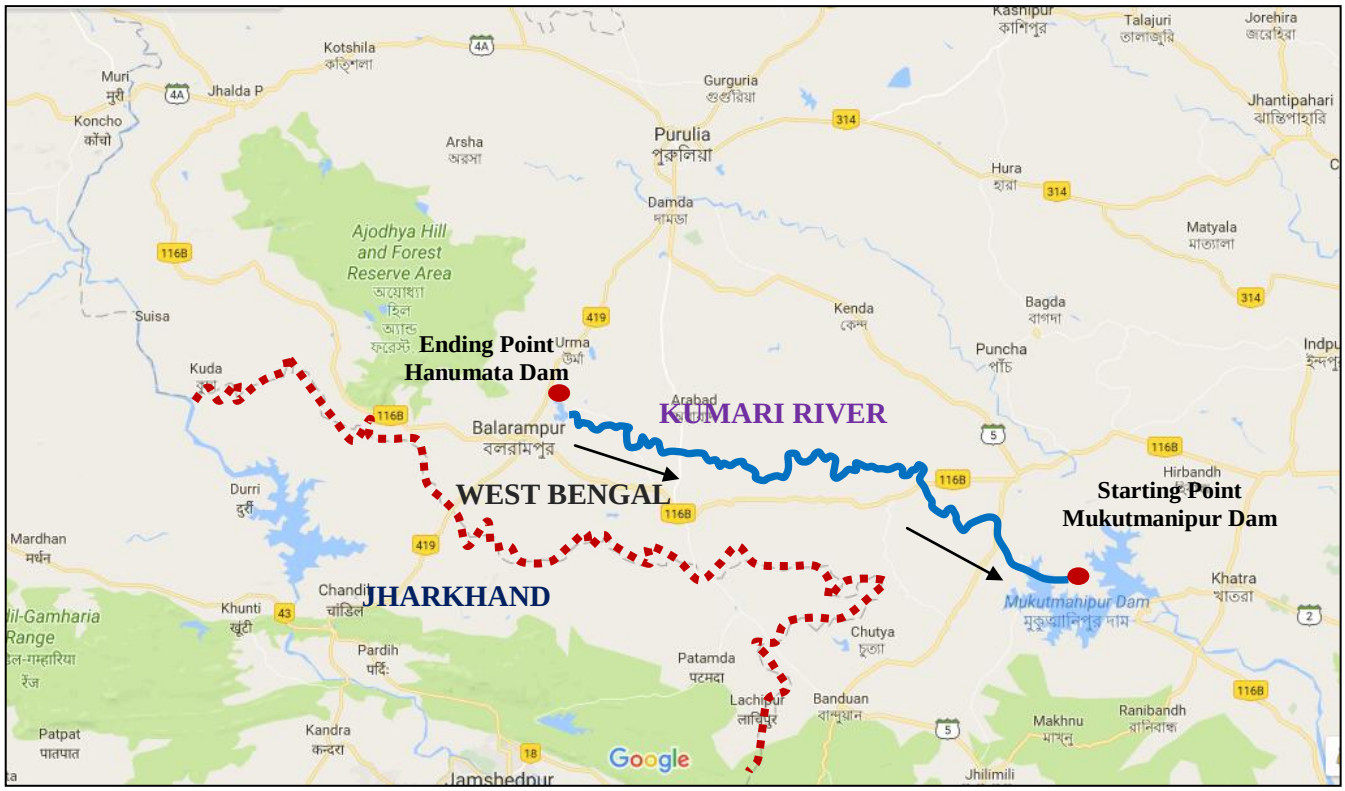
INLAND WATERWAYS AUTHORITY OF INDIA, A-13, SECTOR-1, NOIDA
DIST-GAUTAM BUDHA NAGAR, UTTAR PRADESH, PIN- 201 301(UP)

"FINAL FEASIBILITY REPORT ON HYDROGRAPHIC SURVEY OF KUMARI RIVER (NW-60) (80.446 KM)

STARTING "FROM MUKUTMANIPUR DAM AT CHIDA TO DAM NEAR AMRUHASA VILLAGE"

SURVEY PERIOD 27.10.15 TO 06.11.15



FINAL REPORT ON HYDROGRAPHY SURVEY OF KUMARI RIVER, WEST BENGAL

REPORT SUBMISSION DATE- 29.03.2019

SUBMITTED BY:-

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Acknowledgement

B.S.Geotech PVT.Ltd, Konnagar, Hooghly express its sincere gratitude to **IWAI** for awarding the work and guidance for completing this Project of detailed Hydrographic Survey and the Feasibility Report in **Region-VIII (Kumari River) from Mukutmanipur Dam at Chiada to Dam near Amruhasa village (80.446 km).**

We would like to use this opportunity to pen down our profound gratitude and appreciations to **Shri Jalaj Srivastava, IAS, Chairman, IWAI** for spending their valuable time and guidance for compleing this project of " Detailed Hydrography and Topography survey in Kumari River." B.S.Geotech would also like to thanks **Shri Pravir Pandey, Vice-Chairman, IA&AS., Shri Shashi Bhushan Shukla, Member (Traffic), Shri Alok Ranjan, Member (Finance) and Shri S.K.Gangwar, Member (Technical).**

B.S.Geotech wishes to express their gratitude to **Capt. Ashish Arya, Hydrographic Chief, IWAI, Shri S.V.K. Reddy, Chief Engineer-I, Cdr. P.K. Srivastava, Ex. Hydrographic Chief, IWAI** for his guidance and inspiration for this project. B.S.Geotech would also like to thank **Shri Rajiv Singhal, S.H.S., IWAI** for invaluable support and suggestions provided throughout the survey period. B.S.Geotech is pleased to place on record our sincere thanks to other staff and officers of **IWAI** for their excellent support and co-operation throughout the survey period.

List of Abbreviations

CD	Chart Datum
DGPS	Differential Global Positioning Systems
ETS	Electronic Total Station
GPS	Global Positioning Systems
LBM	Local Bench Mark
MSL	Mean Sea Level
RL	Reference Level
SD	Sounding Datum
SBAS	Satellite-Based Augmentation System
TBC	Trimble Business Centre
FRP	Fiber Reinforced Plastic

Table 1- List of Abbreviations

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<tr><td>2.</td><td>Region number & State(s)</td><td>Region -VIII, West Bengal</td></tr>
<tr><td>3.</td><td>a) Waterway name
b) NW #
c) Total Stretch and length of declared NW (from…. To….; total length)
d) Survey Period (… to …)</td><td>a) Kumari River
b) NW-60
c) From Dam near Mukutmanipur at Chiada to Dam near Amruhasa village (80.446 km)
d) 27th October, 2015 to 06th November, 2015</td></tr>
<tr><td>4.</td><td>Tidal & non tidal portions (from… to, length, average tidal variation)</td><td>Non-Tidal river.</td></tr>
<tr><td>5.</td><td>LAD status (Least Available Depth)

i) < 1.2 m (km)
ii) 1.2 m to 1.4 m (km)
iii) 1.5 m to 1.7 m (km)
iv) 1.8 m to 2.0 m (km)
v) > 2.0 m (km)</td><td><u>Observed Depth</u>
<table>
<tr><th>Sub Stretch-1 (0.00-10.00 km)</th><th>Sub Stretch-2 (10.00-20.00 km)</th><th>Sub Stretch-3 (20.00 – 30.00 km)</th><th>Sub Stretch-4 (30.00-40.00 km)</th></tr>
<tr><td>0</td><td>8.7</td><td>10</td><td>10</td></tr>
<tr><td>0</td><td>1.3</td><td>0</td><td>0</td></tr>
<tr><td>1.5</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>1.8</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>6.7</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>Total-10.0</td><td>Total- 10.0</td><td>Total- 10.00</td><td>Total- 10.00</td></tr>
</table>
<table>
<tr><th>Sub Stretch-5 (40.00-50.00 km)</th><th>Sub Stretch-6 (50.00-60.00 km)</th><th>Sub Stretch-7 (60.00-70.00 km)</th><th>Sub Stretch-8 (70.00-80.446m)</th></tr>
<tr><td>10</td><td>10</td><td>10</td><td>10.446</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>Total- 10.0</td><td>Total- 10.0</td><td>Totai- 10.0</td><td>Total- 10.446</td></tr>
</table>
<table>
<tr><th>Total (km)</th></tr>
<tr><td>69.146</td></tr>
<tr><td>1.3</td></tr>
<tr><td>1.5</td></tr>
<tr><td>1.8</td></tr>
<tr><td>6.7</td></tr>
<tr><td>Total- 80.446</td></tr>
</table></td></tr>
</table>

Sl.	Particulars	Details

LAD status (Least Available Depth)

i) < 1.2 m (km)
ii) 1.2 m to 1.4 m (km)
iii) 1.5 m to 1.7 m (km)
iv) 1.8 m to 2.0 m (km)
v) > 2.0 m (km)

Reduced Depth

Sub Stretch-1 (0.00-10.00 km)	Sub Stretch-2 (10.00-20.00 km)	Sub Stretch-3 (20.00-30.00 km)	Sub Stretch-4 (30.00-40.00km)
6.8	8.8	10	10
0	1.2	0	0
0	0	0	0
0	0	0	0
3.2	0	0	0
Total- 10.0	Total- 10.0	Totai- 10.0	Total- 10.0

i) < 1.2 m (km)
ii) 1.2 m to 1.4 m (km)
iii) 1.5 m to 1.7 m (km)
iv) 1.8 m to 2.0 m (km)
v) > 2.0 m (km)

Sub Stretch-5 (40.00-50.00 km)	Sub Stretch-6 (50.00-60.00 km)	Sub Stretch-7 (60.00-70.00 km)	Sub Stretch-8 (70.00-80.446 km)
10	10	10	10.446
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
Total- 10.0	Total- 10.0	Total-10.0	Total-10.446

Total (km)
76.046
1.2
0
0
3.2
Total- 80.446

<table>
<tr><th>Sl.</th><th>Particulars</th><th>Details</th></tr>
<tr><td>6.</td><td>Cross structures
i) Dams, weirs, barrages etc (total number; with navigation locks or not)</td><td>i) Total RCC Dam- 2 (Two) – (a) Dam near Mukutmanipur and (b) Dam near Amruhasa (Hanumata Dam)
ii) Check Dam-5 (Five), Damage Check Dam-1(one)
iii) Proposed Check Dam-4 (Four)

<table><tr><th>Dam</th><th>Total Length (m)</th><th>Lock Nos</th></tr><tr><td>Mukutmanipur Dam</td><td>130</td><td>11</td></tr></table></td></tr>
<tr><td></td><td>ii) Bridges, Power cables etc [total number; range of horizontal and vertical clearances</td><td>i) RCC Bridge - 4 (Four)
<table><tr><th>Clearance w.r.t H.F.L</th><th>Min (m)</th><th>Max (m)</th></tr><tr><td>Horizontal Clearance (m)</td><td>5.67</td><td>14.96</td></tr><tr><td>Vertical Clearance w.r.t. H.F.L (m)</td><td>3.00</td><td>7.20</td></tr></table>
ii) High Tension Line - 9 (Nine)
<table><tr><th>Clearance w.r.t H.F.L</th><th>Min (m)</th><th>Max (m)</th></tr><tr><td>Horizontal Clearance (m)</td><td>79.89</td><td>396.57</td></tr><tr><td>Vertical Clearance w.r.t. H.F.L (m)</td><td>3.250</td><td>8.720</td></tr></table></td></tr>
<tr><td>7.</td><td>Slope (m/km, cm/km)</td><td><table><tr><th colspan="2">Reach</th><th>River Level Change (m)</th><th>Distance (km)</th><th>Slope (m/km)</th><th>Slope (cm/km)</th></tr><tr><th>From</th><th>To</th><th></th><th></th><th></th><th></th></tr><tr><td>0.00</td><td>10.00</td><td>0</td><td>10.00</td><td>0.000</td><td>0.00</td></tr><tr><td>10.01</td><td>20.00</td><td>7.060</td><td>9.99</td><td>0.707</td><td>70.67</td></tr><tr><td>20.01</td><td>30.00</td><td>12.010</td><td>9.99</td><td>1.202</td><td>120.22</td></tr><tr><td>30.01</td><td>40.00</td><td>11.620</td><td>9.99</td><td>1.163</td><td>116.32</td></tr><tr><td>40.01</td><td>50.00</td><td>10.430</td><td>9.99</td><td>1.044</td><td>104.40</td></tr><tr><td>50.01</td><td>60.00</td><td>19.700</td><td>9.99</td><td>1.972</td><td>197.20</td></tr><tr><td>60.01</td><td>70.00</td><td>19.800</td><td>9.99</td><td>1.982</td><td>198.20</td></tr><tr><td>70.01</td><td>80.446</td><td>27.220</td><td>10.44</td><td>2.608</td><td>260.73</td></tr><tr><td colspan="4">Avg Slope</td><td>1.334 m/km</td><td>133.46 cm/km</td></tr></table></td></tr>
</table>

<table>
<tr><th>Sl.</th><th>Particulars</th><th>Details</th></tr>
<tr><td>8.</td><td>Discharge Report</td><td>
<table>
<tr><th>Stretch No.</th><th>Chainage (km)</th><th>Discharge (m3/sec)</th></tr>
<tr><td>1</td><td>0.053</td><td>325.04</td></tr>
<tr><td>2</td><td>10.584</td><td>435.09</td></tr>
<tr><td>3</td><td>20.187</td><td>46.49</td></tr>
<tr><td>4</td><td>34.541</td><td>33.96</td></tr>
<tr><td>5</td><td>41.5</td><td>40.19</td></tr>
<tr><td>6</td><td>51.39</td><td>44.86</td></tr>
<tr><td>7</td><td>63.627</td><td>16.13</td></tr>
<tr><td>8</td><td>70.373</td><td>79.44</td></tr>
<tr><td>9</td><td>80.398</td><td>37.43</td></tr>
<tr><td colspan="2">Avg. Discharge</td><td>117.62</td></tr>
</table>
</td></tr>
<tr><td>9.</td><td>i) Present IWT operations
ii) Ferry services, tourism, cargo, if any</td><td>i) As Follows
ii) There are two ferry services available in this zone of river near the Chainage of 0.52 km and 10.00 km (Deer park Ferry). There is no cargo available in this zone of river. Mukumanipur Dam, Chandil Dalma wildlife Reserve, Dalma wildlife sanctuary, Ajodhya hill and reserve area, Banpukuria Deer park, Pareshnath Shiv Mandir, Nilgiri Deer park etc. tourist places are located in this river sites.</td></tr>
<tr><td>10.</td><td>Approx Distance of Rail & Road from Industry</td><td>Nearest Railway station- i) Barabhum Railway Station (5.65 km approx from Hanumata Dam near Amruhasa village)
Name of National highway (NH) close to the River- NH- 32 (2.38 km approx from Hanumata Dam) , NH- 60 (63 km approx from Mukutmanipur Dam)
Name of SH- SH- 2, SH- 4, SH-5</td></tr>
<tr><td>11.</td><td>Any other information/ comment</td><td>Recommendation for the Detailed Project Report of the Kumari River for Mukutmanipur Tourirism and its development. Besides, Dredging is also Needful as the channel of the waterways become a shallow depth after 14 km. As a tourist spot, many tourists come Mukutmanipur every year to see the beauty of the Dam site. If the ferry service may develop, the waterway transportation will be accessible.</td></tr>
</table>

Section-1: Introductory Considerations

1.1 River Course: Background information, Historical Information, Origin, End:-

Mukutmanipur is a town in Bankura district of west Bengal, India. It is located at the confluence of the Kangsabati and Kumari rivers close to the Jharkhand border.

Kangsabati River (also variously known as the Kasai and Cossye) rises from the Chota Nagpur plateau in the state of west Bengal, India and passes through the districts of Purulia, Bankura and Paschim Medinipur in West Bengal before draining in the Bay of Bengal. After rising at Murguma near Jhalda in the Chota Nagpur plateau in Purulia district, it passes by Purulia, Khatra and Ranibandh in Bankura district and then enters Paschim Medinipur in the Binpur area. It is joined by Bhairabbanki. At Keshpur, the river splits into two. The northern branch flows through the Daspur area as Palarpai and joins the Rupnarayan River. The other branch flows in a south-easterly direction and on joining the Kaliaghai River forms the Haldi River, which flows into the Bay of Bengal at Haldia.

Kangshabati is created from the confluence of two smaller river streams namely Saharjhor and Girgiri and takes the name of Kangshabati near Tigra village of C. D. Block Jhalda II in the district of Purulia. Purulia, Mukutmanipur, Raipur, Binpur, Midnapore, and Kharagpur etc. towns are located on or near the banks of this river.

In 1956, a giant water dam reservoir was planned at Mukutmanipur, under a big vision mooted by the then CM of Bengal Dr Bidhan Ch. Roy. The Mukutmonipur dam was planned to provide major irrigation facilities to 8,000 square kilometres of agricultural land, stretched across Bankura, Purulia, Paschim Medinipur and parts of upper Hooghly. Approximately two kilometres from the lake is the Bangopalpur Reserve Forest, a home of many species of flora and fauna.

Figure 1- Kumari River site Location

1.2 - Tributaries / Network of River/ Basin:-

Kumari River is the tributary of Kangsabati River.

1.3 - State / District through which river passes:-

The River Kumari passes through the district of Purulia, Bankura and Midnapore in the state of west Bengal.

1.4 – Project Site Google Map:-

Figure 2 - Project Site Location Map

1.5 - Scope of work:-

The Scope of work shall cover all technical aspects of hydrographic survey at par with International Standards including the following for development of the river/canal for inland navigation.

The detailed hydrographic survey is to be carried out by using Automated Hydrographic Survey System (using digital Echo sounder for depth measurement, DGPS Beacons Receivers for position fixing and Hypackmax or equivalent software for data logging). The survey is to be conducted in WGS"84 datum.

- Detailed Hydrographic Survey to assess the navigability of the waterway.
- To collect Water and bottom samples, current meter observation and discharge from the deepest route at every 10 km interval.
- To identify cross structures which are obstructing navigation.
- To identify the length of bank protection required.
- The BM is denoted by a "." mark engraved on a plate. The plate is fixed on a 5cm diameter GI pipe. The GI pipe is cemented with construction pillar of 30cmX30cmX150cm.
- The pillar extends 60.cms above ground level. Inscription "IWAI", "B.S.Geotech" and BM No. can be seen on the face of the pillar.

Section-2: Methodology Adopted to undertake Study

2.1 - Methodology Adopted including Resources and equipment used and calibration: -

Equipment:-

Following equipments are employed for the Bathymetric and Topographic survey:-

Equipment	Make	Version	Qty Employed
Echo sounder	Bathy MF 500	……	1
Current Meter	AEM 213-D	……	1
Tide Gauge	Manual (Pole type)	----------	4
RTK	South S86T	----------	3
GPS Sets	Trimble –Becon Receiver SPS 361	----------	1
Software	HYPACK data acquisition	Version 14	1
Software	AUTOCAD	2013	1
Software	Microsoft Office	2013	1

Table 2 - Equipments

- **Conduct of survey work**

- **Topographic Survey:-**

The Topography survey of Kumari river has been carried out from "Mukutmanipur Dam at Chiada (Lat: - 22°57'18.24"N, Long: - 86°44'42.87"E) to Dam near Amruhasa village (Lat: - 23°06'36.54"N, Long: - 86°15'50.92"E)". The length of the Topography survey is from Chainage 0.00 km to Chainage 80.446 km.

The Topographic survey has been conducted to ascertain following in the survey area:-

- Spot levels
- High bank Line
- Vegetation covered
- Bridges and permanent structures
- Road, culvert and other communication network

GPS RTK (Real Time Kinematic) satellite navigation is a technique used in land survey and in hydrographic survey based on the use of carrier phase measurements of the GPS, GLONASS and / or Galileo signals where a single reference station provides the real-time corrections, providing up to centimeter-level accuracy. When referring to GPS in particular, the system is also commonly referred to as Carrier-Phase Enhancement, CPGPS. RTK systems use a single base station receiver and a number of mobile units. The base station re-broadcasts the phase of the carrier that it measured, and the mobile units compare their own phase measurements with the ones received from the base station. There are several ways to transmit a correction signal from base station to mobile station. The most popular way to achieve real-time, low-cost signal transmission is to use a radio modem, typically in the UHF band. This allows the units to calculate their relative position to millimeters, although their absolute position is accurate only to the same accuracy as the position of the base station.

- **Establishment of Horizontal Control:-**

The Horizontal control for Topography survey: - High precision RTK DGPS in fix mode is using UHF Radio Modem with IHO accuracy standards, with minimum 24 hours observations at some permanent platform/base with Topographic survey Equipments like South (S86T) GNSS RTK, Total Station was used for conducting the topographic survey on UTM Projection at Zone 45 N as directed in the contract specifications.

The Horizontal control for Bathy surveys: - DGPS is receiving corrections from Beacons from the Base stations.

- **Establishment of Vertical Control:-**

Vertical control from C.W.C Gauge of Mukutmanipur Dam is used for the entire survey work. Its value is 134.150 meter w.r.t. M.S.L has been considered for calculating the vertical levels. Total 9 no. BM was established along the 80.446 km Kumari River with the reference of C.W.C Gauge which is situated near Mukutmanipur Dam Site.

Figure 3-C.W.C Gauge at Mukutmanipur Dam site (Chainage-0.00 km)

Topography Survey:-

The survey was commenced on 27th October, 2015 and completed on 6th November, 2015. Then the days were autumn season and arrival of winter season. The climate become normal which reached about 20◦ C. Mostly day weather was sunny and was very favorable for the conduct of survey and the weather condition remains same for the entire duration of the survey.

The survey was undertaken as per the line plan provided and the spot level points in the cross line were spaced at 40 m interval. The plotting of the chart was done on UTM Projection at Zone 45 N as directed in the contract specifications. The spot levels along the river were obtained by using Trimble DGPS. The data was post processed using Trimble Business Center to get the precise position and MSL height values of the rover locations. Topographic survey Equipments: South (S86T) GNSS RTK, Total Station was used for conducting the topographic survey.

Figure 4- During the Topography survey

Bathymetry Survey:-

The length of The Bathymetry survey is from Chainage 0.00 km to Chainage 14.00 km. The Remaining stretches of the river has insufficient layer of water for carried out the Bathymetry survey. Bathy 500 MF was used to obtain soundings onboard the survey boat. A working frequency of 210 KHz was used for sounding operations. The digital output from the echo sounder was automatically fed to the HYPACK data logging software on a real-time basis for the acquisition of survey data. No breakdown of equipment was reported and the performance of the equipment was found to be satisfactory during the entire duration of the survey.

The sound velocity was set to 1499 m/s on single beam echo sounder during acquisition by the Bar check procedure method. The Daily bar checks were done prior to the sounding operation and before the closing of the sounding operation for the day. Being very shallow depths, the echo sounder depths were also cross-checked in between by using demarcated sounding poles during the conduct of the survey. The sounding lines were run using Survey boat to identify the design line of the Kumari River for the possible stretch. The cross lines were run perpendicular to the orientation of river flow (i.e. perpendicular to the orientation of depth contours) in respective stretches. The spot sounding was also carried out in the area where the survey boat cannot be operated due to low depth. The hemisphere DGPS and Sounding Pole were used for Spot sounding at shallow locations in the Kumari River. The DGPS position along with water depths was recorded simultaneously and the tidal reduction was applied to the obtained depths.

Bathy- 500MF Echo sounder: The Bathy- 500MF Echo Sounder is an electronic hydrographic survey instrument used for measuring depths with precision chart recordings and digital data output manufactured by Syqwest Incorporated, USA. The Bathy-500 echo sounding systems are based on the principle that when a sound signal is sent into the water it will be reflected back when it strikes an object. The Bathy-500 is technologically sophisticated, utilizing modern, micro processor based electronics and a thermal chart recorder mechanism. Digital processing enables the instrument to offer fully automatic digitizing capabilities. When interfaced to a NMEA 0183 compatible position sensor, it provides user with a complete, integrated hydrographic survey environment. The instrument front panel consists of a high contrast, backlit four line LCD displays and a fully sealed input keypad. The front panel encompassing system data, status and setup parameters with RS232/RS422 output format. All operating functions are set via the front panel interface. Setup selections are stored within internal, non-volatile memory for instant availability upon power-up. The instrument decodes and processes the NMEA 0183 formatted sentence GGA or GLL from GPS/DGPS using variable Baud rates for communication.

Figure 5-During the Bathymetry survey in Kumari River

2.2 - Description of Bench Marks (B.M) / authentic Reference Level used:-

For Topographic survey, the Horizontal control has been carried out from the C.W.C Gauge level (Chainage-0.00 km) which is situated near Mukutmanipur Dam site. The level of the C.W.C Gauge site is:-

Location Name	Geographic position		UTM position		Elevation w.r.t M.S.L (m)
	Latitude (N)	Longitude (E)	Northing (m)	Easting (m)	
Mukutmanipur Dam Site	22°56'2.916"	86°43'58.583"	2536254.351	472617.932	134.150 m w.r.t M.S.L

Figure 6- C.W.C Gauge location of Kumari River near Mukutmanipur Dam (Chainage-0.00 km)

2.3 - Tidal Influence Zone and tidal variation in different stretches:-

There are no Tidal influences or effects found in this zone of river.

2.4 - Methodology to fix Chart Datum/ Sounding Datum:-

IWAI had provided Sounding Datum at Kangsabati Dam (Confluence), Kharidwar and Rangagora (Purihansha). The same was used to arrive the Sounding Datum values at BM Pillars and at tide gauges.

Sl. No	Place	Sounding Datum w.r.t MSL (Provided by IWAI)
1	Kharidwar (Chainage-20.640 km)	129.357 meter
2	Rangagora(Purihansha) (Chainage-62.608 km)	190.598 meter
3	Kangsabati Dam (Confluence) (Chainage-0.00 km)	123.237 meter

2.5 - Yearly minimum and maximum Water Levels Average of 06 years minimum Water Levels to arrive at Chart Datum (CD) / Sounding Datum (SD):-

The CD level of Kharidwar (Chainage-20.640 km) in the river Kumari is 129.357 meter

The CD level of Rangagora (Chainage-62.608 km) in the river Kumari is 190.598 meter

The CD level of Kangsabati Dam (Chainage-0.00 km) is 123.237 meter.

2.6 -Transfer of Sounding Datum table for Tidal Rivers:-

There is no tidal influence found in this zone of river.

2.7 –Table indicataing tidal variation at different observation points (say at every 10 KM):-

There is no tidal influence found in this zone of river.

2.8 - Salient features of Dam, Barrages, Weirs, Anicut, Locks and Aqueducts etc.:-

There are Five Check Dams, two RCC Dam including Mukutmanipur Dam, Four Proposed Check Dams and one damage Check Dam found in this zone of River.

