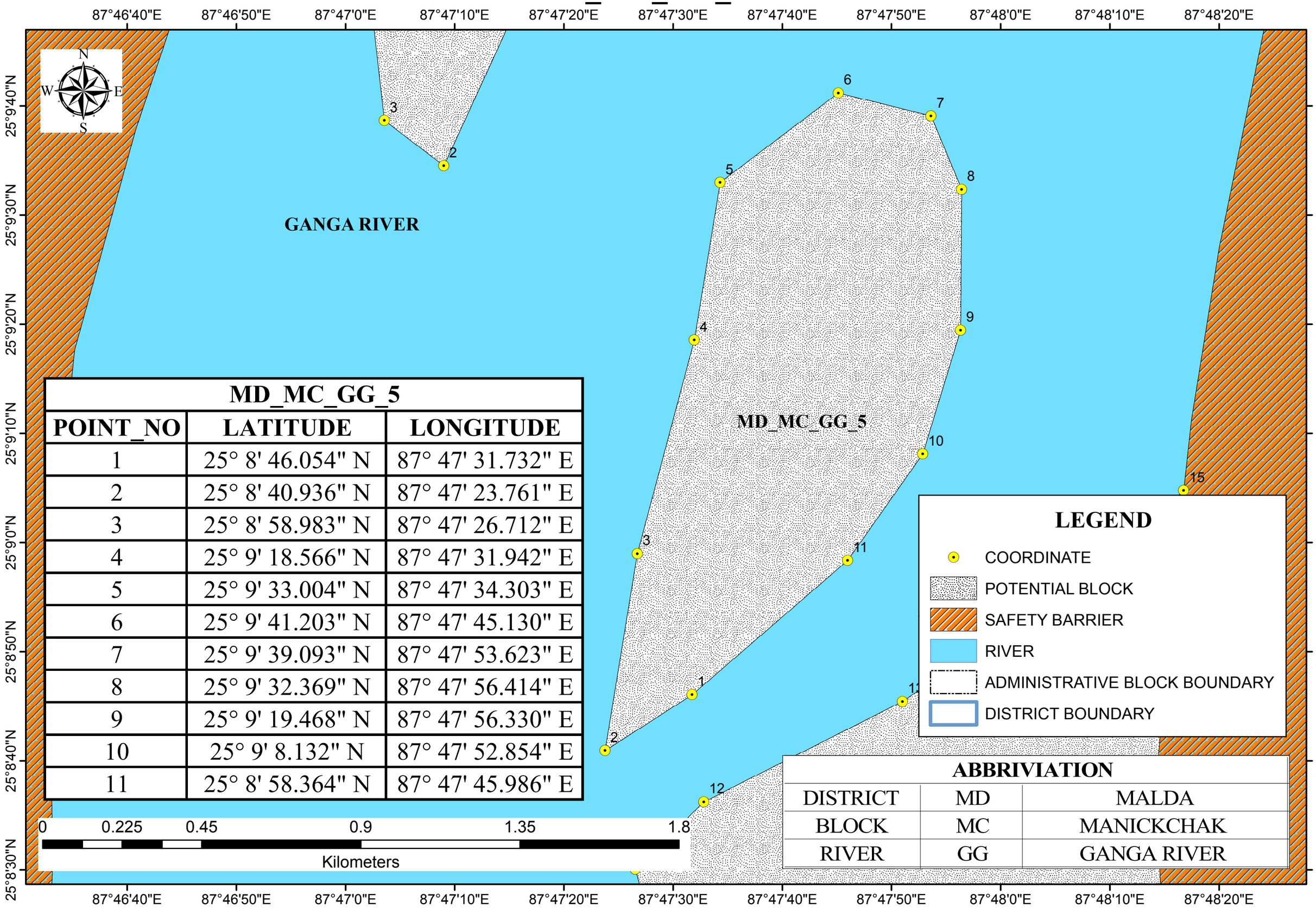
MD_MC_GG_4		
POINT_NO	LATITUDE	LONGITUDE
1	25° 9' 53.744" N	87° 47' 17.824" E
2	25° 9' 34.524" N	87° 47' 9.006" E
3	25° 9' 38.682" N	87° 47' 3.551" E
4	25° 9' 59.165" N	87° 47' 1.225" E
5	25° 10' 21.182" N	87° 47' 1.743" E
6	25° 10' 22.700" N	87° 47' 7.424" E
7	25° 10' 9.230" N	87° 47' 17.168" E

LEGEND

- COORDINATE
- POTENTIAL BLOCK
- SAFETY BARRIER
- RIVER
- ADMINISTRATIVE BLOCK BOUNDARY
- DISTRICT BOUNDARY

ABBRIVIATION		
DISTRICT	MD	MALDA
BLOCK	MC	MANICKCHAK
RIVER	GG	GANGA RIVER

POTENTIAL BLOCK MD_MC_GG_5 OF GANGA RIVER



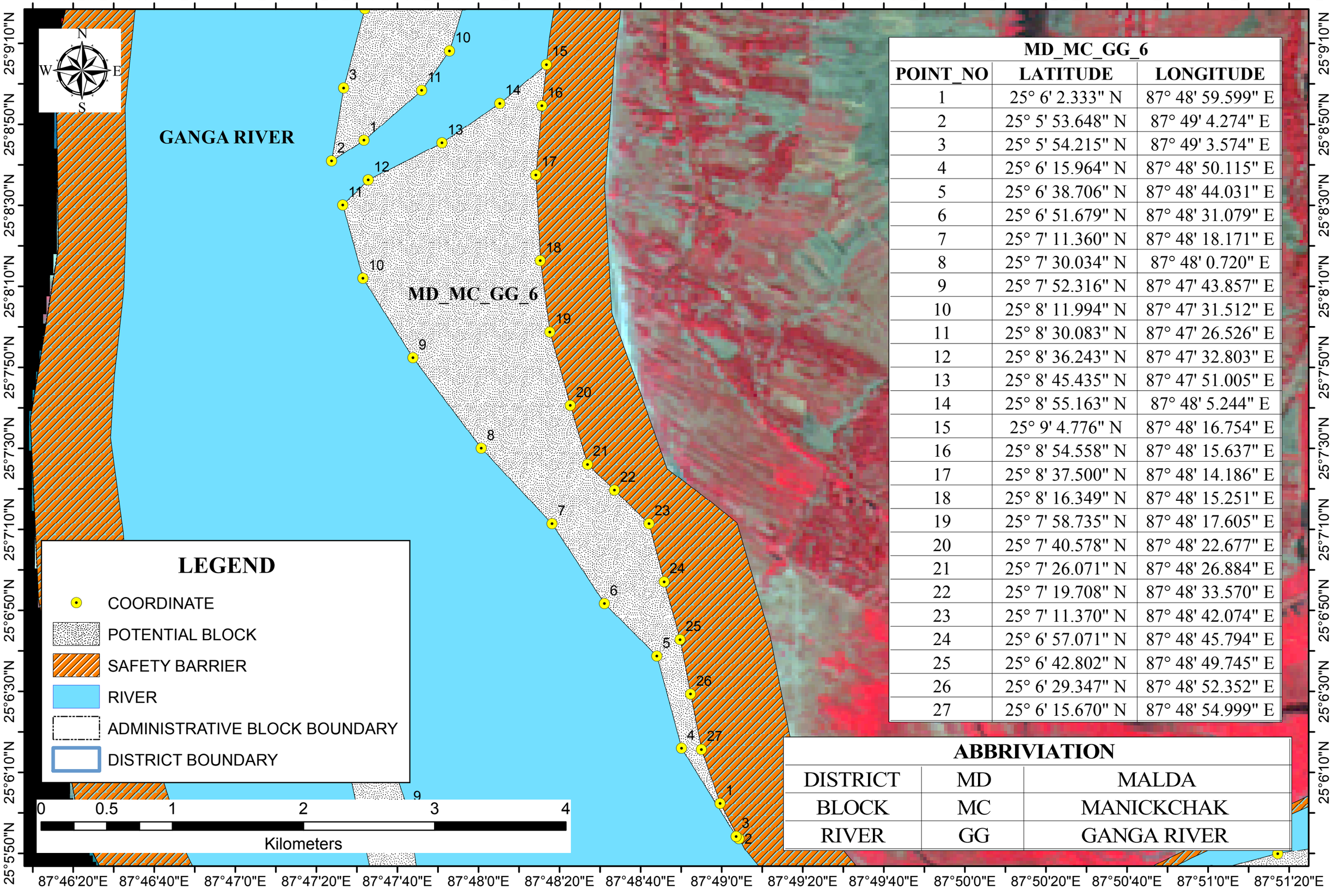
MD_MC_GG_5		
POINT_NO	LATITUDE	LONGITUDE
1	25° 8' 46.054" N	87° 47' 31.732" E
2	25° 8' 40.936" N	87° 47' 23.761" E
3	25° 8' 58.983" N	87° 47' 26.712" E
4	25° 9' 18.566" N	87° 47' 31.942" E
5	25° 9' 33.004" N	87° 47' 34.303" E
6	25° 9' 41.203" N	87° 47' 45.130" E
7	25° 9' 39.093" N	87° 47' 53.623" E
8	25° 9' 32.369" N	87° 47' 56.414" E
9	25° 9' 19.468" N	87° 47' 56.330" E
10	25° 9' 8.132" N	87° 47' 52.854" E
11	25° 8' 58.364" N	87° 47' 45.986" E

LEGEND

- COORDINATE
- POTENTIAL BLOCK
- SAFETY BARRIER
- RIVER
- ADMINISTRATIVE BLOCK BOUNDARY
- DISTRICT BOUNDARY

ABBRIVIATION		
DISTRICT	MD	MALDA
BLOCK	MC	MANICKCHAK
RIVER	GG	GANGA RIVER

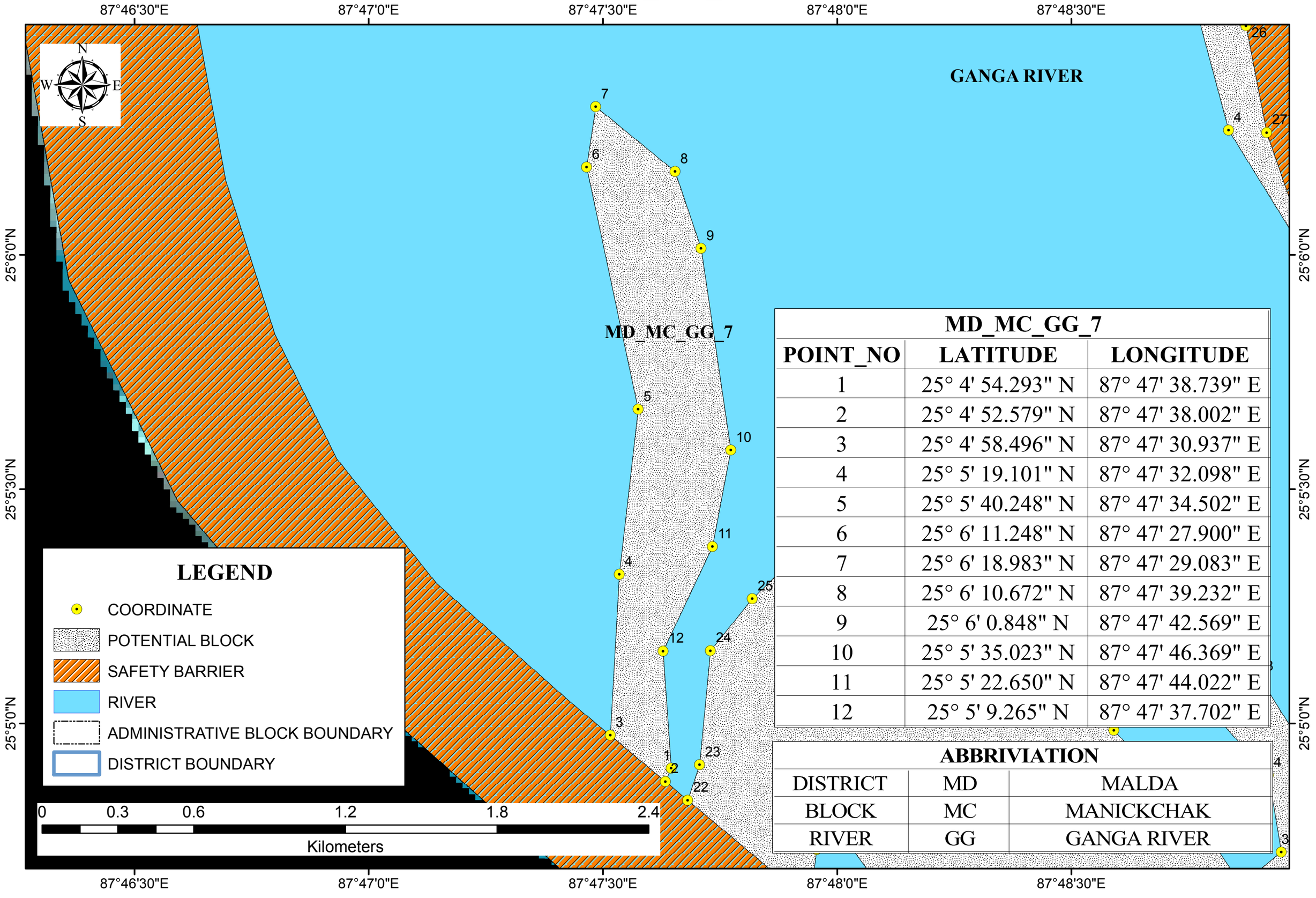
POTENTIAL BLOCK MD_MC_GG_6 OF GANGA RIVER



MD_MC_GG_6		
POINT_NO	LATITUDE	LONGITUDE
1	25° 6' 2.333" N	87° 48' 59.599" E
2	25° 5' 53.648" N	87° 49' 4.274" E
3	25° 5' 54.215" N	87° 49' 3.574" E
4	25° 6' 15.964" N	87° 48' 50.115" E
5	25° 6' 38.706" N	87° 48' 44.031" E
6	25° 6' 51.679" N	87° 48' 31.079" E
7	25° 7' 11.360" N	87° 48' 18.171" E
8	25° 7' 30.034" N	87° 48' 0.720" E
9	25° 7' 52.316" N	87° 47' 43.857" E
10	25° 8' 11.994" N	87° 47' 31.512" E
11	25° 8' 30.083" N	87° 47' 26.526" E
12	25° 8' 36.243" N	87° 47' 32.803" E
13	25° 8' 45.435" N	87° 47' 51.005" E
14	25° 8' 55.163" N	87° 48' 5.244" E
15	25° 9' 4.776" N	87° 48' 16.754" E
16	25° 8' 54.558" N	87° 48' 15.637" E
17	25° 8' 37.500" N	87° 48' 14.186" E
18	25° 8' 16.349" N	87° 48' 15.251" E
19	25° 7' 58.735" N	87° 48' 17.605" E
20	25° 7' 40.578" N	87° 48' 22.677" E
21	25° 7' 26.071" N	87° 48' 26.884" E
22	25° 7' 19.708" N	87° 48' 33.570" E
23	25° 7' 11.370" N	87° 48' 42.074" E
24	25° 6' 57.071" N	87° 48' 45.794" E
25	25° 6' 42.802" N	87° 48' 49.745" E
26	25° 6' 29.347" N	87° 48' 52.352" E
27	25° 6' 15.670" N	87° 48' 54.999" E

ABBRIVIATION		
DISTRICT	MD	MALDA
BLOCK	MC	MANICKCHAK
RIVER	GG	GANGA RIVER

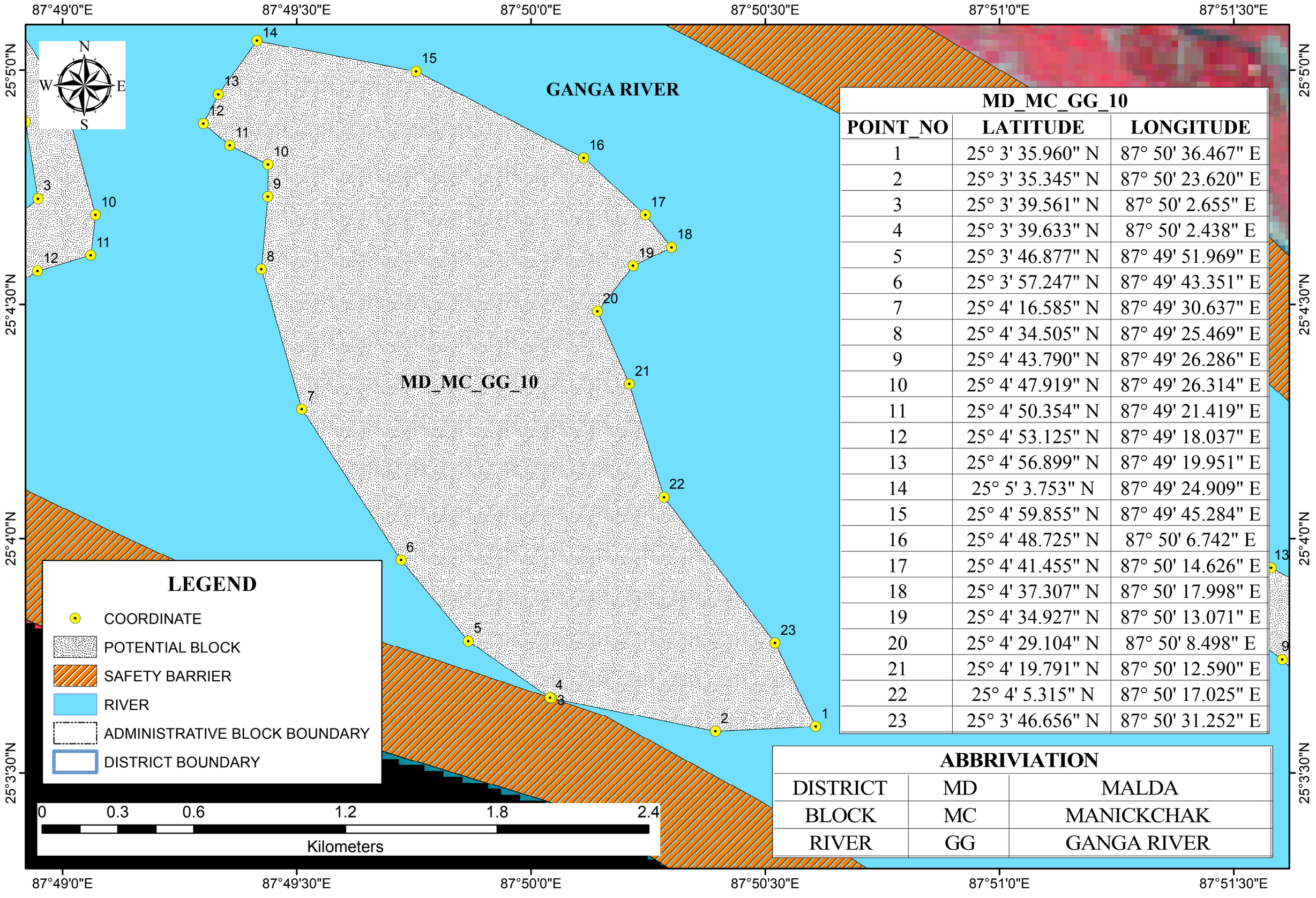
POTENTIAL BLOCK MD_MC_GG_7 OF GANGA RIVER



MD_MC_GG_7		
POINT_NO	LATITUDE	LONGITUDE
1	25° 4' 54.293" N	87° 47' 38.739" E
2	25° 4' 52.579" N	87° 47' 38.002" E
3	25° 4' 58.496" N	87° 47' 30.937" E
4	25° 5' 19.101" N	87° 47' 32.098" E
5	25° 5' 40.248" N	87° 47' 34.502" E
6	25° 6' 11.248" N	87° 47' 27.900" E
7	25° 6' 18.983" N	87° 47' 29.083" E
8	25° 6' 10.672" N	87° 47' 39.232" E
9	25° 6' 0.848" N	87° 47' 42.569" E
10	25° 5' 35.023" N	87° 47' 46.369" E
11	25° 5' 22.650" N	87° 47' 44.022" E
12	25° 5' 9.265" N	87° 47' 37.702" E

ABBRIVIATION		
DISTRICT	MD	MALDA
BLOCK	MC	MANICKCHAK
RIVER	GG	GANGA RIVER

POTENTIAL BLOCK MD_MC_GG_10 OF GANGA RIVER



MD_MC_GG_10		
POINT_NO	LATITUDE	LONGITUDE
1	25° 3' 35.960" N	87° 50' 36.467" E
2	25° 3' 35.345" N	87° 50' 23.620" E
3	25° 3' 39.561" N	87° 50' 2.655" E
4	25° 3' 39.633" N	87° 50' 2.438" E
5	25° 3' 46.877" N	87° 49' 51.969" E
6	25° 3' 57.247" N	87° 49' 43.351" E
7	25° 4' 16.585" N	87° 49' 30.637" E
8	25° 4' 34.505" N	87° 49' 25.469" E
9	25° 4' 43.790" N	87° 49' 26.286" E
10	25° 4' 47.919" N	87° 49' 26.314" E
11	25° 4' 50.354" N	87° 49' 21.419" E
12	25° 4' 53.125" N	87° 49' 18.037" E
13	25° 4' 56.899" N	87° 49' 19.951" E
14	25° 5' 3.753" N	87° 49' 24.909" E
15	25° 4' 59.855" N	87° 49' 45.284" E
16	25° 4' 48.725" N	87° 50' 6.742" E
17	25° 4' 41.455" N	87° 50' 14.626" E
18	25° 4' 37.307" N	87° 50' 17.998" E
19	25° 4' 34.927" N	87° 50' 13.071" E
20	25° 4' 29.104" N	87° 50' 8.498" E
21	25° 4' 19.791" N	87° 50' 12.590" E
22	25° 4' 5.315" N	87° 50' 17.025" E
23	25° 3' 46.656" N	87° 50' 31.252" E

ABBRIVIATION		
DISTRICT	MD	MALDA
BLOCK	MC	MANICKCHAK
RIVER	GG	GANGA RIVER

POTENTIAL BLOCK MD_MC_GG_11 OF GANGA RIVER

87°51'0"E 87°51'30"E 87°52'0"E 87°52'30"E 87°53'0"E

25°4'0"N 25°3'30"N 25°2'30"N

N W E S

MD_MC_GG_11		
POINT_NO	LATITUDE	LONGITUDE
1	25° 3' 20.370" N	87° 52' 53.468" E
2	25° 3' 14.177" N	87° 52' 53.424" E
3	25° 3' 10.433" N	87° 52' 46.599" E
4	25° 3' 12.569" N	87° 52' 34.527" E
5	25° 3' 19.545" N	87° 52' 18.336" E
6	25° 3' 19.927" N	87° 52' 11.917" E
7	25° 3' 16.871" N	87° 52' 5.097" E
8	25° 3' 27.267" N	87° 51' 52.328" E
9	25° 3' 44.563" N	87° 51' 36.207" E
10	25° 3' 57.746" N	87° 51' 17.412" E
11	25° 4' 9.515" N	87° 51' 5.028" E
12	25° 4' 0.128" N	87° 51' 21.961" E
13	25° 3' 56.269" N	87° 51' 34.778" E
14	25° 3' 48.267" N	87° 51' 50.209" E
15	25° 3' 40.643" N	87° 51' 59.599" E
16	25° 3' 33.709" N	87° 52' 8.615" E
17	25° 3' 27.139" N	87° 52' 14.235" E
18	25° 3' 24.320" N	87° 52' 25.546" E
19	25° 3' 22.555" N	87° 52' 33.088" E
20	25° 3' 20.768" N	87° 52' 44.406" E

LEGEND

- COORDINATE
- POTENTIAL BLOCK
- SAFETY BARRIER
- RIVER
- ADMINISTRATIVE BLOCK BOUNDARY
- DISTRICT BOUNDARY

GANGA RIVER

ABBRIVIATION		
DISTRICT	MD	MALDA
BLOCK	MC	MANICKCHAK
RIVER	GG	GANGA RIVER

0 0.3 0.6 1.2 1.8 2.4

Kilometers

POTENTIAL BLOCK MD_MC_GG_12 OF GANGA RIVER

87°56'30"E 87°57'0"E 87°57'30"E

25°1'0"N

25°0'30"N

N W E S

GANGA RIVER

MD_MC_GG_12

8 7 6 9 10 5 1 4 3 2 6

MD_MC_GG_12		
POINT_NO	LATITUDE	LONGITUDE
1	25° 0' 39.226" N	87° 56' 57.359" E
2	25° 0' 22.380" N	87° 56' 55.341" E
3	25° 0' 31.670" N	87° 56' 44.628" E
4	25° 0' 35.870" N	87° 56' 44.118" E
5	25° 0' 50.661" N	87° 56' 44.609" E
6	25° 1' 4.468" N	87° 56' 37.541" E
7	25° 1' 6.552" N	87° 56' 34.536" E
8	25° 1' 14.460" N	87° 56' 35.351" E
9	25° 1' 1.995" N	87° 56' 47.717" E
10	25° 0' 54.393" N	87° 56' 52.944" E

0 0.15 0.3 0.6 0.9 1.2

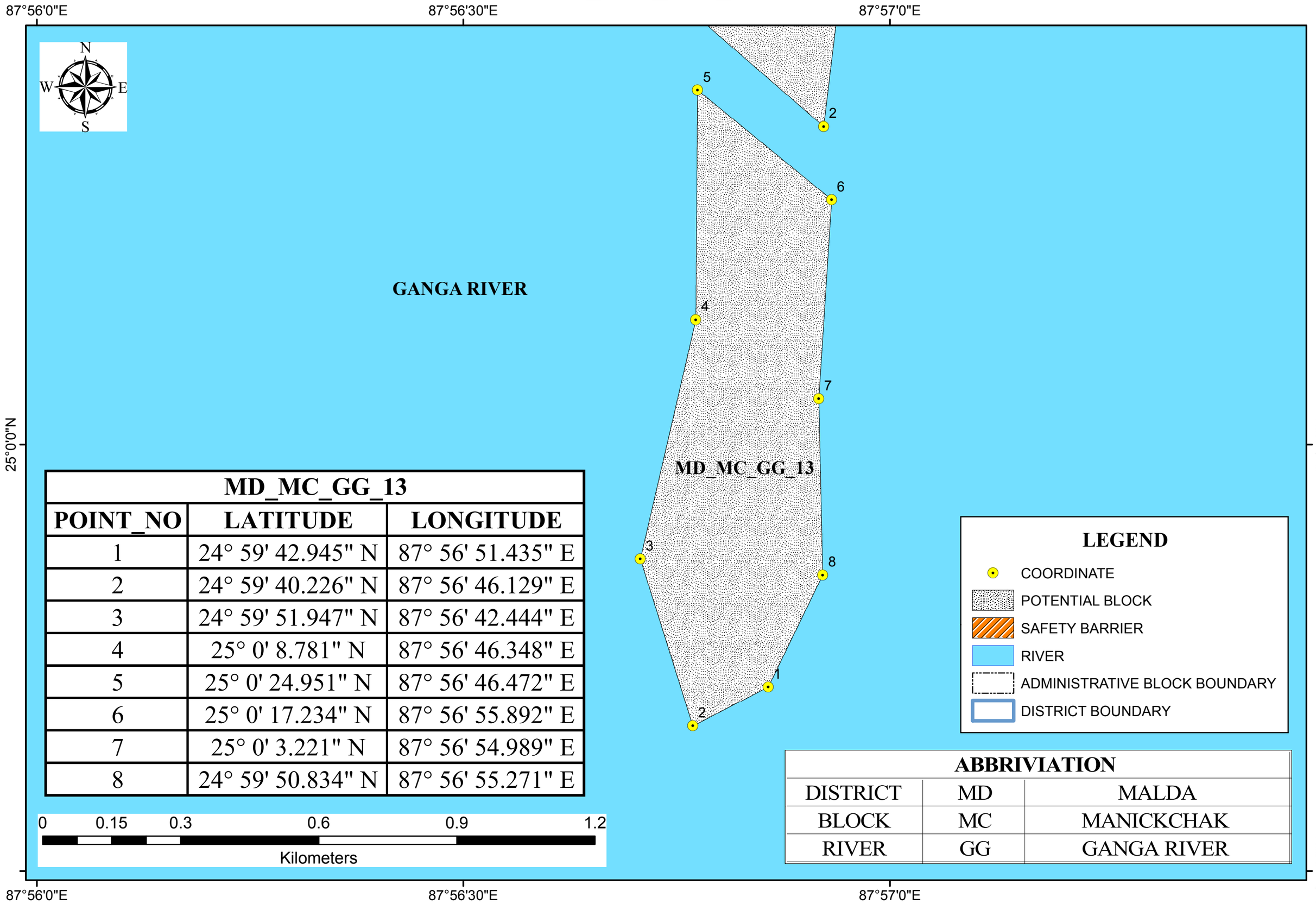
Kilometers

LEGEND

- COORDINATE
- POTENTIAL BLOCK
- SAFETY BARRIER
- RIVER
- ADMINISTRATIVE BLOCK BOUNDARY
- DISTRICT BOUNDARY

ABBRIVIATION		
DISTRICT	MD	MALDA
BLOCK	MC	MANICKCHAK
RIVER	GG	GANGA RIVER

POTENTIAL BLOCK MD_MC_GG_13 OF GANGA RIVER



MD_MC_GG_13		
POINT_NO	LATITUDE	LONGITUDE
1	24° 59' 42.945" N	87° 56' 51.435" E
2	24° 59' 40.226" N	87° 56' 46.129" E
3	24° 59' 51.947" N	87° 56' 42.444" E
4	25° 0' 8.781" N	87° 56' 46.348" E
5	25° 0' 24.951" N	87° 56' 46.472" E
6	25° 0' 17.234" N	87° 56' 55.892" E
7	25° 0' 3.221" N	87° 56' 54.989" E
8	24° 59' 50.834" N	87° 56' 55.271" E

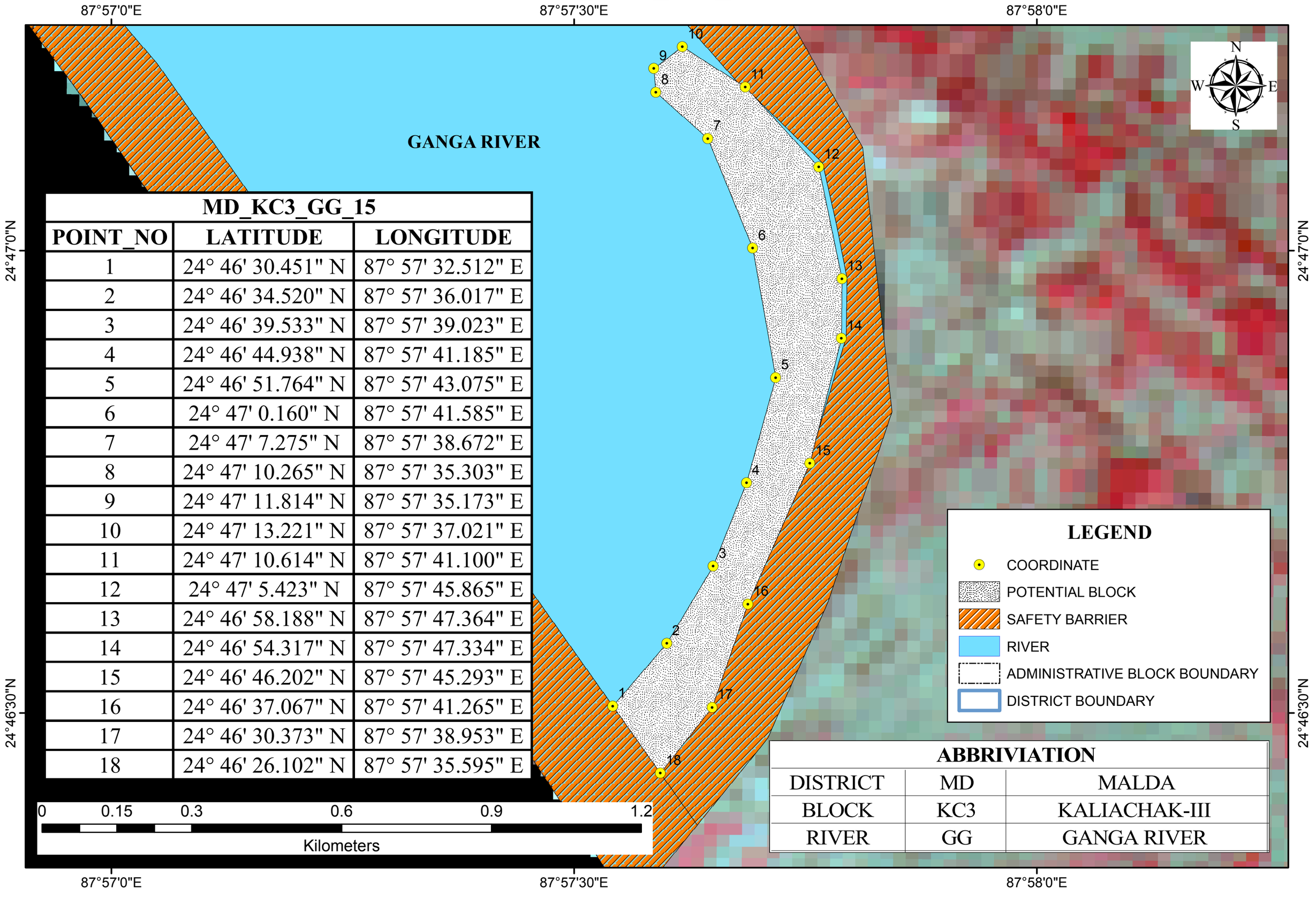
LEGEND

- COORDINATE
- POTENTIAL BLOCK
- SAFETY BARRIER
- RIVER
- ADMINISTRATIVE BLOCK BOUNDARY
- DISTRICT BOUNDARY

ABBRIVIATION		
DISTRICT	MD	MALDA
BLOCK	MC	MANICKCHAK
RIVER	GG	GANGA RIVER

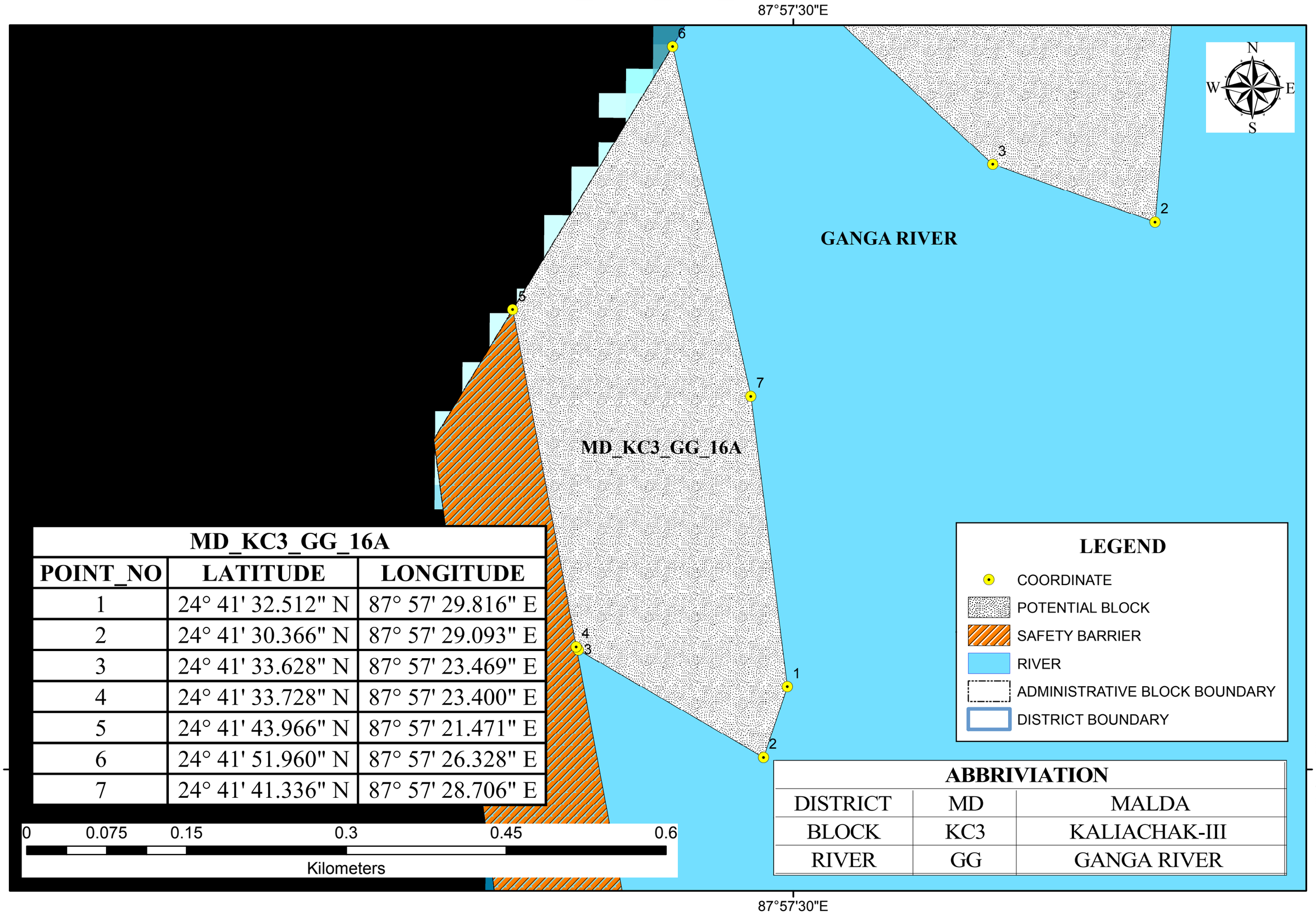
POTENTIAL BLOCK MD_KC3_GG_15 OF GANGA RIVER

MD_KC3_GG_15		
POINT_NO	LATITUDE	LONGITUDE
1	24° 46' 30.451" N	87° 57' 32.512" E
2	24° 46' 34.520" N	87° 57' 36.017" E
3	24° 46' 39.533" N	87° 57' 39.023" E
4	24° 46' 44.938" N	87° 57' 41.185" E
5	24° 46' 51.764" N	87° 57' 43.075" E
6	24° 47' 0.160" N	87° 57' 41.585" E
7	24° 47' 7.275" N	87° 57' 38.672" E
8	24° 47' 10.265" N	87° 57' 35.303" E
9	24° 47' 11.814" N	87° 57' 35.173" E
10	24° 47' 13.221" N	87° 57' 37.021" E
11	24° 47' 10.614" N	87° 57' 41.100" E
12	24° 47' 5.423" N	87° 57' 45.865" E
13	24° 46' 58.188" N	87° 57' 47.364" E
14	24° 46' 54.317" N	87° 57' 47.334" E
15	24° 46' 46.202" N	87° 57' 45.293" E
16	24° 46' 37.067" N	87° 57' 41.265" E
17	24° 46' 30.373" N	87° 57' 38.953" E
18	24° 46' 26.102" N	87° 57' 35.595" E



ABBRIVIATION		
DISTRICT	MD	MALDA
BLOCK	KC3	KALIACHAK-III
RIVER	GG	GANGA RIVER

POTENTIAL BLOCK MD_KC3_GG_16A OF GANGA RIVER



MD_KC3_GG_16A		
POINT_NO	LATITUDE	LONGITUDE
1	24° 41' 32.512" N	87° 57' 29.816" E
2	24° 41' 30.366" N	87° 57' 29.093" E
3	24° 41' 33.628" N	87° 57' 23.469" E
4	24° 41' 33.728" N	87° 57' 23.400" E
5	24° 41' 43.966" N	87° 57' 21.471" E
6	24° 41' 51.960" N	87° 57' 26.328" E
7	24° 41' 41.336" N	87° 57' 28.706" E

LEGEND

- COORDINATE
- POTENTIAL BLOCK
- SAFETY BARRIER
- RIVER
- ADMINISTRATIVE BLOCK BOUNDARY
- DISTRICT BOUNDARY

ABBRIVIATION		
DISTRICT	MD	MALDA
BLOCK	KC3	KALIACHAK-III
RIVER	GG	GANGA RIVER

POTENTIAL BLOCK MD_KC3_GG_16B OF GANGA RIVER

87°57'30"E 87°58'0"E

24°42'0"N

GANGA RIVER

MD_KC3_GG_16B

MD_KC3_GG_16B		
POINT_NO	LATITUDE	LONGITUDE
1	24° 41' 52.866" N	87° 57' 41.505" E
2	24° 41' 46.633" N	87° 57' 40.987" E
3	24° 41' 48.385" N	87° 57' 36.057" E
4	24° 41' 53.366" N	87° 57' 30.681" E
5	24° 41' 58.564" N	87° 57' 30.341" E
6	24° 42' 5.828" N	87° 57' 34.573" E
7	24° 42' 15.012" N	87° 57' 39.924" E
8	24° 42' 16.998" N	87° 57' 40.722" E
9	24° 42' 6.195" N	87° 57' 42.078" E

0 0.1 0.2 0.4 0.6 0.8

Kilometers

LEGEND

- COORDINATE
- POTENTIAL BLOCK
- SAFETY BARRIER
- RIVER
- ADMINISTRATIVE BLOCK BOUNDARY
- DISTRICT BOUNDARY

ABBRIVIATION		
DISTRICT	MD	MALDA
BLOCK	KC3	KALIACHAK-III
RIVER	GG	GANGA RIVER

POTENTIAL BLOCK MD_KC3_GG_17A OF GANGA RIVER

87°58'0"E 87°58'30"E 87°59'0"E 87°59'30"E 88°0'0"E

24°41'0"N 24°40'30"N 24°40'0"N

N W E S

GANGA RIVER

MD_KC3_GG_17A		
POINT_NO	LATITUDE	LONGITUDE
1	24° 40' 28.704" N	87° 59' 0.405" E
2	24° 40' 24.835" N	87° 59' 0.139" E
3	24° 40' 19.894" N	87° 58' 59.394" E
4	24° 40' 13.864" N	87° 59' 0.759" E
5	24° 40' 16.278" N	87° 58' 53.247" E
6	24° 40' 21.903" N	87° 58' 48.114" E
7	24° 40' 27.977" N	87° 58' 39.924" E
8	24° 40' 27.566" N	87° 58' 37.097" E
9	24° 40' 23.686" N	87° 58' 38.479" E
10	24° 40' 18.951" N	87° 58' 39.148" E
11	24° 40' 10.747" N	87° 58' 44.026" E
12	24° 40' 4.713" N	87° 58' 46.097" E
13	24° 40' 4.727" N	87° 58' 43.871" E
14	24° 40' 12.487" N	87° 58' 27.013" E
15	24° 40' 21.217" N	87° 58' 21.280" E
16	24° 40' 28.987" N	87° 58' 16.869" E
17	24° 40' 38.901" N	87° 58' 13.415" E
18	24° 40' 47.095" N	87° 58' 9.949" E
19	24° 40' 54.859" N	87° 58' 6.478" E
20	24° 41' 3.038" N	87° 58' 5.365" E
21	24° 41' 11.692" N	87° 57' 57.194" E
22	24° 41' 21.617" N	87° 57' 52.092" E
23	24° 41' 25.345" N	87° 57' 52.788" E
24	24° 41' 16.273" N	87° 58' 7.418" E
25	24° 41' 10.736" N	87° 58' 14.703" E
26	24° 41' 5.757" N	87° 58' 17.154" E
27	24° 41' 0.771" N	87° 58' 23.470" E
28	24° 40' 55.566" N	87° 58' 30.255" E
29	24° 40' 50.337" N	87° 58' 40.569" E
30	24° 40' 44.039" N	87° 58' 50.170" E
31	24° 40' 34.528" N	87° 58' 57.626" E

LEGEND

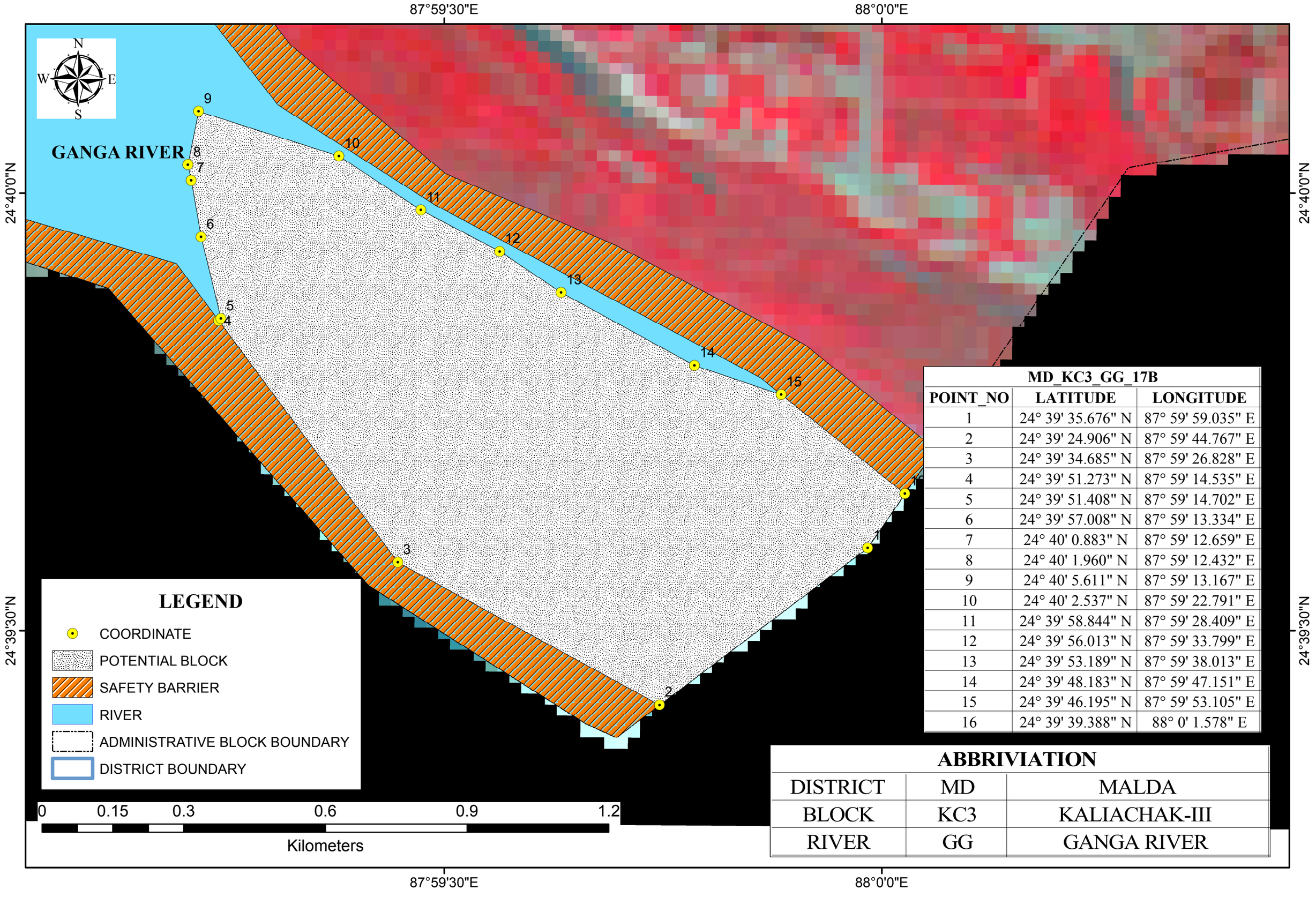
- COORDINATE
- POTENTIAL BLOCK
- SAFETY BARRIER
- RIVER
- ADMINISTRATIVE BLOCK BOUNDARY
- DISTRICT BOUNDARY

0 0.275 0.55 1.1 1.65 2.2

Kilometers

ABBRIVIATION		
DISTRICT	MD	MALDA
BLOCK	KC3	KALIACHAK-III
RIVER	GG	GANGA RIVER

POTENTIAL BLOCK MD_KC3_GG_17B OF GANGA RIVER



MD_KC3_GG_17B		
POINT_NO	LATITUDE	LONGITUDE
1	24° 39' 35.676" N	87° 59' 59.035" E
2	24° 39' 24.906" N	87° 59' 44.767" E
3	24° 39' 34.685" N	87° 59' 26.828" E
4	24° 39' 51.273" N	87° 59' 14.535" E
5	24° 39' 51.408" N	87° 59' 14.702" E
6	24° 39' 57.008" N	87° 59' 13.334" E
7	24° 40' 0.883" N	87° 59' 12.659" E
8	24° 40' 1.960" N	87° 59' 12.432" E
9	24° 40' 5.611" N	87° 59' 13.167" E
10	24° 40' 2.537" N	87° 59' 22.791" E
11	24° 39' 58.844" N	87° 59' 28.409" E
12	24° 39' 56.013" N	87° 59' 33.799" E
13	24° 39' 53.189" N	87° 59' 38.013" E
14	24° 39' 48.183" N	87° 59' 47.151" E
15	24° 39' 46.195" N	87° 59' 53.105" E
16	24° 39' 39.388" N	88° 0' 1.578" E

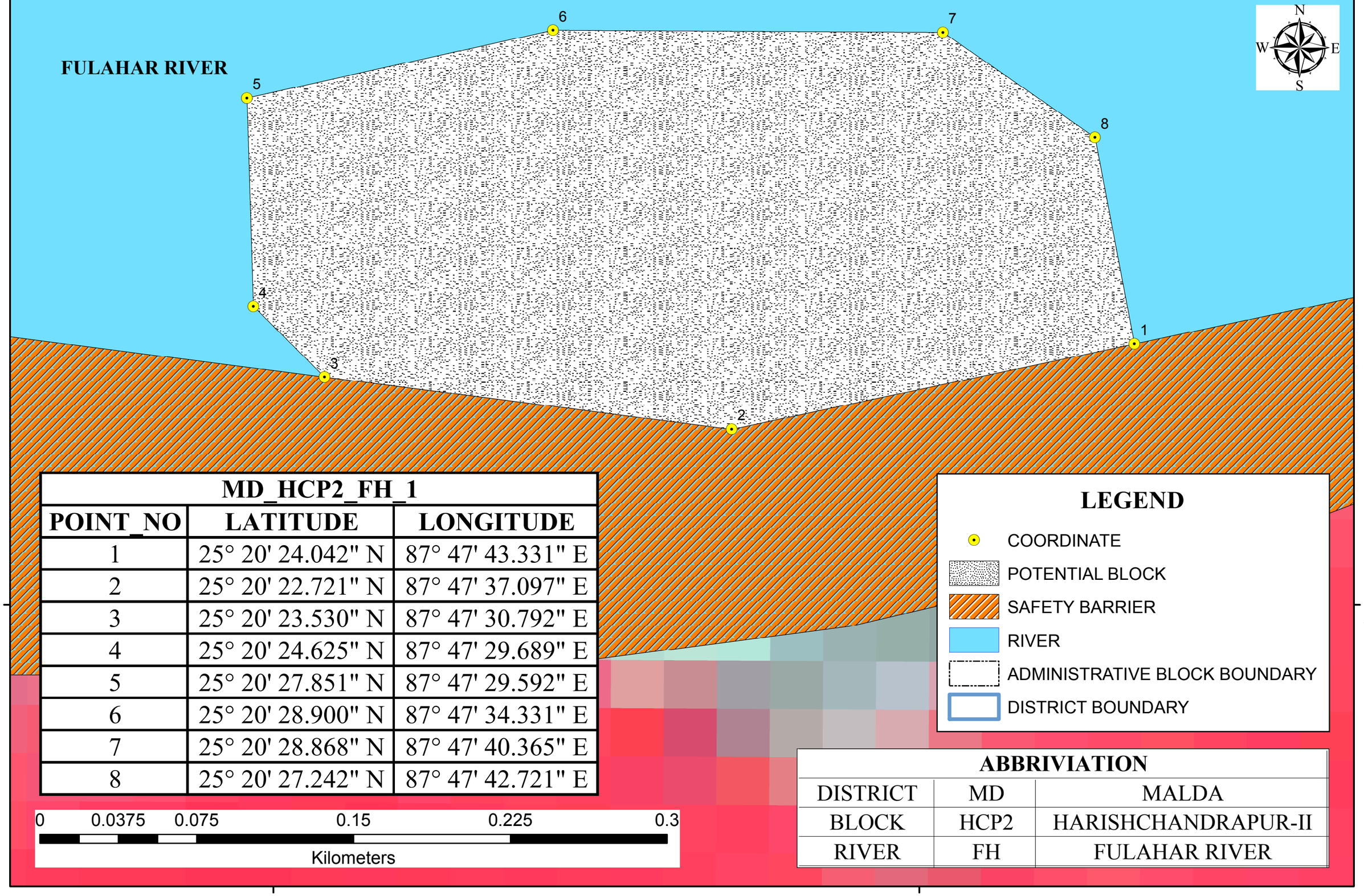
ABBRIVIATION		
DISTRICT	MD	MALDA
BLOCK	KC3	KALIACHAK-III
RIVER	GG	GANGA RIVER

POTENTIAL BLOCK MD_HCP2_FH_1 OF FULAHAR RIVER

87°47'30"E

87°47'40"E

FULAHAR RIVER



25°20'20"N

25°20'20"N

MD_HCP2_FH_1		
POINT_NO	LATITUDE	LONGITUDE
1	25° 20' 24.042" N	87° 47' 43.331" E
2	25° 20' 22.721" N	87° 47' 37.097" E
3	25° 20' 23.530" N	87° 47' 30.792" E
4	25° 20' 24.625" N	87° 47' 29.689" E
5	25° 20' 27.851" N	87° 47' 29.592" E
6	25° 20' 28.900" N	87° 47' 34.331" E
7	25° 20' 28.868" N	87° 47' 40.365" E
8	25° 20' 27.242" N	87° 47' 42.721" E