Mukutmanipur Dam	
Location	Mukutmanipur, District Bankura on the rivers Kangsabati and Kumari about 3.2 km. upstream of their confluence.
Type of Dam	Earthen Gravity Dam with Concrete Saddle Spillway
Catchment Area	3625 sq. km (1400 sq. Miles)
Length of Dam	11.27 km. (7 Miles) including Dyke & Hillock
Height (Max.) of Dam	41.15 m (135 ft.) above River Bed
Length of Spillway / No. of Bays	125.00 m (440 ft.) 11 (Width of each bay 9.14 m)
Optimum Pond Level	134.11 m (410 ft.)
Design Flood Level	135.63 m (445 ft.)
Design Discharge	5663.32 cumec (2,00,000 cusecs)
Total Storage (DS & LS)	103614.16 Ha. m (8, 40,000 ac. ft.)
Total Submerged Area	13,668 ha. (33,760 acre.)
Canal & Barrage Discharge	Left - 192.55 cumecs (6,800 cusecs) Right - 70.75 cumecs (2,500 cusecs)
Length of Canal	Main and Branch - 804.50 km. (500 Miles) Distributaries and Minors - 2413.50 km. (1500 Miles)
Pickup Barrages	i) Silabati, ii) Bhairabanki, iii) Tarafeni
Total Irrigable Area (CCA)	Kharif - 340752 ha. (8,42,000 acre) Rabi - 60704 ha (1,50,000 acre)
Maximum Irrigation Achieved	Kharif - 274,940 ha (6,79,100 acre) Rabi - 45,593 ha (112,614 acre) Boro - 27,944 ha (69,022 acre)

Figure 7- Salient Features of Mukutmanipur Dam

2.9- Description of erected Bench mark Pillars:-

Sl. No	BM No	Location	Chainage (Km)	Latitude (N)	Longitude (E)	Easting (m)	Northing (m)	BM Height above MSL (m)	BM Height above SD (m)
1	BM 1	Mukutmanipur Dam area	0.053	22°58'6.639"	86°47'20.785"	478382.309	2540049.439	138.598	15.361
2	BM 2	Durgadi village	10.584	22°56'52.275"	86°41'10.422"	467831.76	2537781.59	141.179	17.942
3	BM 3	Doldenrya	20.187	23°0'3.788"	86°38'25.287"	463143.408	2543681.441	143.760	13.600
4	BM 4	Dubra	34.541	23°2'49.844"	86°33'40.328"	455046.683	2548809.868	157.477	9.757
5	BM 5	Singugara	41.500	23°3'8.807"	86°31'22.172"	451116.941	2549405.288	164.651	10.111
6	BM 6	Biskudra	51.390	23°2'45.11"	86°27'35.205"	444655.493	2548699.049	175.139	10.219
7	BM 7	Ranggagora	63.627	23°4'24.964"	86°21'45.634"	434720.612	2551809.705	198.213	9.603
8	BM 8	Tumrashou	70.373	23°5'13.619"	86°19'26.777"	430776.63	2553323.68	219.741	16.021
9	BM 9	Amruhasa RCC Dam area	80.398	23°6'33.921"	86°15'51.693"	424669.877	2555822.712	241.269	10.329

Table 3 - Bench Mark Details

2.10- Description of erected Tide Gauges:-

Tide Gauge Name	Chainage (km)	Location	Easting (m)	Northing (m)	Longitude (E)	Latitude (N)	W.L w.r.t M.S.L (m)	Period of observation
GS-(TP)-1	10.584	Kantagara	468968.769	2539274.463	86° 41'50.2396"	22°57'40.9008"	123.400	24 hrs

Table 4- Tide Gauge Details

2.11- Chart Datum / Sounding Datum and Reductions details:-

Sl no	CWC gauge / Dam / Barrage / Weir / Anicut / Bench Mark / tide gauges	Chainage (km)	Stretch for corrected soundings and topo levels (km)	Established Sounding Datum w.r.t. MSL (m) at col. A.	Sounding Datum of Tide Gauge w.r.t. MSL (m)	Correction in WL data for Bathymetric survey (m)	Topo level data to be converted as depth for volume calculation w.r.t. SD (m)
	A	B	C (50% stretch is to be selected on both side of tide gauge)	D	E	F = (E- WL data in MSL)	G = (E- topo levels in MSL)
1	GS - (TP)-1/A67	80.5	80-80.446		230.940	-0.300	Kumari Reduced Topo.xyz
2	GS-(TP)-1/ A 66	79.5	79-80		228.990	-0.300	Submitted in Soft copy
3	GS-(TP)-1/ A 65	78.5	78-79		226.320	-0.300	
4	GS-(TP)-1/ A 64	77.5	77-78		223.200	-0.300	
5	GS-(TP)-1/ A 63	76.5	76-77		219.670	-0.300	
6	GS-(TP)-1/ A 62	75.5	75-76		217.840	-0.300	
7	GS-(TP)-1/ A 61	74.5	74-75		214.650	-0.300	
8	GS-(TP)-1/ A 60	73.5	73-74		212.440	-0.300	
9	GS-(TP)-1/ A 59	72.5	72-73		209.200	-0.300	
10	GS-(TP)-1/ A 58	71.5	71-72		205.650	-0.300	
11	GS-(TP)-1/ A 57	70.5	70-71		203.720	-0.300	
12	GS-(TP)-1/ A 56	69.5	69-70		202.150	-0.300	
13	GS-(TP)-1/ A 55	68.5	68-69		199.070	-0.300	
14	GS-(TP)-1/ A 54	67.5	67-68		197.020	-0.300	
15	GS-(TP)-1/ A 53	66.5	66-67		195.140	-0.300	
16	GS-(TP)-1/ A 52	65.5	65-66		194.330	-0.300	
17	GS-(TP)-1/ A 51	64.5	64-65		191.880	-0.300	
18	GS-(TP)-1/ A 50	63.5	63-64		188.610	-0.300	

Sl no	CWC gauge / Dam / Barrage / Weir / Anicut / Bench Mark / tide gauges	Chainage (km)	Stretch for corrected soundings and topo levels (km)	Established Sounding Datum w.r.t. MSL (m) at col. A.	Sounding Datum of Tide Gauge w.r.t. MSL (m)	Correction in WL data for Bathymetric survey (m)	Topo level data to be converted as depth for volume calculation w.r.t. SD (m)
	A	B	C (50% stretch is to be selected on both side of tide gauge)	D	E	F = (E- WL data in MSL)	G = (E- topo levels in MSL)
19	Rangagora (Purihansha)	62.608		190.598			
20	GS-(TP)-1/ A 49	62.5	62-63		184.770	-0.300	
21	GS-(TP)-1/ A 48	61.5	61-62		184.330	-0.300	
22	GS-(TP)-1/ A 47	60.5	60-61		183.920	-0.300	
23	GS-(TP)-1/ A 46	59.5	59-60		183.620	-0.300	
24	GS-(TP)-1/ A 45	58.5	58-59		183.300	-0.300	
25	GS-(TP)-1/ A 44	57.5	57-58		180.370	-0.300	
26	GS-(TP)-1/ A 43	56.5	56-57		176.790	-0.300	
27	GS-(TP)-1/ A 42	55.5	55-56		173.480	-0.300	
28	GS-(TP)-1/ A 41	54.5	54-55		170.890	-0.300	Submitted in Soft Copy
29	GS-(TP)-1/ A 40	53.5	53-54		168.940	-0.300	
30	GS-(TP)-1/ A 39	52.5	52-53		164.250	-0.300	
31	GS-(TP)-1/ A 38	51.5	51-52		164.920	-0.300	
32	GS-(TP)-1/ A 37	50.5	50-51		164.220	-0.300	
33	GS-(TP)-1/ A 36	49.5	49-50		161.550	-0.300	
34	GS-(TP)-1/ A 35	48.5	48-49		159.990	-0.300	
35	GS-(TP)-1/ A 34	47.5	47-48		159.430	-0.300	
36	GS-(TP)-1/ A 33	46.5	46-47		159.270	-0.300	
37	GS-(TP)-1/ A 32	45.5	45-46		158.310	-0.300	
38	GS-(TP)-1/ A 31	44.5	44-45		157.620	-0.300	
39	GS-(TP)-1/ A 30	43.5	43-44		156.190	-0.300	
40	GS-(TP)-1/ A 29	42.5	42-43		155.470	-0.300	
41	GS-(TP)-1/ A 28	41.5	41-42		154.540	-0.300	
42	GS-(TP)-1/ A 27	40.5	40-41		153.790	-0.300	
43	GS-(TP)-1/ A 26	39.5	39-40		152.840	-0.300	
44	GS-(TP)-1/ A 25	38.5	38-39		151.270	-0.300	
45	GS-(TP)-1/ A 24	37.5	37-38		150.780	-0.300	

Sl no	CWC gauge / Dam / Barrage / Weir / Anicut / Bench Mark / tide gauges	Chainage (km)	Stretch for corrected soundings and topo levels (km)	Established Sounding Datum w.r.t. MSL (m) at col. A.	Sounding Datum of Tide Gauge w.r.t. MSL (m)	Correction in WL data for Bathymetric survey (m)	Topo level data to be converted as depth for volume calculation w.r.t. SD (m)
	A	B	C (50% stretch is to be selected on both side of tide gauge)	D	E	F = (E- WL data in MSL)	G = (E- topo levels in MSL)
46	GS-(TP)-1/ A 23	36.5	36-37		150.060	-0.300	
47	GS-(TP)-1/ A 22	35.5	35-36		148.610	-0.300	
48	GS-(TP)-1/ A 21	34.5	34-35		147.720	-0.300	
49	GS-(TP)-1/ A 20	33.5	33-34		145.920	-0.300	
50	GS-(TP)-1/ A 19	32.5	32-33		145.000	-0.300	
51	GS-(TP)-1/ A 18	31.5	31-32		142.990	-0.300	
52	GS-(TP)-1/ A 17	30.5	30-31		142.170	-0.300	
53	GS-(TP)-1/ A 16	29.5	29-30		140.580	-0.300	
54	GS-(TP)-1/ A 15	28.5	28-29		139.070	-0.300	
55	GS-(TP)-1/ A 14	27.5	27-28		137.810	-0.300	Submitted in Soft Copy
56	GS-(TP)-1/ A 13	26.5	26-27		136.310	-0.300	
57	GS-(TP)-1/ A 12	25.5	25-26		135.130	-0.300	
58	GS-(TP)-1/ A 11	24.5	24-25		134.070	-0.300	
59	GS-(TP)-1/ A 10	23.5	23-24		133.170	-0.300	
60	GS-(TP)-1/ A 9	22.5	22-23		132.980	-0.300	
61	GS-(TP)-1/ A 8	21.5	21-22		131.770	-0.300	
62	Kharidwar	20.64		129.357			
63	GS-(TP)-1/ A 7	20.5	20-21		130.160	-0.300	
64	GS-(TP)-1/ A 6	19.5	19-20		128.260	-0.300	
65	GS-(TP)-1/ A 5	18.5	18-19		126.710	-0.300	
66	GS-(TP)-1/ A 4	17.5	17-18		124.740	-0.300	
67	GS-(TP)-1/ A 3	16.5	16-17		124.470	-0.300	
68	GS-(TP)-1/ A 2	15.5	15-16		124.388	-0.300	
69	GS-(TP)-1/ A 1	14.5	14-15		124.240	-0.300	
70	GS-(TP)-1	10.584	0-15		123.237	-0.163	
71	Kangsabati Dam (Confluence point)	0		123.237			

Table 5 - Chart Datum / Sounding Datum & Reduction Details

2.12- High Flood Level (H.F.L.) at known gauge stations and cross-structures:-

MHWS (Mean High Water Springs) is to be taken in tidal stretches and HFL in non-tidal stretches.

Sl no	Location and description of CWC gauge / Dam / Barrages / Weirs / Anicut / Locks / Aqueducts / BM	Cross-structure details	Chainage (km)	Established HFL / MHWS / FSL / MWL / FRL w.r.t. MSL (m)	Computed HFL at Cross-Structures w.r.t. MSL (m)
1	Rangagora (Purihansha)		62.608	196.320	
2	Kharidwar		20.64	137.400	
3	Kangsabati Dam		0.000	134.320	

Table 6 – H.F.L Details

2.13 - Average Slope:-

Sl. No	Reach		River Level Change (m)	Distance (km)	Slope (m/km)	Slope (cm/km)
	From	To				
1	0.00	10.00	0	10.00	0.000	0.00
2	10.01	20.00	7.060	9.99	0.707	70.67
3	20.01	30.00	12.010	9.99	1.202	120.22
4	30.01	40.00	11.620	9.99	1.163	116.32
5	40.01	50.00	10.430	9.99	1.044	104.40
6	50.01	60.00	19.700	9.99	1.972	197.20
7	60.01	70.00	19.800	9.99	1.982	198.20
8	70.01	80.446	27.220	10.44	2.608	260.73
9	Avg Slope				1.334 m/km	133.46cm/km

Table 7 - Average slope

2.14 - Details of Dam, Barrages, Weirs, Anicut, etc. w.r.t. MSL:-

There are Five Check Dams, one RCC Dam and one damage Dam found in this zone of River.

Sl No	Structure Name	Chainage (km)	Location	Latitude (N)	Longitude (E)	Northing (m)	Easting (m)	Length (m)	Width (m)	Height w.r.t. above M.S.L (m)	Present Condition
1	Mukutmanipur Dam	0.000	Mukutmanipur	22°57'49.97"	86°47'20.19"	2539536.91	478364.63	130.0	8.45	123.400	Complete
2	Check Dam	54.201	Tetto	23° 3'29.17"	86°26'15.299"	2550004.71	442310.90	85.0	3.300	171.190	Complete
3	Damage Check Dam	57.949	Dumurdih	23° 3'50.05"	86°24'32.75"	2550760.38	439469.62	81.0	4.5	180.670	Complete
4	Check Dam	64.998	Basudevpur	23° 4'43.23"	86°21'17.97"	2552375.004	433936.309	76.6	3.500	188.910	Complete
5	Check Dam	69.134	Patpur village	23° 4'46.48"	86°19'49.74"	2552486.508	431426.366	85	4.5	202.450	Complete
6	Check Dam	72.314	Gobind Dih village	23° 5'39.41"	86°19'2.44"	2554120.876	430088.818	80.6	4.77	209.500	Damage
7	Check Dam	74.338	Harjora village	23° 5'43.78"	86°18'7.02"	2554262.384	428512.213	49.00	4.2	214.950	Complete
8	RCC Dam	80.446	Balarampore	23° 6'36.43"	86°15'50.59"	2555900.01	424638.88	95.00	6.1	231.240	Complete

Figure 8- Dam Details

2.15 - Details of Locks:-

There are no locks found in this zone of river.

2.16 - Details of Aqueducts:-

There are no aqueducts found in this zone of River.

2.17- Details of existing Bridges and Crossings over waterway:-

Sl. No	Chainage (km)	Location	Cross-Structure details	Latitude (N)	Longitude (E)	Northing (m)	Easting (m)	Length (m)	Width (m)	No of Piers	Horizontal Clearance (m)	Vertical Clearance w.r.t H.F.L (m)	Present Condition
1	20.216	Chalka	RCC Bridge	23° 0'2.40"	86°38'20.85"	2543639.712	463017.243	170.18	10.38	8	14.96	7.20	Complete
2	34.524	Duarsini	RCC Bridge	23°2'51.77"	86°33'42.37"	2548869.93	455105.21	133.57	8.43	12	7.61	3.00	Complete
3	46.521	Fatepur	Gangan arayan RCC Bridge	23°3'32.56"	86°29'24.99"	2550147.00	447785.78	106.62	6.78	12	6.29	3.00	Complete
4	63.621	Rangagara	Bishari Kumari RCC Bridge	23°4'26.57"	86°21'45.96"	2551859.84	434730.83	61.84	7.11	8	5.67	3.10	Complete

Table 8 - Bridge Details

2.18 - Details of other Cross structures, pipe-lines, under water cables:-

There are four numbers of proposed check Dams found in this zone of river.

Sl. No	Structure Name	Chainage (km)	Latitude (N)	Longitude (E)	Northing	Easting
1	Proposed Check Dam	72.600	23° 5'37.28"	86°18'57.54"	2554055.18	429948.24
2	Proposed Check Dam	73.681	23° 5'45.29"	86°18'27.44"	2554305.53	2554305.53
3	Proposed Check Dam	73.947	23° 5'42.12"	86°18'18.92"	2554209.20	428850.25
4	Proposed Check Dam	74.576	23° 5'36.80"	86°18'02.77"	2554047.79	428390.03

Figure 9-Proposed Check Dam details

2.19 - High Tension Lines / Electric lines / Tele-communication lines:-

Sl. no	Line	Chainage (km)	Location	Position				No of piers	Horizontal clearance (m)	Vertical clearance w.r.t H.F.L (m)	Remarks
				Latitude (N)	Longitude (E)	Easting (m)	Northing (m)				
1.	High Tension Line	20.048	Chalka	22°59'56.34"	86°38'22.616"	463066.818	2543452.598	8	155.29	6.100	Complete
2.	High Tension Line	20.117	Chalka	23°0'1.803"	86°38'25.192"	463140.545	2543620.415	8	141.58	6.100	Complete
3.	High Tension Tower	53.359	Tetto	23°6'40.35"	86°26'48.584"	443356.101	2549674.042	8	396.57	5.390	Complete
4.	High Tension Tower	53.959	Hesiadih	23°3'26.944"	86°26'29.679"	442795.639	2549992.480	8	396.03	5.120	Complete
5.	High Tension Tower	63.499	Rangagara	23°6'40.35"	86°26'48.584"	443356.101	2549674.042	8	79.89	8.650	Complete
6.	High Tension Tower	63.571	Rangagara	23°4'24.843"	86°21'47.494"	434773.514	2551805.772	8	102.59	8.720	Complete
7.	High Tension Tower	63.578	Rangagara	23°6'40.35"	86°26'48.584"	443356.101	2549674.042	8	106.54	3.250	Complete
8.	High Tension Tower	69.120	Patpur village	23°4'44.256"	86°19'49.71"	431424.954	2552417.708	8	149.06	5.940	Complete
9.	High Tension Tower	80.211	Near RCC Dam	23°6'34.809"	86°15'59.112"	424881.037	2549992.480	8	128.01	3.330	Complete

Table 9 - High Tension Lines / Electric lines

2.20 - Current Meter and Discharge details:-

Stretch No.	Chainage (km)	Position				Observed Depth (m) (D)	Velocity (m/sec.)	Average Velocity (m/sec.)	X-Sectional area (sq. m.)	Discharge (m3/sec)
		Easting (m)	Northing (m)	Latitude (N)	Longitude (E)		0.5 D			
1	0.053	478369.611	2539997.551	22°58'04.951"	86°47'20.342"	3.41	0.523	0.523	621.5	325.04
2	10.584	469040.589	2539133.924	22°57'36.335"	86°41'52.772"	3.42	0.527	0.527	825.6	435.09
3	20.187	463071.118	2543642.043	23°00'02.501"	86°38'22.751"	0.5	0.384	0.384	121.08	46.49
4	34.541	455134.187	2548872.733	23°02'51.897"	86°33'43.397"	0.6	0.258	0.258	131.65	33.96
5	41.500	451155.147	2549401.709	23°03'08.695"	86°31'23.515"	0.4	0.480	0.480	83.73	40.19
6	51.390	444652.683	2548779.859	23°02'47.738"	86°27'35.096"	0.4	0.480	0.480	93.47	44.86
7	63.627	434713.772	2551858.087	23°04'26.536"	86°21'45.387"	0.6	0.258	0.258	62.54	16.13
8	70.373	430856.9	2553313.263	23°05'13.292"	86°19'29.6"	0.4	0.480	0.480	165.5	79.44
9	80.398	424682.1	2555876.295	23°06'35.666"	86°15'52.114"	0.3	0.451	0.451	83.01	37.43

Table 10 - Current Meter Details

2.21 - (a) Soil Sample Locations:-

Sample No.	Chainage (km)	Easting (m)	Northing (m)	Latitude (N)	Longitude (E)	Depth (m)
1	10.584	469040.589	2539133.924	22°57'36.335"	86°41'52.772"	3.42
2	20.187	463071.118	2543642.043	23°00'02.501"	86°38'22.751"	0.5
3	34.541	455134.187	2548872.733	23°02'51.897"	86°33'43.397"	0.6
4	41.500	451155.147	2549401.709	23°03'08.695"	86°31'23.515"	0.4
5	51.390	444652.683	2548779.859	23°02'47.738"	86°27'35.096"	0.4
6	63.627	434713.772	2551858.087	23°04'26.536"	86°21'45.387"	0.6
7	70.373	430856.9	2553313.263	23°05'13.292"	86°19'29.6"	0.4
8	80.398	424682.1	2555876.295	23°06'35.666"	86°15'52.114"	0.3

Table 11 - Soil Sample Locations

Note: - The Soil sample report has been shown at Annexure no- 11, page no at 104

(b) Water Sample Locations:-

Sample No.	Chainage (km)	Easting (m)	Northing (m)	Latitude (N)	Longitude (E)	Total Depth (d) (m)	Mid-Depth (0.5d) (m)
1	10.584	469040.589	2539133.924	22°57'36.335"	86°41'52.772"	3.42	1.71
2	20.187	463071.118	2543642.043	23°00'02.501"	86°38'22.751"	0.5	0.25
3	34.541	455134.187	2548872.733	23°02'51.897"	86°33'43.397"	0.6	0.3
4	41.500	451155.147	2549401.709	23°03'08.695"	86°31'23.515"	0.4	0.2
5	51.390	444652.683	2548779.859	23°02'47.738"	86°27'35.096"	0.4	0.2
6	63.627	434713.772	2551858.087	23°04'26.536"	86°21'45.387"	0.6	0.3
7	70.373	430856.9	2553313.263	23°05'13.292"	86°19'29.6"	0.4	0.2
8	80.398	424682.1	2555876.295	23°06'35.666"	86°15'52.114"	0.3	0.15

Table 12 - Water Sample Locations

Note: - The Water sample report has been shown at Annexure no- 12, page no at 113

Section-3: Description of waterway

3.1- From Chainage 0.00 Km to Chainage 10.00 Km. (Mukutmanipur Dam to Kantagara):-

Figure 10- Chainage 0.00 km to Chainage 10.00 km

The width of Kumari River from Chainage 0.00 Km. to Chainage 10.00 Km is approximately 848 m to 2000 m. The average width portion of the river is approximately 1424 m.

Mukutmanipur, a major dam is situated in this stretches of river near at Chainage of 0.00 km. The Position of this Dam is- (Lat: - 22°57'49.97"N, Long: - 86°47'20.19"E). Deer park is also situated in this river stretches. BM-1 is also situated near at Chainage of 0.053 km. Kangsabati Dam is also be called Mukutmanipur Dam. SH-4 is located east portion of the Dam site. Peri pathar, Dhagara, Jamdara, Rajadali, Domohani etc. villages are situated near at Chainage of right bank side of the river. There are two Passenger ferry services are available in this stretches of river near at Chainage of 0.52 km and Chainage 10.00 km. The position of the first ferry ghat (left bank) is (Lat: - 22°57'50.81"N, Long: - 86°47'3.26"E) and right bank is (Lat: 22°58'22.59"N, Long: 86°46'54.90"E). The next ferry ghat name is Deer park ferry service which is located near the Chainage 10.00 km approximately. The position of this ferry ghat (right bank) is (Lat: - 22°57'40.46"N, Long: - 86°44'41.18"E) and left bank is (Lat: - 22°57'33.28"N, Long:- 86°44'57.09"E). But there is no cargo available in this stretches of river.

Class	Chainage (km)		Observed				Reduced w.r.t. Sounding Datum			
	From	To	Min. depth (m)	Max. depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Min. Depth (m)	Max. Depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)
I	0.00	10.00	1.1	21.80	3000	31948.3	1.0	20.50	3000	41392.8
II	0.00	10.00	1.0	21.82	3000	48773.7	0.9	20.52	3000	60918.6
III	0.00	10.00	0.9	21.84	3000	73879.8	0.8	20.52	3000	89243.4
IV	0.00	10.00	0.8	21.86	3000	89753.2	0.7	20.52	3000	106564.8

Figure 11- Mukutmanipur Dam (Chainage-0.00 km)

Bathymetry Survey

a) Length of the stretch for which the Bathymetric Survey has been carried out:-

The Bathymetry survey has been carried out from Mukutmanipur dam to Deer park area. The Length of the Bathymetric survey is Chainage 0.00 km to Chainage 10.00 km.

Topographic Survey:-

a) Length of the stretch for which the Topographic survey has been carried out:-

The Topography survey has been carried out from Mukutmanipur dam to Deer park area. The Length of the Topography survey is Chainage 0.00 km to Chainage 10.00 km.

a) Prominent Dams / Barrage: -

Mukutmanipur Dam is located in this stretches of river near the Chainage of 0.00 km. The position of the Dam is (Lat: - 22°57'49.97"N, Long: - 86°47'20.19"E)

b) Conditions of banks (protected, un-protected) :-

The Bank of the river in this stretch of river mainly protected by Mukutmanipur Dam. The Dam area is protected by concrete pitching both sides. Boulder pitching is also noticed near the dam side which is protected the both side of the river bank. The high embankments are also noticed both sides of the river banks. The minimum width portion of the dam site is 1.00 km and the maximum width portion of the dam site is 3.50 km.

c) Hindrances - Hyacinth, rocks, rapid waterfalls, forest, wild-life sanctuary, security issues:-

Mukutmanipur Birding sites, Deer park is located in this stretches of river. Besides, Mukutmanipur Dam is also located in this stretches of river. The Dam area, Deer Park are protected the riverside area from both side of the river bank.

d) Details of Protected Area- Wildlife Defense: -

Mukutmanipur Birding sites, Deer park is located in this stretches of river.

e) NH/SH/MDR along and/or in vicinity: -

There is no NH found in this stretches of river. SH-2, SH-4 is the nearest roadside in this stretches of river.

f) Railway Line and Stations in the vicinity: -

There is no Railway line found in this stretches of river.

g) Land Use Pattern along Waterway on visual assessment: -

Agricultural land is found both sides bank of the river.

h) Crops / Agriculture in the region on visual assessment:-

The Major crops along the river is Paddy, jute, Potato, Wheat, Mustard, vegetables like capsicum, Broccoli are cultivated in this stretches of river. Besides, pulses, oilseeds are also cultivated in this region of river.

i) Availability of Bulk / Construction Material: -

Roofing Tiles, Brass & Bell Metal are the major clusters available in this stretches of river. Brick, Limestone, cement, sand etc are also available in this stretches of river as a building construction.

j) Existing Industries along Waterway with their types and details:-

There is no major industries build up in this stretches of river. But small kind of handloom and handicrafts are growing up in this region of river. Besides, paper products, chemical and plastic products are also growing up in this region of river. Water treatment plant is located in this stretches of river near the Mukutmanipur Dam site.

k) Existing Ghats, Jetties and Terminals (with conditions and facilities), Existing navigation facilities:-

There are two passenger ferry services available in this stretches of river near the Chainage of 0.52 km and 10.00 km. There is no permanent jetty found in this stretches of river.

l) Existing Cargo Movement:-

Though there are two ferry services available in this zone of river, but there is no cargo available in this stretches of river.

m) Prominent City / Town / Places of Worship / Historical places for Tourism:-

Dhagara, Sunri gara, Phulhari, Damdi, Basantapura, Jambeda, Barda, Kamarkuli, Pareshnath, Dudha Jharna, Banphukuria etc. villages are located in this stretches of the river. Mukutmanipur tourism which is the famous tourist spot located in this stretches of river. Paresnath shiv temple, Ambika kali temple is located in this stretches of river.

n) Village / Colonies along the sub stretch and approx. population:-

Dhagara, Sunri gara, Phulhari, Damdi, Basantapura, Jambeda, Barda, Kamarkuli, Pareshnath, Dudha Jharna, Banphukuria etc. villages are located in this stretches of river.

o) Availability of passenger Ferry services with facilities:-

There are two Passenger ferry services are available in this stretches of river near at Chainage of 0.52 km and Chainage 10.00 km. The position of the first ferry ghat (left bank) is (Lat: - 22°57'50.81"N, Long: - 86°47'3.26"E) and right bank is (Lat: 22°58'22.59"N, Long: 86°46'54.90"E). The next ferry ghat name is Deer park ferry service which is located near the Chainage 10.00 km approximately. The position of this ferry ghat (right bank) is (Lat: - 22°57'40.46"N, Long: - 86°44'41.18"E) and left bank is (Lat: - 22°57'33.28"N, Long: - 86°44'57.09"E). But there is no cargo available in this stretches of river.

p) Available and probable water sport Recreational Facilities:-

There is no water sport and other facilities are available in this stretches of river.

q) Fishing activities:-

Pisciculture is an important factor of economic development of Bankura. District Bankura ranked first in pisciculture within West Bengal. The district provides a majority amount of fish production during the last five years. Ramsagar of Bankura district is widely known destination with about 200 hatcheries. Recently a modern fish production unit has been started at Mukutmanipur.
Under Rashtriya Sam Vikas Yojana (RSVY), nearly 81 hectors of pond area have been excavated. The scheme has been implemented through fishermen's groups in a participatory mode. The fishermen's groups have been encouraged to share a small part of the produce with the Primary Schools to make it a part of the mid-day meal. This has created a stake of community at large in the project.

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

r) Sand Mining:-

Purulia and Bankura district is endowed with mineral resources of wide range of varieties. These varieties are of basically non-metallic types. According to the findings of Geological Survey of India there are ten types of mineral deposits in this district. The main ones are coal, limestone, rock phosphate, china clay, and quartz etc.

s) Tributaries:-

There is no tributary found in this stretches of river.

t) Details of Irrigation Canals and outlets:-

There is no irrigation canal and outlets found in this stretches of river.

u) Details of Nalas, polluted water discharge in to the rivers and treatment plants:-

There are no nalas found in this zone of river.

v) Usage of water (drinking, irrigation, industries, navigation etc.) water quality:-

The water is mainly used for agriculture purposes in this stretches of river. Water treatment plant is located in this stretches of river near Mukutmanipur Dam site. Using the water treatment plant, the drinking water is easily accessible in this zone of river. The water is also present in this dam in lean season. So vegetables, crops like paddy, pulses and oilseeds are easily cultivated in this region of river.