0 0.0375 0.075 0.15 0.225 0.3

Kilometers

LEGEND

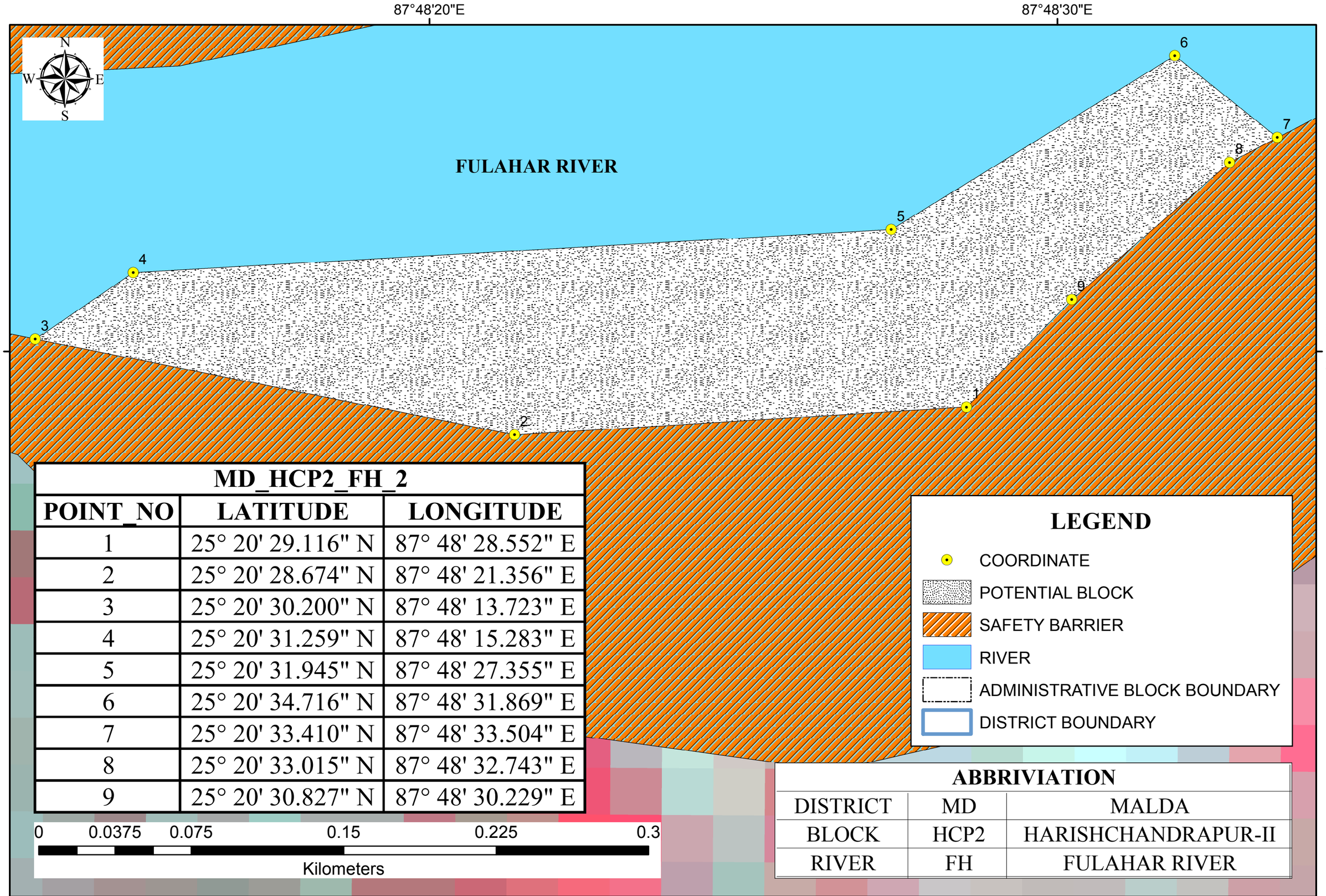
- COORDINATE
- POTENTIAL BLOCK
- SAFETY BARRIER
- RIVER
- ADMINISTRATIVE BLOCK BOUNDARY
- DISTRICT BOUNDARY

ABBRIVIATION		
DISTRICT	MD	MALDA
BLOCK	HCP2	HARISHCHANDRAPUR-II
RIVER	FH	FULAHAR RIVER

87°47'30"E

87°47'40"E

POTENTIAL BLOCK MD_HCP2_FH_2 OF FULAHAR RIVER



MD_HCP2_FH_2		
POINT_NO	LATITUDE	LONGITUDE
1	25° 20' 29.116" N	87° 48' 28.552" E
2	25° 20' 28.674" N	87° 48' 21.356" E
3	25° 20' 30.200" N	87° 48' 13.723" E
4	25° 20' 31.259" N	87° 48' 15.283" E
5	25° 20' 31.945" N	87° 48' 27.355" E
6	25° 20' 34.716" N	87° 48' 31.869" E
7	25° 20' 33.410" N	87° 48' 33.504" E
8	25° 20' 33.015" N	87° 48' 32.743" E
9	25° 20' 30.827" N	87° 48' 30.229" E

LEGEND

- COORDINATE
- POTENTIAL BLOCK
- SAFETY BARRIER
- RIVER
- ADMINISTRATIVE BLOCK BOUNDARY
- DISTRICT BOUNDARY

ABBRIVIATION		
DISTRICT	MD	MALDA
BLOCK	HCP2	HARISHCHANDRAPUR-II
RIVER	FH	FULAHAR RIVER

POTENTIAL BLOCK MD_HCP2_FH_4 OF FULAHAR RIVER

87°48'30"E 87°48'40"E 87°48'50"E 87°49'0"E 87°49'10"E 87°49'20"E 87°49'30"E

25°20'30"N 25°20'20"N 25°20'10"N 25°20'0"N

FULAHAR RIVER

MD_HCP2_FH_4

MD_HCP2_FH_4		
POINT_NO	LATITUDE	LONGITUDE
1	25° 20' 36.170" N	87° 49' 0.629" E
2	25° 20' 33.596" N	87° 48' 59.429" E
3	25° 20' 29.730" N	87° 48' 58.693" E
4	25° 20' 27.472" N	87° 48' 58.678" E
5	25° 20' 24.236" N	87° 49' 0.549" E
6	25° 20' 18.851" N	87° 49' 2.287" E
7	25° 20' 10.361" N	87° 49' 1.520" E
8	25° 20' 2.846" N	87° 48' 59.577" E
9	25° 19' 58.026" N	87° 48' 59.761" E
10	25° 19' 58.255" N	87° 48' 59.693" E
11	25° 20' 12.431" N	87° 48' 54.064" E
12	25° 20' 13.414" N	87° 48' 53.969" E
13	25° 20' 21.476" N	87° 48' 54.142" E
14	25° 20' 23.013" N	87° 48' 48.473" E
15	25° 20' 23.487" N	87° 48' 47.566" E
16	25° 20' 28.621" N	87° 48' 43.541" E
17	25° 20' 33.467" N	87° 48' 38.245" E
18	25° 20' 34.647" N	87° 48' 35.893" E
19	25° 20' 34.638" N	87° 48' 35.874" E
20	25° 20' 34.824" N	87° 48' 35.756" E
21	25° 20' 34.985" N	87° 48' 41.573" E
22	25° 20' 34.731" N	87° 48' 48.670" E
23	25° 20' 35.445" N	87° 48' 55.537" E
24	25° 20' 36.825" N	87° 48' 58.740" E

0 0.125 0.25 0.5 0.75 1

Kilometers

N W E S

LEGEND

- COORDINATE
- POTENTIAL BLOCK
- SAFETY BARRIER
- RIVER
- ADMINISTRATIVE BLOCK BOUNDARY
- DISTRICT BOUNDARY

ABBRIVIATION		
DISTRICT	MD	MALDA
BLOCK	HCP2	HARISHCHANDRAPUR-II
RIVER	FH	FULAHAR RIVER

POTENTIAL BLOCK MD_HCP2_FH_5 OF FULAHAR RIVER

MD_HCP2_FH_5		
POINT_NO	LATITUDE	LONGITUDE
1	25° 19' 38.308" N	87° 49' 23.427" E
2	25° 19' 37.790" N	87° 49' 19.756" E
3	25° 19' 39.736" N	87° 49' 17.995" E
4	25° 19' 42.555" N	87° 49' 13.637" E
5	25° 19' 45.152" N	87° 49' 10.697" E
6	25° 19' 51.719" N	87° 49' 9.203" E
7	25° 19' 56.556" N	87° 49' 9.354" E
8	25° 20' 1.281" N	87° 49' 10.450" E
9	25° 20' 10.844" N	87° 49' 11.461" E
10	25° 20' 17.623" N	87° 49' 10.442" E
11	25° 20' 23.012" N	87° 49' 7.994" E
12	25° 20' 26.241" N	87° 49' 7.306" E
13	25° 20' 29.678" N	87° 49' 8.039" E
14	25° 20' 33.504" N	87° 49' 8.065" E
15	25° 20' 26.726" N	87° 49' 15.103" E
16	25° 20' 25.591" N	87° 49' 15.502" E
17	25° 20' 20.171" N	87° 49' 16.138" E
18	25° 20' 17.690" N	87° 49' 17.659" E
19	25° 20' 16.852" N	87° 49' 18.723" E
20	25° 20' 13.304" N	87° 49' 21.448" E
21	25° 20' 10.900" N	87° 49' 20.690" E
22	25° 20' 9.296" N	87° 49' 19.022" E
23	25° 20' 5.442" N	87° 49' 16.157" E
24	25° 19' 58.897" N	87° 49' 13.747" E
25	25° 19' 54.709" N	87° 49' 12.772" E
26	25° 19' 50.615" N	87° 49' 14.283" E
27	25° 19' 45.111" N	87° 49' 18.031" E
28	25° 19' 40.677" N	87° 49' 22.615" E

0 0.15 0.3 0.6 0.9 1.2

Kilometers

MD_HCP2_FH_5

FULAHAR RIVER

LEGEND

- COORDINATE
- POTENTIAL BLOCK
- SAFETY BARRIER
- RIVER
- ADMINISTRATIVE BLOCK BOUNDARY
- DISTRICT BOUNDARY

ABBRIVIATION		
DISTRICT	MD	MALDA
BLOCK	HCP2	HARISHCHANDRAPUR-II
RIVER	FH	FULAHAR RIVER

87°48'40"E 87°48'50"E 87°49'0"E 87°49'10"E 87°49'20"E 87°49'30"E 87°49'40"E 87°49'50"E 87°50'0"E

25°20'30"N 25°20'20"N 25°20'10"N 25°20'0"N 25°19'50"N 25°19'40"N

POTENTIAL BLOCK MD_HCP2_FH_6 OF FULAHAR RIVER

87°49'0"E 87°49'10"E 87°49'20"E

25°19'40"N

FULAHAR RIVER

MD_HCP2_FH_6

MD_HCP2_FH_6		
POINT_NO	LATITUDE	LONGITUDE
1	25° 19' 35.336" N	87° 49' 11.019" E
2	25° 19' 34.675" N	87° 49' 6.188" E
3	25° 19' 35.385" N	87° 49' 2.171" E
4	25° 19' 35.943" N	87° 48' 59.931" E
5	25° 19' 38.301" N	87° 48' 59.559" E
6	25° 19' 46.241" N	87° 49' 0.414" E
7	25° 19' 40.698" N	87° 49' 5.708" E
8	25° 19' 36.973" N	87° 49' 10.604" E

LEGEND

- COORDINATE
- POTENTIAL BLOCK
- SAFETY BARRIER
- RIVER
- ADMINISTRATIVE BLOCK BOUNDARY
- DISTRICT BOUNDARY

ABBRIVIATION		
DISTRICT	MD	MALDA
BLOCK	HCP2	HARISHCHANDRAPUR-II
RIVER	FH	FULAHAR RIVER

0 0.045 0.09 0.18 0.27 0.36

Kilometers

87°49'0"E 87°49'10"E 87°49'20"E

POTENTIAL BLOCK MD_HCP2_FH_7 OF FULAHAR RIVER

87°51'50"E 87°52'0"E 87°52'10"E

25°16'30"N 25°16'20"N

FULAHAR RIVER

N W E S

MD_HCP2_FH_7		
POINT_NO	LATITUDE	LONGITUDE
1	25° 16' 24.972" N	87° 51' 48.900" E
2	25° 16' 23.610" N	87° 51' 46.545" E
3	25° 16' 24.170" N	87° 51' 44.959" E
4	25° 16' 25.626" N	87° 51' 43.078" E
5	25° 16' 27.396" N	87° 51' 46.344" E
6	25° 16' 28.405" N	87° 51' 50.211" E
7	25° 16' 29.211" N	87° 51' 53.698" E
8	25° 16' 29.738" N	87° 51' 57.637" E
9	25° 16' 31.088" N	87° 52' 2.111" E
10	25° 16' 30.997" N	87° 52' 5.819" E
11	25° 16' 29.899" N	87° 52' 5.281" E
12	25° 16' 27.937" N	87° 51' 59.592" E
13	25° 16' 27.212" N	87° 51' 54.213" E

LEGEND

- COORDINATE
- POTENTIAL BLOCK
- SAFETY BARRIER
- RIVER
- ADMINISTRATIVE BLOCK BOUNDARY
- DISTRICT BOUNDARY

0 0.05 0.1 0.2 0.3 0.4

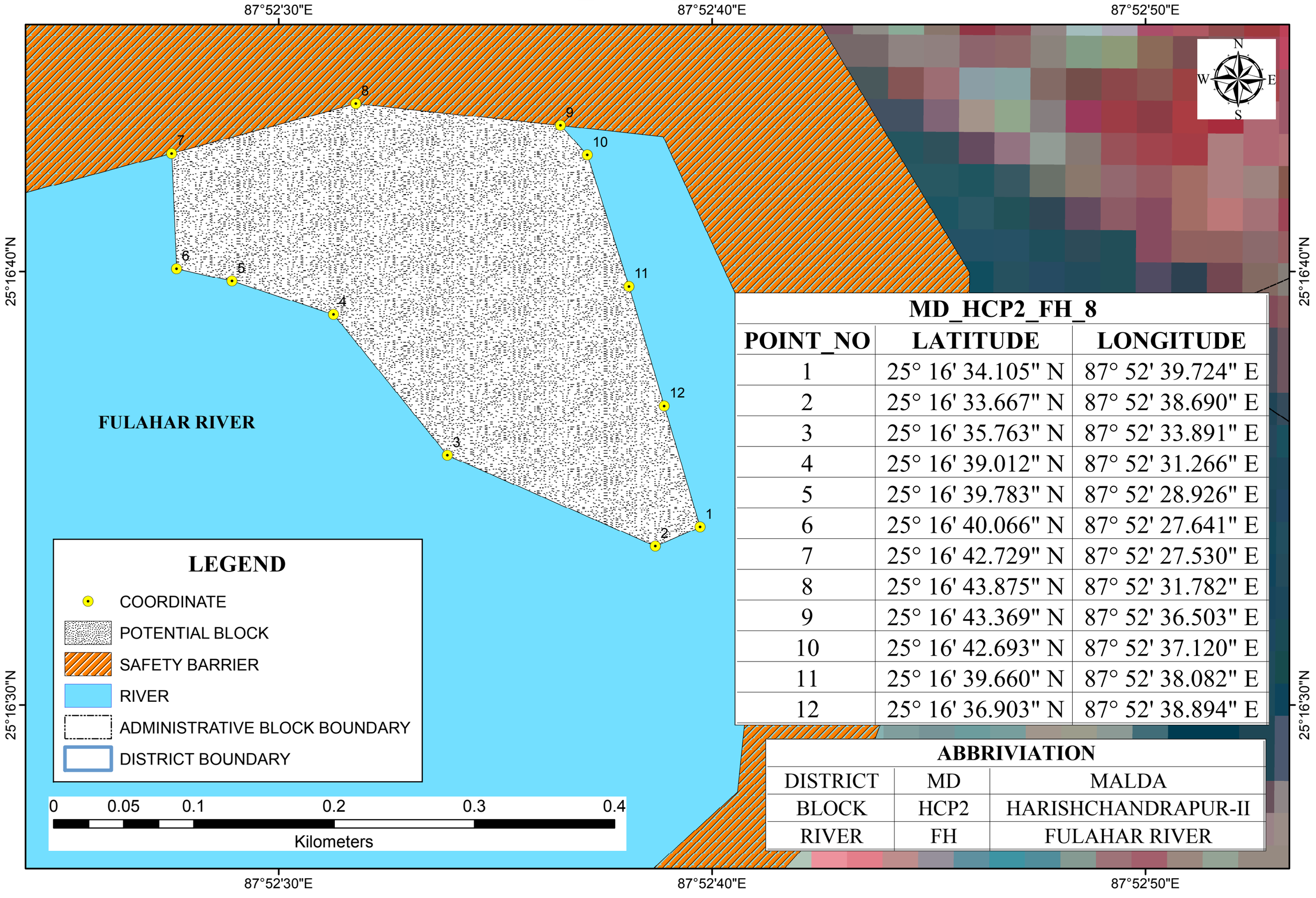
Kilometers

ABBRIVIATION		
DISTRICT	MD	MALDA
BLOCK	HCP2	HARISHCHANDRAPUR-II
RIVER	FH	FULAHAR RIVER

POTENTIAL BLOCK MD_HCP2_FH_8 OF FULAHAR RIVER

87°52'30"E 87°52'40"E 87°52'50"E

25°16'40"N 25°16'30"N



LEGEND

- COORDINATE
- POTENTIAL BLOCK
- SAFETY BARRIER
- RIVER
- ADMINISTRATIVE BLOCK BOUNDARY
- DISTRICT BOUNDARY

0 0.05 0.1 0.2 0.3 0.4

Kilometers

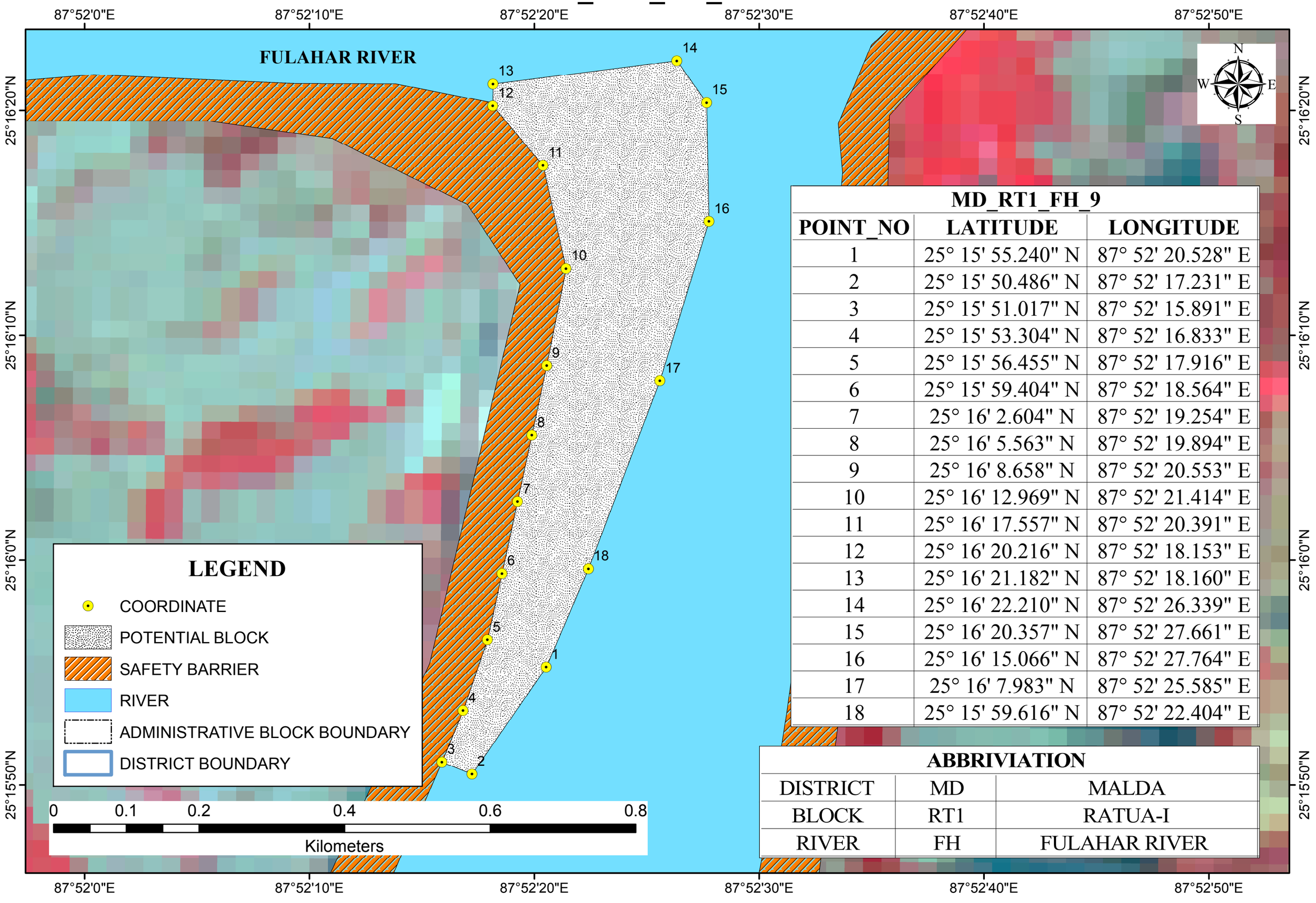
MD_HCP2_FH_8

POINT_NO	LATITUDE	LONGITUDE
1	25° 16' 34.105" N	87° 52' 39.724" E
2	25° 16' 33.667" N	87° 52' 38.690" E
3	25° 16' 35.763" N	87° 52' 33.891" E
4	25° 16' 39.012" N	87° 52' 31.266" E
5	25° 16' 39.783" N	87° 52' 28.926" E
6	25° 16' 40.066" N	87° 52' 27.641" E
7	25° 16' 42.729" N	87° 52' 27.530" E
8	25° 16' 43.875" N	87° 52' 31.782" E
9	25° 16' 43.369" N	87° 52' 36.503" E
10	25° 16' 42.693" N	87° 52' 37.120" E
11	25° 16' 39.660" N	87° 52' 38.082" E
12	25° 16' 36.903" N	87° 52' 38.894" E

ABBRIVIATION

DISTRICT	MD	MALDA
BLOCK	HCP2	HARISHCHANDRAPUR-II
RIVER	FH	FULAHAR RIVER

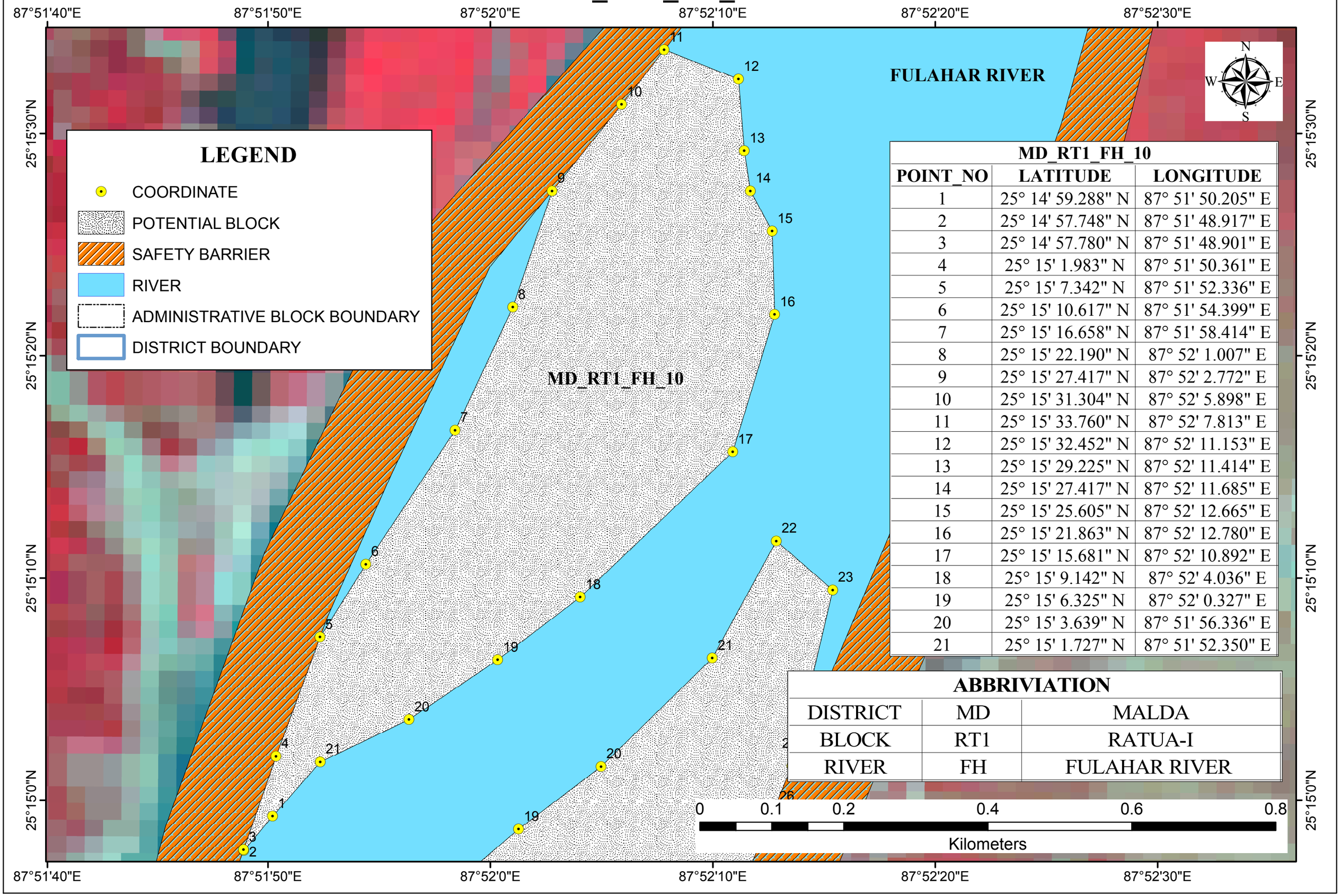
POTENTIAL BLOCK MD_RT1_FH_9 OF FULAHAR RIVER