3.2 - From Chainage 10.00 Km to Chainage 20.00 Km (Kantagara village to Tilabani village):-

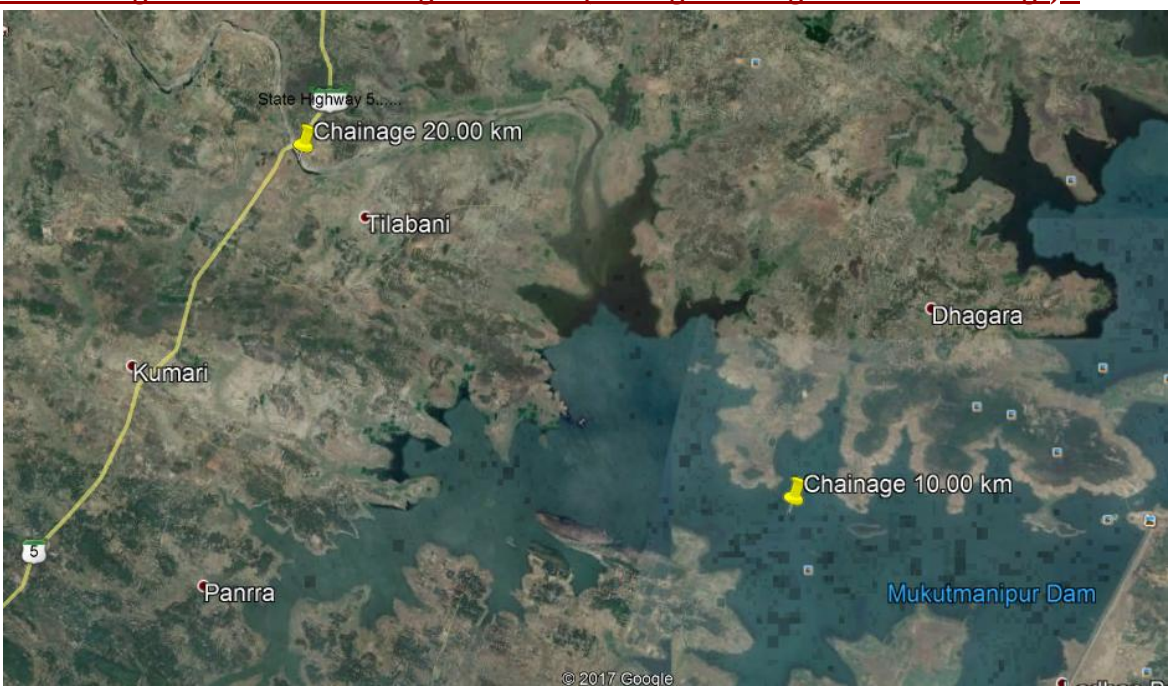


Figure 12 – Chainage 10.00 km to Chainage 20.00 km

The width of Kumari River from Chainage 10.00 Km. to Chainage 20.00 Km is approximately 2000 m to 105 m. The average width portion of the river is approximately 1052 m.

BM-2 is situated near at Chainage of 10.584 km. Kantagara, Budhpur, Mirgichanda, Tontla, Toparbad, Gobindapur, Manikdi, Serengdi, Khariduara, Dhanda, Tilabani etc. villages are situated left bank side of the river and Jamda, Banshketia, Nagdagora etc. villages are situated right bank side of the river. Both side paddy lands are also noticed during the survey period.

Class	Chainage (km)		Observed				Reduced w.r.t. Sounding Datum			
	From	To	Min. depth (m)	Max. depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Min. Depth (m)	Max. Depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)
I	10.00	20.00	0.2	15.70	10000	289343.9	-0.3	15.30	10000	374821.1
II	10.00	20.00	0.2	15.71	10000	443518.4	-0.3	15.31	10000	554377.9
III	10.00	20.00	0.2	15.72	10000	677693	-0.3	15.31	10000	816847.1
IV	10.00	20.00	0.2	15.73	10000	826232.7	-0.3	15.31	10000	973343.8

Bathymetry Survey

b) Length of the stretch for which the Bathymetric Survey has been carried out:-

The Bathymetry survey has been carried out from Deer park area to Tilabani village area. The Length of the Bathymetric survey is Chainage 10.00 km to Chainage 14.00 km.

Topographic Survey:-

b) Length of the stretch for which the Topographic survey has been carried out:-

The Topography survey has been carried out from Deer park area to Tilabani village area. The Length of the Topography survey is Chainage 10.00 km to Chainage 20.00 km.

d) Prominent Dams / Barrage: -

There is no dam found in this stretches of river.

e) Conditions of banks (protected, un-protected):-

In this stretches of river, 8.51 km from deer park area are broadly stretched in many sides. Nilgiri Deer Park, Bonpukuria deer park is located in this stretches of river. So that area is highly protected. Boulder pitching is also noticed near this stretches of river. The high embankments are also noticed both sides of the river banks. Agricultural lands are also found both side of the river bank.

f) Hindrances - Hyacinth, rocks, rapid waterfalls, forest, wild-life sanctuary, security issues:-

Nilgiri Deer Park, Bonpukuria deer park is located in this stretches of river. So the area is protected. Besides, small rocks, boulders are noticed in this stretches of river.

d) Details of Protected Area- Wildlife Defense: -

Nilgiri Deer Park, Bonpukuria deer park is located in this stretches of river.

e) NH/SH/MDR along and/or in vicinity: -

There is no NH found in this stretches of river.

f) Railway Line and Stations in the vicinity: -

There is no Railway line found in this stretches of river.

g) Land Use Pattern along Waterway on visual assessment: -

Agricultural land is found both sides bank of the river.

h) Crops / Agriculture in the region on visual assessment: -

The Major crops along the river is Paddy, Potato, Wheat, Mustard, vegetables like capsicum, Broccoli are cultivated in this stretches of river. Besides, pulses, oilseeds are also cultivated in this region of river.

i) Availability of Bulk / Construction Material: -

Roofing Tiles, Brass & Bell Metal are the major clusters available in this stretches of river. Brick, Limestone, cement, sand etc are also available in this stretches of river as a building construction.

j) Existing Industries along Waterway with their types and details:-

There is no major industries build up in this stretches of river. But small kind of handloom and handicrafts are growing up in this region of river. Besides, paper products, chemical and plastic products are also growing up in this region of river. The Brass and Bell Metal products, Wood Carved products, Soft Stone products, Terracotta toys of the district are world famous in this region of river.

k) Existing Ghats, Jetties and Terminals (with conditions and facilities), Existing navigation facilities:-

Deer park ferry ghat is located near the Chainage 10.00 km approximately. But there is no permanent jetty found in this stretches of river.

l) Existing Cargo Movement:-

There is no cargo available in this stretches of river

m) Prominent City / Town / Places of Worship / Historical places for Tourism:-

Sareng garh, Balarampur, Jharia, Chiada, Baddi, Nilgiri, Doladanga, Kantagara, Budhpur, Banshketia, Tontla, Toparbad, punda, Nagdagora, Sukapata, Gaidumur, Jadavnagar, Dhanda, Tilabani, Doladenrya etc. villages are located in this stretches of river. Nilgiri deer park is located in this stretches of river.

n) Village / Colonies along the sub stretch and approx. population:-

Sareng garh, Balarampur, Jharia, Chiada, Baddi, Nilgiri, Doladanga, Kantagara, Budhpur, Banshketia, Tontla, Toparbad, punda, Nagdagora, Sukapata, Gaidumur, Jadavnagar, Dhanda, Tilabani, Doladenrya etc. villages are located in this stretches of river.

o) Availability of passenger Ferry services with facilities:-

Deer park ferry ghat service is located near the Chainage of 10.00 km. The position of this ferry ghat is (Lat: - 22°57'40.46"N, Long: - 86°44'41.18"E). But there is no cargo available in this stretches of river.

p) Available and probable water sport Recreational Facilities:-

There is no water sport and other facilities are available in this stretches of river.

q) Fishing activities:-

Pisciculture is an important factor of economic development of Bankura. District Bankura ranked first in pisciculture within West Bengal. The district provides a majority amount of fish production during the last five years. Ramsagar of Bankura district is widely known destination with about 200 hatcheries. Recently a modern fish production unit has been started at Mukutmanipur.

r) Sand Mining:-

Purulia and Bankura district is endowed with mineral resources of wide range of varieties. These varieties are of basically non-metallic types. According to the findings of Geological Survey of India there are ten types of mineral deposits in this district. The main ones are coal, limestone, rock phosphate, china clay, and quartz etc.

s) Tributaries:-

There is no tributary found in this stretches of river.

t) Details of Irrigation Canals and outlets:-

There are some outlets found in this stretches of river.

u) Details of Nalas, polluted water discharge in to the rivers and treatment plants:-

There are no nalas found in this zone of river.

v) Usage of water (drinking, irrigation, industries, navigation etc.) water quality:-

The water is mainly used for agriculture purposes in this stretches of river. The agricultural land is found both sides bank of the river.

3.3- From Chainage 20.00 Km to Chainage 30.00 Km (Tilabani village to Ukamgar village):-

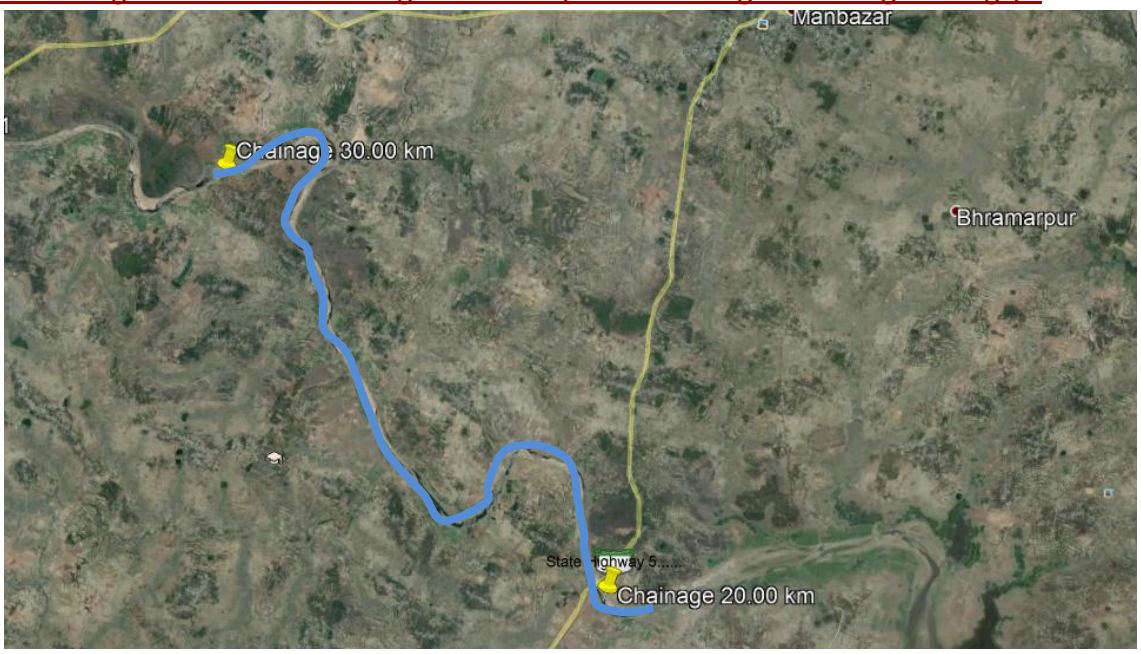


Figure 13 - Chainage 20.00 to Chainage 30.00 km

The width of Kumari River from Chainage 20.00 Km. to Chainage 30.00 Km is approximately 105 m to 170.16 m. The average width portion of the river is approximately 137.58 m.

BM-3 is situated near at Chainage of 20.187 km. An RCC Bridge (Manbazar Bridge) is situated near at Chainage of 20.216 km near Chalka village. The Bridge is linked with SH-5. The Position of the RCC Bridge is (**Lat: - 23° 0'2.40"N, Long: - 86°38'20.85"E**). Two high tension lines are also situated near at Chainage of 20.048 km and 20.117 km. Both side paddy lands are also noticed in this river stretches. Doldenrya, Ichadi, Tetla, Pialisol etc. villages are situated right bank sides of the river and Chalka, Loadi, Gobradi, Dighi, Bhutadi, Sinduradi, Chholagora, Ukamgar etc. villages are located left bank sides of the river.

Class	Chainage (km)		Observed				Reduced w.r.t. Sounding Datum			
	From	To	Min. depth (m)	Max. depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Min. Depth (m)	Max. Depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)
I	20.00	30.00	0.1	0.6	10000	426153.9	-0.3	0	10000	544061
II	20.00	30.00	0.1	0.6	10000	649096.6	-0.3	0	10000	802096.1
III	20.00	30.00	0.1	0.6	10000	981042.1	-0.3	0	10000	1172283.2
IV	20.00	30.00	0.1	0.6	10000	1183762.4	-0.3	0	10000	1383841.6

Figure 14- Manbazar RCC Bridge (Chainage-20.216 km)

Bathymetry Survey

c) Length of the stretch for which the Bathymetric Survey has been carried out:-

The Bathymetry survey was not possible in this stretches of river due to insufficient of water.

Topographic Survey:-

c) Length of the stretch for which the Topographic survey has been carried out:-

The Topography survey has been carried out from Tilabani village to ukamgar area. The Length of the Topography survey is Chainage 20.00 km to Chainage 30.00 km.

g) Prominent Dams / Barrage: -

There is no dam found in this stretches of river.

h) Conditions of banks (protected, un-protected) :-

The bank of the river includes with many villages. The high embankments are noticed both sides bank of the river. Bent curve is noticed in this channel of the stretches. State highway-5 is located in this stretches of river.

i) Hindrances - Hyacinth, rocks, rapid waterfalls, forest, wild-life sanctuary, security issues:-

There is no wildlife sanctuary, rapid waterfalls found in this stretches of river.

d) Details of Protected Area- Wildlife Defense: -

There is no wildlife sanctuary found in this stretches of river.

e) NH/SH/MDR along and/or in vicinity: -

State highway-5 is found in this stretches of river.

f) Railway Line and Stations in the vicinity: -

There is no Railway line found in this stretches of river.

g) Land Use Pattern along Waterway on visual assessment: -

Agricultural land is found both sides bank of the river.

h) Crops / Agriculture in the region on visual assessment: -

The Major crops along the river is Paddy, Potato, Wheat, Mustard, vegetables like capsicum, Broccoli are cultivated in this stretches of river. Besides, pulses, oilseeds are also cultivated in this region of river.

i) Availability of Bulk / Construction Material: -

Roofing Tiles, Brass & Bell Metal are the major clusters available in this stretches of river. Brick, Limestone, cement, sand etc are also available in this stretches of river as a building construction.

j) Existing Industries along Waterway with their types and details:-

There is no major industries build up in this stretches of river. But small kind of handloom and handicrafts are growing up in this region of river. Besides, paper products, chemical and plastic products are also growing up in this region of river.

k) Existing Ghats, Jetties and Terminals (with conditions and facilities), Existing navigation facilities:-

There is no jetty found in this stretches of river.

l) Existing Cargo Movement:-

There is no cargo available in this stretches of river

m) Prominent City / Town / Places of Worship / Historical places for Tourism:-

Chalka, Loadi, Gobradi, Ichadi, Chirudi, Dighi, Tetla, Bhutadi, Sinduradi, Chholagora, Pialisol, ukamgar etc. villages are located in this stretches of river.

n) Village / Colonies along the sub stretch and approx. population:-

Chalka, Loadi, Gobradi, Ichadi, Chirudi, Dighi, Tetla, Bhutadi, Sinduradi, Chholagora, Pialisol, ukamgar etc. villages are located in this stretches of river.

o) Availability of passenger Ferry services with facilities:-

There is no ferry ghats found in this stretches of river.

p) Available and probable water sport Recreational Facilities:-

There is no water sport and other facilities are available in this stretches of river.

q) Fishing activities:-

Pisciculture is an important factor of economic development of Bankura. District Bankura ranked first in pisciculture within West Bengal. The district provides a majority amount of fish production during the last five years. Ramsagar of Bankura district is widely known destination with about 200 hatcheries. Recently a modern fish production unit has been started at Mukutmanipur.

r) Sand Mining:-

Purulia and Bankura district is endowed with mineral resources of wide range of varieties. These varieties are of basically non-metallic types. According to the findings of Geological Survey of India there are ten types of mineral deposits in this district. The main ones are coal, limestone, rock phosphate, china clay, and quartz etc

s) Tributaries:-

There is no tributary found in this stretches of river.

t) Details of Irrigation Canals and outlets:-

There is an irrigational canal and outlets found near the Chainage 24.342 km.

u) Details of Nalas, polluted water discharge in to the rivers and treatment plants:-

There are no nalas found in this zone of river.

v) Usage of water (drinking, irrigation, industries, navigation etc.) water quality:-

The water is mainly used for agriculture purposes in this stretches of river. The agricultural land is found both sides bank of the river.

3.4- From Chainage 30.00 Km to Chainage 40.00 Km (Ukamgar village to Chaukan village):-

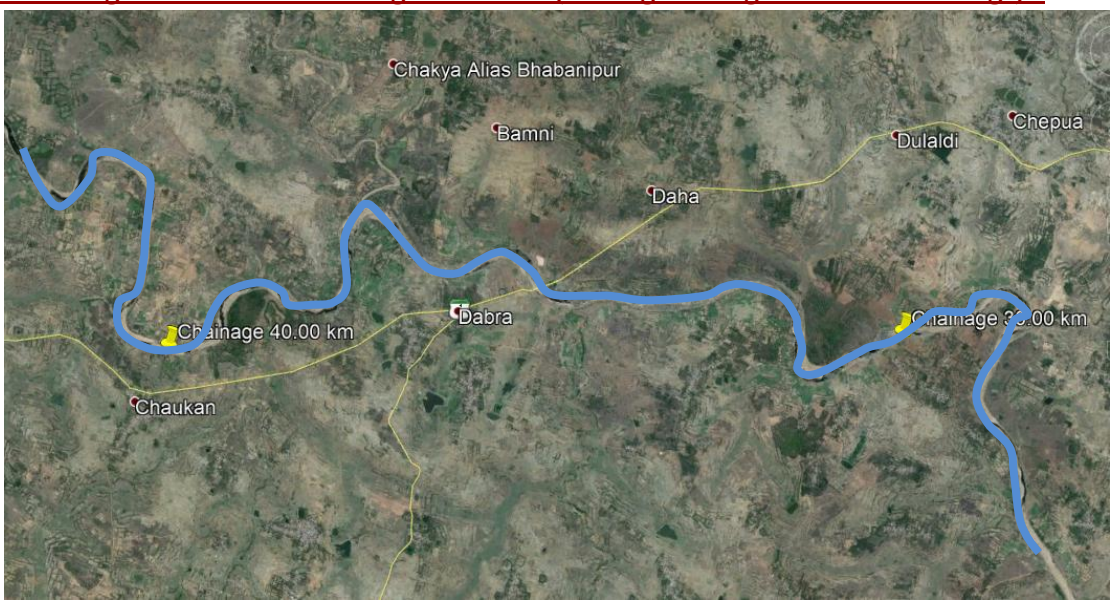


Figure 15 - Chainage 30.00 km to Chainage 40.00 km

The width of Kumari River from Chainage 30.00 Km. to Chainage 40.00 Km is approximately 170.16 m to 80.00 m. The average width portion of the river is approximately 125.08 m.

BM-4 is situated near at Chainage of 34.541 km left bank side of the river. Duarsini RCC Bridge is situated near at Chainage of 34.524 km. The Position of the RCC Bridge is (**Lat: - 23°2'51.77"N, Long: - 86°33'42.37"E**). The Bridge is linked with SH-4. Pitidiri, Nalkundi, Dabra, Jargarya, Sinduradi etc. villages are situated left bank side of the river and Rangtanr, Puran Dulaldi, Daha, Bamni etc. villages are situated right bank side of the river. Both side paddy lands are also noticed in this stretches of river.

Class	Chainage (km)		Observed				Reduced w.r.t. Sounding Datum			
	From	To	Min. depth (m)	Max. depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Min. Depth (m)	Max. Depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)
I	30.00	40.00	0.1	0.6	10000	420416.3	-0.3	0	10000	539000.8
II	30.00	40.00	0.1	0.6	10000	640359.7	-0.3	0	10000	792005.3
III	30.00	40.00	0.1	0.6	10000	967839.8	-0.3	0	10000	1155232.9
IV	30.00	40.00	0.1	0.6	10000	1167829.8	-0.3	0	10000	1363552.5

Figure 16- Duarsini RCC bridge (Chainage- 34.524 km)

Bathymetry Survey

d) Length of the stretch for which the Bathymetric Survey has been carried out:-

The Bathymetry survey was not possible in this stretches of river due to insufficient of water.

Topographic Survey:-

d) Length of the stretch for which the Topographic survey has been carried out:-

The Topography survey has been carried out from ukamgar to Chaukan village area. The Length of the Topography survey is Chainage 30.00 km to Chainage 40.00 km.

j) Prominent Dams / Barrage: -

There is no dam found in this stretches of river.

k) Conditions of banks (protected, un-protected):-

The bank of the river includes with many villages. The high embankments are noticed both sides bank of the river. Bent curve is noticed in this channel of the stretches. State highway-5 is located in this stretches of river.

l) Hindrances - Hyacinth, rocks, rapid waterfalls, forest, wild-life sanctuary, security issues:-

There is no wildlife sanctuary, rapid waterfalls found in this stretches of river.

d) Details of Protected Area- Wildlife Defense: -

There is no wildlife sanctuary found in this stretches of river.

e) NH/SH/MDR along and/or in vicinity: -

State highway-4 is found in this stretches of river.

f) Railway Line and Stations in the vicinity: -

There is no Railway line found in this stretches of river.

g) Land Use Pattern along Waterway on visual assessment: -

Agricultural land is found both sides bank of the river.

h) Crops / Agriculture in the region on visual assessment: -

The Major crops along the river is Paddy, Potato, Wheat, Mustard, vegetables like capsicum, Broccoli are cultivated in this stretches of river. Besides, pulses, oilseeds are also cultivated in this region of river.

i) Availability of Bulk / Construction Material: -

Roofing Tiles, Brass & Bell Metal are the major clusters available in this stretches of river. Brick, Limestone, cement, sand etc are also available in this stretches of river as a building construction.

j) Existing Industries along Waterway with their types and details:-

There is no major industries build up in this stretches of river. But small kind of handloom and handicrafts are growing up in this region of river. Besides, paper products, chemical and plastic products are also growing up in this region of river.

k) Existing Ghats, Jetties and Terminals (with conditions and facilities), Existing navigation facilities:-

There is no jetty found in this stretches of river.

l) Existing Cargo Movement:-

There is no cargo available in this stretches of river

m) Prominent City / Town / Places of Worship / Historical places for Tourism:-

Rangataur, Puran Dulaldi, Pitidiri, Daha, Bamni, Dabra, Nalkundi, Jargarya, Janra etc. villages are located in this stretches of river.

n) Village / Colonies along the sub stretch and approx. population:-

Rangataur, Puran Dulaldi, Pitidiri, Daha, Bamni, Dabra, Nalkundi, Jargarya, Janra etc. villages etc. villages are located in this stretches of river.

o) Availability of passenger Ferry services with facilities:-

There is no ferry ghats found in this stretches of river.

p) Available and probable water sport Recreational Facilities:-

There is no water sport and other facilities are available in this stretches of river.

q) Fishing activities:-

Pisciculture is an important factor of economic development of Bankura. District Bankura ranked first in pisciculture within West Bengal. The district provides a majority amount of fish production during the last five years. Ramsagar of Bankura district is widely known destination with about 200 hatcheries. Recently a modern fish production unit has been started at Mukutmanipur.

r) Sand Mining:-

Purulia and Bankura district is endowed with mineral resources of wide range of varieties. These varieties are of basically non-metallic types. According to the findings of Geological Survey of India there are ten types of mineral deposits in this district. The main ones are coal, limestone, rock phosphate, china clay, and quartz etc.

s) Tributaries:-

There is no tributary found in this stretches of river.

t) Details of Irrigation Canals and outlets:-

There are two irrigational canal and outlets found near the Chainage 34.213 km, 34.530 km and 36.840 km in the left and right side respectively.

u) Details of Nalas, polluted water discharge in to the rivers and treatment plants:-

There are no nalas found in this zone of river.

v) Usage of water (drinking, irrigation, industries, navigation etc.) water quality:-

The water is mainly used for agriculture purposes in this stretches of river. The agricultural land is found both sides bank of the river.

3.5- From Chainage 40.00 Km to Chainage 50.00 Km. (Chaukan village to Biskudra village):-

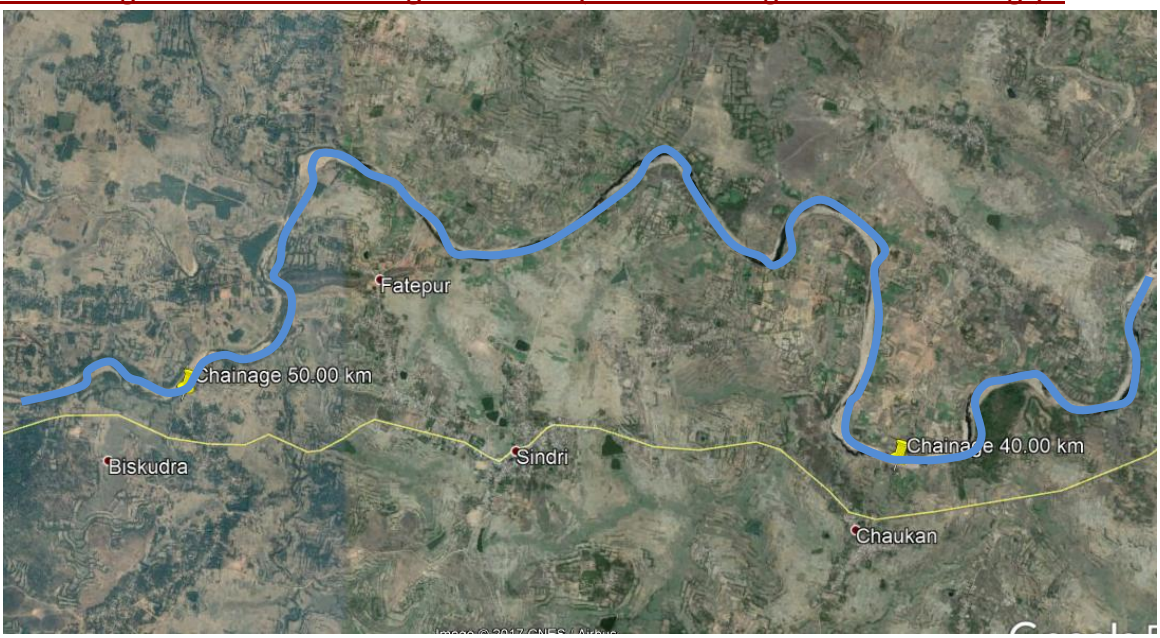


Figure 17- Chainage 40.00 km to Chainage 50.00 km

The width of Kumari River from Chainage 40.00 Km. to Chainage 50.00 Km is approximately 80 m to 90 m. The average width portion of the river is approximately 85m.

BM-5 is situated near at Chainage of 41.500 km left bank side of the river. Ganganarayan RCC Bridge is situated near at Chainage of 46.521 km. The Position of the RCC Bridge is- (**Lat: - 23°3'32.56"N, Long: - 86°29'24.99"E**). This Bridge is linked with Fatepur village. An outlet is situated near at Chainage of 44.600 km right bank side of the river. Chaukan, Singugara, Ajodhya, Fatepur, Sindri etc. villages are situated left bank side of the river and Janra, Kadma, Maharra, Larra, Kaparra etc. villages are situated right bank side of the river.

Class	Chainage (km)		Observed				Reduced w.r.t. Sounding Datum			
	From	To	Min. depth (m)	Max. depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Min. Depth (m)	Max. Depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)
I	40.00	50.00	0.1	0.4	10000	428310.9	-0.3	0	10000	546599.9
II	40.00	50.00	0.1	0.4	10000	652376.8	-0.3	0	10000	805153.6
III	40.00	50.00	0.1	0.4	10000	985999	-0.3	0	10000	1176512.9
IV	40.00	50.00	0.1	0.4	10000	1189743.1	-0.3	0	10000	1388969.6

Figure 18- Ganganarayan RCC Bridge (Chainage- 46.521 km)

Bathymetry Survey

e) Length of the stretch for which the Bathymetric Survey has been carried out:-

The Bathymetry survey was not possible in this stretches of river due to insufficient of water.