MD_RT1_FH_9		
POINT_NO	LATITUDE	LONGITUDE
1	25° 15' 55.240" N	87° 52' 20.528" E
2	25° 15' 50.486" N	87° 52' 17.231" E
3	25° 15' 51.017" N	87° 52' 15.891" E
4	25° 15' 53.304" N	87° 52' 16.833" E
5	25° 15' 56.455" N	87° 52' 17.916" E
6	25° 15' 59.404" N	87° 52' 18.564" E
7	25° 16' 2.604" N	87° 52' 19.254" E
8	25° 16' 5.563" N	87° 52' 19.894" E
9	25° 16' 8.658" N	87° 52' 20.553" E
10	25° 16' 12.969" N	87° 52' 21.414" E
11	25° 16' 17.557" N	87° 52' 20.391" E
12	25° 16' 20.216" N	87° 52' 18.153" E
13	25° 16' 21.182" N	87° 52' 18.160" E
14	25° 16' 22.210" N	87° 52' 26.339" E
15	25° 16' 20.357" N	87° 52' 27.661" E
16	25° 16' 15.066" N	87° 52' 27.764" E
17	25° 16' 7.983" N	87° 52' 25.585" E
18	25° 15' 59.616" N	87° 52' 22.404" E

ABBRIVIATION		
DISTRICT	MD	MALDA
BLOCK	RT1	RATUA-I
RIVER	FH	FULAHAR RIVER

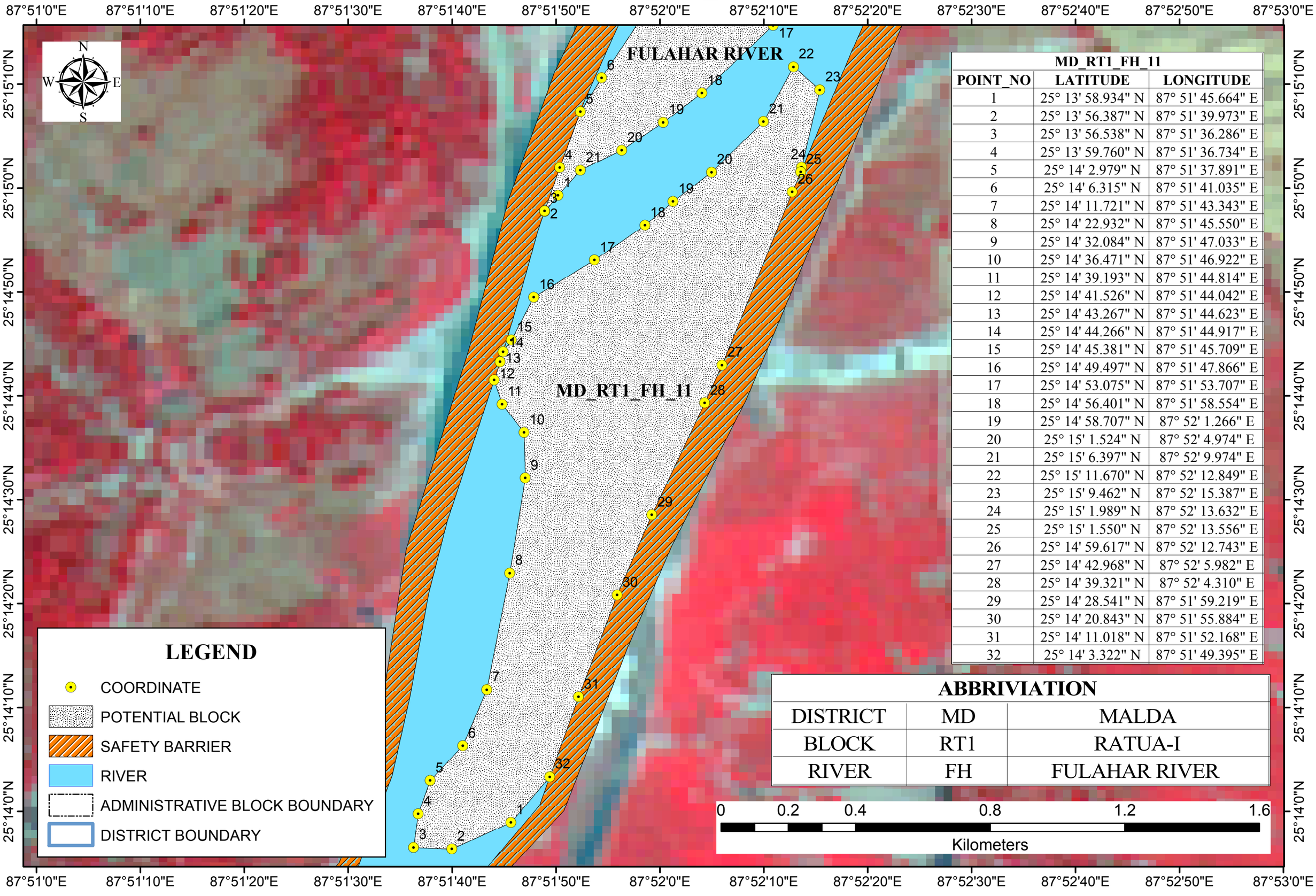
POTENTIAL BLOCK MD_RT1_FH_10 OF FULAHAR RIVER



MD_RT1_FH_10		
POINT_NO	LATITUDE	LONGITUDE
1	25° 14' 59.288" N	87° 51' 50.205" E
2	25° 14' 57.748" N	87° 51' 48.917" E
3	25° 14' 57.780" N	87° 51' 48.901" E
4	25° 15' 1.983" N	87° 51' 50.361" E
5	25° 15' 7.342" N	87° 51' 52.336" E
6	25° 15' 10.617" N	87° 51' 54.399" E
7	25° 15' 16.658" N	87° 51' 58.414" E
8	25° 15' 22.190" N	87° 52' 1.007" E
9	25° 15' 27.417" N	87° 52' 2.772" E
10	25° 15' 31.304" N	87° 52' 5.898" E
11	25° 15' 33.760" N	87° 52' 7.813" E
12	25° 15' 32.452" N	87° 52' 11.153" E
13	25° 15' 29.225" N	87° 52' 11.414" E
14	25° 15' 27.417" N	87° 52' 11.685" E
15	25° 15' 25.605" N	87° 52' 12.665" E
16	25° 15' 21.863" N	87° 52' 12.780" E
17	25° 15' 15.681" N	87° 52' 10.892" E
18	25° 15' 9.142" N	87° 52' 4.036" E
19	25° 15' 6.325" N	87° 52' 0.327" E
20	25° 15' 3.639" N	87° 51' 56.336" E
21	25° 15' 1.727" N	87° 51' 52.350" E

ABBRIVIATION		
DISTRICT	MD	MALDA
BLOCK	RT1	RATUA-I
RIVER	FH	FULAHAR RIVER

POTENTIAL BLOCK MD_RT1_FH_11 OF FULAHAR RIVER



MD_RT1_FH_11		
POINT_NO	LATITUDE	LONGITUDE
1	25° 13' 58.934" N	87° 51' 45.664" E
2	25° 13' 56.387" N	87° 51' 39.973" E
3	25° 13' 56.538" N	87° 51' 36.286" E
4	25° 13' 59.760" N	87° 51' 36.734" E
5	25° 14' 2.979" N	87° 51' 37.891" E
6	25° 14' 6.315" N	87° 51' 41.035" E
7	25° 14' 11.721" N	87° 51' 43.343" E
8	25° 14' 22.932" N	87° 51' 45.550" E
9	25° 14' 32.084" N	87° 51' 47.033" E
10	25° 14' 36.471" N	87° 51' 46.922" E
11	25° 14' 39.193" N	87° 51' 44.814" E
12	25° 14' 41.526" N	87° 51' 44.042" E
13	25° 14' 43.267" N	87° 51' 44.623" E
14	25° 14' 44.266" N	87° 51' 44.917" E
15	25° 14' 45.381" N	87° 51' 45.709" E
16	25° 14' 49.497" N	87° 51' 47.866" E
17	25° 14' 53.075" N	87° 51' 53.707" E
18	25° 14' 56.401" N	87° 51' 58.554" E
19	25° 14' 58.707" N	87° 52' 1.266" E
20	25° 15' 1.524" N	87° 52' 4.974" E
21	25° 15' 6.397" N	87° 52' 9.974" E
22	25° 15' 11.670" N	87° 52' 12.849" E
23	25° 15' 9.462" N	87° 52' 15.387" E
24	25° 15' 1.989" N	87° 52' 13.632" E
25	25° 15' 1.550" N	87° 52' 13.556" E
26	25° 14' 59.617" N	87° 52' 12.743" E
27	25° 14' 42.968" N	87° 52' 5.982" E
28	25° 14' 39.321" N	87° 52' 4.310" E
29	25° 14' 28.541" N	87° 51' 59.219" E
30	25° 14' 20.843" N	87° 51' 55.884" E
31	25° 14' 11.018" N	87° 51' 52.168" E
32	25° 14' 3.322" N	87° 51' 49.395" E

ABBRIVIATION		
DISTRICT	MD	MALDA
BLOCK	RT1	RATUA-I
RIVER	FH	FULAHAR RIVER

POTENTIAL BLOCK MD_RT1_FH_12 OF FULAHAR RIVER

87°51'0"E 87°51'10"E 87°51'20"E 87°51'30"E 87°51'40"E 87°51'50"E

25°13'50"N 25°13'40"N 25°13'30"N 25°13'20"N 25°13'10"N

N W E S

FULAHAR RIVER

MD_RT1_FH_12

MD_RT1_FH_12		
POINT_NO	LATITUDE	LONGITUDE
1	25° 13' 10.133" N	87° 51' 21.682" E
2	25° 13' 10.133" N	87° 51' 21.625" E
3	25° 13' 15.174" N	87° 51' 21.013" E
4	25° 13' 23.210" N	87° 51' 20.100" E
5	25° 13' 30.842" N	87° 51' 19.754" E
6	25° 13' 35.199" N	87° 51' 21.941" E
7	25° 13' 39.415" N	87° 51' 24.186" E
8	25° 13' 44.595" N	87° 51' 26.161" E
9	25° 13' 49.020" N	87° 51' 27.828" E
10	25° 13' 43.129" N	87° 51' 27.303" E
11	25° 13' 28.950" N	87° 51' 24.934" E
12	25° 13' 19.918" N	87° 51' 25.154" E
13	25° 13' 15.415" N	87° 51' 22.995" E

0 0.075 0.15 0.3 0.45 0.6

Kilometers

LEGEND

- COORDINATE
- POTENTIAL BLOCK
- SAFETY BARRIER
- RIVER
- ADMINISTRATIVE BLOCK BOUNDARY
- DISTRICT BOUNDARY

ABBRIVIATION		
DISTRICT	MD	MALDA
BLOCK	RT1	RATUA-I
RIVER	FH	FULAHAR RIVER

POTENTIAL BLOCK MD_RT1_FH_13 OF FULAHAR RIVER

87°51'20"E 87°51'30"E

25°13'10"N

25°13'0"N

FULAHAR RIVER

MD_RT1_FH_13

N W E S

MD_RT1_FH_13		
POINT_NO	LATITUDE	LONGITUDE
1	25° 13' 3.772" N	87° 51' 28.303" E
2	25° 13' 0.421" N	87° 51' 27.712" E
3	25° 13' 0.821" N	87° 51' 25.588" E
4	25° 13' 5.862" N	87° 51' 23.921" E
5	25° 13' 9.089" N	87° 51' 23.660" E
6	25° 13' 12.304" N	87° 51' 25.385" E
7	25° 13' 8.933" N	87° 51' 28.339" E

0 0.0375 0.075 0.15 0.225 0.3

Kilometers

LEGEND

- COORDINATE
- POTENTIAL BLOCK
- SAFETY BARRIER
- RIVER
- ADMINISTRATIVE BLOCK BOUNDARY
- DISTRICT BOUNDARY

ABBRIVIATION		
DISTRICT	MD	MALDA
BLOCK	RT1	RATUA-I
RIVER	FH	FULAHAR RIVER

POTENTIAL BLOCK MD_RT1_FH_14 OF FULAHAR RIVER

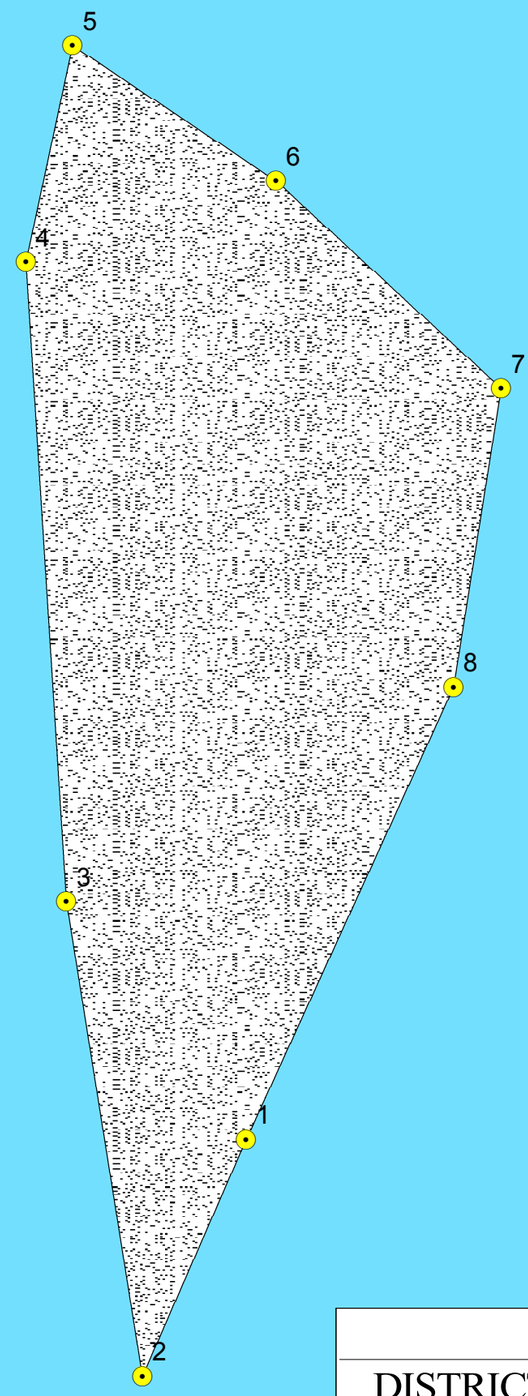
87°53'20"E

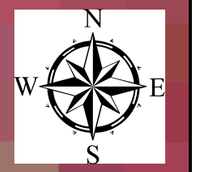
87°53'30"E

25°12'40"N

25°12'30"N

FULAHAR RIVER





MD_RT1_FH_14		
POINT_NO	LATITUDE	LONGITUDE
1	25° 12' 30.689" N	87° 53' 26.630" E
2	25° 12' 27.729" N	87° 53' 25.332" E
3	25° 12' 33.670" N	87° 53' 24.383" E
4	25° 12' 41.672" N	87° 53' 23.874" E
5	25° 12' 44.378" N	87° 53' 24.461" E
6	25° 12' 42.685" N	87° 53' 27.001" E
7	25° 12' 40.088" N	87° 53' 29.819" E
8	25° 12' 36.350" N	87° 53' 29.224" E

0 0.0475 0.095 0.19 0.285 0.38

Kilometers

LEGEND

- COORDINATE
- POTENTIAL BLOCK
- SAFETY BARRIER
- RIVER
- ADMINISTRATIVE BLOCK BOUNDARY
- DISTRICT BOUNDARY

ABBRIVIATION		
DISTRICT	MD	MALDA
BLOCK	RT1	RATUA-I
RIVER	FH	FULAHAR RIVER

POTENTIAL BLOCK MD_RT1_FH_15 OF FULAHAR RIVER

MD_RT1_FH_15		
POINT_NO	LATITUDE	LONGITUDE
1	25° 10' 7.403" N	87° 53' 8.880" E
2	25° 10' 7.356" N	87° 53' 6.224" E
3	25° 10' 16.359" N	87° 53' 11.015" E
4	25° 10' 22.370" N	87° 53' 12.712" E
5	25° 10' 41.726" N	87° 53' 12.143" E
6	25° 10' 58.489" N	87° 53' 13.683" E
7	25° 11' 13.542" N	87° 53' 13.555" E
8	25° 11' 23.447" N	87° 53' 11.264" E
9	25° 11' 26.659" N	87° 53' 13.650" E
10	25° 11' 27.714" N	87° 53' 16.966" E
11	25° 11' 17.821" N	87° 53' 17.131" E
12	25° 11' 2.118" N	87° 53' 18.199" E
13	25° 10' 53.292" N	87° 53' 19.789" E
14	25° 10' 49.639" N	87° 53' 19.290" E
15	25° 10' 44.714" N	87° 53' 15.946" E
16	25° 10' 37.823" N	87° 53' 17.550" E
17	25° 10' 29.429" N	87° 53' 18.907" E
18	25° 10' 17.815" N	87° 53' 19.295" E
19	25° 10' 9.053" N	87° 53' 19.680" E
20	25° 10' 8.564" N	87° 53' 16.118" E

FULAHAR RIVER

MD_RT1_FH_15

LEGEND

- COORDINATE
- POTENTIAL BLOCK
- SAFETY BARRIER
- RIVER
- ADMINISTRATIVE BLOCK BOUNDARY
- DISTRICT BOUNDARY

ABBRIVIATION		
DISTRICT	MD	MALDA
BLOCK	RT1	RATUA-I
RIVER	FH	FULAHAR RIVER

0 0.2 0.4 0.8 1.2 1.6

Kilometers

87°52'20"E 87°52'30"E 87°52'40"E 87°52'50"E 87°53'0"E 87°53'10"E 87°53'20"E 87°53'30"E 87°53'40"E 87°53'50"E 87°54'0"E 87°54'10"E

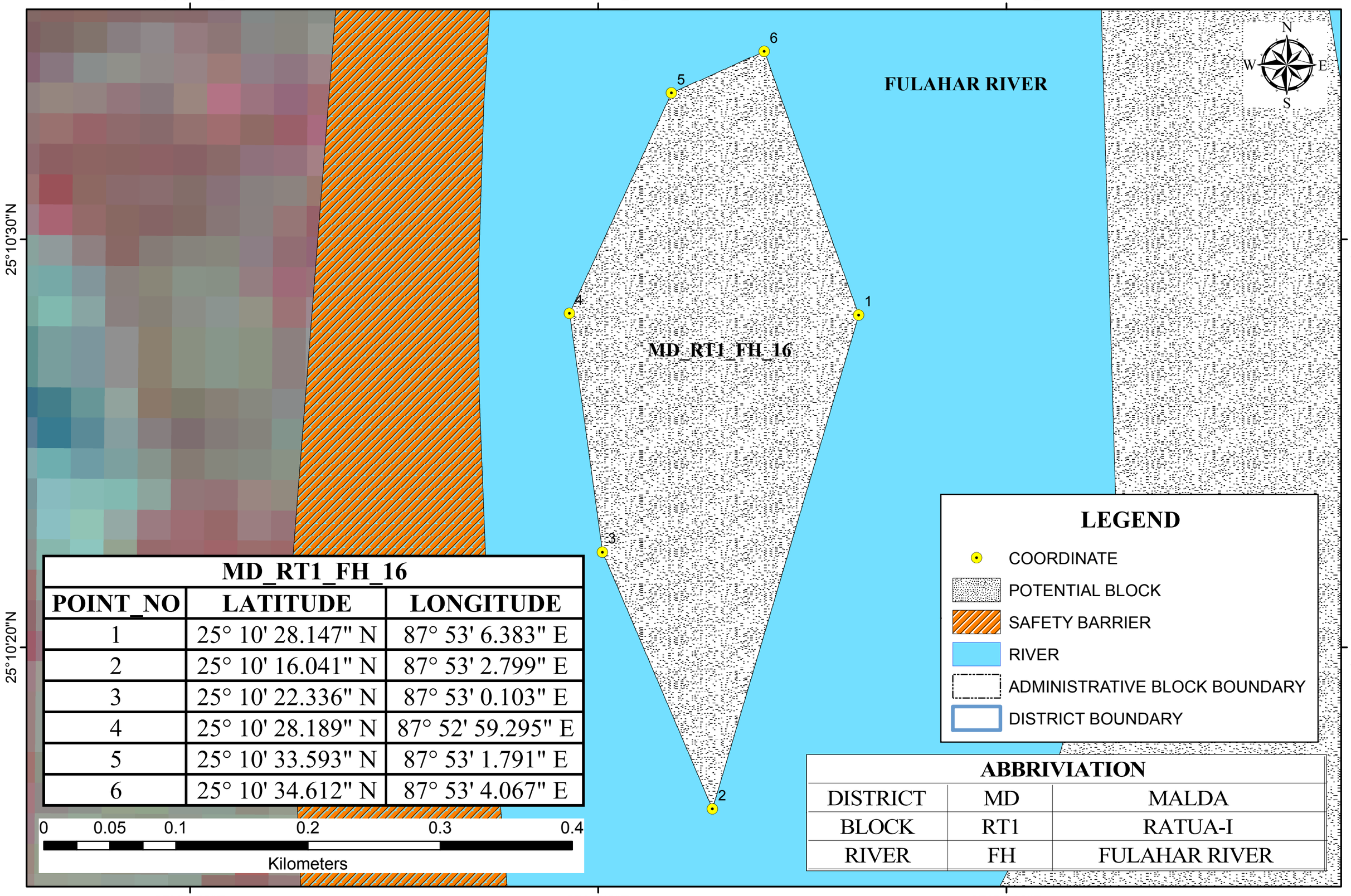
25°11'20"N 25°11'10"N 25°11'0"N 25°10'50"N 25°10'40"N 25°10'30"N 25°10'20"N 25°10'10"N

POTENTIAL BLOCK MD_RT1_FH_16 OF FULAHAR RIVER

87°52'50"E 87°53'0"E 87°53'10"E

25°10'30"N

25°10'20"N



MD_RT1_FH_16		
POINT_NO	LATITUDE	LONGITUDE
1	25° 10' 28.147" N	87° 53' 6.383" E
2	25° 10' 16.041" N	87° 53' 2.799" E
3	25° 10' 22.336" N	87° 53' 0.103" E
4	25° 10' 28.189" N	87° 52' 59.295" E
5	25° 10' 33.593" N	87° 53' 1.791" E
6	25° 10' 34.612" N	87° 53' 4.067" E