Topographic Survey:-

e) Length of the stretch for which the Topographic survey has been carried out:-

The Topography survey has been carried out from Chaukan village to Biskudra_village area. The Length of the Topography survey is Chainage 40.00 km to Chainage 50.00 km.

m) Prominent Dams / Barrage: -

There is no dam found in this stretches of river.

n) Conditions of banks (protected, un-protected):-

The bank of the river includes with many villages. The high embankments are noticed both sides bank of the river. Bent curve is noticed in this channel of the stretches.

o) Hindrances - Hyacinth, rocks, rapid waterfalls, forest, wild-life sanctuary, security issues:-

There is no wildlife sanctuary, rapid waterfalls found in this stretches of river.

d) Details of Protected Area- Wildlife Defense: -

There is no wildlife sanctuary found in this stretches of river.

e) NH/SH/MDR along and/or in vicinity: -

There is no NH/SH found in this stretches of river.

f) Railway Line and Stations in the vicinity: -

There is no Railway line found in this stretches of river.

g) Land Use Pattern along Waterway on visual assessment: -

Agricultural land is found both sides bank of the river.

h) Crops / Agriculture in the region on visual assessment: -

The Major crops along the river is Paddy, Potato, Wheat, Mustard, vegetables like capsicum, Broccoli are cultivated in this stretches of river. Besides, pulses, oilseeds are also cultivated in this region of river.

i) Availability of Bulk / Construction Material: -

Roofing Tiles, Brass & Bell Metal are the major clusters available in this stretches of river. Brick, Limestone, cement, sand etc are also available in this stretches of river as a building construction.

j) Existing Industries along Waterway with their types and details:-

There is no major industries build up in this stretches of river. But small kind of handloom and handicrafts are growing up in this region of river. Besides, paper products, chemical and plastic products are also growing up in this region of river.

k) Existing Ghats, Jetties and Terminals (with conditions and facilities), Existing navigation facilities:-

There is no jetty found in this stretches of river.

l) Existing Cargo Movement:-

There is no cargo available in this stretches of river

m) Prominent City / Town / Places of Worship / Historical places for Tourism:-

Singugara, Janra, Ajodhya, Chaukan, Sindri, Kadma, Fatepur, Kaparra etc. villages are located in this stretches of river.

n) Village / Colonies along the sub stretch and approx. population:-

Singugara, Janra, Ajodhya, Chaukan, Sindri, Kadma, Fatepur, Kaparra etc. villages are located in this stretches of river.

o) Availability of passenger Ferry services with facilities:-

There is no ferry ghats found in this stretches of river.

p) Available and probable water sport Recreational Facilities:-

There is no water sport and other facilities are available in this stretches of river.

q) Fishing activities:-

Pisciculture is an important factor of economic development of Bankura. District Bankura ranked first in pisciculture within West Bengal. The district provides a majority amount of fish production during the last five years. Ramsagar of Bankura district is widely known destination with about 200 hatcheries. Recently a modern fish production unit has been started at Mukutmanipur.

r) Sand Mining:-

Purulia and Bankura district is endowed with mineral resources of wide range of varieties. These varieties are of basically non-metallic types. According to the findings of Geological Survey of India there are ten types of mineral deposits in this district. The main ones are coal, limestone, rock phosphate, china clay, and quartz etc

s) Tributaries:-

There is no tributary found in this stretches of river.

t) Details of Irrigation Canals and outlets:-

There are three irrigational canal and outlets found near the Chainage of 44.557 km, 48.118 km in the right side and Chainage 48.900 km in the left bank side respectively.

u) Details of Nalas, polluted water discharge in to the rivers and treatment plants:-

There are no nalas found in this zone of river.

v) Usage of water (drinking, irrigation, industries, navigation etc.) water quality:-

The water is mainly used for agriculture purposes in this stretches of river. The agricultural land is found both sides bank of the river.

3.6- From Chainage 50.00 Km to Chainage 60.00 Km (Biskudra village to Lanka village):-

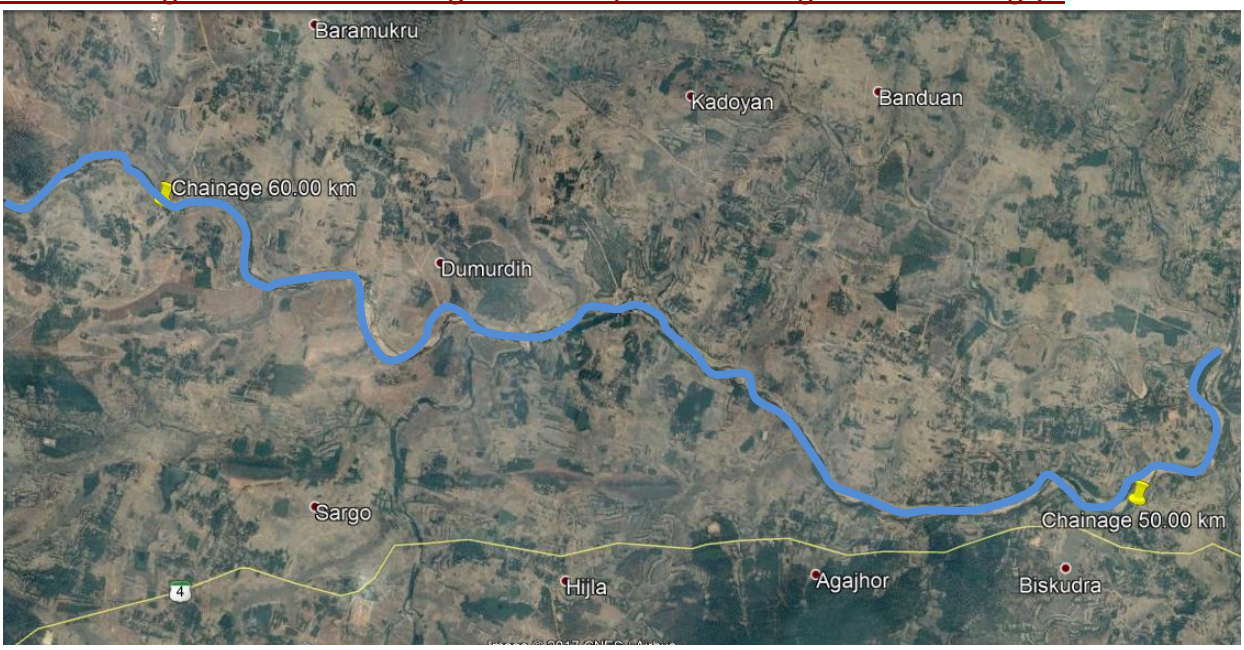


Figure 19- Chainage 50.00 km to Chainage 60.00 km

The width of Kumari River from Chainage 50.00 Km. to Chainage 60.00 Km is approximately 73m to 61 m. The average width portion of the river is approximately 67 m.

BM-6 is situated near at Chainage of 51.390 km. Two high tension lines are situated near at Chainage of 53.359 km and 53.959 km. There are two check Dams located in this stretches of river out of which one is good condition, situated near at Chainage of 54.201 km and another is damage check dam which is located near at Chainage of 57.949 km. The position of the Check Dams are (**Lat: - 23° 3'29.17"N, Long: - 86°26'15.299"E), (Lat: - 23° 3'50.05"N, Long: - 86°24'32.75"**). An outlet is situated near at Chainage of 56.100 km left bank side of the river. Tasarbanki, Tetto, Hesiadih, Chhota Mukru, Dumurdih etc. villages are situated right bank side of the river and Agajhar, Hijla, Bardaha, Sargo, Bankati, Dumurdih etc. villages are situated right bank side of the river.

Class	Chainage (km)		Observed				Reduced w.r.t. Sounding Datum			
	From	To	Min. depth (m)	Max. depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Min. Depth (m)	Max. Depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)
I	50.00	60.00	0.1	0.4	10000	420092.2	-0.3	0	10000	539515.1
II	50.00	60.00	0.1	0.4	10000	639860.8	-0.3	0	10000	793710.1
III	50.00	60.00	0.1	0.4	10000	967087.3	-0.3	0	10000	1158436
IV	50.00	60.00	0.1	0.4	10000	1166922.6	-0.3	0	10000	1366926.7

.

Figure 20- Check Dam (Chainage- 54.201 km)

Figure 21- Damage Check Dam (Chainage- 57.949 km)

Bathymetry Survey

f) Length of the stretch for which the Bathymetric Survey has been carried out:-

The Bathymetry survey was not possible in this stretches of river due to insufficient of water.

Topographic Survey:-

f) Length of the stretch for which the Topographic survey has been carried out:-

The Topography survey has been carried out from Biskudra village to Lanka village area. The Length of the Topography survey is Chainage 50.00 km to Chainage 60.00 km.

p) Prominent Dams / Barrage: -

There is no dam found in this stretches of river.

q) Conditions of banks (protected, un-protected):-

The bank of the river includes with many villages. The high embankments are noticed both sides bank of the river. Bent curve is noticed in this channel of the stretches. Two check dams are located in this stretches of river near the Chainage of 54.201 km and 57.949 km. The last dam is damaged. So the dam areas are protected with Boulder and concrete pitching. Besides high embankment is also protected the riverside area.

r) Hindrances - Hyacinth, rocks, rapid waterfalls, forest, wild-life sanctuary, security issues:-

There is no wildlife sanctuary, rapid waterfalls found in this stretches of river.

d) Details of Protected Area- Wildlife Defense: -

There is no wildlife sanctuary found in this stretches of river.

e) NH/SH/MDR along and/or in vicinity: -

There is no NH/SH found in this stretches of river.

f) Railway Line and Stations in the vicinity: -

There is no Railway line found in this stretches of river.

g) Land Use Pattern along Waterway on visual assessment: -

Agricultural land is found both sides bank of the river.

h) Crops / Agriculture in the region on visual assessment: -

The Major crops along the river is Paddy, Potato, Wheat, Mustard, vegetables like capsicum, Broccoli are cultivated in this stretches of river. Besides, pulses, oilseeds are also cultivated in this region of river.

i) Availability of Bulk / Construction Material: -

Roofing Tiles, Brass & Bell Metal are the major clusters available in this stretches of river. Brick, Limestone, cement, sand etc are also available in this stretches of river as a building construction.

j) Existing Industries along Waterway with their types and details:-

There is no major industries build up in this stretches of river. But small kind of handloom and handicrafts are growing up in this region of river. Besides, paper products, chemical and plastic products are also growing up in this region of river.

k) Existing Ghats, Jetties and Terminals (with conditions and facilities), Existing navigation facilities:-

There is no jetty found in this stretches of river.

l) Existing Cargo Movement:-

There is no cargo available in this stretches of river

m) Prominent City / Town / Places of Worship / Historical places for Tourism:-

Biskudra, Tasarbanki, Tetto, Agajhor, Bardaha Chhota Mukru, Hesiadih, Dumurdih, Bankati, Bagalbandh etc. villages are located in this stretches of river.

n) Village / Colonies along the sub stretch and approx. population:-

Biskudra, Tasarbanki, Tetto, Agajhor, Bardaha Chhota Mukru, Hesiadih, Dumurdih, Bankati, Bagalbandh etc. villages are located in this stretches of river.

o) Availability of passenger Ferry services with facilities:-

There is no ferry ghats found in this stretches of river.

p) Available and probable water sport Recreational Facilities:-

There is no water sport and other facilities are available in this stretches of river.

q) Fishing activities:-

Pisciculture is an important factor of economic development of Bankura. District Bankura ranked first in pisciculture within West Bengal. The district provides a majority amount of fish production during the last five years. Ramsagar of Bankura district is widely known destination with about 200 hatcheries. Recently a modern fish production unit has been started at Mukutmanipur.

r) Sand Mining:-

Purulia and Bankura district is endowed with mineral resources of wide range of varieties. These varieties are of basically non-metallic types. According to the findings of Geological Survey of India there are ten types of mineral deposits in this district. The main ones are coal, limestone, rock phosphate, china clay, and quartz etc**s) Tributaries:-**

There is no tributary found in this stretches of river.

t) Details of Irrigation Canals and outlets:-

There are three irrigational canal and outlets found near the Chainage of 56.350 km in the left bank side of the river.

u) Details of Nalas, polluted water discharge in to the rivers and treatment plants:-

There are no nalas found in this zone of river.

v) Usage of water (drinking, irrigation, industries, navigation etc.) water quality:-

The water is mainly used for agriculture purposes in this stretches of river. The agricultural land is found both sides bank of the river.

3.7- From Chainage 60.00 Km to Chainage 70.00 Km (Lanka village to Tumrashou village):-

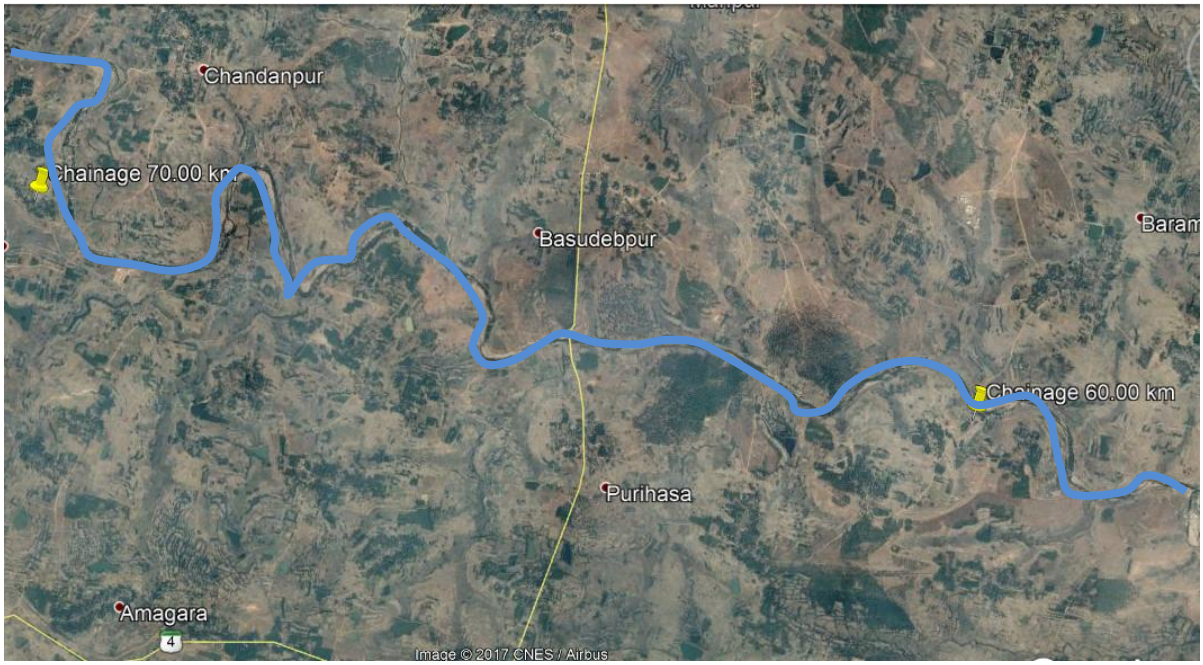


Figure 22- Chainage 60.00 km to Chainage 70.00 km

The width of Kumari River from Chainage 60.00 Km. to Chainage 70.00 Km is approximately 61m to 121m. The average width portion of the river is approximately 91m.

BM-7 is situated near at Chainage of 63.627 km left bank side of the river. Four high tension lines are situated near at Chainage of 63.499 km, 63.571 km, 63.578 km and 69.120 km in this stretches of river respectively. Bishari Kumari RCC Bridge is situated near at Chainage of 63.621 km. This RCC Bridge is communicated between Barabazar to Purihasa. The Position of the RCC Bridge is (**Lat: - 23°4'26.57"N, Long: - 86°21'45.96"E**). There are two check Dams located in this stretches of river near at Chainage of 64.998 km and 69.134 km. The Position of the Check Dams are **(Lat: - 23° 4'43.23"N, Long: - 86°21'17.97"E), (Lat: - 23° 4'46.48"N, Long: - 86°19'49.74"E)** respectively.

Class	Chainage (km)		Observed				Reduced w.r.t. Sounding Datum			
	From	To	Min. depth (m)	Max. depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Min. Depth (m)	Max. Depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)
I	60.00	70.00	0.1	0.4	10000	422587.8	-0.3	0	10000	542946.3
II	60.00	70.00	0.1	0.4	10000	643662.1	-0.3	0	10000	798834.5
III	60.00	70.00	0.1	0.4	10000	972831.4	-0.3	0	10000	1165723.6
IV	60.00	70.00	0.1	0.4	10000	1173852	-0.3	0	10000	1375472.1

Figure 23- Bishari Kumari RCC Bridge (Chainage- 63.621 km)

Figure 24- Check Dam (Chainage- 63.998 km)

Figure 25- Check Dam (Chainage- 69.134 km)

Figure 26- High Tension Lines (Chainage- 63.499 km, 63.571 km, 63.578 km and 69.120 km)

Bathymetry Survey

g) Length of the stretch for which the Bathymetric Survey has been carried out:-

The Bathymetry survey was not possible in this stretches of river due to insufficient of water.

Topographic Survey:-

g) Length of the stretch for which the Topographic survey has been carried out:-

The Topography survey has been carried out from Lanka village to Tumrashou. The Length of the Topography survey is Chainage 60.00 km to Chainage 70.00 km.

s) Prominent Dams / Barrage: -

There is no dam found in this stretches of river.

t) Conditions of banks (protected, un-protected):-

The bank of the river includes with many villages. The high embankments are noticed both sides bank of the river. Bent curve is noticed in this channel of the stretches. State highway-5 is located in this stretches of river. Two check dams are located in this stretches of river near the Chainage of 64.998 km and 69.134 km. So the dam areas are protected with Boulder and concrete pitching. Besides high embankment is also protected the riverside area.

u) Hindrances - Hyacinth, rocks, rapid waterfalls, forest, wild-life sanctuary, security issues:-

There is no wildlife sanctuary, rapid waterfalls found in this stretches of river.

d) Details of Protected Area- Wildlife Defense: -

There is no wildlife sanctuary found in this stretches of river.

e) NH/SH/MDR along and/or in vicinity: -

SH-4 is not directly but linked with this stretches of river.

f) Railway Line and Stations in the vicinity: -

There is no Railway line found in this stretches of river.

g) Land Use Pattern along Waterway on visual assessment: -

Agricultural land is found both sides bank of the river.

h) Crops / Agriculture in the region on visual assessment: -

The Major crops along the river is Paddy, Potato, Wheat, Mustard, vegetables like capsicum, Broccoli are cultivated in this stretches of river. Besides, pulses, oilseeds are also cultivated in this region of river.

i) Availability of Bulk / Construction Material: -

Roofing Tiles, Brass & Bell Metal are the major clusters available in this stretches of river. Brick, Limestone, cement, sand etc are also available in this stretches of river as a building construction.

j) Existing Industries along Waterway with their types and details:-

There is no major industries build up in this stretches of river. But small kind of handloom and handicrafts are growing up in this region of river. Besides, paper products, chemical and plastic products are also growing up in this region of river.

k) Existing Ghats, Jetties and Terminals (with conditions and facilities), Existing navigation facilities:-

There is no jetty found in this stretches of river.

l) Existing Cargo Movement:-

There is no cargo available in this stretches of river

m) Prominent City / Town / Places of Worship / Historical places for Tourism:-

Purihasa, Lanka, Rupapatia, Basudevpur, Raladih, Rangagara, Raghunathdih, karmabera, Murgabera, chandanpur, patpur etc. villages are located in this stretches of river.

n) Village / Colonies along the sub stretch and approx. population:-

Purihasa, Lanka, Rupapatia, Basudevpur, Raladih, Rangagara, Raghunathdih, karmabera, Murgabera, chandanpur, patpur etc. villages are located in this stretches of river.

o) Availability of passenger Ferry services with facilities:-

There is no ferry ghats found in this stretches of river.

p) Available and probable water sport Recreational Facilities:-

There is no water sport and other facilities are available in this stretches of river.

q) Fishing activities:-

Pisciculture is an important factor of economic development of Bankura. District Bankura ranked first in pisciculture within West Bengal. The district provides a majority amount of fish production during the last five years. Ramsagar of Bankura district is widely known destination with about 200 hatcheries. Recently a modern fish production unit has been started at Mukutmanipur.

r) Sand Mining:-

Purulia and Bankura district is endowed with mineral resources of wide range of varieties. These varieties are of basically non-metallic types. According to the findings of Geological Survey of India there are ten types of mineral deposits in this district. The main ones are coal, limestone, rock phosphate, china clay, and quartz etc

s) Tributaries:-

There is no tributary found in this stretches of river.

t) Details of Irrigation Canals and outlets:-

There is an irrigational canal and outlets found near the Chainage of 65.192 km in the left bank side of the river.

u) Details of Nalas, polluted water discharge in to the rivers and treatment plants:-

There are no nalas found in this zone of river.

v) Usage of water (drinking, irrigation, industries, navigation etc.) water quality:-

The water is mainly used for agriculture purposes in this stretches of river. The agricultural land is found both sides bank of the river.

3.8- From Chainage 70.00 Km to Chainage 80.446 Km (Tumrashou village to Amruhasa village):-

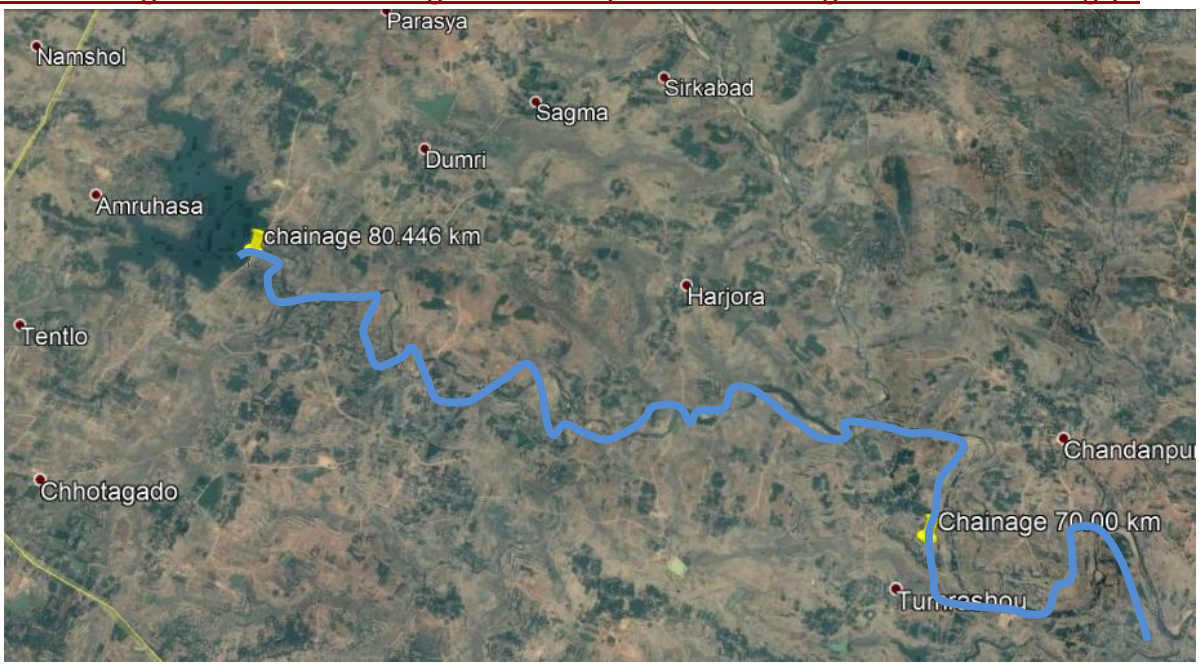


Figure 27- Chainage 70.00 km to Chainage 80.446 km

The width of Kumari River from Chainage70.00 Km. to Chainage 80.446 Km is approximately 121m to 1000 m. The average width portion of the river is approximately 560.5m.

BM-8 is situated near at Chainage of 70.373 km left bank side of the river. There are two check Dams and one RCC Dam situated near at Chainage of 72.314 km, 74.338 km and 80.446 km respectively. The Position of the Dams are **(Lat: - 23° 5'39.41"N, Long: - 86°19'2.44"E), (Lat: - 23° 5'43.78"N, Long: - 86°18'7.02"E), (Lat: - 23° 6'36.43"N, Long: - 86°15'50.59"E)** respectively. One high tension line is situated near at Chainage of 80.211 km. Chandanpur, Gobinddiah, Harjora, Paradda, Layadi, Dumri etc. villages are situated right bank side of the river and Tuima, Supurdi etc. villages are situated left bank side of the river. An outlet is situated near at Chainage of 72.170 km right bank side of the river.

Class	Chainage (km)		Observed				Reduced w.r.t. Sounding Datum			
	From	To	Min. depth (m)	Max. depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Min. Depth (m)	Max. Depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)
I	70.00	80.446	0.1	0.4	10000	418687.1	-0.3	0	10000	535704.9
II	70.00	80.446	0.1	0.4	10000	637723.8	-0.3	0	10000	789378.3
III	70.00	80.446	0.1	0.4	10000	963853.1	-0.3	0	10000	1153250.6
IV	70.00	80.446	0.1	0.4	10000	1163019.8	-0.3	0	10000	1361143.3

Figure 28- RCC Dam (Chainage- 80.446 km)

Figure 29- Check Dam (Chainage- 72.314 km)

Figure 30- Check Dam (Chainage-74.338 km)

Bathymetry Survey

h) Length of the stretch for which the Bathymetric Survey has been carried out:-

The Bathymetry survey was not possible in this stretches of river due to insufficient of water.

Topographic Survey:-

h) Length of the stretch for which the Topographic survey has been carried out:-

The Topography survey has been carried out from Tumrashou village to Amruhasa village. The Length of the Topography survey is Chainage 70.00 km to Chainage 80.446 km.

v) Prominent Dams / Barrage: -

There are two check dams and one RCC dam found in this stretches of river near the Chainage of 72.314 km, 74.338 km and 80.446 km respectively in this stretches of river.

w) Conditions of banks (protected, un-protected):-

The bank of the river includes with many villages. The high embankments are noticed both sides bank of the river. Bent curve is noticed in this channel of the stretches. Two check dams and one RCC dam are located in this stretches of river near the Chainage of 72.314 km, 74.338 km and 80.446 km respectively. So the dam areas are protected with Boulder and concrete pitching. Besides high embankment is also protected the riverside area.

x) Hindrances - Hyacinth, rocks, rapid waterfalls, forest, wild-life sanctuary, security issues:-

There is no wildlife sanctuary, rapid waterfalls found in this stretches of river. But there are two check dams and one RCC dam located in this stretches of river. West Bengal-Jharkhand border is close to the riverside area. The Border area is protected and also provides a major security with other states.

d) Details of Protected Area- Wildlife Defense: -

There is no wildlife sanctuary found in this stretches of river. West Bengal-Jharkhand border is far from 8.9 km approx from Balarampur area located in this zone of river.

e) NH/SH/MDR along and/or in vicinity: -

NH-32 is not located along the river but close to the Amruhasa village.

f) Railway Line and Stations in the vicinity: -

There is no Railway line found in this stretches of river. But Barabhum railway station is located 5.31 km from Amruhasa village.

g) Land Use Pattern along Waterway on visual assessment: -

Agricultural land is found both sides bank of the river.

h) Crops / Agriculture in the region on visual assessment: -

The Major crops along the river is Paddy, Potato, Wheat, Mustard, vegetables like capsicum, Broccoli are cultivated in this stretches of river. Besides, pulses, oilseeds are also cultivated in this region of river.

i) Availability of Bulk / Construction Material: -

Roofing Tiles, Brass & Bell Metal are the major clusters available in this stretches of river. Brick, Limestone, cement, sand etc are also available in this stretches of river as a building construction.

j) Existing Industries along Waterway with their types and details:-

There is no major industries build up in this stretches of river. But small kind of handloom and handicrafts are growing up in this region of river. Besides, paper products, chemical and plastic products are also growing up in this region of river.

k) Existing Ghats, Jetties and Terminals (with conditions and facilities), Existing navigation facilities:-

There is no jetty found in this stretches of river.

l) Existing Cargo Movement:-

There is no cargo available in this stretches of river.

m) Prominent City / Town / Places of Worship / Historical places for Tourism:-

Chandanpur, Gobinddih, Harjora, Supurdi, Hetyadi, Amruhasa, Tuima etc. villages are located in this stretches of river.

n) Village / Colonies along the sub stretch and approx. population:-

Chandanpur, Gobinddih, Harjora, Supurdi, Hetyadi, Amruhasa, Tuima etc. villages are located in this stretches of river.

o) Availability of passenger Ferry services with facilities:-

There is no ferry ghats found in this stretches of river.

p) Available and probable water sport Recreational Facilities:-

There is no water sport and other facilities are available in this stretches of river.

q) Fishing activities:-

Pisciculture is an important factor of economic development of Bankura. District Bankura ranked first in pisciculture within West Bengal. The district provides a majority amount of fish production during the last five years. Ramsagar of Bankura district is widely known destination with about 200 hatcheries. Recently a modern fish production unit has been started at Mukutmanipur.

r) Sand Mining:-

Purulia and Bankura district is endowed with mineral resources of wide range of varieties. These varieties are of basically non-metallic types. According to the findings of Geological Survey of India there are ten types of mineral deposits in this district. The main ones are coal, limestone, rock phosphate, china clay, and quartz etc.

s) Tributaries:-

There is no tributary found in this stretches of river.

t) Details of Irrigation Canals and outlets:-

There are three irrigational canal and outlets found near the Chainage of 72.187 km, 74.338 km in the right bank side and Chainage 75 km in the left bank side of the river.

u) Details of Nalas, polluted water discharge in to the rivers and treatment plants:-

There are no nalas found in this zone of river.

v) Usage of water (drinking, irrigation, industries, navigation etc.) water quality:-

The water is mainly used for agriculture purposes in this stretches of river. The agricultural land is found both sides bank of the river.

Section 4: Terminals

The Floating Terminal Mukutmanipur Dam is located in this zone of river. Mukutmanipur Dam is also the tourist place in west Bengal state. This Dam is mainly used for the irrigation purposes. This terminal is being developed and may more develop in the future for the tourist place.

Sl No	Floating Terminal	Chainage (km)	Location	Latitude (N)	Longitude (E)	Northing (m)	Easting (m)	Length (m)	Width (m)	Height w.r.t. above M.S.L (m)	Present Condition
1	Mukutmanipur Dam	0.000	Mukutmanipur	22°57'49.97"	86°47'20.19"	2539536.91	478364.63	130.0	8.45	123.400	Complete

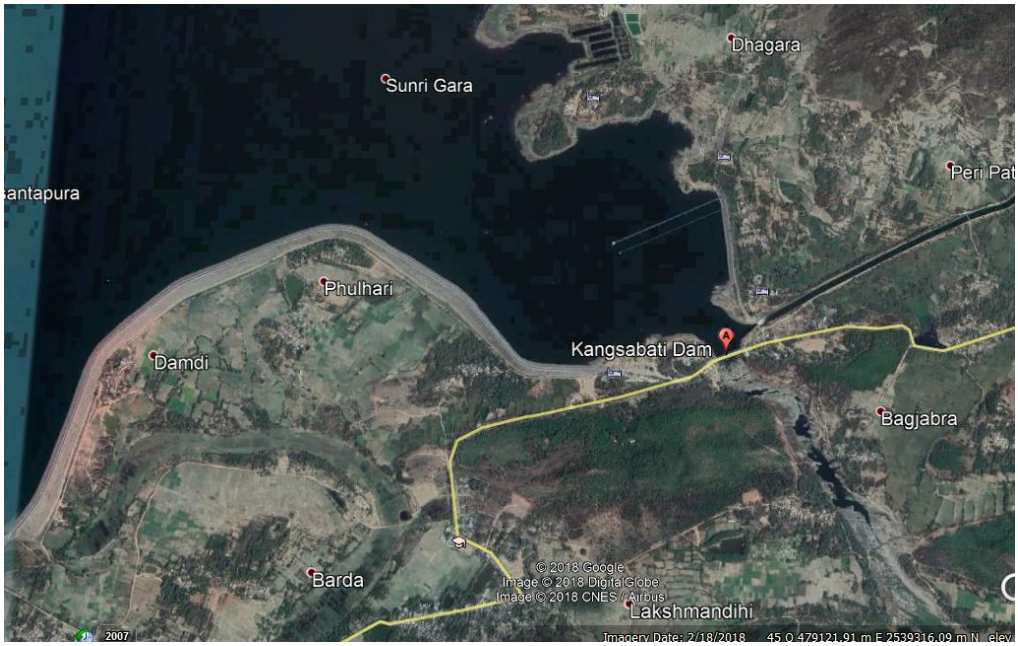


Figure 31- Mukutmanipur Floating Terminal (Chainage-0.00 km)

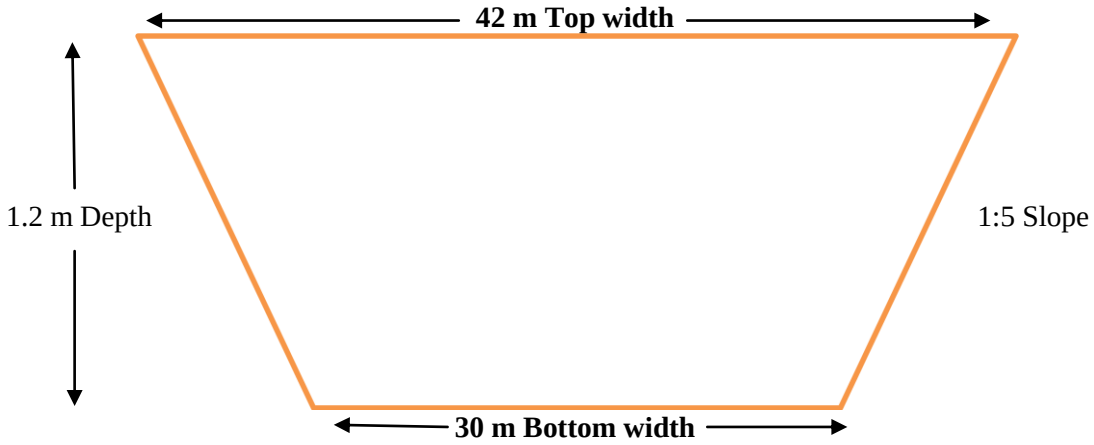
4.1 Details of Land use, owner etc.:-

The both sides bank of the River Kumari used for cultivation. The Bank side is covered with Mukutmanipur Dam, RCC Dam and Check Dam etc. Agriculture is the primary occupation in this zone of river. Paddy land is found both bank side of the river side. Some major industries are also located in this zone of river. Deer park and small forest are also located in this zone of river. The Farmers are cultivated their crops with using this fertile land and grows a huge amount of crops every year. Besides, some portions of the land are surrounded by small industries and Forests. Though bolder pitching is found in some places, But in Recent times, the bank of the river has been worn away in some places for lack of trees.

Section 5: Fairway development:-

Dredging sections, summary of depths and dredging quantity for different classification of waterways (stretch-wise)

Class-I:-

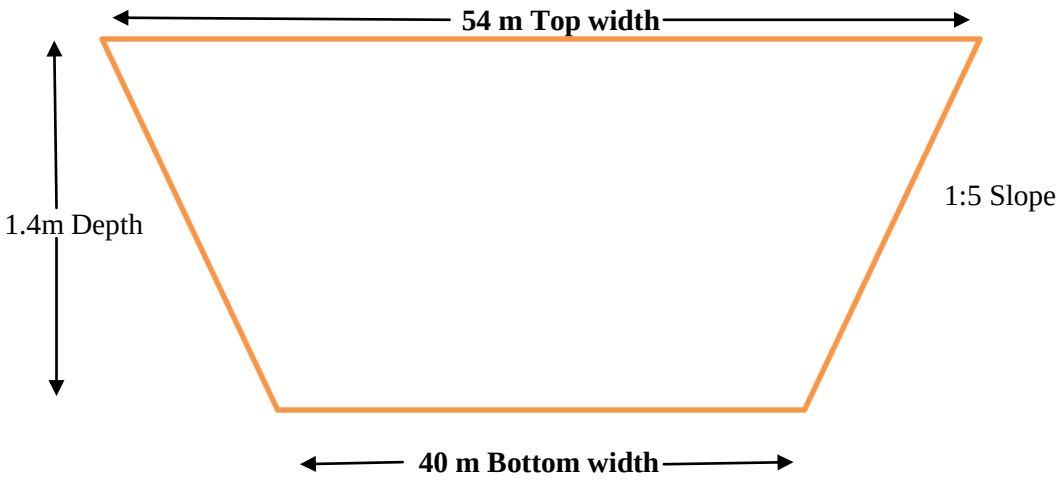


Class-I

Location		Chainage (km)		Observed Dredging Qty. w.r.t Sounding Datum					Reduced Dredging Qty. w.r.t Sounding Datum				
From	To	From	To	Min. depth (m)	Max depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Cumulative Dredging Qty. (cu.m.)	Min Depth (m)	Max. Depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Cumulative Dredging Qty. (cu.m.)
Kangsabati Dam	Kantagara	0.00	10.00	1.1	21.8	3000	31948.3	31948.3	1.0	20.5	3000	41392.8	41392.8
Kantagara	Tilabani	10.00	20.00	0.2	15.7	10000	289343.9	321292.2	-0.3	15.3	10000	374821.1	416213.9
Tilabani	Ukamgar	20.00	30.00	0.1	0.6	10000	426153.9	747446.1	-0.3	0	10000	544061	960274.9
Ukamgar	Choukan	30.00	40.00	0.1	0.6	10000	420416.3	1167862.4	-0.3	0	10000	539000.8	1499275.7
Choukan	Biskudra	40.00	50.00	0.1	0.4	10000	428310.9	1596173.3	-0.3	0	10000	546599.9	2045875.6
Biskudra	lanka	50.00	60.00	0.1	0.4	10000	420092.2	2016265.5	-0.3	0	10000	539515.1	2585390.7
lanka	Tumrashou	60.00	70.00	0.1	0.4	10000	422587.8	2438853.3	-0.3	0	10000	542946.3	3128337
Tumrashou	Amruhasa	70.00	80.446	0.1	0.4	10000	418687.1	2857540.4	-0.3	0	10000	535704.9	3664041.9
Total						73000	2857540.4		Total		73000	3664041.9	

Table 13- Dredging quantity in class-I

Class-II:-

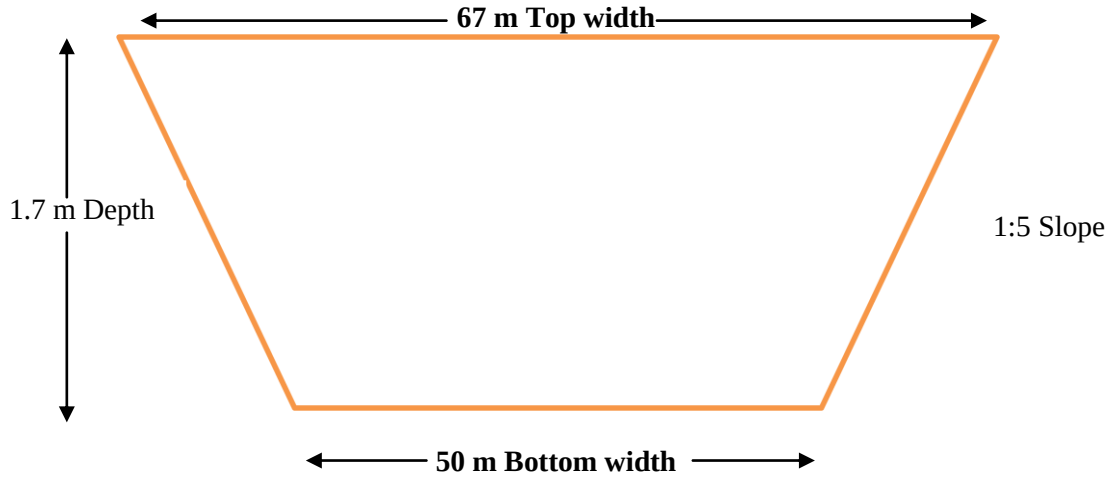


Class-II

Location		Chainage (km)		Observed Dredging Qty. w.r.t Sounding Datum					Reduced Dredging Qty. w.r.t Sounding Datum				
From	To	From	To	Min depth (m)	Max depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Cumulative Dredging Qty. (cu.m.)	Min Depth (m)	Max Depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Cumulative Dredging Qty. (cu.m.)
Kangsabati Dam	Kantagara	0.00	10.00	1.0	21.82	3000	48773.7	48773.7	0.9	20.52	3000	60918.6	60918.6
Kantagara	Tilabani	10.00	20.00	0.2	15.71	10000	443518.4	492292.1	-0.3	15.31	10000	554377.9	615296.5
Tilabani	Ukamgar	20.00	30.00	0.1	0.6	10000	649096.6	1141388.7	-0.3	0	10000	802096.1	1417392.6
Ukamgar	Choukan	30.00	40.00	0.1	0.6	10000	640359.7	1781748.4	-0.3	0	10000	792005.3	2209397.9
Choukan	Biskudra	40.00	50.00	0.1	0.4	10000	652376.8	2434125.2	-0.3	0	10000	805153.6	3014551.5
Biskudra	lanka	50.0	60.0	0.1	0.4	10000	639860.8	3073986	-0.3	0	10000	793710.1	3808261.6
lanka	Tumrashou	60.0	70.0	0.1	0.4	10000	643662.1	3717648.1	-0.3	0	10000	798834.5	4607096.1
Tumrashou	Amruhasa	70.00	80.446	0.1	0.4	10000	637723.8	4355371.9	-0.3	0	10000	789378.3	5396474.4
Total						73000	4355371.9		Total		73000	5396474.4	

Table 14- Dredging quantity in class-II

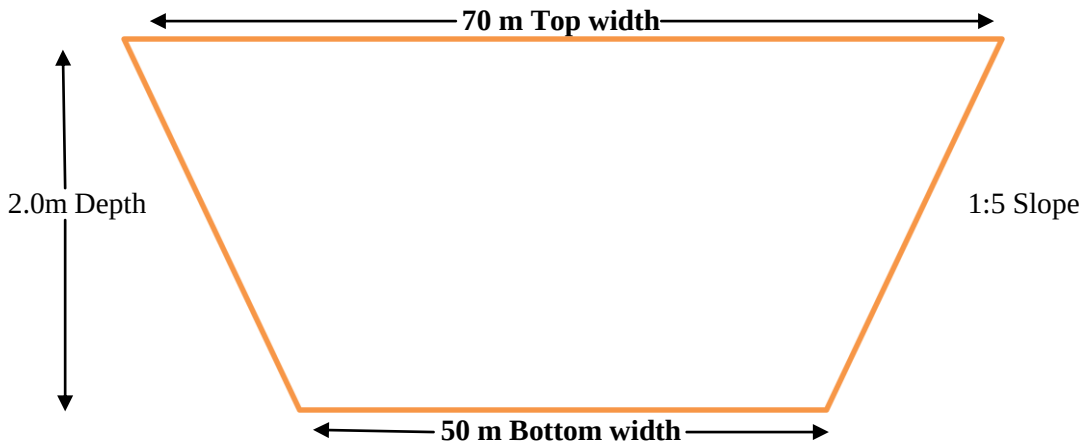
Class-III:-



Class-III													
Location		Chainage (km)		Observed Dredging Qty. w.r.t Sounding Datum					Reduced Dredging Qty. w.r.t Sounding Datum				
From	To	From	To	Min depth (m)	Max.depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Cumulative Dredging Qty. (cu.m.)	Min Depth (m)	Max Depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Cumulative Dredging Qty. (cu.m.)
Kangsabati Dam	Kantagara	0.00	10.00	0.9	21.84	3000	73879.8	73879.8	0.8	20.5	3000	89243.4	89243.4
Kantagara	Tilabani	10.00	20.00	0.2	15.72	10000	677693	751572.8	-0.3	15.3	10000	816847.1	906090.5
Tilabani	Ukamgar	20.00	30.00	0.1	0.6	10000	981042.1	1732614.9	-0.3	0	10000	1172283.2	2078373.7
Ukamgar	Choukan	30.00	40.00	0.1	0.6	10000	967839.8	2700454.7	-0.3	0	10000	1155232.9	3233606.6
Choukan	Biskudra	40.00	50.00	0.1	0.4	10000	985999	3686453.7	-0.3	0	10000	1176512.9	4410119.5
Biskudra	lanka	50.0	60.0	0.1	0.4	10000	967087.3	4653541	-0.3	0	10000	1158436	5568555.5
lanka	Tumrashou	60.0	70.0	0.1	0.4	10000	972831.4	5626372.4	-0.3	0	10000	1165723.6	6734279.1
Tumrashou	Amruhasa	70.00	80.446	0.1	0.4	10000	963853.1	6590225.5	-0.3	0	10000	1153250.6	7887529.7
Total						73000	6590225.5		Total		73000	7887529.7	

Table 15- Dredging quantity in class-III

Class-IV:-



Class-IV													
Location		Chainage (km)		Observed Dredging Qty. w.r.t Sounding Datum					Reduced Dredging Qty. w.r.t Sounding Datum				
From	To	From	To	Min depth (m)	Max. depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Cumulative Dredging Qty. (cu.m.)	Min Depth (m)	Max Depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Cumulative Dredging Qty. (cu.m.)
Kangsabati Dam	Kantagara	0.00	10.00	0.8	21.86	3000	89753.2	89753.2	0.7	20.52	3000	106564.8	106564.8
Kantagara	Tilabani	10.00	20.00	0.2	15.73	10000	826232.7	915985.9	-0.3	15.31	10000	973343.8	1079908.6
Tilabani	Ukamgar	20.00	30.00	0.1	0.6	10000	1183762.4	2099748.3	-0.3	0	10000	1383841.6	2463750.2
Ukamgar	Choukan	30.00	40.00	0.1	0.6	10000	1167829.8	3267578.1	-0.3	0	10000	1363552.5	3827302.7
Choukan	Biskudra	40.00	50.00	0.1	0.4	10000	1189743.1	4457321.2	-0.3	0	10000	1388969.6	5216272.3
Biskudra	lanka	50.00	60.00	0.1	0.4	10000	1166922.6	5624243.8	-0.3	0	10000	1366926.7	6583199
lanka	Tumrashou	60.00	70.00	0.1	0.4	10000	1173852	6798095.8	-0.3	0	10000	1375472.1	7958671.1
Tumrashou	Amruhasa	70.00	80.446	0.1	0.4	10000	1163019.8	7961115.6	-0.3	0	10000	1361143.3	9319814.4
Total						73000	7961115.6		Total		73000	9319814.4	

Table 16- Dredging quantity in class- IV

Section 6: Conclusion

The Survey stretch of Kumari River is 80.446 km, branches of the Kangsabati River situated near at Purulia Site. The waterway of the Kumari River includes with many villages, RCC Dams, RCC Bridges etc. Mukutmanipur Dam is situated in this zone of river near Chainage 0.00 km. There are two nos of ferry services available in this zone of river near the Chainage of 0.52 km and 10.00 km approximately.There is no cargo service available in this zone of river. The water level of the dam site is appropriate for the bathymetry survey but after the Chainage 14.00 km, the water level is not sufficient for the bathymetry survey. Tourists can have beautiful view of the river side like Mukutmanipur Dam, Ajodhya Hill, Deer park and its natural surroundings from the bridges situated on NH no- 32. Balarampur, Mukutmanipur, Barabhum, Raghunathpur etc. places are situated in this zone of river. NH-32, NH-60, NH-60A is the major communicative way in this zone and state-Highways like SH-2, SH-4, SH-5 are located for a better communication system and good transportation for the villagers and also for the tourists. Barabhum Railway station is the nearest railway station which is close to the Hanumata Dam site.

Mukumanipur Dam, Chandil Dalma wildlife Reserve, Dalma wildlife sanctuary, Ajodhya hill and reserve area, Banpukuria Deer park, Pareshnath Shiv Mandir, Nilgiri Deer park etc. tourist places are located in this river sites.

6.1 Class wise Avg. Reduced Depths/Percentage:-

Sl. No	From Chainage (km)	To Chainage (km)	Minimum Avg. Reduced Depth/Percentage				Maximum Avg. Reduced Depth/percentage			
			Class-I	Class-II	Class-III	Class-IV	Class-I	Class-II	Class-III	Class-IV
1	0	10	4.68/0.0468	4.64/0.0464	4.59/0.0459	4.55/0.0455	14.73/0.1473	14.77/0.1477	14.77/0.1477	14.77/0.1477
2	10	20	0.28/0.0028	0.26/0.0026	0.23/0.0023	0.22/0.0022	4.86/0.0486	4.87/0.0487	4.87/0.0487	4.87/0.0487
3	20	30	-0.3/-0.003	-0.3/-0.003	-0.3/-0.003	-0.3/-0.003	0/0	0/0	0/0	0/0
4	30	40	-0.3/-0.003	-0.3/-0.003	-0.3/-0.003	-0.3/-0.003	0/0	0/0	0/0	0/0
5	40	50	-0.3/-0.003	-0.3/-0.003	-0.3/-0.003	-0.3/-0.003	0/0	0/0	0/0	0/0
6	50	60	-0.3/-0.003	-0.3/-0.003	-0.3/-0.003	-0.3/-0.003	0/0	0/0	0/0	0/0
7	60	70	-0.3/-0.003	-0.3/-0.003	-0.3/-0.003	-0.3/-0.003	0/0	0/0	0/0	0/0
8	70	80.446	-0.3/-0.003	-0.3/-0.003	-0.3/-0.003	-0.3/-0.003	0/0	0/0	0/0	0/0

6.2 Range of Depths:-

Sl No	From Chainage (km)	To Chainage (km)	Reduced Depth				
			<1.2 m	1.2 m to 1.4 m	1.5 m to 1.7 m	1.8 m to 2.0 m	>2.0 m
			(km)	(km)	(km)	(km)	(km)
1	0.00	10.00	6.8	0	0	0	3.2
2	10.00	20.00	8.8	1.2	0	0	0
3	20.00	30.00	10	0	0	0	0
4	30.00	40.00	10	0	0	0	0
5	40.00	50.00	10	0	0	0	0
6	50.00	60.00	10	0	0	0	0
7	60.00	70.00	10	0	0	0	0
8	70.00	80.446	10.446	0	0	0	0

6.3 Min/Max and Avg. Width of Waterway:-

Sl. No	From Chainage (km)	To Chainage (km)	Min. width of waterway (m)	Max. width of waterway (m)	Avg. width of waterway (m)
1	0.00	10.00	848.00	2000.00	1848.00
2	10.00	20.00	2000.00	105.00	2052.50
3	20.00	30.00	105.00	170.16	190.08
4	30.00	40.00	170.16	80.00	210.16
5	40.00	50.00	80.00	90.00	125.00
6	50.00	60.00	80.00	61.00	110.50
7	60.00	70.00	61.00	121.00	121.50
8	70.00	80.446	121.00	1000.00	621.00

6.4 Average Slope:

Reach		Slope (m/km)
From	To	
0.00	10.00	0.000
10.01	20.00	0.707
20.01	30.00	1.202
30.01	40.00	1.163
40.01	50.00	1.044
50.01	60.00	1.972
60.01	70.00	1.982
70.01	80.446	2.608
Average Slope		1.33 m/km

6.5 Dredging Summary:-

Class	Observed Dredging Qty. w.r.t Sounding Datum (Cubic Meter)	Reduced Dredging Qty. w.r.t Sounding Datum (Cubic Meter)
Class-I	2857540.40	3664041.90
Class-II	4355371.90	5396474.40
Class-III	6590225.50	7887529.70
Class-IV	7961115.60	9319814.40

The Detailed Project Report may be organized as Mukutmanipur dam is located near the Chainage 0.00 km. The Dam side is a really tourist spot which brings many tourists every year for its pleasant weather and natural beauty. The Dam is mainly used for irrigation purposes in this zone of river. Besides, Dredging is also Needful as the channels of the waterways become a shallow depth after 14 km. If the ferry services more develop in this zone, the waterway transportation will be accessible in this zone of river.

Annexure:-

Annexure-1- Source and type of data collected from various agencies:-

The Chart Datum value and HFL values of Rangagora, Kharidwar and Kangsabati Dam has been provided by IWAI office.