0 0.05 0.1 0.2 0.3 0.4

Kilometers

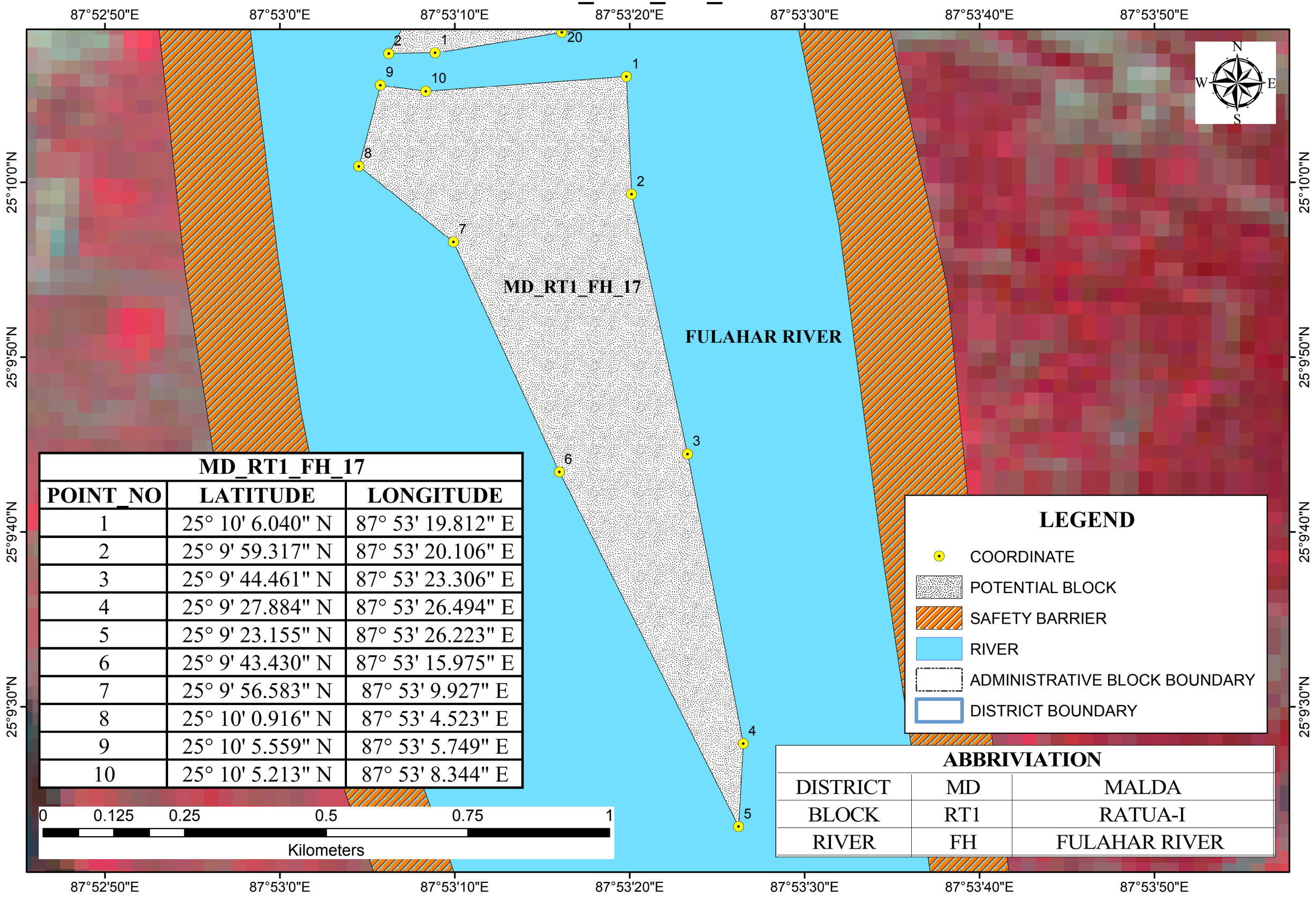
LEGEND

- COORDINATE
- POTENTIAL BLOCK
- SAFETY BARRIER
- RIVER
- ADMINISTRATIVE BLOCK BOUNDARY
- DISTRICT BOUNDARY

ABBRIVIATION		
DISTRICT	MD	MALDA
BLOCK	RT1	RATUA-I
RIVER	FH	FULAHAR RIVER

87°52'50"E 87°53'0"E 87°53'10"E

POTENTIAL BLOCK MD_RT1_FH_17 OF FULAHAR RIVER



MD_RT1_FH_17		
POINT_NO	LATITUDE	LONGITUDE
1	25° 10' 6.040" N	87° 53' 19.812" E
2	25° 9' 59.317" N	87° 53' 20.106" E
3	25° 9' 44.461" N	87° 53' 23.306" E
4	25° 9' 27.884" N	87° 53' 26.494" E
5	25° 9' 23.155" N	87° 53' 26.223" E
6	25° 9' 43.430" N	87° 53' 15.975" E
7	25° 9' 56.583" N	87° 53' 9.927" E
8	25° 10' 0.916" N	87° 53' 4.523" E
9	25° 10' 5.559" N	87° 53' 5.749" E
10	25° 10' 5.213" N	87° 53' 8.344" E

LEGEND

- COORDINATE
- POTENTIAL BLOCK
- SAFETY BARRIER
- RIVER
- ADMINISTRATIVE BLOCK BOUNDARY
- DISTRICT BOUNDARY

ABBRIVIATION		
DISTRICT	MD	MALDA
BLOCK	RT1	RATUA-I
RIVER	FH	FULAHAR RIVER

POTENTIAL BLOCK MD_MC_FH_18 OF FULAHAR RIVER

87°51'0"E 87°51'10"E 87°51'20"E 87°51'30"E

25°5'50"N 25°5'40"N 25°5'30"N

FULAHAR RIVER

N W E S

MD_MC_FH_18		
POINT_NO	LATITUDE	LONGITUDE
1	25° 5' 36.574" N	87° 51' 2.988" E
2	25° 5' 34.692" N	87° 51' 0.101" E
3	25° 5' 36.487" N	87° 50' 59.874" E
4	25° 5' 42.523" N	87° 50' 57.318" E
5	25° 5' 45.728" N	87° 51' 0.882" E
6	25° 5' 49.935" N	87° 51' 17.205" E
7	25° 5' 51.803" N	87° 51' 28.790" E
8	25° 5' 47.183" N	87° 51' 28.069" E
9	25° 5' 44.694" N	87° 51' 20.461" E
10	25° 5' 42.009" N	87° 51' 14.452" E
11	25° 5' 39.529" N	87° 51' 8.904" E
12	25° 5' 38.635" N	87° 51' 7.067" E

LEGEND

- COORDINATE
- POTENTIAL BLOCK
- SAFETY BARRIER
- RIVER
- ADMINISTRATIVE BLOCK BOUNDARY
- DISTRICT BOUNDARY

0 0.075 0.15 0.3 0.45 0.6

Kilometers

ABBRIVIATION		
DISTRICT	MD	MALDA
BLOCK	MC	MANICKCHAK
RIVER	FH	FULAHAR RIVER

POTENTIAL BLOCK MD_MDO_MH_1 OF MAHANANDA RIVER

88°8'0"E

25°2'0"N

25°2'0"N

N

W

E

S

MAHANANDA RIVER

5 6 7 8 9 10 11 12 13 14 15 16 17 18 1 2 3 4

MD_MDO_MH_1		
POINT_NO	LATITUDE	LONGITUDE
1	25° 1' 54.904" N	88° 8' 8.714" E
2	25° 1' 48.204" N	88° 8' 7.519" E
3	25° 1' 48.610" N	88° 8' 5.116" E
4	25° 1' 52.496" N	88° 8' 3.028" E
5	25° 1' 58.245" N	88° 8' 2.977" E
6	25° 1' 58.571" N	88° 8' 5.068" E
7	25° 1' 58.585" N	88° 8' 5.154" E
8	25° 1' 58.650" N	88° 8' 5.537" E
9	25° 1' 58.723" N	88° 8' 5.918" E
10	25° 1' 58.804" N	88° 8' 6.296" E
11	25° 1' 58.892" N	88° 8' 6.673" E
12	25° 1' 58.987" N	88° 8' 7.048" E
13	25° 1' 59.090" N	88° 8' 7.420" E
14	25° 1' 59.200" N	88° 8' 7.790" E
15	25° 1' 59.318" N	88° 8' 8.157" E
16	25° 1' 59.443" N	88° 8' 8.522" E
17	25° 1' 59.447" N	88° 8' 8.533" E
18	25° 1' 58.493" N	88° 8' 8.747" E

LEGEND

- COORDINATE
- POTENTIAL BLOCK
- SAFETY BARRIER
- RIVER
- ADMINISTRATIVE BLOCK BOUNDARY
- DISTRICT BOUNDARY

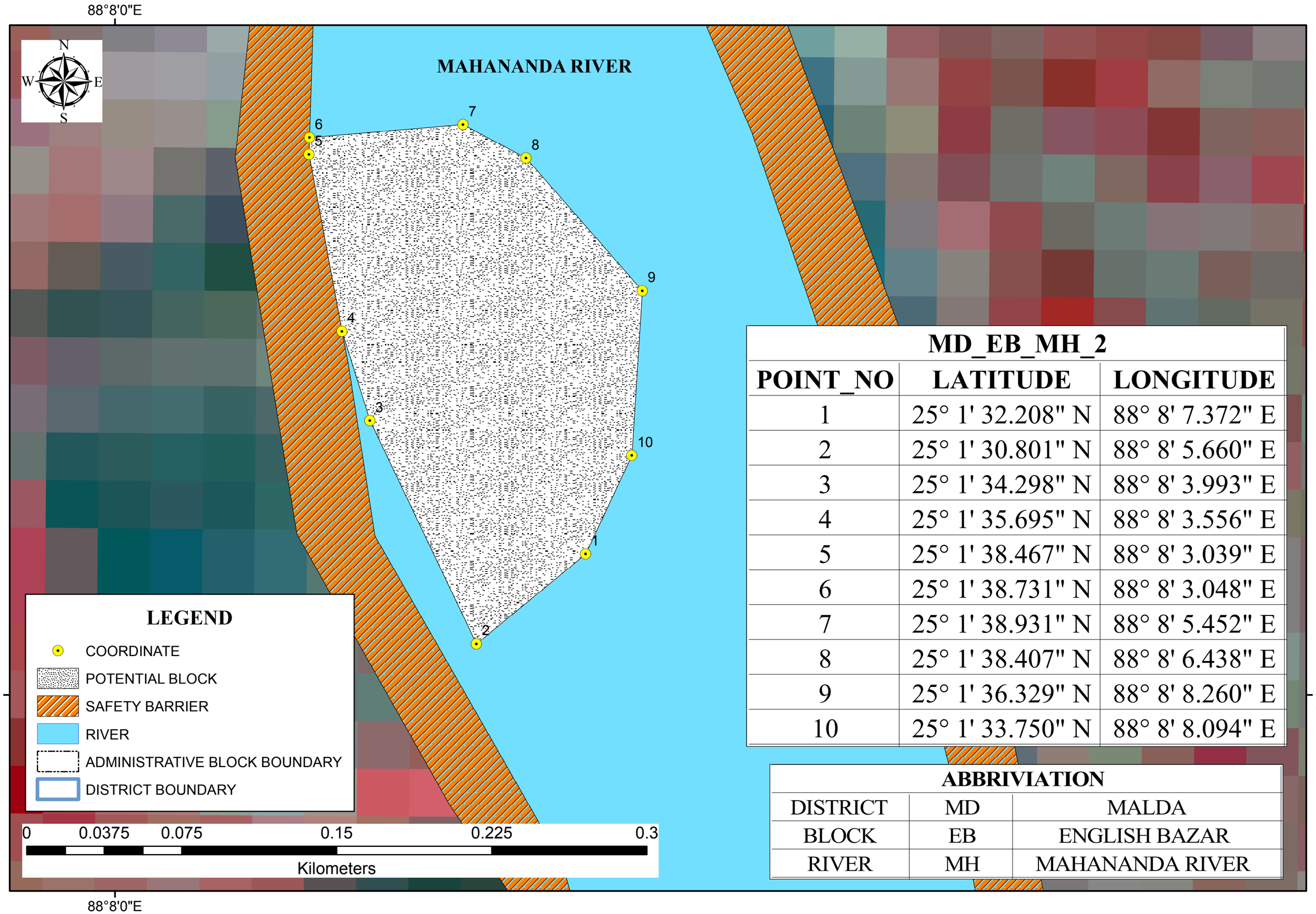
0 0.0375 0.075 0.15 0.225 0.3

Kilometers

88°8'0"E

ABBRIVIATION		
DISTRICT	MD	MALDA
BLOCK	MDO	OLD MALDA
RIVER	MH	MAHANANDA RIVER

POTENTIAL BLOCK MD_EB_MH_2 OF MAHANANDA RIVER



MD_EB_MH_2		
POINT_NO	LATITUDE	LONGITUDE
1	25° 1' 32.208" N	88° 8' 7.372" E
2	25° 1' 30.801" N	88° 8' 5.660" E
3	25° 1' 34.298" N	88° 8' 3.993" E
4	25° 1' 35.695" N	88° 8' 3.556" E
5	25° 1' 38.467" N	88° 8' 3.039" E
6	25° 1' 38.731" N	88° 8' 3.048" E
7	25° 1' 38.931" N	88° 8' 5.452" E
8	25° 1' 38.407" N	88° 8' 6.438" E
9	25° 1' 36.329" N	88° 8' 8.260" E
10	25° 1' 33.750" N	88° 8' 8.094" E

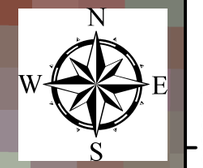
ABBRIVIATION		
DISTRICT	MD	MALDA
BLOCK	EB	ENGLISH BAZAR
RIVER	MH	MAHANANDA RIVER

POTENTIAL BLOCK MD_EB_MH_3 OF MAHANANDA RIVER

88°9'30"E

25°0'30"N

MAHANANDA RIVER



MD_EB_MH_3		
POINT_NO	LATITUDE	LONGITUDE
1	25° 0' 10.749" N	88° 9' 20.807" E
2	25° 0' 8.319" N	88° 9' 18.095" E
3	25° 0' 12.382" N	88° 9' 16.532" E
4	25° 0' 13.472" N	88° 9' 16.162" E
5	25° 0' 17.899" N	88° 9' 14.561" E
6	25° 0' 18.409" N	88° 9' 14.243" E
7	25° 0' 23.588" N	88° 9' 12.291" E
8	25° 0' 28.143" N	88° 9' 7.502" E
9	25° 0' 30.065" N	88° 9' 6.605" E
10	25° 0' 31.375" N	88° 9' 6.276" E
11	25° 0' 28.750" N	88° 9' 12.056" E
12	25° 0' 24.319" N	88° 9' 17.819" E
13	25° 0' 18.613" N	88° 9' 21.589" E
14	25° 0' 14.610" N	88° 9' 22.117" E

LEGEND

- COORDINATE
- POTENTIAL BLOCK
- SAFETY BARRIER
- RIVER
- ADMINISTRATIVE BLOCK BOUNDARY
- DISTRICT BOUNDARY

0 0.075 0.15 0.3 0.45 0.6

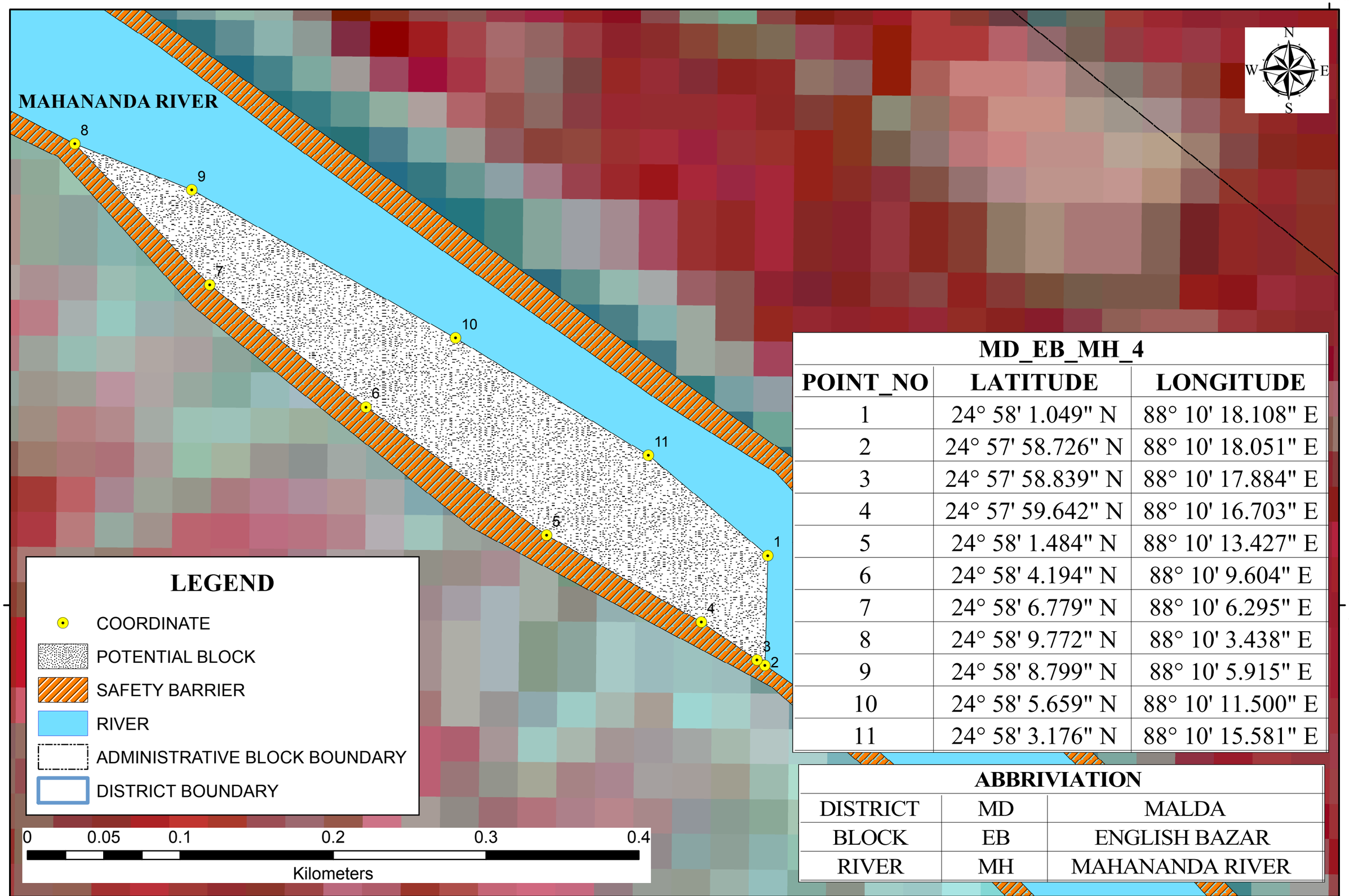
Kilometers

ABBRIVIATION		
DISTRICT	MD	MALDA
BLOCK	EB	ENGLISH BAZAR
RIVER	MH	MAHANANDA RIVER

88°9'30"E

POTENTIAL BLOCK MD_EB_MH_4 OF MAHANANDA RIVER

88°10'30"E



MD_EB_MH_4		
POINT_NO	LATITUDE	LONGITUDE
1	24° 58' 1.049" N	88° 10' 18.108" E
2	24° 57' 58.726" N	88° 10' 18.051" E
3	24° 57' 58.839" N	88° 10' 17.884" E
4	24° 57' 59.642" N	88° 10' 16.703" E
5	24° 58' 1.484" N	88° 10' 13.427" E
6	24° 58' 4.194" N	88° 10' 9.604" E
7	24° 58' 6.779" N	88° 10' 6.295" E
8	24° 58' 9.772" N	88° 10' 3.438" E
9	24° 58' 8.799" N	88° 10' 5.915" E
10	24° 58' 5.659" N	88° 10' 11.500" E
11	24° 58' 3.176" N	88° 10' 15.581" E

ABBRIVIATION		
DISTRICT	MD	MALDA
BLOCK	EB	ENGLISH BAZAR
RIVER	MH	MAHANANDA RIVER

88°10'30"E

POTENTIAL BLOCK MD_CH2_NG_1 OF NAGRI RIVER

88°6'30"E

N
W E
S

9
8
7
6
12
13
3 5
4
2
1

NAGRI RIVER

25°19'0"N

LEGEND

- COORDINATE
- POTENTIAL BLOCK
- SAFETY BARRIER
- RIVER
- ADMINISTRATIVE BLOCK BOUNDARY
- DISTRICT BOUNDARY

ABBRIVIATION		
DISTRICT	MD	MALDA
BLOCK	CH2	CHANCHAL-II
RIVER	NG	NAGRI RIVER

0 0.05 0.1 0.2 0.3 0.4

Kilometers

MD_CH2_NG_1		
POINT_NO	LATITUDE	LONGITUDE
1	25° 19' 0.339" N	88° 6' 26.553" E
2	25° 19' 0.264" N	88° 6' 23.597" E
3	25° 19' 2.707" N	88° 6' 25.580" E
4	25° 19' 2.744" N	88° 6' 25.611" E
5	25° 19' 2.828" N	88° 6' 25.687" E
6	25° 19' 6.860" N	88° 6' 29.375" E
7	25° 19' 6.933" N	88° 6' 29.443" E
8	25° 19' 9.238" N	88° 6' 31.125" E
9	25° 19' 10.505" N	88° 6' 32.049" E
10	25° 19' 12.593" N	88° 6' 33.574" E
11	25° 19' 8.663" N	88° 6' 35.061" E
12	25° 19' 6.278" N	88° 6' 32.738" E
13	25° 19' 3.547" N	88° 6' 29.988" E

25°19'0"N

88°6'30"E

POTENTIAL BLOCK MD_CH2_NG_2 OF NAGRI RIVER

88°6'10"E 88°6'20"E 88°6'30"E

25°18'50"N

25°18'40"N

NAGRI RIVER

N W E S

LEGEND

- COORDINATE
- POTENTIAL BLOCK
- SAFETY BARRIER
- RIVER
- ADMINISTRATIVE BLOCK BOUNDARY
- DISTRICT BOUNDARY

ABBRIVIATION		
DISTRICT	MD	MALDA
BLOCK	CH2	CHANCHAL-II
RIVER	NG	NAGRI RIVER

0 0.05 0.1 0.2 0.3 0.4

Kilometers

MD_CH2_NG_2		
POINT_NO	LATITUDE	LONGITUDE
1	25° 18' 36.869" N	88° 6' 16.978" E
2	25° 18' 36.626" N	88° 6' 16.241" E
3	25° 18' 38.725" N	88° 6' 16.185" E
4	25° 18' 43.856" N	88° 6' 15.474" E
5	25° 18' 48.839" N	88° 6' 16.314" E
6	25° 18' 51.575" N	88° 6' 18.421" E
7	25° 18' 51.553" N	88° 6' 20.058" E
8	25° 18' 51.139" N	88° 6' 19.595" E
9	25° 18' 48.675" N	88° 6' 18.179" E
10	25° 18' 47.208" N	88° 6' 17.822" E
11	25° 18' 45.467" N	88° 6' 17.398" E
12	25° 18' 45.431" N	88° 6' 17.394" E
13	25° 18' 42.085" N	88° 6' 16.979" E
14	25° 18' 40.197" N	88° 6' 16.802" E
15	25° 18' 39.359" N	88° 6' 16.724" E
16	25° 18' 38.857" N	88° 6' 16.677" E
17	25° 18' 37.629" N	88° 6' 16.863" E

POTENTIAL BLOCK MD_CH2_NG_3 OF NAGRI RIVER

88°6'0"E 88°6'30"E

25°18'0"N 25°17'30"N

N W E S

LEGEND

- COORDINATE
- POTENTIAL BLOCK
- SAFETY BARRIER
- RIVER
- ADMINISTRATIVE BLOCK BOUNDARY
- DISTRICT BOUNDARY

ABBRIVIATION		
DISTRICT	MD	MALDA
BLOCK	CH2	CHANCHAL-II
RIVER	NG	NAGRI RIVER

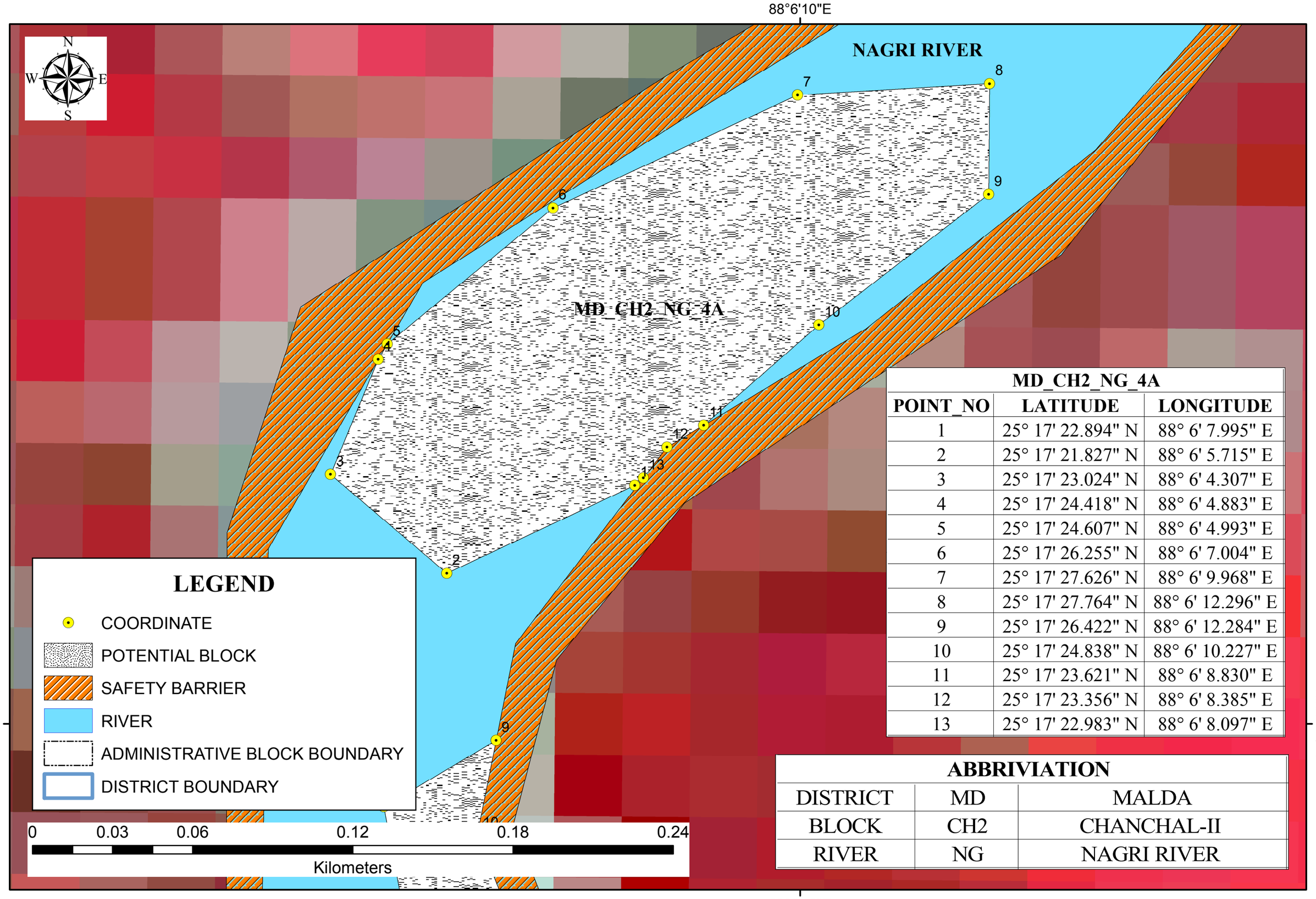
0 0.125 0.25 0.5 0.75 1

Kilometers

NAGRI RIVER

MD_CH2_NG_3		
POINT_NO	LATITUDE	LONGITUDE
1	25° 17' 35.362" N	88° 6' 21.022" E
2	25° 17' 35.270" N	88° 6' 19.166" E
3	25° 17' 36.942" N	88° 6' 20.650" E
4	25° 17' 40.333" N	88° 6' 24.580" E
5	25° 17' 41.758" N	88° 6' 26.136" E
6	25° 17' 42.931" N	88° 6' 27.417" E
7	25° 17' 43.913" N	88° 6' 28.429" E
8	25° 17' 45.412" N	88° 6' 29.975" E
9	25° 17' 47.970" N	88° 6' 30.282" E
10	25° 17' 48.081" N	88° 6' 30.296" E
11	25° 17' 51.871" N	88° 6' 30.303" E
12	25° 17' 52.041" N	88° 6' 30.303" E
13	25° 17' 52.922" N	88° 6' 30.081" E
14	25° 17' 56.755" N	88° 6' 28.389" E
15	25° 17' 59.274" N	88° 6' 27.277" E
16	25° 18' 1.086" N	88° 6' 26.432" E
17	25° 18' 6.222" N	88° 6' 24.039" E
18	25° 18' 7.071" N	88° 6' 23.644" E
19	25° 18' 9.577" N	88° 6' 22.724" E
20	25° 18' 13.613" N	88° 6' 21.243" E
21	25° 18' 14.658" N	88° 6' 20.860" E
22	25° 18' 14.993" N	88° 6' 22.224" E
23	25° 18' 13.049" N	88° 6' 23.483" E
24	25° 18' 8.365" N	88° 6' 25.314" E
25	25° 18' 2.954" N	88° 6' 27.734" E
26	25° 17' 59.380" N	88° 6' 29.433" E
27	25° 17' 55.601" N	88° 6' 31.017" E
28	25° 17' 53.895" N	88° 6' 31.540" E
29	25° 17' 52.673" N	88° 6' 31.624" E
30	25° 17' 50.710" N	88° 6' 31.890" E
31	25° 17' 48.747" N	88° 6' 32.099" E
32	25° 17' 44.931" N	88° 6' 31.837" E
33	25° 17' 42.013" N	88° 6' 28.632" E
34	25° 17' 40.687" N	88° 6' 26.576" E
35	25° 17' 38.485" N	88° 6' 24.342" E