Annexure-2 - Min. / max. depth, length of shoal per km-wise for different classification in the designed dredged channel:-

Class-I:-

Class-I											
Chainage (km)		Observed Dredging Qty. w.r.t Sounding Datum					Reduced Dredging Qty. w.r.t Sounding Datum				
From	To	Min. depth (m)	Max. depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Cumulative Dredging Qty (cu.m.)	Min. Depth (m)	Max. Depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Cumulative Dredging Qty (cu.m.)
0	1	1.1	8.8	1000	10791.9	10791.9	1	8.2	1000	13941.4	13941.4
1	2	4.4	10.8	0	0	10791.9	3.9	10.3	0	0	13941.4
2	3	10.5	18.1	0	0	10791.9	9.8	17.9	0	0	13941.4
3	4	11.7	18.8	0	0	10791.9	11.4	17.8	0	0	13941.4
4	5	1.8	15.9	1000	10800	21591.9	1.1	14.5	1000	13950	27891.4
5	6	1.5	21.8	1000	10356.4	31948.3	1.1	20.5	1000	13501.4	41392.8
6	7	8.5	21.3	0	0	31948.3	7.6	20.3	0	0	41392.8
7	8	4.7	10.1	0	0	31948.3	4.3	9.6	0	0	41392.8
8	9	3.6	19.6	0	0	31948.3	3.2	17.6	0	0	41392.8
9	10	3.7	11.1	0	0	31948.3	3.4	10.6	0	0	41392.8
10	11	1.1	8.6	1000	8697.7	40646	0.9	8.3	1000	11926.4	53319.2
11	12	1	15.7	1000	7640.2	48286.2	0.9	15.3	1000	10393.7	63712.9
12	13	1.1	14.1	1000	4621.2	52907.4	1	13.6	1000	6045.9	69758.8
13	14	1.1	7.5	1000	10639.3	63546.7	1	7.3	1000	14003.4	83762.2
14	15	0.9	5.3	1000	43180.3	106727	0.5	4.1	1000	55774.5	139536.7
15	16	0.3	0.7	1000	43005	149732	-0.3	0	1000	55547.8	195084.5
16	17	0.3	0.5	1000	42589.6	192321.6	-0.3	0	1000	54979.9	250064.4
17	18	0.2	0.5	1000	43197.3	235518.9	-0.3	0	1000	55550.5	305614.9
18	19	0.2	0.6	1000	43093.7	278612.6	-0.3	0	1000	55471.6	361086.5
19	20	0.2	0.5	1000	42679.6	321292.2	-0.3	0	1000	55127.4	416213.9
20	21	0.2	0.4	1000	43093.8	364386	-0.3	0	1000	55416	471629.9
21	22	0.2	0.5	1000	42741.1	407127.1	-0.3	0	1000	55132.6	526762.5
22	23	0.1	0.3	1000	42251	449378.1	-0.3	0	1000	52910.4	579672.9
23	24	0.1	0.3	1000	42284.9	491663	-0.3	0	1000	53459.6	633132.5
24	25	0.2	0.5	1000	43011.1	534674.1	-0.3	0	1000	54580.3	687712.8
25	26	0.3	0.6	1000	43060.8	577734.9	-0.3	0	1000	55225.6	742938.4
26	27	0.2	0.4	1000	42797.9	620532.8	-0.3	0	1000	55051.2	797989.6
27	28	0.1	0.3	1000	42707.1	663239.9	-0.3	0	1000	54419.7	852409.3
28	29	0.2	0.4	1000	41191.8	704431.7	-0.3	0	1000	52758.6	905167.9

Class-I												
Chainage (km)		Observed Dredging Qty. w.r.t Sounding Datum					Reduced Dredging Qty. w.r.t Sounding Datum				
From	To	Min. depth (m)	Max. depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Cumulative Dredging Qty (cu.m.)	Min. Depth (m)	Max. Depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Cumulative Dredging Qty (cu.m.)
29	30	0.3	0.6	1000	43014.4	747446.1	-0.3	0	1000	55107	960274.9
30	31	0.2	0.5	1000	42284	789730.1	-0.3	0	1000	54268.3	1014543.2
31	32	0.2	0.5	1000	42559.5	832289.6	-0.3	0	1000	54524.6	1069067.8
32	33	0.3	0.5	1000	38576.2	870865.8	-0.3	0	1000	49100.8	1118168.6
33	34	0.3	0.6	1000	43003.8	913869.6	-0.3	0	1000	54084.9	1172253.5
34	35	0.1	0.3	1000	42107.2	955976.8	-0.3	0	1000	54021.3	1226274.8
35	36	0.2	0.4	1000	42644.3	998621.1	-0.3	0	1000	54901	1281175.8
36	37	0.2	0.4	1000	42301.4	1040922.5	-0.3	0	1000	54584.3	1335760.1
37	38	0.2	0.5	1000	42510.4	1083432.9	-0.3	0	1000	54760.9	1390521
38	39	0.3	0.5	1000	42549.6	1125982.5	-0.3	0	1000	54895.6	1445416.6
39	40	0.1	0.3	1000	41879.9	1167862.4	-0.3	0	1000	53859.1	1499275.7
40	41	0.1	0.3	1000	42079.9	1209942.3	-0.3	0	1000	53329.5	1552605.2
41	42	0.2	0.3	1000	43052	1252994.3	-0.3	0	1000	55083.1	1607688.3
42	43	0.1	0.4	1000	42347	1295341.3	-0.3	0	1000	53477.4	1661165.7
43	44	0.2	0.4	1000	42053.6	1337394.9	-0.3	0	1000	53916.4	1715082.1
44	45	0.2	0.2	1000	42389.8	1379784.7	-0.3	0	1000	53765.2	1768847.3
45	46	0.1	0.3	1000	43085.5	1422870.2	-0.3	0	1000	54484.5	1823331.8
46	47	0.1	0.4	1000	42709.4	1465579.6	-0.3	0	1000	54289.1	1877620.9
47	48	0.2	0.4	1000	42321.6	1507901.2	-0.3	0	1000	54435.4	1932056.3
48	49	0.1	0.3	1000	42055.4	1549956.6	-0.3	0	1000	54128	1986184.3
49	50	0.2	0.2	1000	46216.7	1596173.3	-0.3	0	1000	59691.3	2045875.6
50	51	0.1	0.3	1000	41906.2	1638079.5	-0.3	0	1000	54128.1	2100003.7
51	52	0.2	0.3	1000	42998.9	1681078.4	-0.3	0	1000	55539.9	2155543.6
52	53	0.2	0.4	1000	42725.7	1723804.1	-0.3	0	1000	55125.9	2210669.5
53	54	0.1	0.3	1000	43091.6	1766895.7	-0.3	0	1000	55140.7	2265810.2
54	55	0.1	0.2	1000	42540.6	1809436.3	-0.3	0	1000	54333.3	2320143.5
55	56	0.1	0.2	1000	42983.2	1852419.5	-0.3	0	1000	55178.9	2375322.4
56	57	0.1	0.2	1000	42065.6	1894485.1	-0.3	0	1000	54145.7	2429468.1
57	58	0.2	0.3	1000	41786.8	1936271.9	-0.3	0	1000	53228.8	2482696.9
58	59	0.1	0.3	1000	37804.4	1974076.3	-0.3	0	1000	48378.2	2531075.1
59	60	0.2	0.4	1000	42189.2	2016265.5	-0.3	0	1000	54315.6	2585390.7
60	61	0.1	0.2	1000	42354.3	2058619.8	-0.3	0	1000	54705.2	2640095.9
61	62	0.2	0.4	1000	42432.2	2101052	-0.3	0	1000	54807.8	2694903.7
62	63	0.1	0.3	1000	43071.5	2144123.5	-0.3	0	1000	55634.1	2750537.8
63	64	0.1	0.3	1000	42924.9	2187048.4	-0.3	0	1000	55444.4	2805982.2
64	65	0.1	0.3	1000	41012.8	2228061.2	-0.3	0	1000	52592.5	2858574.7
65	66	0.2	0.4	1000	42423.6	2270484.8	-0.3	0	1000	53993.7	2912568.4
66	67	0.1	0.3	1000	41287.1	2311771.9	-0.3	0	1000	51898.3	2964466.7
67	68	0.2	0.4	1000	41898.8	2353670.7	-0.3	0	1000	54118.4	3018585.1

Class-I												
Chainage (km)		Observed Dredging Qty. w.r.t Sounding Datum					Reduced Dredging Qty. w.r.t Sounding Datum				
From	To	Min. depth (m)	Max. depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Cumulative Dredging Qty (cu.m.)	Min. Depth (m)	Max. Depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Cumulative Dredging Qty (cu.m.)
68	69	0.2	0.4	1000	42490.1	2396160.8	-0.3	0	1000	54882.9	3073468
69	70	0.1	0.3	1000	42692.5	2438853.3	-0.3	0	1000	54869	3128337
70	71	0.1	0.3	1000	42827.5	2481680.8	-0.3	0	1000	54481.8	3182818.8
71	72	0.2	0.4	1000	41282.4	2522963.2	-0.3	0	1000	52728.9	3235547.7
72	73	0.1	0.3	1000	36512.8	2559476	-0.3	0	1000	46602	3282149.7
73	74	0.2	0.4	1000	41471.3	2600947.3	-0.3	0	1000	53291.8	3335441.5
74	75	0.1	0.4	1000	39500.6	2640447.9	-0.3	0	1000	50403.8	3385845.3
75	76	0.2	0.4	1000	38475.2	2678923.1	-0.3	0	1000	49192.1	3435037.4
76	77	0.1	0.3	1000	40550.8	2719473.9	-0.3	0	1000	52045.4	3487082.8
77	78	0.2	0.3	1000	40372.8	2759846.7	-0.3	0	1000	51651.1	3538733.9
78	79	0.1	0.2	1000	40861.5	2800708.2	-0.3	0	1000	52212.9	3590946.8
79	80.45	0.1	0.2	1000	56832.2	2857540.4	-0.3	0	1000	73095.1	3664041.9
Total				73000	2857540.4		Total		73000	3664041.9	

Table 17- Minimum & Maximum depth per km wise (Class-I)

Class-II:-

Class-II											
Chainage (km)		Observed Dredging Qty. w.r.t Sounding Datum					Reduced Dredging Qty. w.r.t Sounding Datum				
From	To	Min. depth (m)	Max. depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Cumulative Dredging Qty (cu.m.)	Min. Depth (m)	Max. Depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Cumulative Dredging Qty (cu.m.)
0	1	1	8.9	1000	16437.3	16437.3	0.9	8.3	1000	20487.3	20487.3
1	2	4.39	10.81	0	0	16437.3	3.89	10.31	0	0	20487.3
2	3	10.48	18.12	0	0	16437.3	9.78	17.92	0	0	20487.3
3	4	11.69	18.81	0	0	16437.3	11.39	17.81	0	0	20487.3
4	5	1.7	16	1000	16450	32887.3	1	14.6	1000	20499.9	40987.2
5	6	1.48	21.82	1000	15886.4	48773.7	1.08	20.52	1000	19931.4	60918.6
6	7	8.48	21.32	0	0	48773.7	7.58	20.32	0	0	60918.6
7	8	4.69	10.11	0	0	48773.7	4.29	9.61	0	0	60918.6
8	9	3.5	19.7	0	0	48773.7	3.1	17.7	0	0	60918.6
9	10	3.68	11.12	0	0	48773.7	3.38	10.62	0	0	60918.6
10	11	1	8.7	1000	14487.3	63261	0.8	8.4	1000	19151.1	80069.7
11	12	0.99	15.71	1000	12386.3	75647.3	0.89	15.31	1000	16129.3	96199
12	13	1.08	14.12	1000	7703.2	83350.5	0.98	13.62	1000	9887.6	106086.6
13	14	1.09	7.51	1000	16358	99708.5	0.99	7.31	1000	20690.6	126777.2
14	15	0.88	5.32	1000	65770	165478.5	0.48	4.12	1000	81960.1	208737.3
15	16	0.3	0.7	1000	65502.8	230981.3	-0.3	0	1000	81628.9	290366.2
16	17	0.3	0.5	1000	64870.6	295851.9	-0.3	0	1000	80791.1	371157.3
17	18	0.2	0.5	1000	65796	361647.9	-0.3	0	1000	81623.4	452780.7
18	19	0.2	0.6	1000	65638.1	427286	-0.3	0	1000	81505.3	534286
19	20	0.2	0.5	1000	65006.1	492292.1	-0.3	0	1000	81010.5	615296.5
20	21	0.2	0.4	1000	65637.9	557930	-0.3	0	1000	81550.9	696847.4
21	22	0.2	0.5	1000	65100.9	623030.9	-0.3	0	1000	80950	777797.4
22	23	0.1	0.3	1000	64354.5	687385.4	-0.3	0	1000	78533.7	856331.1
23	24	0.1	0.3	1000	64405.8	751791.2	-0.3	0	1000	79101.6	935432.7
24	25	0.2	0.5	1000	65512.6	817303.8	-0.3	0	1000	80665.8	1016098.5
25	26	0.3	0.6	1000	65588.5	882892.3	-0.3	0	1000	81341.4	1097439.9
26	27	0.2	0.4	1000	65187.8	948080.1	-0.3	0	1000	80925.8	1178365.7
27	28	0.1	0.3	1000	65049.5	1013129.6	-0.3	0	1000	80205	1258570.7
28	29	0.2	0.4	1000	62741.9	1075871.5	-0.3	0	1000	77740.5	1336311.2
29	30	0.3	0.6	1000	65517.2	1141388.7	-0.3	0	1000	81081.4	1417392.6
30	31	0.2	0.5	1000	64405.1	1205793.8	-0.3	0	1000	79710.7	1497103.3
31	32	0.2	0.5	1000	64823.6	1270617.4	-0.3	0	1000	80258.8	1577362.1
32	33	0.3	0.5	1000	58756.9	1329374.3	-0.3	0	1000	72402.4	1649764.5
33	34	0.3	0.6	1000	65500.6	1394874.9	-0.3	0	1000	79910.9	1729675.4
34	35	0.1	0.3	1000	64140.7	1459015.6	-0.3	0	1000	79406.8	1809082.2
35	36	0.2	0.4	1000	64953.4	1523969	-0.3	0	1000	80467.9	1889550.1

Class-II												
Chainage (km)		Observed Dredging Qty. w.r.t Sounding Datum					Reduced Dredging Qty. w.r.t Sounding Datum				
From	To	Min. depth (m)	Max. depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Cumulative Dredging Qty (cu.m.)	Min. Depth (m)	Max. Depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Cumulative Dredging Qty (cu.m.)
36	37	0.2	0.4	1000	64430.8	1588399.8	-0.3	0	1000	80083.5	1969633.6
37	38	0.2	0.5	1000	64749.3	1653149.1	-0.3	0	1000	80082	2049715.6
38	39	0.3	0.5	1000	64809.4	1717958.5	-0.3	0	1000	80505.2	2130220.8
39	40	0.1	0.3	1000	63789.9	1781748.4	-0.3	0	1000	79177.1	2209397.9
40	41	0.1	0.3	1000	64090.1	1845838.5	-0.3	0	1000	78745.3	2288143.2
41	42	0.2	0.3	1000	65574.4	1911412.9	-0.3	0	1000	81094.5	2369237.7
42	43	0.1	0.4	1000	64501	1975913.9	-0.3	0	1000	78936	2448173.7
43	44	0.2	0.4	1000	64052.9	2039966.8	-0.3	0	1000	79417	2527590.7
44	45	0.2	0.2	1000	64566.1	2104532.9	-0.3	0	1000	79407.1	2606997.8
45	46	0.1	0.3	1000	65625.7	2170158.6	-0.3	0	1000	80528.5	2687526.3
46	47	0.1	0.4	1000	65051.6	2235210.2	-0.3	0	1000	79948.8	2767475.1
47	48	0.2	0.4	1000	64462.8	2299673	-0.3	0	1000	79966.2	2847441.3
48	49	0.1	0.3	1000	64057.1	2363730.1	-0.3	0	1000	79431.2	2926872.5
49	50	0.2	0.2	1000	70395.1	2434125.2	-0.3	0	1000	87679	3014551.5
50	51	0.1	0.3	1000	63829.6	2497954.8	-0.3	0	1000	79543.1	3094094.6
51	52	0.2	0.3	1000	65493.5	2563448.3	-0.3	0	1000	81616.6	3175711.2
52	53	0.2	0.4	1000	65078.4	2628526.7	-0.3	0	1000	80999.3	3256710.5
53	54	0.1	0.3	1000	65634.9	2694161.6	-0.3	0	1000	81060.1	3337770.6
54	55	0.1	0.2	1000	64795.2	2758956.8	-0.3	0	1000	79888.6	3417659.2
55	56	0.1	0.2	1000	65469.6	2824426.4	-0.3	0	1000	81245.4	3498904.6
56	57	0.1	0.2	1000	64071.7	2888498.1	-0.3	0	1000	79654.4	3578559
57	58	0.2	0.3	1000	63645.9	2952144	-0.3	0	1000	78540.1	3657099.1
58	59	0.1	0.3	1000	57582.2	3009726.2	-0.3	0	1000	71304.8	3728403.9
59	60	0.2	0.4	1000	64259.8	3073986	-0.3	0	1000	79857.7	3808261.6
60	61	0.1	0.2	1000	64511.4	3138497.4	-0.3	0	1000	80323.3	3888584.9
61	62	0.2	0.4	1000	64630	3203127.4	-0.3	0	1000	80541.5	3969126.4
62	63	0.1	0.3	1000	65604	3268731.4	-0.3	0	1000	81755.4	4050881.8
63	64	0.1	0.3	1000	65381.5	3334112.9	-0.3	0	1000	81477.7	4132359.5
64	65	0.1	0.3	1000	62467.9	3396580.8	-0.3	0	1000	77233.9	4209593.4
65	66	0.2	0.4	1000	64617.5	3461198.3	-0.3	0	1000	79703.2	4289296.6
66	67	0.1	0.3	1000	62886.6	3524084.9	-0.3	0	1000	76863.9	4366160.5
67	68	0.2	0.4	1000	63818	3587902.9	-0.3	0	1000	79529.4	4445689.9
68	69	0.2	0.4	1000	64718.9	3652621.8	-0.3	0	1000	80651.3	4526341.2
69	70	0.1	0.3	1000	65026.3	3717648.1	-0.3	0	1000	80754.9	4607096.1
70	71	0.1	0.3	1000	65232.9	3782881	-0.3	0	1000	80413.8	4687509.9
71	72	0.2	0.4	1000	62879	3845760	-0.3	0	1000	77765.4	4765275.3
72	73	0.1	0.3	1000	55614.4	3901374.4	-0.3	0	1000	68745.8	4834021.1
73	74	0.2	0.4	1000	63166.4	3964540.8	-0.3	0	1000	78442	4912463.1
74	75	0.1	0.4	1000	60170.1	4024710.9	-0.3	0	1000	74320.5	4986783.6

Class-II											
Chainage (km)		Observed Dredging Qty. w.r.t Sounding Datum					Reduced Dredging Qty. w.r.t Sounding Datum				
From	To	Min. depth (m)	Max. depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Cumulative Dredging Qty (cu.m.)	Min. Depth (m)	Max. Depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Cumulative Dredging Qty (cu.m.)
75	76	0.2	0.4	1000	58604	4083314.9	-0.3	0	1000	72475.3	5059258.9
76	77	0.1	0.3	1000	61765.3	4145080.2	-0.3	0	1000	76614.3	5135873.2
77	78	0.2	0.3	1000	61488.9	4206569.1	-0.3	0	1000	76126.7	5211999.9
78	79	0.1	0.2	1000	62238.5	4268807.6	-0.3	0	1000	76986.7	5288986.6
79	80.45	0.1	0.2	1000	86564.3	4355371.9	-0.3	0	1000	107487.8	5396474.4
Total				73000	4355371.9		Total		73000	5396474.4	

Table 18 - Minimum & Maximum depth per km wise (Class II)

Class-III:-

Class-III											
Chainage (km)		Observed Dredging Qty. w.r.t Sounding Datum					Reduced Dredging Qty. w.r.t Sounding Datum				
From	To	Min. depth (m)	Max. depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Cumulative Dredging Qty (cu.m.)	Min. Depth (m)	Max. Depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Cumulative Dredging Qty (cu.m.)
0	1	0.9	9	1000	24848.3	24848.3	0.8	8.2	1000	30167.5	30167.5
1	2	4.38	10.82	0	0	24848.3	3.88	10.3	0	0	30167.5
2	3	10.46	18.14	0	0	24848.3	9.76	17.9	0	0	30167.5
3	4	11.68	18.82	0	0	24848.3	11.38	17.8	0	0	30167.5
4	5	1.6	16.1	1000	24862.4	49710.7	0.9	14.5	1000	29887.4	60054.9
5	6	1.46	21.84	1000	24169.1	73879.8	1.06	20.5	1000	29188.5	89243.4
6	7	8.46	21.34	0	0	73879.8	7.56	20.3	0	0	89243.4
7	8	4.68	10.12	0	0	73879.8	4.28	9.6	0	0	89243.4
8	9	3.4	19.8	0	0	73879.8	3	17.6	0	0	89243.4
9	10	3.66	11.14	0	0	73879.8	3.36	10.6	0	0	89243.4
10	11	0.9	8.8	1000	24349.6	98229.4	0.7	8.3	1000	30441.9	119685.3
11	12	0.98	15.72	1000	20560.8	118790.2	0.88	15.3	1000	25443.3	145128.6
12	13	1.06	14.14	1000	13517.9	132308.1	0.96	13.6	1000	16524.4	161653
13	14	1.08	7.52	1000	25914	158222.1	0.98	7.3	1000	32055.7	193708.7
14	15	0.86	5.34	1000	99404.6	257626.7	0.3	4.1	1000	119493.2	313201.9
15	16	0.3	0.7	1000	99001.2	356627.9	-0.3	0	1000	119009.4	432211.3
16	17	0.3	0.5	1000	98045	454672.9	-0.3	0	1000	117799.6	550010.9
17	18	0.2	0.5	1000	99443.9	554116.8	-0.3	0	1000	119090.9	669101.8
18	19	0.2	0.6	1000	99205.4	653322.2	-0.3	0	1000	118881.1	787982.9
19	20	0.2	0.5	1000	98250.6	751572.8	-0.3	0	1000	118107.6	906090.5
20	21	0.2	0.4	1000	99205.9	850778.7	-0.3	0	1000	119010	1025100.5
21	22	0.2	0.5	1000	98392.7	949171.4	-0.3	0	1000	117895.3	1142995.8
22	23	0.1	0.3	1000	97265.2	1046436.6	-0.3	0	1000	115258.8	1258254.6
23	24	0.1	0.3	1000	97343.1	1143779.7	-0.3	0	1000	115856.8	1374111.4
24	25	0.2	0.5	1000	99015.7	1242795.4	-0.3	0	1000	118052.3	1492163.7
25	26	0.3	0.6	1000	99130	1341925.4	-0.3	0	1000	118770.4	1610934.1
26	27	0.2	0.4	1000	98524.2	1440449.6	-0.3	0	1000	118124	1729058.1
27	28	0.1	0.3	1000	98315.6	1538765.2	-0.3	0	1000	117312	1846370.1
28	29	0.2	0.4	1000	94827	1633592.2	-0.3	0	1000	113544.1	1959914.2
29	30	0.3	0.6	1000	99022.7	1732614.9	-0.3	0	1000	118459.5	2078373.7
30	31	0.2	0.5	1000	97340.9	1829955.8	-0.3	0	1000	116332.3	2194706
31	32	0.2	0.5	1000	97975.4	1927931.2	-0.3	0	1000	117188.1	2311894.1
32	33	0.3	0.5	1000	88805.3	2016736.5	-0.3	0	1000	105844.1	2417738.2
33	34	0.3	0.6	1000	98999.3	2115735.8	-0.3	0	1000	117134.3	2534872.5
34	35	0.1	0.3	1000	96939.2	2212675	-0.3	0	1000	115849.2	2650721.7
35	36	0.2	0.4	1000	98170.1	2310845.1	-0.3	0	1000	117355.9	2768077.6

Class-III											
Chainage (km)		Observed Dredging Qty. w.r.t Sounding Datum					Reduced Dredging Qty. w.r.t Sounding Datum				
From	To	Min. depth (m)	Max. depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Cumulative Dredging Qty (cu.m.)	Min. Depth (m)	Max. Depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Cumulative Dredging Qty (cu.m.)
36	37	0.2	0.4	1000	97381.9	2408227	-0.3	0	1000	116433.7	2884511.3
37	38	0.2	0.5	1000	97862.5	2506089.5	-0.3	0	1000	116363.6	3000874.9
38	39	0.3	0.5	1000	97953.3	2604042.8	-0.3	0	1000	117220.2	3118095.1
39	40	0.1	0.3	1000	96411.9	2700454.7	-0.3	0	1000	115511.5	3233606.6
40	41	0.1	0.3	1000	96861.6	2797316.3	-0.3	0	1000	115186.8	3348793.4
41	42	0.2	0.3	1000	99110.4	2896426.7	-0.3	0	1000	118503.7	3467297.1
42	43	0.1	0.4	1000	97486.8	2993913.5	-0.3	0	1000	115562.9	3582860
43	44	0.2	0.4	1000	96809.5	3090723	-0.3	0	1000	115969.5	3698829.5
44	45	0.2	0.2	1000	97585.5	3188308.5	-0.3	0	1000	116251.1	3815080.6
45	46	0.1	0.3	1000	99186.5	3287495	-0.3	0	1000	117910.6	3932991.2
46	47	0.1	0.4	1000	98318.7	3385813.7	-0.3	0	1000	116867.7	4049858.9
47	48	0.2	0.4	1000	97429.2	3483242.9	-0.3	0	1000	116648	4166506.9
48	49	0.1	0.3	1000	96815.3	3580058.2	-0.3	0	1000	115761.4	4282268.3
49	50	0.2	0.2	1000	106395.5	3686453.7	-0.3	0	1000	127851.2	4410119.5
50	51	0.1	0.3	1000	96472.1	3782925.8	-0.3	0	1000	115969.6	4526089.1
51	52	0.2	0.3	1000	98987.1	3881912.9	-0.3	0	1000	118947	4645036.1
52	53	0.2	0.4	1000	98360.7	3980273.6	-0.3	0	1000	118110.4	4763146.5
53	54	0.1	0.3	1000	99200.6	4079474.2	-0.3	0	1000	118392.3	4881538.8
54	55	0.1	0.2	1000	97932.2	4177406.4	-0.3	0	1000	116657.9	4998196.7
55	56	0.1	0.2	1000	98950.6	4276357	-0.3	0	1000	118607.7	5116804.4
56	57	0.1	0.2	1000	96838.3	4373195.3	-0.3	0	1000	116218.8	5233023.2
57	58	0.2	0.3	1000	96193.3	4469388.6	-0.3	0	1000	114855.6	5347878.8
58	59	0.1	0.3	1000	87029.8	4556418.4	-0.3	0	1000	104165.6	5452044.4
59	60	0.2	0.4	1000	97122.6	4653541	-0.3	0	1000	116511.1	5568555.5
60	61	0.1	0.2	1000	97502.5	4751043.5	-0.3	0	1000	117095.6	5685651.1
61	62	0.2	0.4	1000	97681.5	4848725	-0.3	0	1000	117423.3	5803074.4
62	63	0.1	0.3	1000	99153.7	4947878.7	-0.3	0	1000	119192.7	5922267.1
63	64	0.1	0.3	1000	98817.1	5046695.8	-0.3	0	1000	118788.2	6041055.3
64	65	0.1	0.3	1000	94414	5141109.8	-0.3	0	1000	112519.7	6153575
65	66	0.2	0.4	1000	97662.4	5238772.2	-0.3	0	1000	116579.5	6270154.5
66	67	0.1	0.3	1000	95047.2	5333819.4	-0.3	0	1000	112725.8	6382880.3
67	68	0.2	0.4	1000	96455.3	5430274.7	-0.3	0	1000	115948.4	6498828.7
68	69	0.2	0.4	1000	97816.2	5528090.9	-0.3	0	1000	117586	6616414.7
69	70	0.1	0.3	1000	98281.5	5626372.4	-0.3	0	1000	117864.4	6734279.1
70	71	0.1	0.3	1000	98592.6	5724965	-0.3	0	1000	117640.3	6851919.4
71	72	0.2	0.4	1000	95034.3	5819999.3	-0.3	0	1000	113647.2	6965566.6
72	73	0.1	0.3	1000	84052.7	5904052	-0.3	0	1000	100479.8	7066046.4
73	74	0.2	0.4	1000	95469.7	5999521.7	-0.3	0	1000	114489.2	7180535.6
74	75	0.1	0.4	1000	90945.6	6090467.3	-0.3	0	1000	108655.1	7289190.7

Class-III											
Chainage (km)		Observed Dredging Qty. w.r.t Sounding Datum					Reduced Dredging Qty. w.r.t Sounding Datum				
From	To	Min. depth (m)	Max. depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Cumulative Dredging Qty (cu.m.)	Min. Depth (m)	Max. Depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Cumulative Dredging Qty (cu.m.)
75	76	0.2	0.4	1000	88573.3	6179040.6	-0.3	0	1000	105901	7395091.7
76	77	0.1	0.3	1000	93351.4	6272392	-0.3	0	1000	111861	7506952.7
77	78	0.2	0.3	1000	92936.2	6365328.2	-0.3	0	1000	111218.1	7618170.8
78	79	0.1	0.2	1000	94066.3	6459394.5	-0.3	0	1000	112503.1	7730673.9
79	80.45	0.1	0.2	1000	130831	6590225.5	-0.3	0	1000	156855.8	7887529.7
Total				73000	6590225.5				73000	7887529.7	

Table 19 - Minimum & Maximum depth per km wise (Class III)

Class - IV:-

Class-IV											
Chainage (km)		Observed Dredging Qty. w.r.t Sounding Datum					Reduced Dredging Qty. w.r.t Sounding Datum				
From	To	Min. depth (m)	Max. depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Cumulative Dredging Qty (cu.m.)	Min. Depth (m)	Max. Depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Cumulative Dredging Qty (cu.m.)
0	1	0.8	9.1	1000	30476.7	30476.7	0.7	8.3	1000	36793.5	36793.5
1	2	4.37	10.83	0	0	30476.7	3.87	10.31	0	0	36793.5
2	3	10.44	18.16	0	0	30476.7	9.74	17.92	0	0	36793.5
3	4	11.67	18.83	0	0	30476.7	11.37	17.81	0	0	36793.5
4	5	1.5	16.2	1000	29999.9	60476.6	0.8	14.6	1000	35249.9	72043.4
5	6	1.44	21.86	1000	29276.6	89753.2	1.04	20.52	1000	34521.4	106564.8
6	7	8.44	21.36	0	0	89753.2	7.54	20.32	0	0	106564.8
7	8	4.67	10.13	0	0	89753.2	4.27	9.61	0	0	106564.8
8	9	3.3	19.9	0	0	89753.2	2.9	17.7	0	0	106564.8
9	10	3.64	11.16	0	0	89753.2	3.34	10.62	0	0	106564.8
10	11	0.8	8.9	1000	31540.1	121293.3	0.6	8.4	1000	38184.3	144749.1
11	12	0.97	15.73	1000	26996.6	148289.9	0.87	15.31	1000	32314.9	177064
12	13	1.04	14.16	1000	18240.4	166530.3	0.94	13.62	1000	21797.7	198861.7
13	14	1.07	7.53	1000	33496.3	200026.6	0.97	7.31	1000	40711	239572.7
14	15	0.84	5.36	1000	119945.2	319971.8	0.28	4.12	1000	140933.3	380506
15	16	0.3	0.7	1000	119458.3	439430.1	-0.3	0	1000	140363.1	520869.1
16	17	0.3	0.5	1000	118304.4	557734.5	-0.3	0	1000	138944.4	659813.5
17	18	0.2	0.5	1000	119992.6	677727.1	-0.3	0	1000	140528.7	800342.2
18	19	0.2	0.6	1000	119704.8	797431.9	-0.3	0	1000	140265.7	940607.9
19	20	0.2	0.5	1000	118554	915985.9	-0.3	0	1000	139300.7	1079908.6
20	21	0.2	0.4	1000	119705.6	1035691.5	-0.3	0	1000	140407.5	1220316.1
21	22	0.2	0.5	1000	118723.6	1154415.1	-0.3	0	1000	139075.2	1359391.3
22	23	0.1	0.3	1000	117364.5	1271779.6	-0.3	0	1000	136239.1	1495630.4
23	24	0.1	0.3	1000	117458	1389237.6	-0.3	0	1000	136853.3	1632483.7
24	25	0.2	0.5	1000	119475.8	1508713.4	-0.3	0	1000	139408.1	1771891.8
25	26	0.3	0.6	1000	119613.9	1628327.3	-0.3	0	1000	140151.7	1912043.5
26	27	0.2	0.4	1000	118883.3	1747210.6	-0.3	0	1000	139375.1	2051418.6
27	28	0.1	0.3	1000	118631.1	1865841.7	-0.3	0	1000	138516.7	2189935.3
28	29	0.2	0.4	1000	114422.6	1980264.3	-0.3	0	1000	133997.8	2323933.1
29	30	0.3	0.6	1000	119484	2099748.3	-0.3	0	1000	139817.1	2463750.2
30	31	0.2	0.5	1000	117455.4	2217203.7	-0.3	0	1000	137314.7	2601064.9
31	32	0.2	0.5	1000	118220.2	2335423.9	-0.3	0	1000	138312.1	2739377
32	33	0.3	0.5	1000	107155	2442578.9	-0.3	0	1000	124983	2864360
33	34	0.3	0.6	1000	119456.8	2562035.7	-0.3	0	1000	138468.8	3002828.8
34	35	0.1	0.3	1000	116971.4	2679007.1	-0.3	0	1000	136733.9	3139562.7