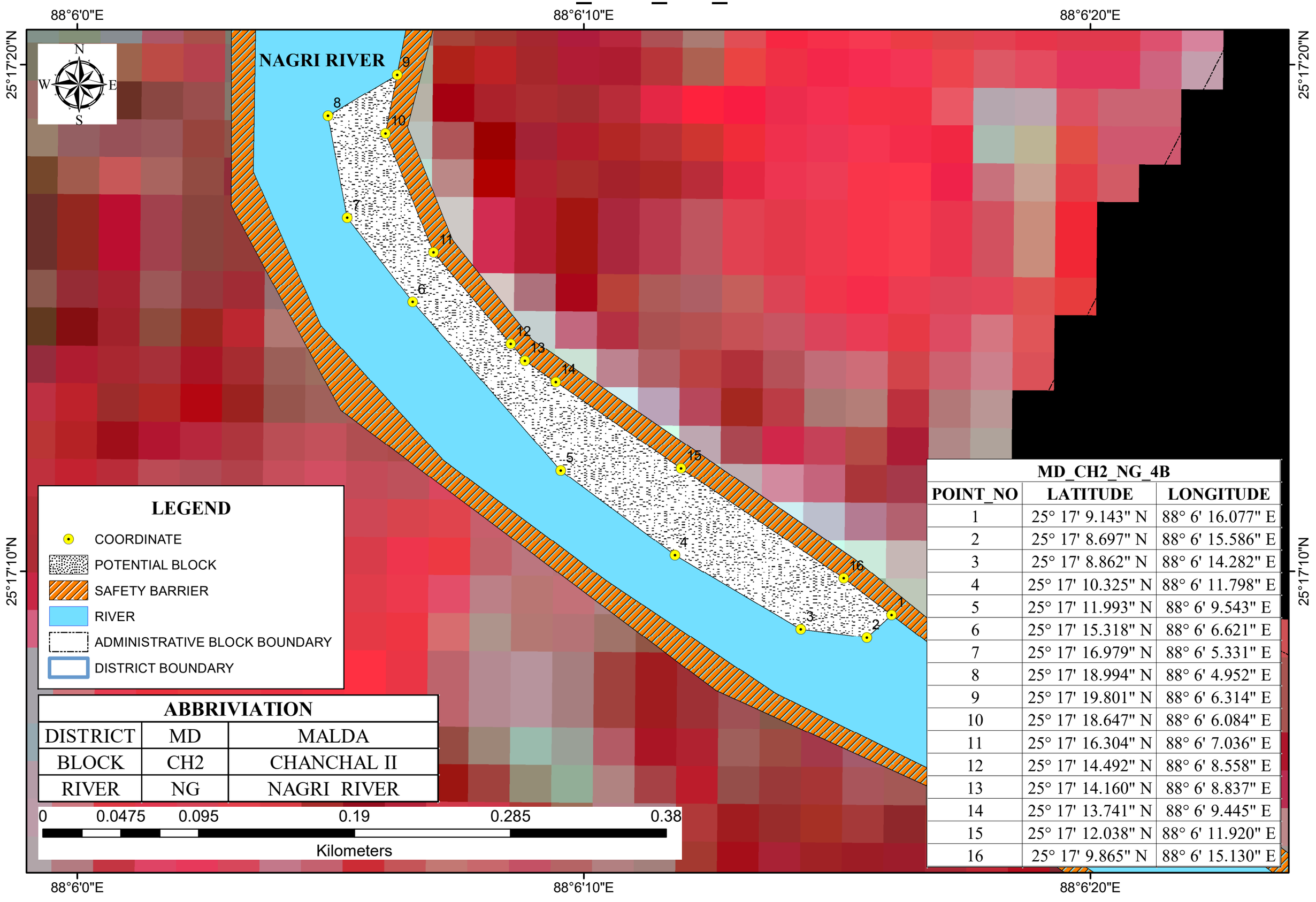
POTENTIAL BLOCK MD_CH2_NG_4A OF NAGRI RIVER



MD_CH2_NG_4A		
POINT_NO	LATITUDE	LONGITUDE
1	25° 17' 22.894" N	88° 6' 7.995" E
2	25° 17' 21.827" N	88° 6' 5.715" E
3	25° 17' 23.024" N	88° 6' 4.307" E
4	25° 17' 24.418" N	88° 6' 4.883" E
5	25° 17' 24.607" N	88° 6' 4.993" E
6	25° 17' 26.255" N	88° 6' 7.004" E
7	25° 17' 27.626" N	88° 6' 9.968" E
8	25° 17' 27.764" N	88° 6' 12.296" E
9	25° 17' 26.422" N	88° 6' 12.284" E
10	25° 17' 24.838" N	88° 6' 10.227" E
11	25° 17' 23.621" N	88° 6' 8.830" E
12	25° 17' 23.356" N	88° 6' 8.385" E
13	25° 17' 22.983" N	88° 6' 8.097" E

ABBRIVIATION		
DISTRICT	MD	MALDA
BLOCK	CH2	CHANCHAL-II
RIVER	NG	NAGRI RIVER

POTENTIAL BLOCK MD_CH2_NG_4B OF NAGRI RIVER



ABBRIVIATION		
DISTRICT	MD	MALDA
BLOCK	CH2	CHANCHAL II
RIVER	NG	NAGRI RIVER

MD_CH2_NG_4B		
POINT_NO	LATITUDE	LONGITUDE
1	25° 17' 9.143" N	88° 6' 16.077" E
2	25° 17' 8.697" N	88° 6' 15.586" E
3	25° 17' 8.862" N	88° 6' 14.282" E
4	25° 17' 10.325" N	88° 6' 11.798" E
5	25° 17' 11.993" N	88° 6' 9.543" E
6	25° 17' 15.318" N	88° 6' 6.621" E
7	25° 17' 16.979" N	88° 6' 5.331" E
8	25° 17' 18.994" N	88° 6' 4.952" E
9	25° 17' 19.801" N	88° 6' 6.314" E
10	25° 17' 18.647" N	88° 6' 6.084" E
11	25° 17' 16.304" N	88° 6' 7.036" E
12	25° 17' 14.492" N	88° 6' 8.558" E
13	25° 17' 14.160" N	88° 6' 8.837" E
14	25° 17' 13.741" N	88° 6' 9.445" E
15	25° 17' 12.038" N	88° 6' 11.920" E
16	25° 17' 9.865" N	88° 6' 15.130" E

POTENTIAL BLOCK MD_CH2_NG_5 OF NAGRI RIVER

88°6'10"E

88°6'20"E

25°16'50"N

25°16'40"N

NAGRI RIVER

N

W

E

S

LEGEND

- COORDINATE
- POTENTIAL BLOCK
- SAFETY BARRIER
- RIVER
- ADMINISTRATIVE BLOCK BOUNDARY
- DISTRICT BOUNDARY

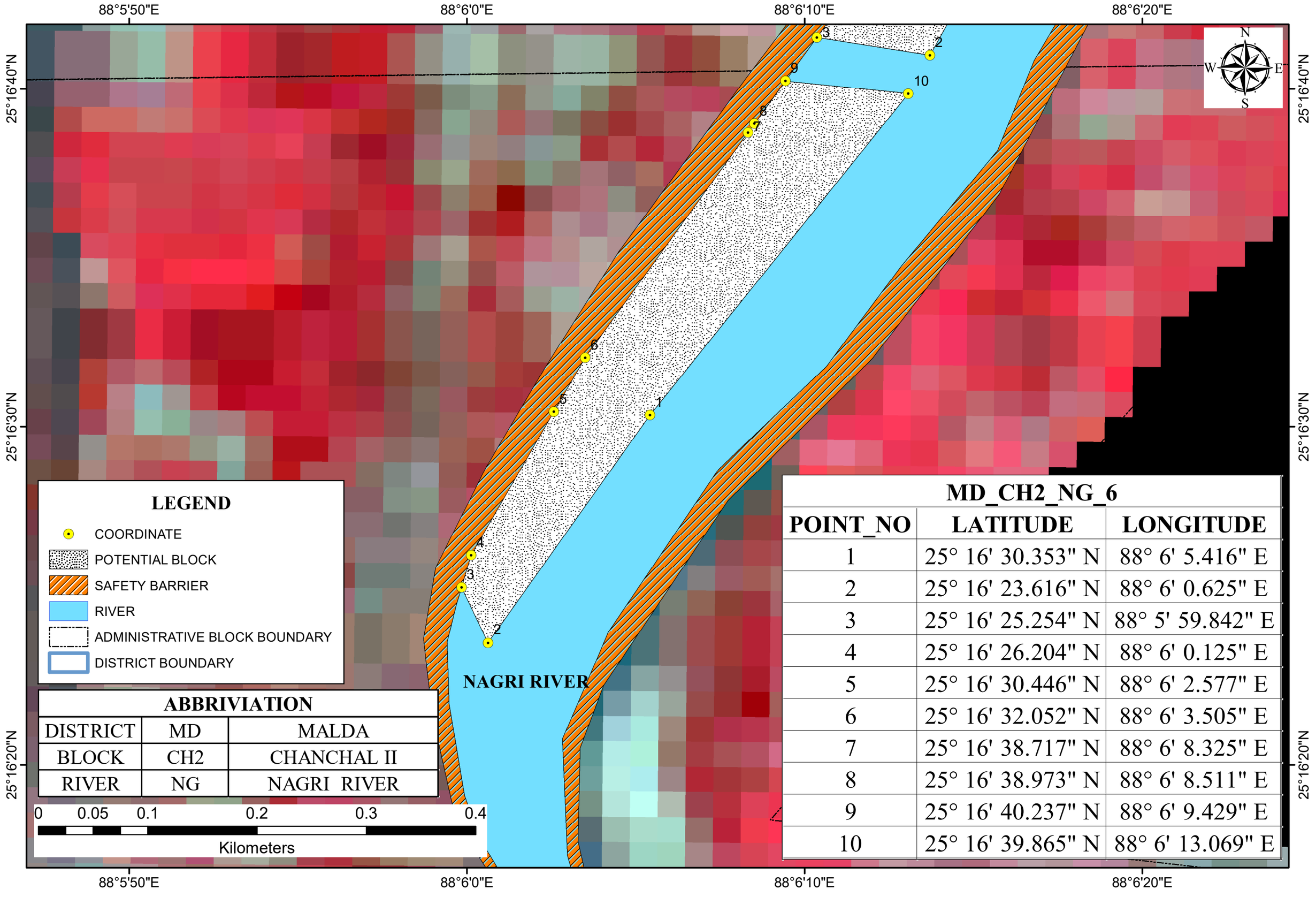
ABBRIVIATION		
DISTRICT	MD	MALDA
BLOCK	CH2	CHANCHAL II
RIVER	NG	NAGRI RIVER

0 0.0475 0.095 0.19 0.285 0.38

Kilometers

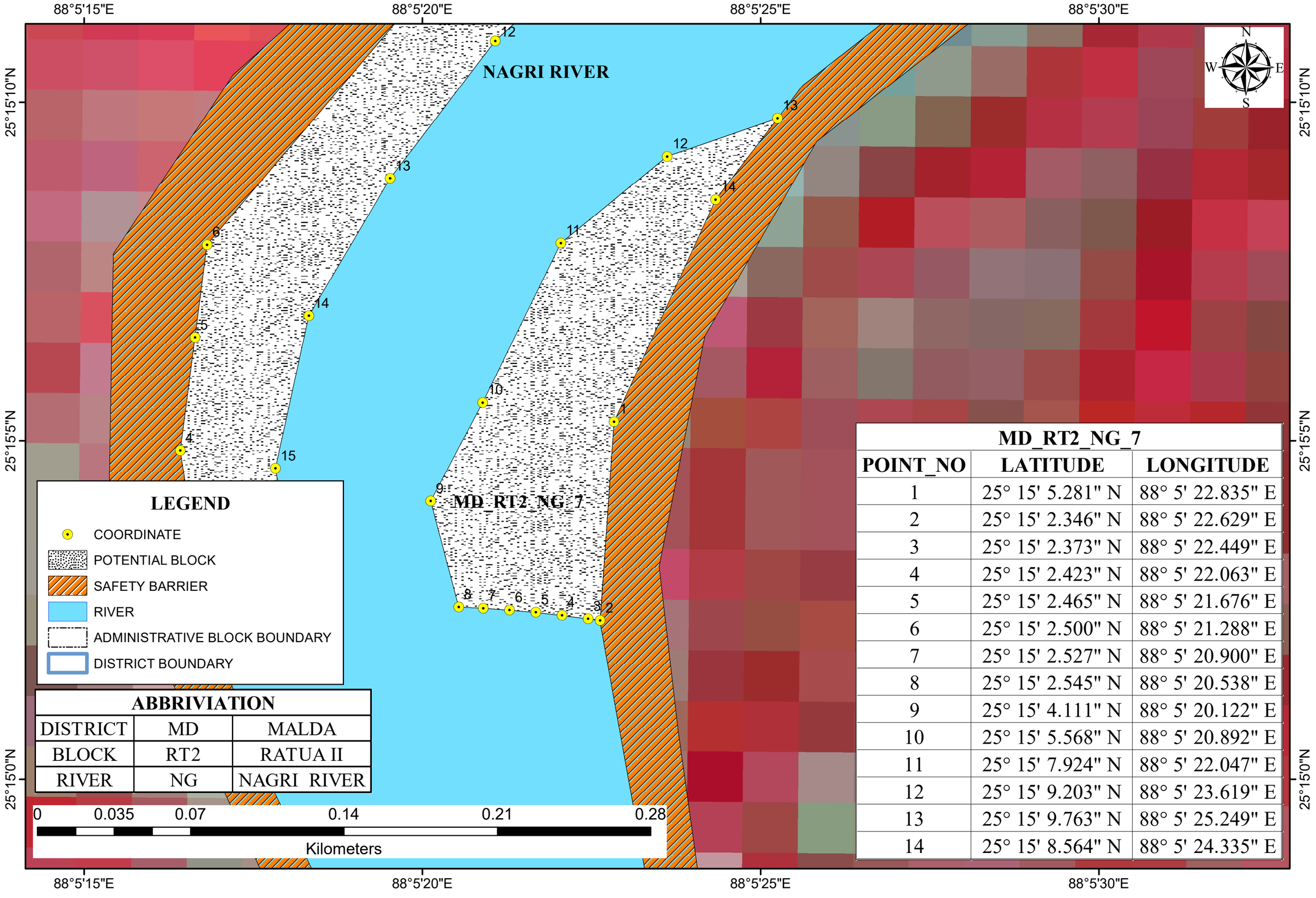
MD_CH2_NG_5		
POINT_NO	LATITUDE	LONGITUDE
1	25° 16' 46.288" N	88° 6' 16.675" E
2	25° 16' 40.997" N	88° 6' 13.705" E
3	25° 16' 41.524" N	88° 6' 10.364" E
4	25° 16' 42.510" N	88° 6' 11.080" E
5	25° 16' 44.123" N	88° 6' 12.253" E
6	25° 16' 47.451" N	88° 6' 14.408" E
7	25° 16' 51.761" N	88° 6' 18.025" E
8	25° 16' 49.821" N	88° 6' 18.717" E

POTENTIAL BLOCK MD_CH2_NG_6 OF NAGRI RIVER



MD_CH2_NG_6		
POINT_NO	LATITUDE	LONGITUDE
1	25° 16' 30.353" N	88° 6' 5.416" E
2	25° 16' 23.616" N	88° 6' 0.625" E
3	25° 16' 25.254" N	88° 5' 59.842" E
4	25° 16' 26.204" N	88° 6' 0.125" E
5	25° 16' 30.446" N	88° 6' 2.577" E
6	25° 16' 32.052" N	88° 6' 3.505" E
7	25° 16' 38.717" N	88° 6' 8.325" E
8	25° 16' 38.973" N	88° 6' 8.511" E
9	25° 16' 40.237" N	88° 6' 9.429" E
10	25° 16' 39.865" N	88° 6' 13.069" E

POTENTIAL BLOCK MD_RT2_NG_7 OF NAGRI RIVER



ABBRIVIATION		
DISTRICT	MD	MALDA
BLOCK	RT2	RATUA II
RIVER	NG	NAGRI RIVER

MD_RT2_NG_7		
POINT_NO	LATITUDE	LONGITUDE
1	25° 15' 5.281" N	88° 5' 22.835" E
2	25° 15' 2.346" N	88° 5' 22.629" E
3	25° 15' 2.373" N	88° 5' 22.449" E
4	25° 15' 2.423" N	88° 5' 22.063" E
5	25° 15' 2.465" N	88° 5' 21.676" E
6	25° 15' 2.500" N	88° 5' 21.288" E
7	25° 15' 2.527" N	88° 5' 20.900" E
8	25° 15' 2.545" N	88° 5' 20.538" E
9	25° 15' 4.111" N	88° 5' 20.122" E
10	25° 15' 5.568" N	88° 5' 20.892" E
11	25° 15' 7.924" N	88° 5' 22.047" E
12	25° 15' 9.203" N	88° 5' 23.619" E
13	25° 15' 9.763" N	88° 5' 25.249" E
14	25° 15' 8.564" N	88° 5' 24.335" E

POTENTIAL BLOCK MD_RT2_NG_8 OF NAGRI RIVER

88°5'5"E 88°5'10"E 88°5'15"E 88°5'20"E 88°5'25"E 88°5'30"E

25°15'15"N 25°15'10"N 25°15'5"N 25°15'0"N

NAGRI RIVER

MD_RT2_NG_8

LEGEND

- COORDINATE
- POTENTIAL BLOCK
- SAFETY BARRIER
- RIVER
- ADMINISTRATIVE BLOCK BOUNDARY
- DISTRICT BOUNDARY

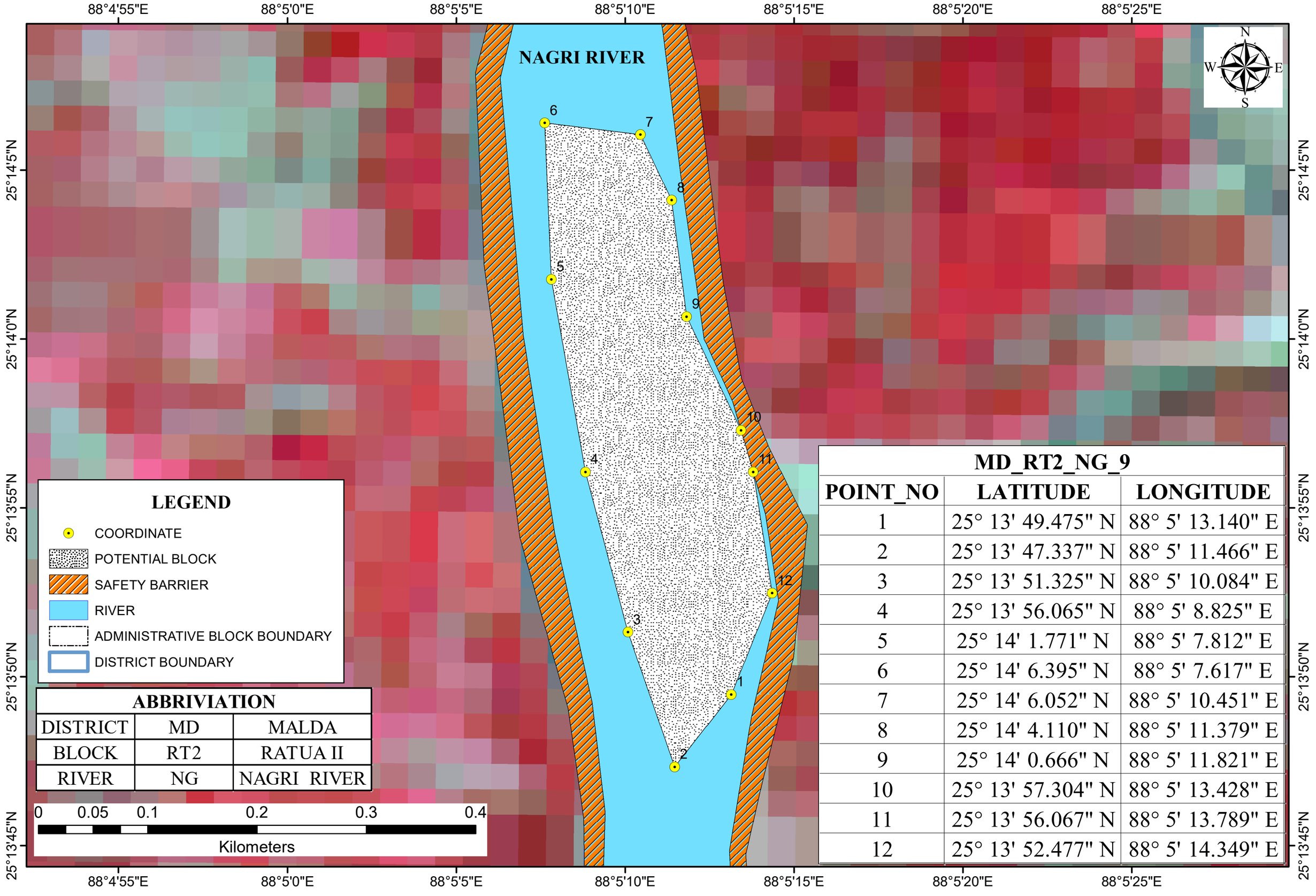
ABBRIVIATION		
DISTRICT	MD	MALDA
BLOCK	RT2	RATUA II
RIVER	NG	NAGRI RIVER

0 0.05 0.1 0.2 0.3 0.4

Kilometers

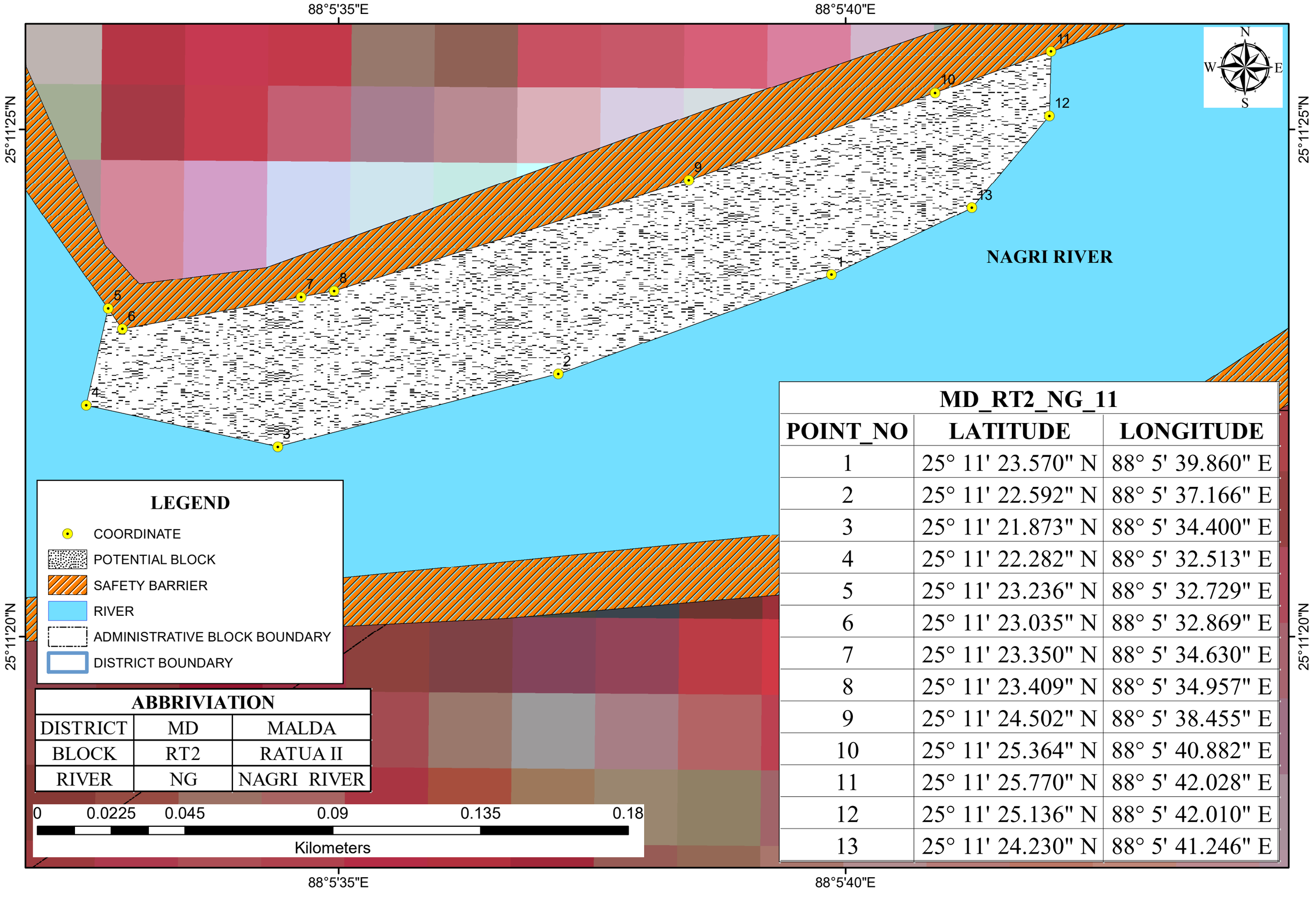
MD_RT2_NG_8		
POINT_NO	LATITUDE	LONGITUDE
1	25° 15' 2.373" N	88° 5' 17.013" E
2	25° 15' 2.360" N	88° 5' 16.926" E
3	25° 15' 2.557" N	88° 5' 16.784" E
4	25° 15' 4.857" N	88° 5' 16.422" E
5	25° 15' 6.526" N	88° 5' 16.639" E
6	25° 15' 7.898" N	88° 5' 16.818" E
7	25° 15' 12.040" N	88° 5' 20.343" E
8	25° 15' 14.909" N	88° 5' 23.903" E
9	25° 15' 14.108" N	88° 5' 24.769" E
10	25° 15' 12.818" N	88° 5' 24.758" E
11	25° 15' 11.763" N	88° 5' 22.030" E
12	25° 15' 10.910" N	88° 5' 21.076" E
13	25° 15' 8.879" N	88° 5' 19.521" E
14	25° 15' 6.845" N	88° 5' 18.321" E
15	25° 15' 4.591" N	88° 5' 17.828" E
16	25° 15' 2.760" N	88° 5' 18.166" E
17	25° 15' 2.511" N	88° 5' 18.339" E
18	25° 15' 2.500" N	88° 5' 18.174" E
19	25° 15' 2.465" N	88° 5' 17.786" E
20	25° 15' 2.423" N	88° 5' 17.399" E