Class-IV												
Chainage (km)		Observed Dredging Qty. w.r.t Sounding Datum					Reduced Dredging Qty. w.r.t Sounding Datum					
From	To	Min. depth (m)	Max. depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Cumulative Dredging Qty (cu.m.)	Min. Depth (m)	Max. Depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Cumulative Dredging Qty (cu.m.)
35	36	0.2	0.4	1000	118455.9	2797463	-0.3	0	1000	138498.6	3278061.3
36	37	0.2	0.4	1000	117505	2914968	-0.3	0	1000	137297.6	3415358.9
37	38	0.2	0.5	1000	118084	3033052	-0.3	0	1000	137345.5	3552704.4
38	39	0.3	0.5	1000	118193.1	3151245.1	-0.3	0	1000	138298.3	3691002.7
39	40	0.1	0.3	1000	116333	3267578.1	-0.3	0	1000	136300	3827302.7
40	41	0.1	0.3	1000	116874.6	3384452.7	-0.3	0	1000	136038.6	3963341.3
41	42	0.2	0.3	1000	119590.1	3504042.8	-0.3	0	1000	139876.9	4103218.2
42	43	0.1	0.4	1000	117631.9	3621674.7	-0.3	0	1000	136547.6	4239765.8
43	44	0.2	0.4	1000	116814.4	3738489.1	-0.3	0	1000	136851.2	4376617
44	45	0.2	0.2	1000	117750.1	3856239.2	-0.3	0	1000	137299.6	4513916.6
45	46	0.1	0.3	1000	119682	3975921.2	-0.3	0	1000	139282.6	4653199.2
46	47	0.1	0.4	1000	118638.1	4094559.3	-0.3	0	1000	138063.6	4791262.8
47	48	0.2	0.4	1000	117561.7	4212121	-0.3	0	1000	137615.3	4928878.1
48	49	0.1	0.3	1000	116820.6	4328941.6	-0.3	0	1000	136596.1	5065474.2
49	50	0.2	0.2	1000	128379.6	4457321.2	-0.3	0	1000	150798.1	5216272.3
50	51	0.1	0.3	1000	116405.9	4573727.1	-0.3	0	1000	136775.5	5353047.8
51	52	0.2	0.3	1000	119442.1	4693169.2	-0.3	0	1000	140280.2	5493328
52	53	0.2	0.4	1000	118685.7	4811854.9	-0.3	0	1000	139324.4	5632652.4
53	54	0.1	0.3	1000	119699.2	4931554.1	-0.3	0	1000	139766.2	5772418.6
54	55	0.1	0.2	1000	118167.9	5049722	-0.3	0	1000	137741.6	5910160.2
55	56	0.1	0.2	1000	119397.5	5169119.5	-0.3	0	1000	139950.1	6050110.3
56	57	0.1	0.2	1000	116848.1	5285967.6	-0.3	0	1000	137104.8	6187215.1
57	58	0.2	0.3	1000	116070.2	5402037.8	-0.3	0	1000	135601.5	6322816.6
58	59	0.1	0.3	1000	105013.9	5507051.7	-0.3	0	1000	122937.1	6445753.7
59	60	0.2	0.4	1000	117192.1	5624243.8	-0.3	0	1000	137445.3	6583199
60	61	0.1	0.2	1000	117648.9	5741892.7	-0.3	0	1000	138115.1	6721314.1
61	62	0.2	0.4	1000	117866.1	5859758.8	-0.3	0	1000	138492	6859806.1
62	63	0.1	0.3	1000	119642.6	5979401.4	-0.3	0	1000	140579.4	7000385.5
63	64	0.1	0.3	1000	119236.2	6098637.6	-0.3	0	1000	140101.9	7140487.4
64	65	0.1	0.3	1000	113923.3	6212560.9	-0.3	0	1000	132820.9	7273308.3
65	66	0.2	0.4	1000	117843.8	6330404.7	-0.3	0	1000	137643.4	7410951.7
66	67	0.1	0.3	1000	114686.4	6445091.1	-0.3	0	1000	133222.6	7544174.3
67	68	0.2	0.4	1000	116385.9	6561477	-0.3	0	1000	136751.5	7680925.8
68	69	0.2	0.4	1000	118027.9	6679504.9	-0.3	0	1000	138681.4	7819607.2
69	70	0.1	0.3	1000	118590.9	6798095.8	-0.3	0	1000	139063.9	7958671.1
70	71	0.1	0.3	1000	118965.7	6917061.5	-0.3	0	1000	138905.7	8097576.8
71	72	0.2	0.4	1000	114671.9	7031733.4	-0.3	0	1000	134144.7	8231721.5
72	73	0.1	0.3	1000	101418.9	7133152.3	-0.3	0	1000	118607.5	8350329
73	74	0.2	0.4	1000	115198.9	7248351.2	-0.3	0	1000	135082.9	8485411.9

Class-IV											
Chainage (km)		Observed Dredging Qty. w.r.t Sounding Datum					Reduced Dredging Qty. w.r.t Sounding Datum				
From	To	Min. depth (m)	Max. depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Cumulative Dredging Qty (cu.m.)	Min. Depth (m)	Max. Depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Cumulative Dredging Qty (cu.m.)
74	75	0.1	0.4	1000	109738.5	7358089.7	-0.3	0	1000	128271.2	8613683.1
75	76	0.2	0.4	1000	106874.8	7464964.5	-0.3	0	1000	125004.8	8738687.9
76	77	0.1	0.3	1000	112640.9	7577605.4	-0.3	0	1000	131996.2	8870684.1
77	78	0.2	0.3	1000	112139.6	7689745	-0.3	0	1000	131262.8	9001946.9
78	79	0.1	0.2	1000	113504.9	7803249.9	-0.3	0	1000	132792.5	9134739.4
79	80.45	0.1	0.2	1000	157865.7	7961115.6	-0.3	0	1000	185075	9319814.4
Total				73000	7961115.6				73000	9319814.4	

Table 20- Minimum & Maximum depth per km wise (Class IV)

Annexure-3 - Details of collected Water level of different gauge stations w.r.t. MSL (CWC, Irrigation, Ports, Maritime Boards, Observed stations during survey etc.) – Table indicating Chainage (zero at downstream) and following:-

Date	Tide Pole name	Chainage (km)	Time	T. Reading (m)	Zero of TP w.r.t. MSL (m)	W.L w.r.t. MSL (m)	SD value w.r.t. MSL (m)	Corrected Tide (m)
				A	B	C = A+B	D	E = D-C
02.11.15	GS-(TP)-1	10.584	24 hrs	0.25	123.150	123.400	123.237	-0.163
	GS-(TP)-1/A1	14.5	24 hrs	0.28	124.260	124.540	124.240	-0.300
	GS-(TP)-1/ A 2	15.5	24 hrs	0.31	124.378	124.688	124.388	-0.300
	GS-(TP)-1/ A 3	16.5	24 hrs	0.35	124.420	124.770	124.470	-0.300
	GS-(TP)-1/ A 4	17.5	24 hrs	0.4	124.640	125.040	124.740	-0.300
	GS-(TP)-1/ A 5	18.5	24 hrs	0.43	126.580	127.010	126.710	-0.300
	GS-(TP)-1/ A 6	19.5	24 hrs	0.46	128.100	128.560	128.260	-0.300
	GS-(TP)-1/ A 7	20.5	24 hrs	0.48	129.980	130.460	130.160	-0.300
	GS-(TP)-1/ A 8	21.5	24 hrs	0.49	131.580	132.070	131.770	-0.300
	GS-(TP)-1/ A 9	22.5	24 hrs	0.51	132.770	133.280	132.980	-0.300
	GS-(TP)-1/ A 10	23.5	24 hrs	0.55	132.920	133.470	133.170	-0.300
	GS-(TP)-1/ A 11	24.5	24 hrs	0.58	133.790	134.370	134.070	-0.300
	GS-(TP)-1/ A 12	25.5	24 hrs	0.61	134.820	135.430	135.130	-0.300
	GS-(TP)-1/ A 13	26.5	24 hrs	0.65	135.960	136.610	136.310	-0.300
	GS-(TP)-1/ A 14	27.5	24 hrs	0.69	137.420	138.110	137.810	-0.300
	GS-(TP)-1/ A 15	28.5	24 hrs	0.71	138.660	139.370	139.070	-0.300
	GS-(TP)-1/ A 16	29.5	24 hrs	0.75	140.130	140.880	140.580	-0.300
	GS-(TP)-1/ A 17	30.5	24 hrs	0.79	141.680	142.470	142.170	-0.300
	GS-(TP)-1/ A 18	31.5	24 hrs	0.81	142.480	143.290	142.990	-0.300
	GS-(TP)-1/ A 19	32.5	24 hrs	0.83	144.470	145.300	145.000	-0.300
	GS-(TP)-1/ A 20	33.5	24 hrs	0.85	145.370	146.220	145.920	-0.300
	GS-(TP)-1/ A 21	34.5	24 hrs	0.89	147.130	148.020	147.720	-0.300
	GS-(TP)-1/ A 22	35.5	24 hrs	0.25	148.660	148.910	148.610	-0.300
	GS-(TP)-1/ A 23	36.5	24 hrs	0.28	150.080	150.360	150.060	-0.300
	GS-(TP)-1/ A 24	37.5	24 hrs	0.31	150.770	151.080	150.780	-0.300
	GS-(TP)-1/ A 25	38.5	24 hrs	0.35	151.220	151.570	151.270	-0.300
	GS-(TP)-1/ A 26	39.5	24 hrs	0.4	152.740	153.140	152.840	-0.300
	GS-(TP)-1/ A 27	40.5	24 hrs	0.43	153.660	154.090	153.790	-0.300
	GS-(TP)-1/ A 28	41.5	24 hrs	0.46	154.380	154.840	154.540	-0.300
	GS-(TP)-1/ A 29	42.5	24 hrs	0.48	155.290	155.770	155.470	-0.300
	GS-(TP)-1/ A 30	43.5	24 hrs	0.49	156.000	156.490	156.190	-0.300
	GS-(TP)-1/ A 31	44.5	24 hrs	0.51	157.410	157.920	157.620	-0.300
	GS-(TP)-1/ A 32	45.5	24 hrs	0.55	158.060	158.610	158.310	-0.300
	GS-(TP)-1/ A 33	46.5	24 hrs	0.58	158.990	159.570	159.270	-0.300
	GS-(TP)-1/ A 34	47.5	24 hrs	0.61	159.120	159.730	159.430	-0.300
	GS-(TP)-1/ A 35	48.5	24 hrs	0.65	159.640	160.290	159.990	-0.300
02.11.15	GS-(TP)-1/ A 36	49.5	24 hrs	0.69	161.160	161.850	161.550	-0.300

Date	Tide Pole name	Chainage (km)	Time	T. Reading (m)	Zero of TP w.r.t. MSL (m)	W.L w.r.t. MSL (m)	SD value w.r.t. MSL (m)	Corrected Tide (m)
	GS-(TP)-1/ A 37	50.5	24 hrs	0.71	163.810	164.520	164.220	-0.300
	GS-(TP)-1/ A 38	51.5	24 hrs	0.25	164.970	165.220	164.920	-0.300
	GS-(TP)-1/ A 39	52.5	24 hrs	0.28	164.270	164.550	164.250	-0.300
	GS-(TP)-1/ A 40	53.5	24 hrs	0.31	168.930	169.240	168.940	-0.300
	GS-(TP)-1/ A 41	54.5	24 hrs	0.35	170.840	171.190	170.890	-0.300
	GS-(TP)-1/ A 42	55.5	24 hrs	0.4	173.380	173.780	173.480	-0.300
	GS-(TP)-1/ A 43	56.5	24 hrs	0.43	176.660	177.090	176.790	-0.300
	GS-(TP)-1/ A 44	57.5	24 hrs	0.46	180.210	180.670	180.370	-0.300
	GS-(TP)-1/ A 45	58.5	24 hrs	0.48	183.120	183.600	183.300	-0.300
	GS-(TP)-1/ A 46	59.5	24 hrs	0.49	183.430	183.920	183.620	-0.300
	GS-(TP)-1/ A 47	60.5	24 hrs	0.51	183.710	184.220	183.920	-0.300
	GS-(TP)-1/ A 48	61.5	24 hrs	0.55	184.080	184.630	184.330	-0.300
	GS-(TP)-1/ A 49	62.5	24 hrs	0.58	184.490	185.070	184.770	-0.300
	GS-(TP)-1/ A 50	63.5	24 hrs	0.61	188.300	188.910	188.610	-0.300
	GS-(TP)-1/ A 51	64.5	24 hrs	0.65	191.530	192.180	191.880	-0.300
	GS-(TP)-1/ A 52	65.5	24 hrs	0.69	193.940	194.630	194.330	-0.300
	GS-(TP)-1/ A 53	66.5	24 hrs	0.71	194.730	195.440	195.140	-0.300
	GS-(TP)-1/ A 54	67.5	24 hrs	0.25	197.070	197.320	197.020	-0.300
	GS-(TP)-1/ A 55	68.5	24 hrs	0.28	199.090	199.370	199.070	-0.300
	GS-(TP)-1/ A 56	69.5	24 hrs	0.31	202.140	202.450	202.150	-0.300
	GS-(TP)-1/ A 57	70.5	24 hrs	0.35	203.670	204.020	203.720	-0.300
	GS-(TP)-1/ A 58	71.5	24 hrs	0.4	205.550	205.950	205.650	-0.300
	GS-(TP)-1/ A 59	72.5	24 hrs	0.43	209.070	209.500	209.200	-0.300
	GS-(TP)-1/ A 60	73.5	24 hrs	0.46	212.280	212.740	212.440	-0.300
	GS-(TP)-1/ A 61	74.5	24 hrs	0.48	214.470	214.950	214.650	-0.300
	GS-(TP)-1/ A 62	75.5	24 hrs	0.49	217.650	218.140	217.840	-0.300
	GS-(TP)-1/ A 63	76.5	24 hrs	0.51	219.460	219.970	219.670	-0.300
	GS-(TP)-1/ A 64	77.5	24 hrs	0.55	222.950	223.500	223.200	-0.300
	GS-(TP)-1/ A 65	78.5	24 hrs	0.58	226.040	226.620	226.320	-0.300
	GS-(TP)-1/ A 66	79.5	24 hrs	0.61	228.680	229.290	228.990	-0.300
	GS-(TP)-1/ A 67	80.5	24 hrs	0.65	230.590	231.240	230.940	-0.300

Table 21- Details of Collected water level at different gauge stations

Annexure-4- Details of Bathymetric surveys carried out:-

The Bathymetry Survey was not carried out after 14.00 km due to insufficient layer of water.

Date of Survey	Type of survey	Chainage	
		From (km)	To (km)
02.11.15	Bathymetry Survey	0.00	14.00

Table 22- Details of Bathymetry survey

Annexure-5-Bank Protection along the Bank:-

The Bank of the river Kumari is mostly covered with many Dams including Mukutmanipur Dam. RCC Dam, Check dam, RCC Bridges are also situated in this river zone. The Dam area is highly protected with concrete pitching, Boulder pitching etc. Besides, RCC Bridges and high tension lines are also protected by concrete pitching. Embankment and Boulder pitching are also noticed both side bank of the river. Ajodhya hill and forest reserve, Dalma wildlife sanctuary, Chandil Dalma wildlife Reserve, Banpukuria Deer park are located near the riverside area. So the Forest and hill area are protected the riverbank side area. Besides high embankment are also protected the river bank side.

Annexure-6 Details of Features across the Bank:-

The bank of the river Kumari is covered with villages, RCC Dam, Irrigation canals and outlets, Check Dams, RCC Bridges, and High Tension lines etc. The both side river bank are highly protected by embankment and bolder pitching due to flood, erosion etc. The villagers are also situated near the bank side of the river. Recently different kinds of industries are also located near the bank side of the river. Ajodhya hill and forest reserve, Dalma wildlife sanctuary, Chandil Dalma wildlife Reserve, Banpukuria Deer park are located near the riverside area. Raghunathpur, Balarampur, Purulia etc. places are situated in this zone of river.

Annexure-7 Detailed methodology adopted for carrying out survey. Horizontal Control and Vertical Details Control:-

- **Establishment of Horizontal Control:-**

  The Horizontal control for Topography surveys: - High precision RTK DGPS in fix mode is using UHF Radio Modem with IHO accuracy standards, with minimum 24 hours observations at some permanent platform/base with the Topographic survey Equipments: South (S86T) GNSS RTK, Total Station was used for conducting the topographic survey done on UTM Projection at Zone 45 N as directed in the contract specifications..

  The Horizontal control for Bathy surveys: - DGPS is receiving corrections from Beacons from the Base station.

- **Establishment of Vertical Control:-**

  Vertical control from C.W.C Gauge is used for the entire survey work. Its value is 134.150 meter w.r.t. MSL has been considered for calculating the vertical levels. Total 9 no. BM was established along the 80.446 km Kumari River with the reference of C.W.C Gauge which is situated near Mukutmanipur Dam Site.

Topography Survey:-

The survey was commenced on 27th October, 2015 and completed on 6th November, 2015. Then the days were autumn season and arrival of winter season. The climate become normal which reached about 20◦ C. Mostly day weather was sunny and was very favorable for the conduct of survey and the weather condition remains same for the entire duration of the survey.

The survey was undertaken as per the line plan provided and the spot level points in the cross line were spaced at 40 m interval. The plotting of the chart was done on UTM Projection at Zone 45 N as directed in the contract specifications. The spot levels along the river were obtained by using Trimble DGPS. The data was post processed using Trimble Business Center to get the precise position and MSL height values of the rover locations. The topographic survey for the entire survey stretch was conducted to collect the following data:-

- Spot levels
- Delineation of Islands
- Fixing of bridges and marks
- Assess the type of river bank
- Extending the vertical and horizontal control throughout the survey area
- Collection of local information along the river Banks

Topographic survey Equipments: South (S86T) GNSS RTK, Total Station was used for conducting the topographic survey.

South RTK (S86T) satellite navigation is a technique used in land survey and in hydrographic survey based on the use of carrier phase measurements of the GPS, GLONASS and / or Galileo signals where a single reference station provides the real-time corrections, providing up to centimeter-level accuracy. When referring to GPS in particular, the system is also commonly referred to as Carrier-Phase Enhancement, CPGPS. RTK systems use a single base station receiver and a number of mobile units. The base station re-broadcasts the phase of the carrier that it measured, and the mobile units compare their own phase measurements with the ones received from the base station. There are several ways to transmit a correction signal from base station to mobile station. The most popular way to achieve real-time, low-cost signal transmission is to use a radio modem, typically in the UHF band. This allows the units to calculate their relative position to millimeters, although their absolute position is accurate only to the same accuracy as the position of the base station.

RTK systems are available in dual-frequency and single-frequency versions. Dual-frequency systems deliver greater precision, faster and over longer baselines than single-frequency systems. Leica GS09 & GS12 GNSS RTK that used for the survey contains dual-frequency requires antenna and controller to suit any surveying task with a wide range of functionality. Leica GS09 & GS12 GNSS RTK Rover is extremely light-weight and cable free rover is comfortable to use and withstand even for rough use and topple over. It uses a single base station receiver and a number of mobile units. The base station re-broadcasts the phase of the carrier that it measured, and the mobile units compare their own phase measurements with the ones received from the base station. So, that centimeter level accuracy can be achieved from latitude, longitude and altitude. RTK technique in terms of general navigation, it is perfectly suited to roles like surveying. In this case, the base station is located at a known surveyed location, often a benchmark, and the mobile units can then produce a highly accurate map by taking fixes relative to that point. RTK has also found uses in auto drive/autopilot systems, precision farming and similar roles.

Figure 32- Topography Survey Instruments

- **Bathymetry Survey:-**

The bathymetry survey was carried out using Bathy 500 portable shallow water Echosounder supported by DGPS Beacon Receiver and HYPACK Data collection and processing software. The survey equipment was installed as per the standard procedure the survey vessel equipped with safety gears.

Bathy- 500MF Echosounder: The Bathy- 500MF echosounder is an electronic hydrographic survey instrument used for measuring depths with precision chart recordings and digital data output manufactured by Syqwest Incorporated, USA. The Bathy-500 echo sounding systems are based on the principle that when a sound signal is sent into the water it will be reflected back when it strikes an object. The Bathy-500 is technologically sophisticated, utilizing modern, micro processor based electronics and a thermal chart recorder mechanism. Digital processing enables the instrument to offer fully automatic digitizing capabilities. When interfaced to a NMEA 0183 compatible position sensor, it provides user with a complete, integrated hydrographic survey environment. The instrument front panel consists of a high contrast, backlit four line LCD displays and a fully sealed input keypad. The front panel encompassing system data, status and setup parameters with RS232/RS422 output format. All operating functions are set via the front panel interface. Setup selections are stored within internal, non-volatile memory for instant availability upon power-up. The instrument decodes and processes the NMEA 0183 formatted sentence GGA or GLL from GPS/DGPS using variable Baud rates for communication.

Figure 33- Bathymetry Survey Instruments

Annexure-8-Photographs of Equipment:-

Following equipment was employed for the bathymetric and topographic survey:-

Equipment	Make	Version	Qty Employed
Echo sounder	Bathy MF 500	……	1
Current Meter	AEM 213-D	……	1
Tide Gauge	Manual (Pole type)	-	4
RTK	South S86T		3
GPS Sets	Trimble –Becon Rover SPS 361		1
Software	HYPACK data acquisition	Version 14	1
Software	AUTOCAD	2013	1
Software	Microsoft Office	2013	1

- **Survey vessel :-**

Figure 34- Survey Vessel

- **Positioning System:-**

- 1 no Trimble DGPS system (SPS361)

Figure 35- DGPS Survey Instrument

- **Navigation & Data Logging System:-**

- To provide on-line route guidance, log navigation data, provide QC of navigation data, etc. The system comprises the following equipment:
- 1 no. DELL Laptop
- 1 no. Hypack version 2014 Navigation & Data Logging Software
- 1 no. Positioning & sensor interfaces
- Sufficient Paper Rolls

- **Single Beam Echo Sounder System:-**

  - 1 no. Bathy 500MF multi frequency Echo sounder
  - 1 no. transducer 210 kHz + mounting bracket & base plate

Figure 36- Echo Sounder Instrument

- **Current Meter:-**

  - 1 no. current meter (AEM 213-D) was used during water velocity
  - observation

Figure 37- Current Meter Reading & Water Sampler

- **Calibration:-**

  All the equipments of Machinery details are attached in **Annexure** portion

Annexure-9-Bench Mark Forms:-

BM Name	Northing (m)	Easting (m)	B.M Height above M.S.L (m)	Latitude (N)	Longitude (E)	B.M Height above S.D (m)
BM-1	2540049.439	478382.309	138.598	22°58'6.639"	86°47'20.785"	15.361

Pillar Established by: - B.S Geotech Pvt. Ltd. Surveyor – Mr. Bimal Das;
Date of Establishment: 29.10.15

Station Description :-

Benchmark is located near Mukutmanipur Dam Site.

The BM is denoted by a "." mark engraved on a plate. The plate is fixed on a 5cm diameter GI pipe. The GI pipe is cemented with construction pillar of 30cmX30cmX150cm.The pillar extends 60.cms above ground level. Inscription "IWAI", and BM-1 No. can be seen on the face of the pillar.

Life of Station : 15Yrs	Datum: - WGS 84	**ZONE :** 45N

Figure 38- BM Form & Google image view of BM-1

BM Name	Northing (m)	Easting (m)	B.M Height above M.S.L (m)	Latitude (N)	Longitude (E)	B.M Height above S.D (m)
BM-2	2537781.59	467831.76	141.179	22°56'52.275"	86°41'10.422"	17.942

Pillar Established by: - B.S Geotech Pvt. Ltd. Surveyor – Mr. Bimal Das;
Date of Establishment: 29.10.15

Station Description :-

Benchmark is located near Durgadi village.

The BM is denoted by a "." mark engraved on a plate. The plate is fixed on a 5cm diameter GI pipe. The GI pipe is cemented with construction pillar of 30cm X 30cm X 150cm.The pillar extends 60.cms above ground level. Inscription "IWAI", and BM-2 No. can be seen on the face of the pillar.

Life of Station : 15Yrs	Datum: - WGS 84	**ZONE :** 45N

Figure 39- BM Form & Google image view of BM-2

BM Name	Northing (m)	Easting (m)	B.M Height above M.S.L (m)	Latitude (N)	Longitude (E)	B.M Height above S.D (m)
BM-3	2543681.441	463143.408	143.76	23°0'3.788"	86°38'25.287"	13.600

Pillar Established by: - B.S Geotech Pvt. Ltd. Surveyor – Mr. Bimal Das;
Date of Establishment: 30.10.15

Station Description :-

Benchmark is located near close to the State highway No-5.

The BM is denoted by a "." mark engraved on a plate. The plate is fixed on a 5cm diameter GI pipe. The GI pipe is cemented with construction pillar of 30cmX30cmX150cm.The pillar extends 60.cms above ground level. Inscription "IWAI", and BM-3 No. can be seen on the face of the pillar.

Life of Station : 15Yrs	Datum: - WGS 84	**ZONE :** 45N

Figure 40- BM Form & Google image view of BM-3

BM Name	Northing (m)	Easting (m)	B.M Height above M.S.L (m)	Latitude (N)	Longitude (E)	B.M Height above S.D (m)
BM-4	2548809.868	455046.683	157.477	23°2'49.844"	86°33'40.328"	9.757

Pillar Established by: - B.S Geotech Pvt. Ltd. Surveyor – Mr. Bimal Das;
Date of Establishment: 30.10.15

Station Description :-

Benchmark is located near the SH-4.

The BM is denoted by a "." mark engraved on a plate. The plate is fixed on a 5cm diameter GI pipe. The GI pipe is cemented with construction pillar of 30cmX30cmX150cm.The pillar extends 60.cms above ground level. Inscription "IWAI", and BM-4 No. can be seen on the face of the pillar.

Life of Station : 15Yrs	Datum: - WGS 84	**ZONE :** 45N

Figure 41-BM Form & Google image view of BM-4

BM Name	Northing (m)	Easting (m)	B.M Height above M.S.L (m)	Latitude (N)	Longitude (E)	B.M Height above S.D (m)
BM-5	2549405.288	451116.941	164.651	23°3'8.807"	86°31'22.172"	10.111

Pillar Established by: - B.S Geotech Pvt. Ltd. Surveyor – Mr. Bimal Das;
Date of Establishment – 02.11.15

Station Description :-

Benchmark is located near Singgugara village.

The BM is denoted by a "." mark engraved on a plate. The plate is fixed on a 5cm diameter GI pipe. The GI pipe is cemented with construction pillar of 30cmX30cmX150cm.The pillar extends 60.cms above ground level. Inscription "IWAI", and BM-5 No. can be seen on the face of the pillar.

Life of Station : 15Yrs	Datum: - WGS 84	**ZONE :** 45N

Figure 42-BM Form & Google image view of BM-5

BM Name	Northing (m)	Easting (m)	B.M Height above M.S.L (m)	Latitude (N)	Longitude (E)	B.M Height above S.D (m)
BM-6	2548699.049	444655.493	175.139	23°2'45.11"	86°27'35.205"	10.219

Pillar Established by: - B.S Geotech Pvt. Ltd. Surveyor – Mr. Bimal Das;
Date of Establishment – 02.11.15

Station Description :-

Benchmark is located near Biskudra village.