POTENTIAL BLOCK MD_RT2_NG_9 OF NAGRI RIVER



MD_RT2_NG_9		
POINT_NO	LATITUDE	LONGITUDE
1	25° 13' 49.475" N	88° 5' 13.140" E
2	25° 13' 47.337" N	88° 5' 11.466" E
3	25° 13' 51.325" N	88° 5' 10.084" E
4	25° 13' 56.065" N	88° 5' 8.825" E
5	25° 14' 1.771" N	88° 5' 7.812" E
6	25° 14' 6.395" N	88° 5' 7.617" E
7	25° 14' 6.052" N	88° 5' 10.451" E
8	25° 14' 4.110" N	88° 5' 11.379" E
9	25° 14' 0.666" N	88° 5' 11.821" E
10	25° 13' 57.304" N	88° 5' 13.428" E
11	25° 13' 56.067" N	88° 5' 13.789" E
12	25° 13' 52.477" N	88° 5' 14.349" E

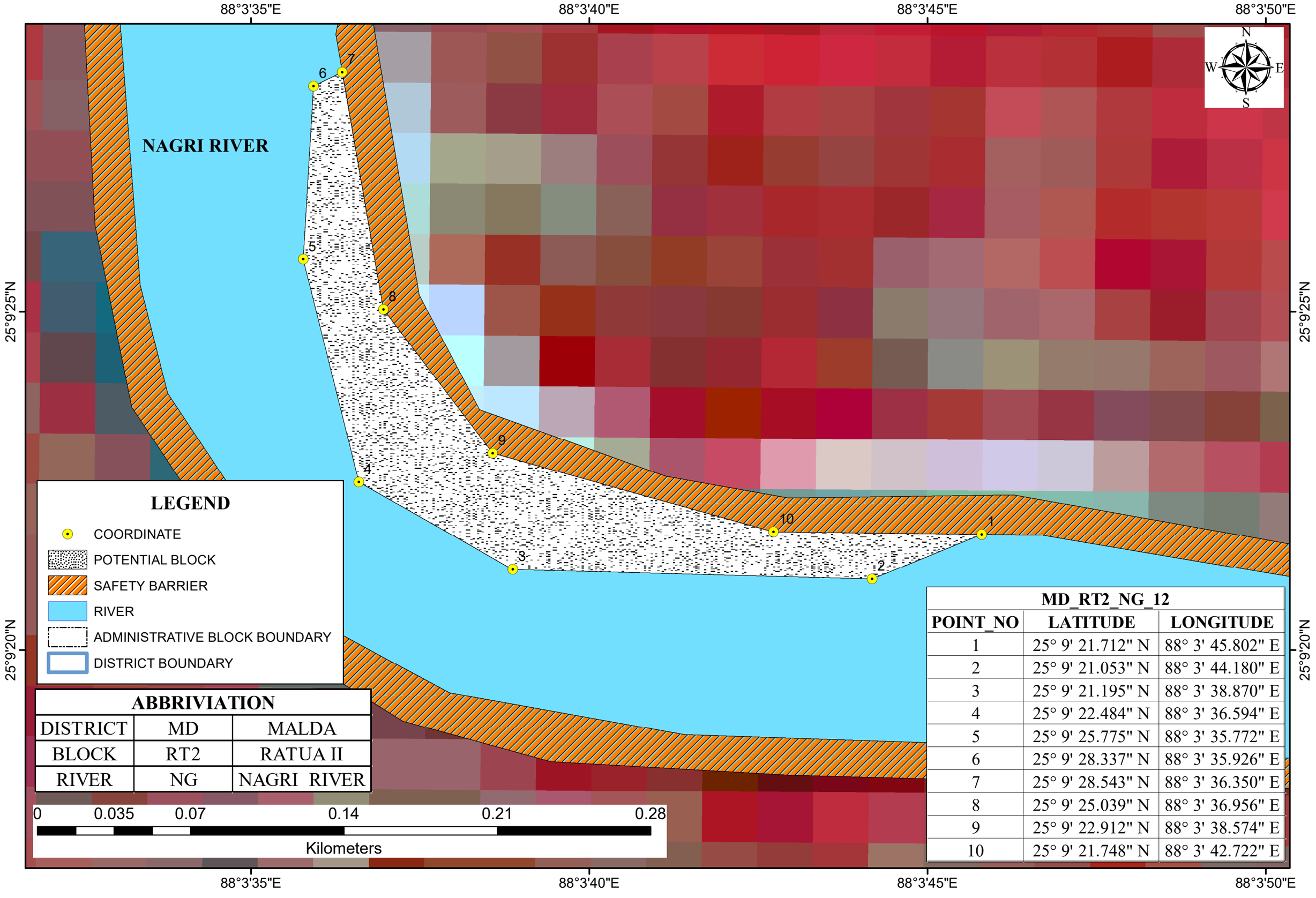
POTENTIAL BLOCK MD_RT2_NG_11 OF NAGRI RIVER



ABBRIVIATION		
DISTRICT	MD	MALDA
BLOCK	RT2	RATUA II
RIVER	NG	NAGRI RIVER

MD_RT2_NG_11		
POINT_NO	LATITUDE	LONGITUDE
1	25° 11' 23.570" N	88° 5' 39.860" E
2	25° 11' 22.592" N	88° 5' 37.166" E
3	25° 11' 21.873" N	88° 5' 34.400" E
4	25° 11' 22.282" N	88° 5' 32.513" E
5	25° 11' 23.236" N	88° 5' 32.729" E
6	25° 11' 23.035" N	88° 5' 32.869" E
7	25° 11' 23.350" N	88° 5' 34.630" E
8	25° 11' 23.409" N	88° 5' 34.957" E
9	25° 11' 24.502" N	88° 5' 38.455" E
10	25° 11' 25.364" N	88° 5' 40.882" E
11	25° 11' 25.770" N	88° 5' 42.028" E
12	25° 11' 25.136" N	88° 5' 42.010" E
13	25° 11' 24.230" N	88° 5' 41.246" E

POTENTIAL BLOCK MD_RT2_NG_12 OF NAGRI RIVER



ABBRIVIATION		
DISTRICT	MD	MALDA
BLOCK	RT2	RATUA II
RIVER	NG	NAGRI RIVER

MD_RT2_NG_12		
POINT_NO	LATITUDE	LONGITUDE
1	25° 9' 21.712" N	88° 3' 45.802" E
2	25° 9' 21.053" N	88° 3' 44.180" E
3	25° 9' 21.195" N	88° 3' 38.870" E
4	25° 9' 22.484" N	88° 3' 36.594" E
5	25° 9' 25.775" N	88° 3' 35.772" E
6	25° 9' 28.337" N	88° 3' 35.926" E
7	25° 9' 28.543" N	88° 3' 36.350" E
8	25° 9' 25.039" N	88° 3' 36.956" E
9	25° 9' 22.912" N	88° 3' 38.574" E
10	25° 9' 21.748" N	88° 3' 42.722" E

POTENTIAL BLOCK MD_EB_KD_1 OF KALINDRI RIVER

88°3'50"E 88°4'0"E

25°3'50"N 25°3'40"N

KALINDRI RIVER

N W E S

MD_EB_KD_1		
POINT_NO	LATITUDE	LONGITUDE
1	25° 3' 40.128" N	88° 3' 58.019" E
2	25° 3' 38.674" N	88° 3' 56.453" E
3	25° 3' 41.250" N	88° 3' 52.320" E
4	25° 3' 45.230" N	88° 3' 49.106" E
5	25° 3' 49.137" N	88° 3' 46.420" E
6	25° 3' 51.828" N	88° 3' 45.310" E
7	25° 3' 52.815" N	88° 3' 45.827" E
8	25° 3' 52.583" N	88° 3' 45.990" E
9	25° 3' 51.000" N	88° 3' 47.412" E
10	25° 3' 49.638" N	88° 3' 48.640" E
11	25° 3' 48.099" N	88° 3' 50.046" E
12	25° 3' 45.695" N	88° 3' 52.410" E
13	25° 3' 43.397" N	88° 3' 54.490" E
14	25° 3' 41.441" N	88° 3' 56.397" E

LEGEND

- COORDINATE
- POTENTIAL BLOCK
- SAFETY BARRIER
- RIVER
- ADMINISTRATIVE BLOCK BOUNDARY
- DISTRICT BOUNDARY

0 0.05 0.1 0.2 0.3 0.4

Kilometers

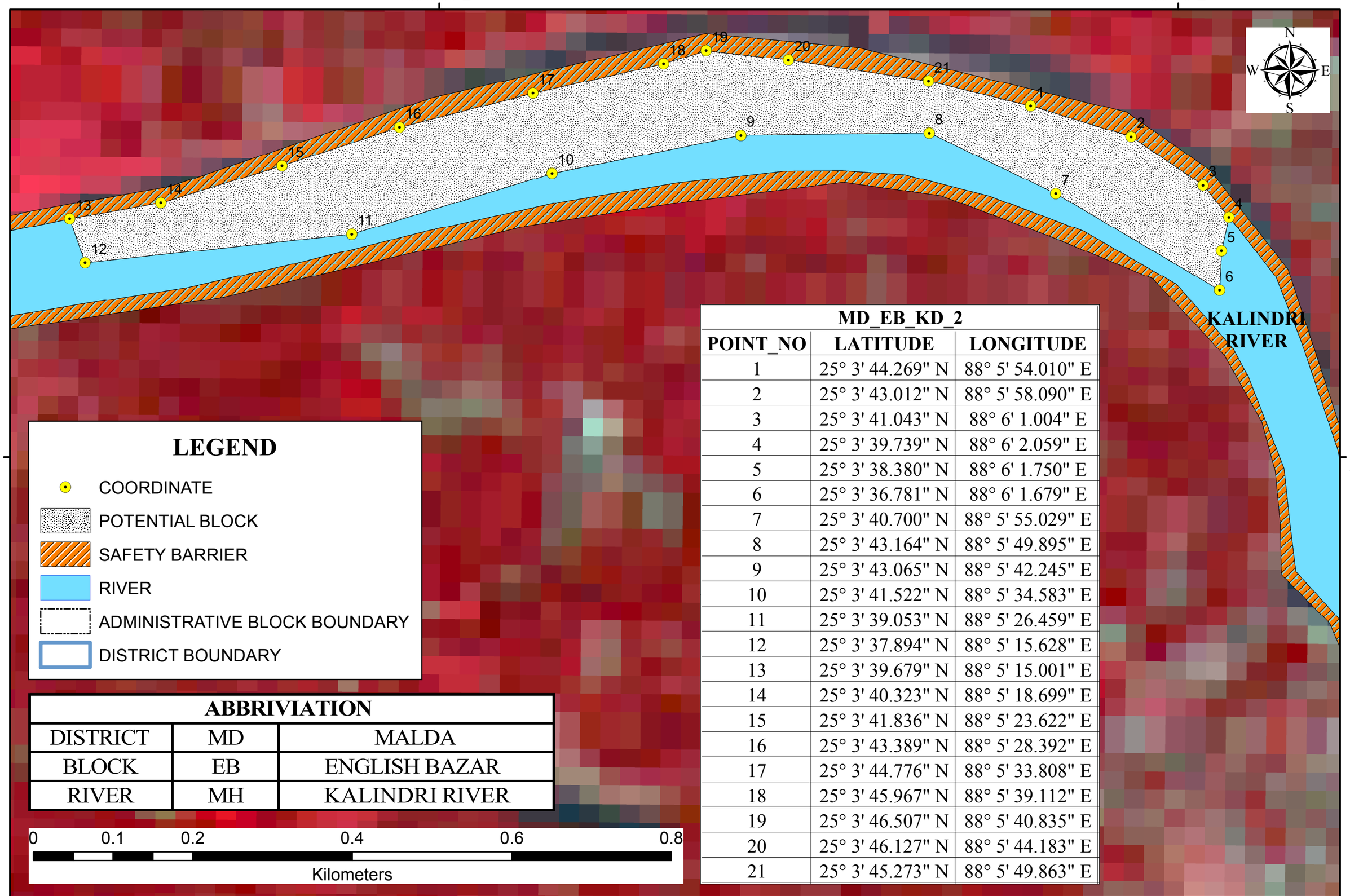
ABBRIVIATION		
DISTRICT	MD	MALDA
BLOCK	EB	ENGLISH BAZAR
RIVER	MH	KALINDRI RIVER

POTENTIAL BLOCK MD_EB_KD_2 OF KALINDRI RIVER

88°5'30"E

88°6'0"E

25°3'30"N



LEGEND

- COORDINATE
- POTENTIAL BLOCK
- SAFETY BARRIER
- RIVER
- ADMINISTRATIVE BLOCK BOUNDARY
- DISTRICT BOUNDARY

ABBRIVIATION		
DISTRICT	MD	MALDA
BLOCK	EB	ENGLISH BAZAR
RIVER	MH	KALINDRI RIVER

0 0.1 0.2 0.4 0.6 0.8

Kilometers

MD_EB_KD_2		
POINT_NO	LATITUDE	LONGITUDE
1	25° 3' 44.269" N	88° 5' 54.010" E
2	25° 3' 43.012" N	88° 5' 58.090" E
3	25° 3' 41.043" N	88° 6' 1.004" E
4	25° 3' 39.739" N	88° 6' 2.059" E
5	25° 3' 38.380" N	88° 6' 1.750" E
6	25° 3' 36.781" N	88° 6' 1.679" E
7	25° 3' 40.700" N	88° 5' 55.029" E
8	25° 3' 43.164" N	88° 5' 49.895" E
9	25° 3' 43.065" N	88° 5' 42.245" E
10	25° 3' 41.522" N	88° 5' 34.583" E
11	25° 3' 39.053" N	88° 5' 26.459" E
12	25° 3' 37.894" N	88° 5' 15.628" E
13	25° 3' 39.679" N	88° 5' 15.001" E
14	25° 3' 40.323" N	88° 5' 18.699" E
15	25° 3' 41.836" N	88° 5' 23.622" E
16	25° 3' 43.389" N	88° 5' 28.392" E
17	25° 3' 44.776" N	88° 5' 33.808" E
18	25° 3' 45.967" N	88° 5' 39.112" E
19	25° 3' 46.507" N	88° 5' 40.835" E
20	25° 3' 46.127" N	88° 5' 44.183" E
21	25° 3' 45.273" N	88° 5' 49.863" E

88°5'30"E

88°6'0"E

25°3'30"N

ANNEXURE 5.1

Compliance to the Observations
Government of West Bengal
Office of the District Land & Land Reforms Officer, Malda
District Survey Report, Malda, West Bengal
Memo No. 2021/DLLRO (MLD)/MM/2020, dated 21.09.2021

SL NO	OBSERVATIONS	COMPLIANCE
1	No comments/ objections/ suggestions have been received	Not Applicable

ANNEXURE 5.2

Compliance to the Minutes of the twenty-eighth meeting of the reconstituted State Level Expert Appraisal Committee, West Bengal held on 08.01.2022 at 10:30 a.m. at the Conference Room, Paribesh Bhawan, Kolkata

Sl. No.	Observations	Compliance
1	In the drainage map watersheds and micro-watersheds should be marked	The watershed level up to 3rd order streams are marked in the drainage map and is depicted in Plate No. 3A
2	Hydrographs at key intersections along the entire stretch of the river falling in the particular district along with a discussion on the runoff of the river in the upstream and downstream within the district.	Given in section 3.6 page no 27 to 30. Depth of mining has been selected in accordance with the depth to water level depicting from the Hydrographs.
3	A separate map showing locations of dams, barrages, bridge, river bed tube wells, river bed collector wells and infiltration galleries.	Given as Plate no 1B. All major bridges, Barrages, river bed wells, and other hydraulic structures are marked in the drainage map of the district and also labelled.
4	Depth to base flow in the riverbed sand mining areas, present and proposed, in pre-monsoon and post-monsoon periods.	Depth of the base flow is below proposed mining depth as observed from the field study. During study period, no mining activity commenced.
5	Field photographs showing activities of replenishment study.	Representative Photographs of Survey of the River bed profile used for replenishment and aggradation measurement study is being furnished in Plate No. 4.
6	A map showing long-term (10-year or more) erosion-accretion areas on both the banks of the rivers which would help to identify no-mining zone on the river bed along with a discussion.	Given in Plate no 5A & 5B. Though all the rivers of the district doesn't shows much difference when studied the image archives from 2001 to 2021, however, a stretch of Ganga River is being furnished as one of the representative image detection study.
7	In each proposed block, the RL of the sand surface (pre and post Monsoon) will be useful and the suggested mining depth corresponds to a particular RL of the deepest layer mined (not depth on absolute terms in case replenished quantity is different)	Elevation levels for each potential zones are furnished as Annexure-2. However, DGPS survey of each blocks shall be carried while preparation of the Mining Plans and final adjustment of depth parameters shall be done accordingly. In no circumstances, mining depth shall be increased beyond the depth suggested for each potential zones in this DSR.
8	Depth of mining considered for calculation of potential reserve. It presumes that base flow depth is more than the mining depth in pre-monsoon period. That needs to be substantiated with data for each block.	Depths of Mining Considered for each potential zone are furnished on the basis of average and are given in Table no 7.15, Page no 91-92. However, after finalization of the sand Blocks, each block shall be surveyed again during the course of Mining Plan preparation and final depths shall be suggested accordingly.
9	Ground water level pre and post monsoon in the watershed (of district) may be put in a map.	Complied with. The same has been furnished as Plate no 3B and 3C.
10	It was also suggested to show in maps the approach roads (accessibility plan complying with guidelines) for the blocks.	The major transport networks for the district are depicted in Figure no 10.2, Page no 103. The accessibility from each block shall be detailed in the Mining Plan.

Sl. No.	Observations	Compliance
11	Sand mining in designated upstream blocks may affect the replenishment in blocks downstream and this consideration may be relevant for estimating the percentage of replenishment. What should be the percentage for minable reserve with respect to potential reserve of sand?	This study shall be undertaken by the Mines Branch, Dep. of Industry, Commerce & Enterprise, GoWB in subsequent years and annual reports shall be generated covering these points. However, as per the EMGSM, 2020, not more than 60% of the area will be covered under extraction plan.
12	Data on river flow on all seasons and the sediment load data (especially during seasons of replenishment) will constitute a baseline condition to judge any effect of increased mining on the river flow characteristics.	This study shall be undertaken by the Mines Branch, Dep. of Industry, Commerce & Enterprise, GoWB in subsequent years and annual reports shall be generated covering these points.
13	Existing mining leases may be shown on river map along with potential blocks	Existing Mining Leases having Environmental Clearance as on 31st January, 2022 are furnished in Plate no 2A and 2B.
14	On the river map, potential new blocks and existing blocks may also be designated by serial or code number so that it matches with the tables.	Furnished in Plate no 2A and 2B
15	It will be appropriate if the methodology adopted (not only the available theory) for annual replenishment estimation is clearly and objectively narrated with applicable data and sample calculations.	Change detection through satellite imagery study, Field evidences and empirical formulae are utilized for replenishment study. Detail discussions are done in section 7 of this report.
16	Representative satellite and/or drone photography, if used for surveying, may also be produced in DSR.	All the plates are satellite imagery based and are furnished in Plate no 2A and 2B.
17	The suggested mining depth should be indicated for each block in the table (not done for Purba Bardhaman).	Complied with. Suggested mining depths are furnished as Annexure-2.
18	Order of sections in the report is not logical in some reports.	Corrected and as per specified format of DSR.
19	A table showing all general compliances in DSR as per the Mining Rules may be furnished.	Complied with. Given as Annexure-1.
20	For existing mines (sand and other minerals), minable reserve has not been mentioned.	Details of the mining leases given in Table no 8.1 & 8.2, Page no 96-99.
21	All the documents leave much to be desired in respect of reserve assessment and replenishments estimations.	Given in section 7.2/V, page no 74-88.
22	Reserve assessment has been rudimentary and the replenishment estimation needs to be carried out using accepted methods and models available for the purpose.	No attempt has been done for mineable reserve assessment in this DSR. Efforts have been restricted to define the potential sand resources in each river of the district. Mineable reserve estimation shall be done once the Blocks are demarcated as per West

Sl. No.	Observations	Compliance
		Bengal Minor Mineral Concession Rules, 2016 and based on EMGSM 2020.
23	Rivers are one of the main sources to supply sand for construction projects. Depending on river morphology and hydraulic characteristics, its sediment transport capacity, and mining operation method, the extraction of river bed materials may affect its ecosystem through bank and bed erosion. This needs to be incorporated in the DSR.	Mining impact given in Chapter 11.
24	To advance the mechanisms of river pit infilling, the effects of various parameters (i.e., the distance between pits, the pit plan shape, the pit depth, sediment size, and approaching flow velocity) needs to be investigated.	This study shall be undertaken by the Mines Branch, Dep. of Industry, Commerce & Enterprise, GoWB in subsequent years and annual reports shall be generated covering these points.
25	Monitoring should provide data to evaluate the upstream and downstream effects of sand and gravel extraction activities, and long-term changes. A brief report summarizing the annual results of the physical and biological monitoring should document the evolution of the sites over time, and the cumulative effects of sand and gravel extraction. The summary should also recommend any maintenance or modification of extraction rates needed to minimize impacts of extraction.	This study shall be undertaken by the Mines Branch, Dep. of Industry, Commerce & Enterprise, GoWB in subsequent years and annual reports shall be generated covering these points.
26	Sand Replenishment, Geomorphology and Hydrology Physical monitoring requirements of sand and gravel extraction activities should include surveyed channel cross-sections, longitudinal profiles, bed material measurements, geomorphic maps, and discharge and sediment transport measurements. The physical data will illustrate bar replenishment and any changes in channel morphology, bank erosion, or particle size.	Explained in detailed in Chapter no 7.
27	With reference to (point no 4.1.1 g) of enforcement guidelines 2020 read with Standard environmental conditions for sand mining (point no 8 page 73) of SSMMG-2016, all DSRs so prepared, should contain a chapter on NO MINING ZONE with name of mouza, dag no and geo references along with areas of sensitivity. Appraisal of the DSRs should NOT be taken for consideration without the chapter on NO MINING ZONE and AREAS of SENSITIVITY.	Section on No mining zone is given in Page no 92-94.

Sl. No.	Observations	Compliance
28	The areas of sensitivity should contain those NON-FOREST AREAS which are in excellent line of habitat for wild animals, birds, turtles, dolphins and other aquatic life, which need be excluded from the list of mining areas on ecological and environmental grounds. This is utmost necessary and has to be done to avoid conflict about wetland use in near future.	ENVIS centre on Wildlife and Protection areas map as published in August 2020, shows wildlife habitat in the potential sand mining areas.
29	For example, low lying swamps by the side of river Ajay in Paschim Midnapur and Ahiran lake, pathanbeel, Bishnupur beel area in Murshidabad District provide an excellent nitche for migratory birds in the winter. Part of river Damodar and the confluence of Damodar and Hooghly in East Barddhaman District house one of the last surviving habitats of endangered gangetic dolphin (Platinista gangeticus), should be identified in consultation with the concerned forest circles of the Department of Forests and to be excluded from the list of mining areas.	Part of comment 30.
30	Though all the DSRs so prepared, have not followed the same format yet it is felt that necessary remedial measures to mitigate the effect of mining and a reclamation plan in mined out areas should be included, especially in those DSRs which have not yet mentioned the same.	DSR Format Compliance under Notification S. O. 3611 (E), Dated 25th July 2018, Appendix-X (I).
31	Data, satellite imageries and allied information in respect of flora, fauna and their habitat biological environment, if collected from ENVIS centre may be included in the DSRs for ready reference.	Source of all the secondary figures and tables included in the DSR.
32	DSR comprises of secondary data which are required to be endorsed by concerned Departments.	References for secondary data are furnished in the DSR under references.
33	Revision should be done every year and actual survey should be done.	This study shall be undertaken by the Mines Branch, Dep. of Industry, Commerce & Enterprise, GoWB in subsequent years and annual reports shall be generated covering these points.
34	It is to be clearly mentioned that there are no other minerals than sand in this district.	Noted.
35	Dates of NIC database and other data should be provided	Noted and given in page no 12-13.
36	Outcome / response to the public consultation should be mentioned	Given as compliance statements in the DSR.

Sl. No.	Observations	Compliance
37	No-Mining-Zone should be clearly mentioned with special mention to the ecologically and otherwise sensitive zones. Bridges and river-bed tubewells should also be clearly demarcated. Wildlife should also be considered	Restricted zone given as Plate no 2A and 2B. Location of bridges, dam given in 1B
38	Hydrographs of the rivers and volume of rain should be studied to correlate with the minable sand reserve	Incorporated in the Replenishment study section 7.2/V, page no 74-88.
39	Text parts (as in Chapter 6) should be provided with proper reference and citation of authentic books. Sources of Tables and figures should be mentioned. Some are very old data – those should be replaced by latest data	Source of all the secondary figures and tables included in the DSR
40	Depth of mining and distance from banks should be clearly mentioned and highlighted	Given as Annexure-2.
41	Secondary (Collected) data/ map from other departments should be certified from the respective departments (e.g., Forest and wildlife data, demography, aquifer, transportation route to the blocks)	References used from Public Domain/ Websites are furnished in the Reference section in this DSR.
42	Evidence (like dated photographs) of surveying, collection of primary data to be provided	Field photographs are furnished in Plate 4.
43	Sample calculation and methodology for calculation for minable resource and replenishment data to be provided with proper units	Given in Table no 7.7 and Table no 7.10.
44	If any predictive model is used, its validity should be established	Predictive Model has been carried out based on EMGSM 2020. The validity checking requires consecutive study which needs to be undertaken by the concerned department.
45	Evidence for 4 times physical survey to be provided	Field photographs are furnished in Plate 4. Field registers are available at office and can be furnished on demand.
46	Land utilization and forests data are upto 2013/2014 – should be updated	Latest available data incorporated in the DSR.

ANNEXURE 5.3

Compliance to the SEAC members' comments received through mail on 25th March 2022

Sr. No.	Observations	Compliance
1	Inclusion executive summary at the beginning	Executive summary included in page no 1.
2	Compliance table of the DM/SEAC members' observations may be placed at the end. Instead, a table of compliance with the guidelines to be placed at the beginning indicating the page number	Complied with and given as separate document.
3	DSR specific observation should not be included in all in the compliance table of all the DSR.	Complied with.
4	DSR compliance table should come just after the executive summary	Complied with and given as Annexxure-1
5	Need to mention page number in the DSR compliance table.	Modified table furnished as Annexure-1
6	Legend should be given for sand bar coding	Complied with and furnished as abbreviation in Annexure-2.
7	Citation of reference should be given for Empirical formula by which Replenishment calculated.	Complied with and given in page no 80 to 83.
8	Map Source to be given for each map such as Watershed, Transport, Location, Drainage etc.	Complied with and given in Plate no 1 and 3.
9	Mention conclusion and Recommendation instead Summary	Complied with and given in page no 111-112.
10	Reference should be in a standard referencing format	Complied with and given in page no 113.
11	Source and date of collecting data for satellite imagery should be given.	Complied with and given in Plate no 2.

ANNEXURE 5.4

Compliance to the Minutes of the 61st meeting of the SEIAA, West Bengal held on 23.05.2022 at Kolkata

Sl. No.	Observations	Compliance
1	List of definitions of technical terms used in the DSR to be included.	Complied with.
2	Each potential zone should have a unique code no. and area bearing all the coordinates of all the points defining the boundary.	Complied with. Please refer Annexure 3.
3	A map showing the potential zone with the legend, mentioning all the coordinates of the polygon, defining the zone to be attached as annexure in the DSR.	Complied with. Please refer Annexure 4.
4	Dept. of Industry, Commerce & Enterprises will issue unique code with reference to the original coding of potential zones to each lessee. This unique code issued to lessee should be reflected in the LoI.	Shall be complied with.
5	Dept. of Industry, Commerce & Enterprises will upload the updated map showing the location of the LoI issued against the area and sand mining lease areas in different colour coding.	Shall be complied with.
6	Date of approval should be mentioned in all the pages of the annexures of DSRs.	Noted.
7	The consultant is further requested to refer the DSRs prepared by other states in order to confirm that no relevant point is missed out in any of our DSRs.	Complied with.
8	The consultant may also refer to the baseline data available with Irrigation Dept.	At present Replenishment Study is being conducted for all the sand producing Districts of West Bengal. This will be covered in the relevant reports.

ANNEXURE 5.5

Compliance to the Minutes of the 66th meeting of the SEIAA, West Bengal held on 06.07.2022 at Kolkata

Sl. No.	Observations	Compliance
1	The format of all the DSRs should be uniform.	Complied with.
2	The corrections required to be done regarding Annexure-3.	Complied with. Please refer Annexure 3.
3	List of existing lease is attached with the documents in Chapter 8.1. The list should contain the date of issue and validity.	Complied with. The details of the existing leases updated as per the data provided from concern department.
4	Sequence of meetings and observation given by SEAC and SEIAA should be mentioned in chronological order and be a part of the whole document.	Complied with. Please refer Annexure-5.

Annexure 6
SEIAA 74th Meeting (15th September, 2022) Minutes of Meeting

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

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Subject:- 74th meeting of SEIAA

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

From :- 15 September 2022

To :- 15 September 2022

1. Proposal No. :- **SIA/WB/IND/19745/2016** File No- **EN/T-II-1/091/2018** Proposed expansion of existing cement grinding unit from 3.6 MTPA to 4.8 MTPA to produce Portland Slag Cement (PSC), Portland Pozzolana Cement (PPC), Ordinary Portland Cement (OPC), Composite Cement & Ground Granulated Blast Furnace Slag (GGBS) at Salboni (Plot nos. given in Annexure 1), Dist – Paschim Medinipur, West Bengal by **M/s. JSW Cement Ltd.**	Type-**EC**

INTRODUCTION

The proponent made online application vide proposal no. **SIA/WB/IND/19745/2016** dated **23 Mar 2021** 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. **3(b) Cement plants**, under Category "**B1**" of EIA Notification 2006 and the proposal is appraised at State level.

Earlier the project proponent (PP) had obtained Environmental Clearance from SEIAA, West Bengal vide letter no. 2015/EN/T-II-1/002/2017 dated 07.09.2017.

The PP obtained ToR for the proposed expansion project vide Memo No. 688- 2N-45/2015(E) dated 05.12.2018.

SEAC recommended the proposed project for Environmental Clearance during its 48th meeting held on 10.08.2022 with the following additional conditions :

i) The PP should deposit one time processing fee as per Notification No 924/T-II1/021/2022 dated 23.05.2022 issued by Dept. of Environment, GoWB and upload the paid challan in the PARIVESH Portal. Notification and details can be accessed in the link http://environmentwb.gov.in/pdf/Notification.

ii) Plan for installation of digital display board for showing all environmental parameters and EMP data. Beneficiary details of the social part of the EMP should also be displayed.

PROJECT DETAILS

The project of M/s **JSW CEMENT LTD** located in as follows :

State of the project				
S. No.	**State**	**District**	**Tehsil**	**Village**
1.	West Bengal	West Medinipur	Medinipur Sadar	Salboni

14. **Project configuration/product details**						
S.	**Project**	**Quantity**	**Unit**	**Other Unit**	**Mode of**	**Other Mode of**

No.	configuration/product details				Transport/Transmission of Product	Transport
NIL						

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.)	Slag	2.521	9	MTPA	TISCO/IISCO	Road,Rail		185
(2.)	fly ash	0.203	9	MTPA	Kolaghat / Domestic	Road		50
(3.)	Coal	0.064	9	MTPA	Indigenous Raniganj	Road		280
(4.)	Clinker	2.176	9	MTPA	Nandyal, A.P Japan, Indonesia etc.	Road,Rail		1280
(5.)	Gypsum	0.160	9	MTPA	Paradeep Port and Iran, Japan etc.	Road,Rail		130

Details of previous ToR is as follows :

ToR issued vide Memo No. 688- 2N-45/2015(E) dated 05.12.2018.

DELIBERATION IN SEIAA

SEIAA considered the recommendation of SEAC and observed that the PP is required to upload the following documents in the PARIVESH Portal:

i) **The PP should deposit one time processing fee as per Notification No 924/T-II1/021/2022 dated 23.05.2022 issued by Dept. of Environment, GoWB and upload the paid challan in the PARIVESH Portal. Notification and details can be accessed in the link http://environmentwb.gov.in/pdf/Notification.**

ii) **Plan for installation of digital display board for showing all environmental parameters and EMP data. Beneficiary details of the social part of the EMP should also be displayed.**

iii) **Land use map showing the areas of different uses adding upto 100%.**

iv) **Plantation Plan for green belt to be approved by the concerned DFO.**

RECOMMENDATIONS OF SEIAA

Therefore, the application for EC is deferred for additional information.

Conclusion

Deferred

2. 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**	Type- **EC**

INTRODUCTION

The proponent made online application vide proposal no. **SIA/WB/MIS/267917/2022** dated **14 Apr 2022** 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.

The project was placed in the 73rd meeting of SEIAA held on 08.09.2022 and it was observed that some clarification required to be uploaded in the PARIVESH Portal. The project proponent uploaded documents on 13.09.2022.

PROJECT DETAILS

The project of M/s **NXTRA DATA LIMITED** located in as follows :

State of the project

S. No.	State	District	Tehsil	Village
(1.)	West Bengal	North 24 Parganas	Rajarhat	-

14. **Project configuration/product details**

S. No.	Project configuration/product details	Quantity	Unit	Other Unit	Mode of Transport/Transmission of Product	Other Mode of Transport
Development of an B+G+6 storied Business Building. Total built up area is 29857.970 sqm and land area is 11,528.67 sq.m						

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)
NIL								

DELIBERATION IN SEIAA

SEIAA considered the submission made by the project proponent vide their letter no. NIL dated 13.09.2022 uploaded on 13.09.2022 and accepted the same.

RECOMMENDATIONS OF SEIAA

The application for EC is approved based on the NKDA Building Permit No. PIN 0220070620220125 dated 07.02.2022.

Conclusion

Recommended

S.No	Conditions
(1)	**I. 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 buildings 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 Forest (Conservation) Act, 1986, in case of the diversion of forest land for non-forest purpose involved in the project. iv. The project proponent shall obtain clearance from the National Board for Wildlife, if applicable. v. 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. 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 Chief Controller of Explosives, Fire Department, Civil Aviation Department shall be obtained, as applicable, by project proponents from the respective competent authorities. ix. The provisions of the Solid Waste (Management) Rules, 2016, e-Waste (Management) Rules, 2016, and the Plastics Waste (Management) Rules, 2016 shall be followed. x. The project proponent shall follow the ECBC/ECBC-R prescribed by Bureau of Energy Efficiency, Ministry of Power strictly. xi. 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** i. 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. ii. 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 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. As per the proposal submitted by the proponent, waste water shall be discharged to WBHIDCO sewerage system to be treated in their centralized STP.
ii. 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.
iii. Buildings shall be designed to follow the natural topography as much as possible. Minimum cutting and filling should be done.
iv. Total fresh water use shall not exceed the proposed requirement as provided in the project details.
v. 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.
vi. 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.
vii. 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.
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.
ix. Water demand during construction should be reduced by use of pre-mixed concrete, curing agents and other best practices referred.
x. 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.
xi. 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.

xii. All recharge should be limited to shallow aquifer.

xiii. No ground water shall be used during construction phase of the project.

xiv. 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.

xv. No sewage or untreated effluent water would be discharged through storm water drains.

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.

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.

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

i. 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.

iv. 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

i. 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.

iii. 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.

ix. 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:-

i. 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

i. 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 **190** 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. 156/17-T-9 dated 20.04.2022.

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

i. 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 and to 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

i. 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.

iii. 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 submitted 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 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. Additional conditions

i. The project proponent should obtain Licence from Petroleum and Explosive Safety Organisation (PESO) for storage of HSD.

ii. The project proponent should provide electric charging facilities for vehicles.

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.

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.

ix. 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).

x. 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.

3. Proposal No. :- **SIA/WB/MIS/270950/2022** File No- **EN/T-II-1/030/2022** Proposed modification of Residential Complex 'The 102' at D. H Road, Mouza - Sarmestarchak, JL. No.- 17, Touzi No- 351, BI, R.S Dag No – 115 & 117, corresponding to L.R Dag Nos.- 114 & 116, Mouza – Daulatpur, J.L No – 79, Touzi Nos.-1776, R.S./ L.R. Dag Nos. –28, 29, 30, 31, 32, 33, 34, 47(P), 48 & 49, PO – Pailan Hat, P.S – Bishnupur, Within Kulerdari Gram Panchayat, Dist – South 24 Parganas, West Bengal by **M/s. PS Vinayak Complex LLP.**	Type-**EC**

INTRODUCTION

The proponent made online application vide proposal no. **SIA/WB/MIS/270950/2022** dated **03 May 2022** 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.

Previously, M/s. P. S. Vinayak Complex LLP obtained EC for the project "THE 101" vide No. 431/EN/T-II-1/013/2017 dated 22.02.2018 with proposal no. SIA/WB/MIS/63430/2017. The project name was changed from 'The 101' to 'The 102' in the said EC based on the application made by the project proponent on 01.08.2018.

Thereafter the project proponent informed SEIAA of dividing the whole project into 2 separate projects viz. 'The 102' and 'CGEWHO' vide their letter No. Nil dated 23.09.2019. They also requested to bifurcate the original EC into 2 separate ECs with a change of built up area. Since there was no scope to bifurcate the EC, the project proponent was advised to apply for EC for the 2 separate projects.

Now the project proponent has applied afresh for the Residential Complex 'The 102' consisting Tower 5 to 10 - B+G+15 & Podium – G + 2 storied. Total built up area is 79233.35 sq.m. and land area is 21771.188 sq.m. total no. of flats – 658 nos.

SEAC recommended the proposed project for Environmental Clearance during its 48th meeting held on 10.08.2022 with the following additional conditions :

a) Environmental parameters and the beneficiary details should be displayed on the display board.

b) Embankment protection should be as per stipulated guidelines.

PROJECT DETAILS

The project of M/s **PS VINAYAK COMPLEX LLP** located in as follows :

State of the project				
S. No.	**State**	**District**	**Tehsil**	**Village**
(1.)	West Bengal	South 24	Bishnupur - I	Sarmestarchak,

		Parganas		Daulatpur

14. **Project configuration/product details**

S. No.	Project configuration/product details	Quantity	Unit	Other Unit	Mode of Transport/Transmission of Product	Other Mode of Transport
Residential Complex 'The 102' consisting Tower 5 to 10 - B+G+15 & Podium – G + 2 storied. Total built up area is 79233.35 sq.m. and land area is 21771.188 sq.m. total no. of flats – 658 nos.						

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)
NIL								

DELIBERATION IN SEIAA

SEIAA considered the recommendation of SEAC and observed that the PP is required to upload the following documents in the PARIVESH Portal and present their case before SEIAA :

1. **The title Deed of the additional land procured.**
2. **Mouza map showing all the Dag Nos. mentioning the coordinates within the project boundary. The additional land area for exclusive tree plantation should be separately marked.**
3. **All the Mutation Certificates and land conversion certificates of all the dag nos.**

RECOMMENDATIONS OF SEIAA

Therefore, the application for EC is deferred for additional information.

Conclusion

Deferred

4. Proposal No. :- **SIA/WB/MIS/286034/2022** File No- **EN/T-II-1/052/2022**
Proposed expansion of [increase 4 nos. flats (4 BHK)] Housing Complex "The Khaki Estate" at Plot No. AA IID/41/1, Premises No. 03-0702, J.L. No. 12, P.O- New Town Action Area – II, Mouza- Raigachhi, Rajarhat Bishnupur I GP, P.S- New Town, North 24 Parganas, West Bengal by **Indian Police Service Officers Welfare Society, West Bengal**

Type- **EC**

INTRODUCTION

The proponent made online application vide proposal no. **SIA/WB/MIS/286034/2022** dated **29 Jul 2022** 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.

PROJECT DETAILS

The project of M/s **INDIAN POLICE SERVICE OFFICERS WELFARE SOCIETY, WEST**

BENGAL located in as follows :

State of the project				
S. No.	**State**	**District**	**Tehsil**	**Village**
(1.)	West Bengal	North 24 Parganas	Rajarhat	-

14. **Project configuration/product details**

S. No.	Project configuration/product details	Quantity	Unit	Other Unit	Mode of Transport/Transmission of Product	Other Mode of Transport
Block A :G+10, Block B :G+8, Block C : B+G+9, Block D :G+8, Block E :G+10, Facility Block F :G+3 Total Built-up Area : 49822.26 sq.m.						

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)
NIL								

1.2. **Expansion Details :**

S. No.	Product/Activity (Capacity / Area)	Quantity		Unit	Other Unit
		From	To		
Expansion of [increase 4 nos. flats (4 BHK)] Housing Complex "The Khaki Estate" Total Built-up Area : 1868.63 sq.m.					

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 NKDA Building Permit No. (PIN R0030070220210907 dated 10.09.2021) vide Memo No. 4979/NKDA/Admin(BPS)415/2013 dated 30.06.2022.

Conclusion

Recommended

S.No	Conditions
(1)	**I. 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 buildings 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 Forest (Conservation) Act, 1986, in case of the diversion of forest land for non-forest purpose involved in the project.

iv. The project proponent shall obtain clearance from the National Board for Wildlife, if applicable.

v. 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.

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 Chief Controller of Explosives, Fire Department, Civil Aviation Department shall be obtained, as applicable, by project proponents from the respective competent authorities.

ix. The provisions of the Solid Waste (Management) Rules, 2016, e-Waste (Management) Rules, 2016, and the Plastics Waste (Management) Rules, 2016 shall be followed.

x. 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, GoI 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-IA.III dated 30.09.2020.

II. Air quality monitoring and preservation

i. 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.

ii. 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 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. As per the proposal submitted by the proponent, waste water shall be discharged to WBHIDCO sewerage system to be treated in their centralized STP.

ii. 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.

iii. Buildings shall be designed to follow the natural topography as much as possible. Minimum cutting and filling should be done.

iv. Total fresh water use shall not exceed the proposed requirement as provided in the project details.

v. 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.

vi. 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.

vii. 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.

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.

ix. Water demand during construction should be reduced by use of pre-mixed concrete, curing agents and other best practices referred.

x. 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.

xi. 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.

xii. All recharge should be limited to shallow aquifer.

xiii. No ground water shall be used during construction phase of the project.

xiv. 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.

xv. No sewage or untreated effluent water would be discharged through storm water drains.

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.

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.

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

i. 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.

iv. 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

i. 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.

iii. 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.

ix. 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:-

i. 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

i. 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 **340** 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. 2944/17-T-9 dated 14.01.2022.

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.

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i. 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 and to 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

i. 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.

iii. 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.

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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.

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 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. Additional conditions

i. Stack height of DG sets should conform to the CPCB norms.

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.
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.
ix.	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).
x.	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.

5. Proposal No. :- **SIA/WB/NCP/22954/2018** File No- **EN/T-II-1/040/2018** Proposed residential project "Ganga Greens" at Holding No. 19, G.T. Road, Bhadrakali, P.O. Bhadrakali, Uttarpara Kortung Municipality Ward No.9, PS – Uttarpara, Dist – Hooghly, PIN – 712232, West Bengal by **Malay Kumar Banerjee, Sanjay Banerjee, Ajay Banerjee** (Violation Case).	Type- **TOR**

INTRODUCTION

This has reference to the online application vide proposal no. **SIA/WB/NCP/22954/2018** dated **06 Jun 2018** along with the copies of EIA/EMP seeking Terms of reference (TOR) under the provisions of the EIA Notification, 2006 for the above mentioned proposed project. The proposed project activity is listed at S.No **8(a) Building and Construction projects** under Category **B** of EIA Notification, 2006 and the proposal is appraised at state level.

PROJECT DETAILS

The project of M/s **MALAY KUMAR BANERJEE SANJAY BANERJEE AJAY BANERJEE** located in as follows :

State of the project			
S. No.	**State**	**District**	**Tehsil**
(1.)	West Bengal	Hooghly	Serampur Uttarpara

Town/Village : **Bhadrakali**

The salient features of the project submitted by the project proponent is available at Report under online proposal no. **SIA/WB/NCP/22954/2018**

DELIBERATION IN SEIAA

SEIAA considered the recommendation of SEAC and accepted the same.

RECOMMENDATIONS OF SEIAA

SEIAA approved the proposal for ToR under violation category.

Conclusion

Recommended

S.No	Conditions
(1)	SEIAA, in pursuance of the provisions of the EIA Notification 2006 and MoEF&CC O.M. No. 22-21/2020-IA.III dated 07.07.2021, grants Terms of Reference (ToR) for undertaking Environment Impact Assessment (EIA) and preparation of Environment Management Plan (EMP) and specific ToR for the assessment of ecological damage, remediation plan and natural and community resource augmentation plan as enumerated in Annexure-2 for the proposed residential project "Ganga Greens" at 19B, G.T. Road, Bhadrakali, Uttarpara-Kortung Municipality Ward No.9, PS – Uttarpara, Dist – Hooghly, PIN – 712232, West Bengal. The ToRs are valid for a period of one year, which can be extended for a maximum period of three years provided an application in this regard is

submitted by the project proponent, well before expiry of the validity period. EIA/EMP to be submitted before the expiry of the ToR for consideration of EC application or otherwise.

Annexure – 2

Terms of Reference for EIA and preparation of Environment Management Plan (EMP)

A. Conditions :-

i. Project description, its importance and the benefits.

ii. Project site details (location on toposheet of the study area of 10m, coordinates. google Map, layout map land use geological features and geo-hydrological status of the study area, drainage),

iii. Land use as per the approved Master Plan of the area. Permission/approvals required from the land owning agencies. Development Authorities, Local Body, Water Supply & Sewerage Board. Etc.,

iv. Land acquisition status and R&R details.

v. Forest and Wildlife and eco-sensitive zones. if any in the study area of 10 km - Clearances require under the Forest (Conservation) Act. 1980, the Wildlife (Protection) Act, 1972 and/or the Environment (Protection) Act, 1986.

vi. Baseline environmental study for ambient air (PM10, PM2.5, S02, NOx CO), water (both surface and ground) noise and soil for one month (except monsoon period) as per MoEF&CC/CPCB guidelines at minimum 5 locations in the study area of 10 km.

vii. Details on flora and fauna and socio-economic aspects in the study area.

viii. Likely Impact of the project on the environmental parameters (ambient air, surface and ground water, land, flora and fauna and socio-economic etc.).

ix. Source of water for different identified purposes with the permissions required from the concerned authorities, both for surface water and the ground water (by CGWA) as the case may be. Rain water harvesting, etc.

x. Waste water management (treatment, reuse and disposal) for the project and also the study area.

xi. Management of solid waste and the construction & demolition wasta for the project vis-à-vis the Solid Waste Management Rules, 2016 and the Construction Demolition Rules, 2016.

xii. Energy efficient measures (LED lights, solar power, etc.) during construction as well as during operational phase of the project.

xiii. Assessment of ecological damage with respect to air, water, land and other environmental attributes. The collection and analysis of data shall

be done by an environmental laboratory duly notified under the Environment (Protection) Act 1986. or an environmental laboratory accredited by NABL. or a laboratory of a Council of Scientific and Industrial Research (CSIR) institution working in the field of environment.

xiv. Preparation of EMP comprising remediation plan and natural and community resource augmentation plan corresponding to the ecological damage assessed and economic benefits derived due to Violation.

xv. The remediation plan and the natural and community resource augmentation plan to be prepared as an independent chapter in the EIA report by the accredited consultants.

B. Additional conditions :-

i. The unit should 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. DFO approved plantation plan should be submitted.

ii. The project proponent should submit a compliance report based on the Notification issued by SEIAA, vide No. 2495/EN-T-II/011/2018 dated 17.12.2019.

iii. The project proponent shall submit the damage assessment plan, remediation plan and Community Augmentation Plan to the State Level Expert Appraisal Committee (SEAC) and finalised by the concerned Regulatory Authority based on recommendation of SEAC and direction issued by the Principal Secretary, Dept. of Env. vide No. 1312/EN/T-II-1/052/2016 dated 30.05.2018. The amount shall be deposited prior to the grant of environmental clearance.

iv. The project proponent shall also comply with the penalty provisions for violation cases as directed in O.M. No. 22-21/2020-IA.III dated 07.07.2021 issued by MoEF&CC.

v. The Project Proponent and the Consultant should abide by the MoEF&CC Notification dated 03.03.2016 and Office Memorandum dated 30.09.2011 and 05.10.2011 along with other stipulations.

MISCELLANEOUS

1. Discussion on draft DSRs of **Malda and Cooch Behar**.

   DSRs of Malda and Cooch Behar are approved.

2. Hon'ble NGT, Eastern Bench order dated 06.09.2022 in OA 62/2021/EZ, OA 63/2021/EZ, OA 64/2021/EZ and OA 65/2021/EZ.

   The DSR of Paschim Medinipur was received by SEIAA on 31.08.2022 and the same was approved by SEIAA on 08.09.2022.

Annexure 1

List of Plot Nos. for the proposed expansion of existing cement grinding unit from 3.6 MTPA to 4.8 MTPA to produce Portland Slag Cement (PSC), Portland Pozzolana Cement (PPC), Ordinary Portland Cement (OPC), Composite Cement & Ground Granulated Blast Furnace Slag (GGBS) at Salboni, Dist – Paschim Medinipur, West Bengal by **M/s. JSW Cement Ltd.**

Mouza & JL No.	Plot No.	Area (in acres)
Gaighata - 455	321	1.25
Kulpheni - 456	175	0.73
	177	1.11
	183	0.26
	184	0.50
	186	0.83
	188	0.38
	189	1.16
	190	0.14
	197	0.72
	198	0.06
	199	0.05
	201	0.24
	203	1.34
	204	0.30
	447	0.48
	448	0.15
	450	0.21
	451	0.36
	452	0.10
	453	0.23
	454	0.62
Nutanbankati - 446	1	4.31
Kulpheni - 456	180	0.23
Nutanbankati - 446	2	2.20
	4	5.74
Jambedia - 445	349	51.33
Kulpheni - 456	96	0.18
	110	2.25
	125	0.06
	170	0.05
	172	8.05
	173	5.39
	174	1.58
	176	0.62
	178	0.47
	179	0.64
	181	0.29
	187	0.50
	191	0.33
	192	0.06
	194	28.52
	196	4.58
	200	0.10
	202	1.14
	205	0.16
	177/449	0.30
Gaighata - 455	1	0.93
	1/322	1.24
	1/327	0.73
Total		**133.2**