The BM is denoted by a "." mark engraved on a plate. The plate is fixed on a 5cm diameter GI pipe. The GI pipe is cemented with construction pillar of 30cmX30cmX150cm.The pillar extends 60.cms above ground level. Inscription "IWAI", and BM-6 No. can be seen on the face of the pillar.

Life of Station : 15Yrs	Datum: - WGS 84	**ZONE :** 45N

Figure 43-BM Form & Google image view of BM-6

BM Name	Northing (m)	Easting (m)	B.M Height above M.S.L (m)	Latitude (N)	Longitude (E)	B.M Height above S.D (m)
BM-7	2551809.705	434720.612	198.213	23°4'24.964"	86°21'45.634"	9.603

Pillar Established by: - B.S Geotech Pvt. Ltd. Surveyor – Mr. Bimal Das;
Date of Establishment – 03.11.15

Station Description :-

Benchmark is located near Rangagara village.

The BM is denoted by a "." mark engraved on a plate. The plate is fixed on a 5cm diameter GI pipe. The GI pipe is cemented with construction pillar of 30cmX30cmX150cm.The pillar extends 60.cms above ground level. Inscription "IWAI", and BM-7 No. can be seen on the face of the pillar.

Life of Station : 15Yrs	Datum: - WGS 84	**ZONE :** 45N

Figure 44-BM Form & Google image view of BM-7

BM Name	Northing (m)	Easting (m)	B.M Height above M.S.L (m)	Latitude (N)	Longitude (E)	B.M Height above S.D (m)
BM-8	2553323.68	430776.63	219.741	23°5'13.619"	86°19'26.777"	16.021

Pillar Established by: - B.S Geotech Pvt. Ltd. Surveyor – Mr. Bimal Das;
Date of Establishment: 04.11.15

Station Description :-

Benchmark is located near Tumrashou village.

The BM is denoted by a "." mark engraved on a plate. The plate is fixed on a 5cm diameter GI pipe. The GI pipe is cemented with construction pillar of 30cm X 30cm X 150 cm. The pillar extends 60.cms above ground level. Inscription "IWAI", and BM-8 No. can be seen on the face of the pillar.

Life of Station : 15Yrs	Datum: - WGS 84	**ZONE :** 45N

Figure 45- BM Form & Google image view of BM-8

BM Name	Northing	Easting	B.M Height above M.S.L (m)	Latitude (N)	Longitude (E)	B.M Height above S.D (m)
BM-9	2555822.712	424669.877	241.269	23°6'33.921"	86°15'51.693"	10.329

Pillar Established by : - B.S Geotech Pvt. Ltd. Surveyor – Surveyor – Mr. Bimal Das;
Date of Establishment: 04.11.15

Station Description :-

Benchmark is located close to the RCC Dam area, near Amruhasa village.

The BM is denoted by a "." mark engraved on a plate. The plate is fixed on a 5cm diameter GI pipe. The GI pipe is cemented with construction pillar of 30cmX30cmX150cm.The pillar extends 60.cms above ground level. Inscription "IWAI", and BM-9 No. can be seen on the face of the pillar.

Life of Station : 15Yrs	Datum: - WGS 84	**ZONE :** 45N

Figure 46-BM Form & Google image view of BM-9

Annexure-10- Levelling Calculation and Levelling Diagram:-

Levelling from BM-2 to GS-1

BS	IS	FS	RISE (+)	FALL (-)	RL	REMARKS
0.455					141.179	BM-2
0.425		2.991		2.536	138.643	
0.350		3.115		2.690	135.953	
0.545		3.065		2.715	133.238	
0.388		2.865		2.320	130.918	
0.680		2.980		2.592	128.326	
0.794		3.150		2.470	125.856	
		3.250		2.456	123.400	GS-1

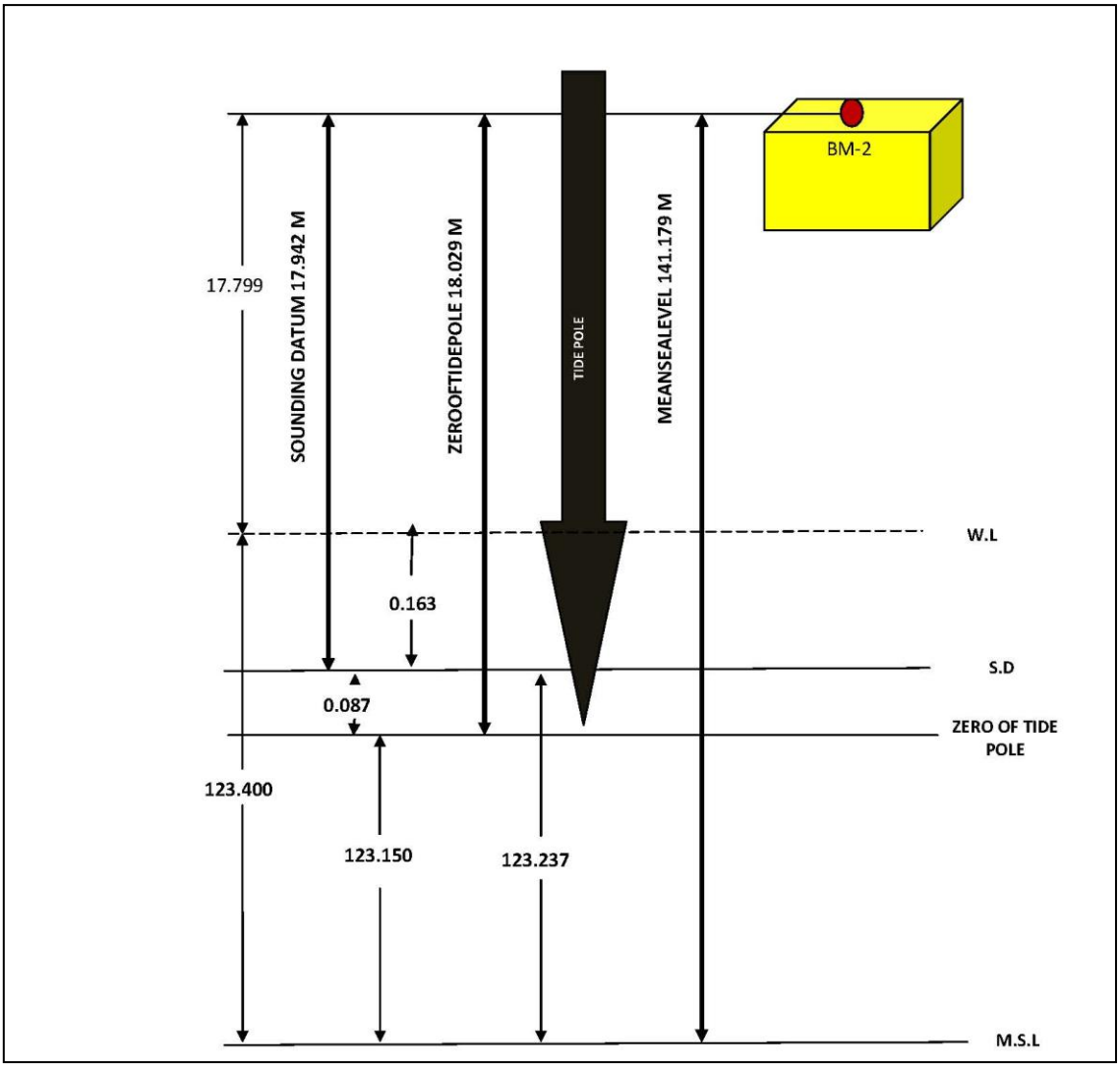


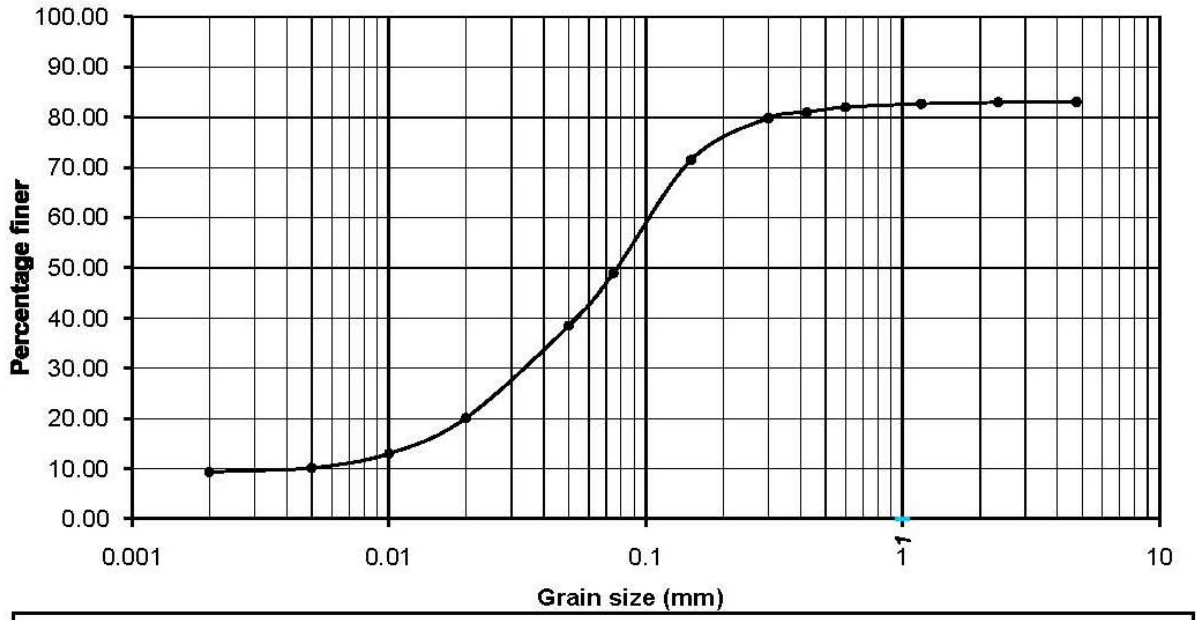
Table 23-Leveling Calculation of Kumari River

Annexure-11 Soil Sample Report:-

RESULTS OF TEST OF SOIL SAMPLES											
SITE – KUMARI RIVER											
PHYSICAL ANALYSIS OF SOIL											
Sl.No.	DATE	LOCATION	GRAVEL (%)	SAND (%)	SILT+CLAY (%)	SPECIFIC GRAVITY	pH VALUE	SILT (%)	CLAY (%)	Cu	Cc
1	5/11/2015	BM-2	16.98	34.00	49.02	2.62	7.30	39.65	9.37	18.52	1.94
2	5/11/2015	BM-3	13.42	36.50	50.08	2.64	7.10	40.60	9.48	19.60	2.36
3	5/11/2015	BM-4	14.20	65.20	20.60	2.66	7.20	18.80	1.80	12.48	3.11
4	5/11/2015	BM-5	21.40	34.50	44.10	2.63	7.30	37.60	6.50	12.17	1.04
5	6/11/2015	BM-6	14.50	65.00	20.50	2.66	7.20	18.50	2.00	12.50	3.12
6	7/11/2015	BM-7	18.00	58.40	23.60	2.66	7.10	21.20	2.40	13.88	3.20
7	7/11/2015	BM-8	4.60	72.50	22.90	2.65	7.00	18.60	4.30	11.25	3.47
8	7/11/2015	BM-9	12.89	36.00	51.11	2.64	7.00	41.50	9.61	14.29	1.20

Note: - The positions of the soil samples have been shown at Para no- 2.20 (a), page no-29

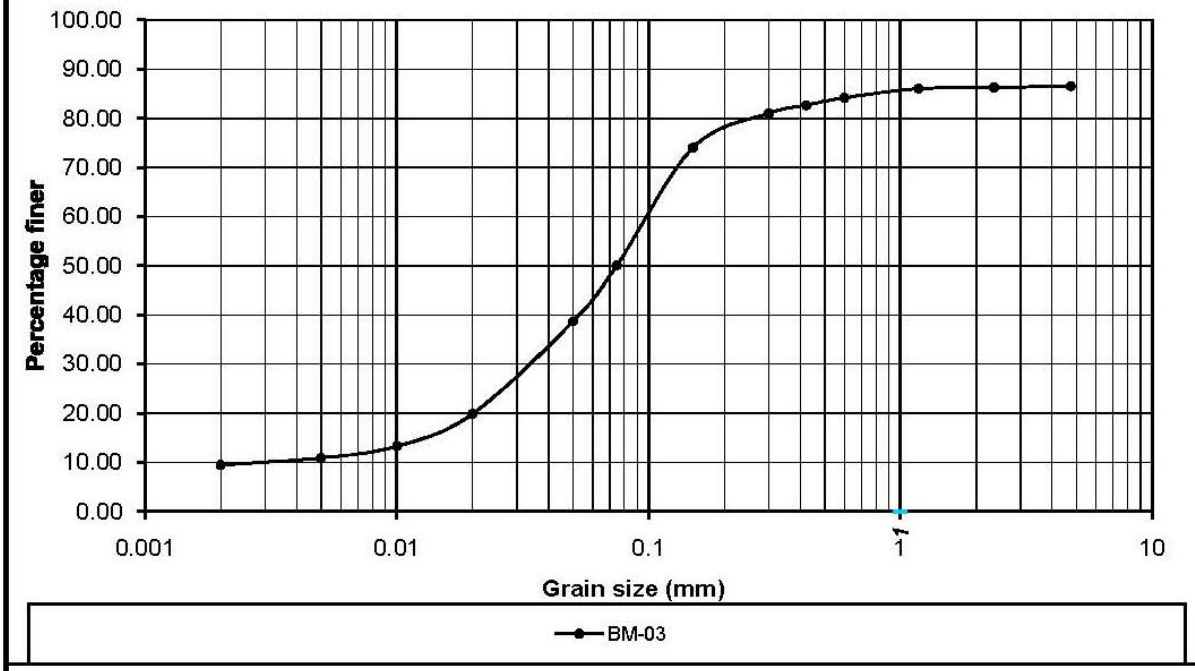
GRAIN SIZE DISTRIBUTION CURVES



Grain size (mm)	*<0.002*	*0.002-0.075*	*0.075-4.75*	*>4.75*
Sample No.	**Clay (%)**	**Silt (%)**	**Sand (%)**	**Gravel (%)**
BM2	9.37	39.65	34.00	16.98

*Silt & Clay

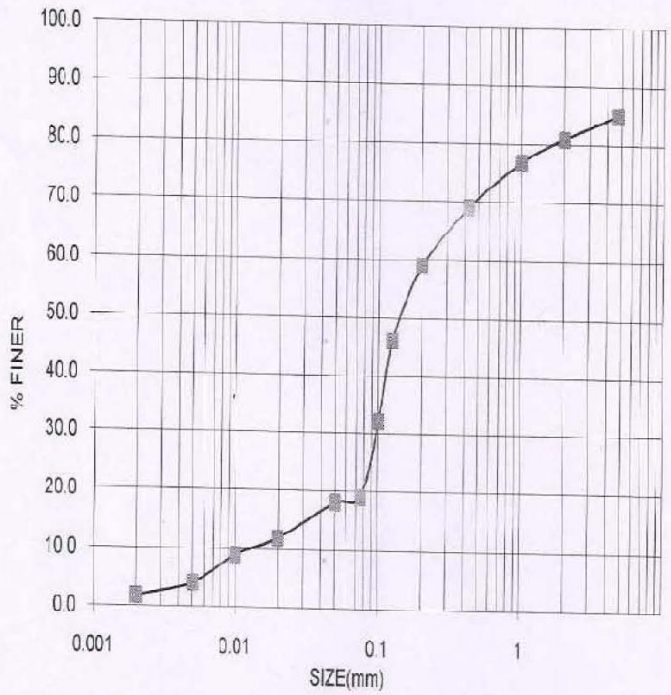
GRAIN SIZE DISTRIBUTION CURVES



Grain size (mm)	*<0.002*	*0.002-0.075*	*0.075-4.75*	*>4.75*
Sample No.	**Clay (%)**	**Silt (%)**	**Sand (%)**	**Gravel (%)**
BM-03	9.48	40.60	36.50	13.42

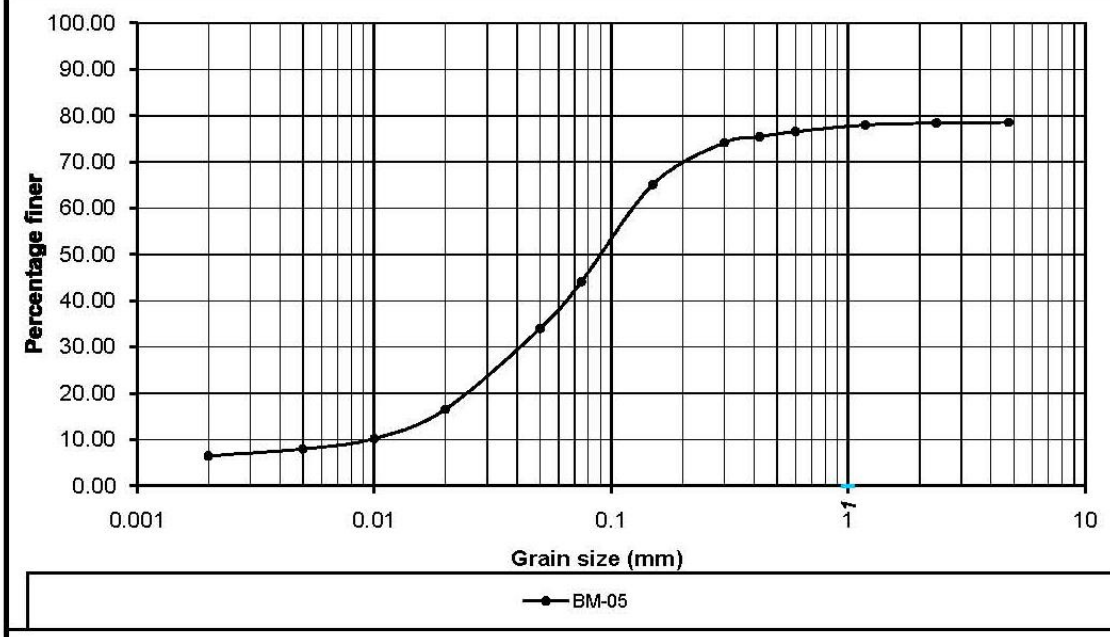
*Silt & Clay

GRAIN SIZE DISTRIBUTION CURVES



Grain size (mm)	<0.002	0.002-0.075	0.075-4.75	>4.75
Sample No.	Clay (%)	Silt (%)	Sand (%)	Gravel (%)
BM-4	1.8	18.8	65.20	14.20

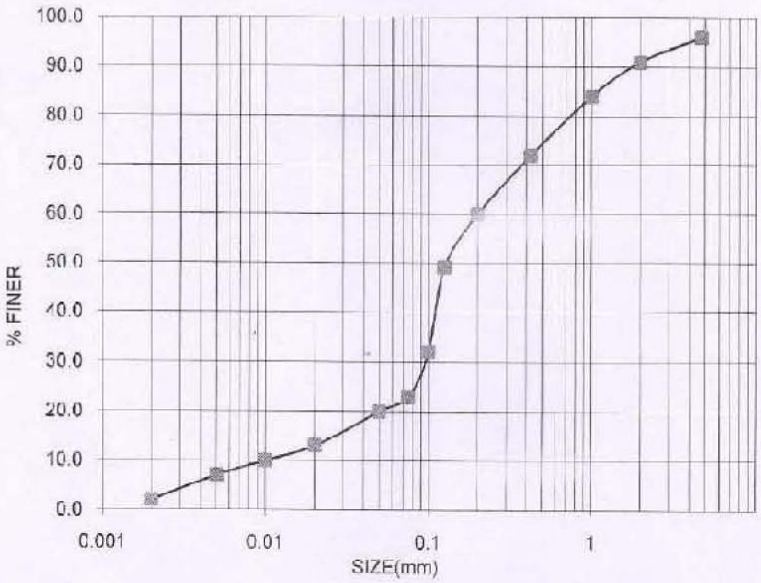
GRAIN SIZE DISTRIBUTION CURVES



Grain size (mm)	*<0.002*	*0.002-0.075*	*0.075-4.75*	*>4.75*
Sample No.	**Clay (%)**	**Silt (%)**	**Sand (%)**	**Gravel (%)**
BM-05	6.50	37.60	34.50	21.40

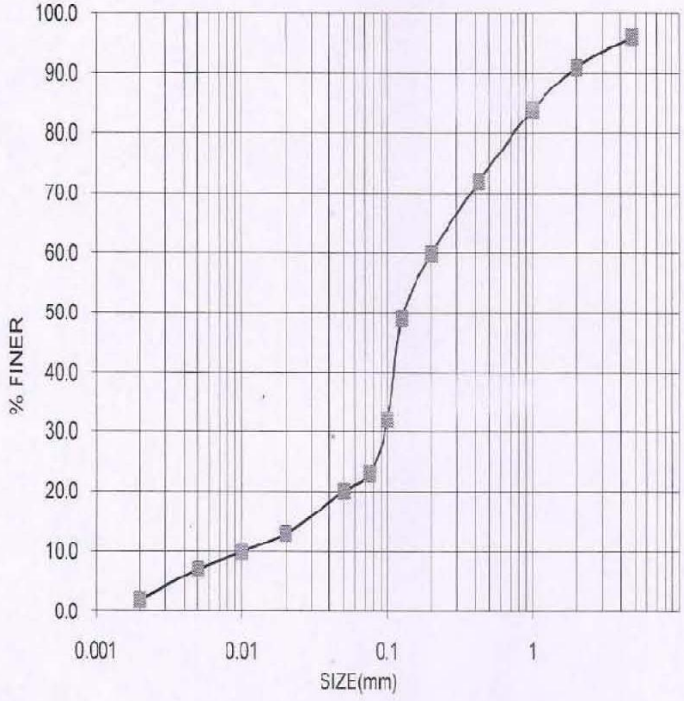
*Silt & Clay

GRAIN SIZE DISTRIBUTION CURVES

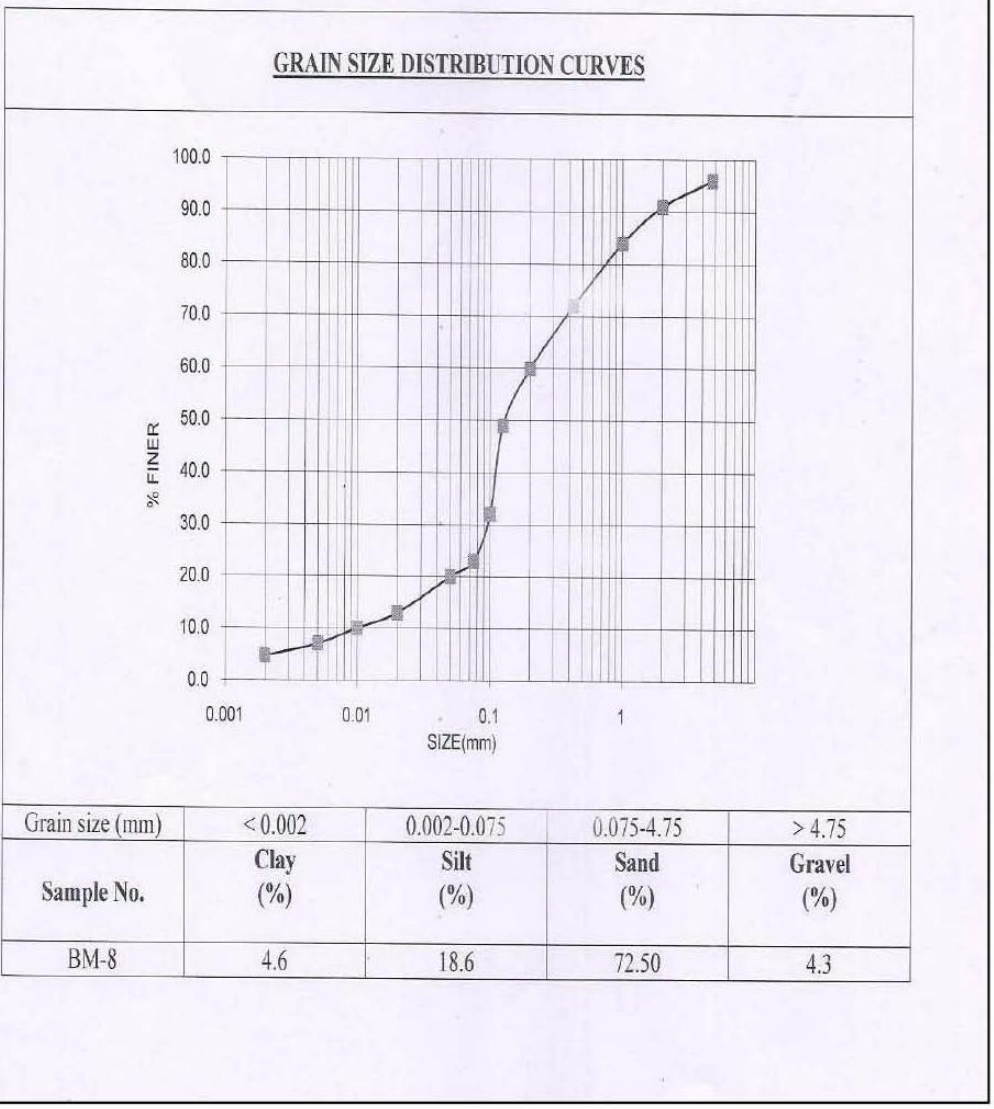


Grain size (mm)	< 0.002	0.002-0.075	0.075-4.75	> 4.75
Sample No.	**Clay (%)**	**Silt (%)**	**Sand (%)**	**Gravel (%)**
BM-6	2.0	18.5	65.00	14.5

GRAIN SIZE DISTRIBUTION CURVES

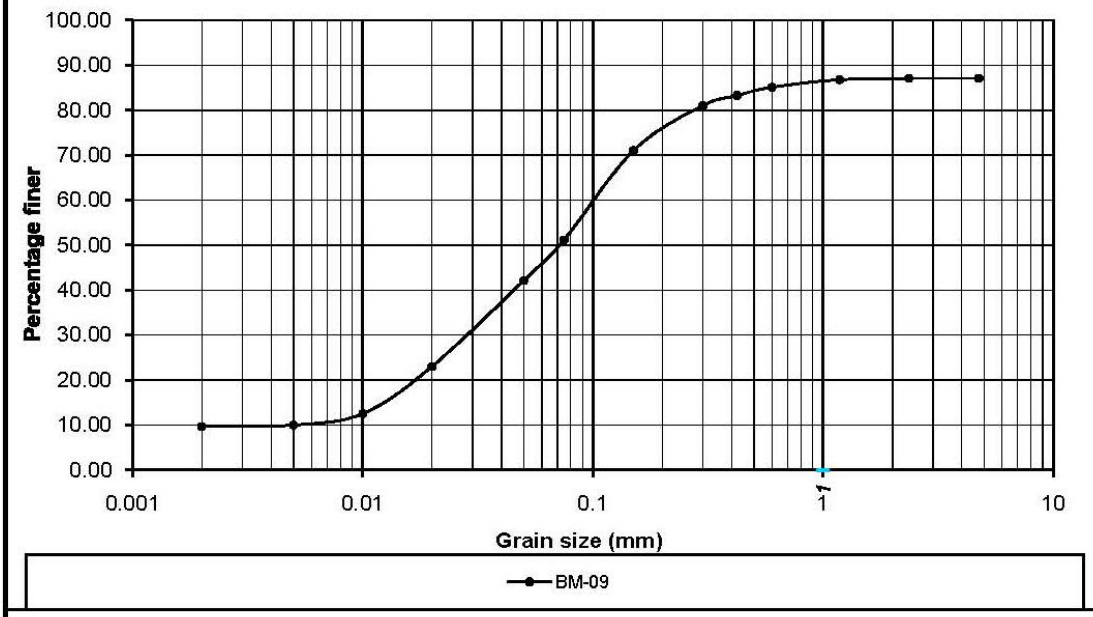


Grain size (mm)	< 0.002	0.002-0.075	0.075-4.75	> 4.75
Sample No.	Clay (%)	Silt (%)	Sand (%)	Gravel (%)
BM-7	2.4	21.2	58.40	18.0



Grain size (mm)	< 0.002	0.002-0.075	0.075-4.75	> 4.75
Sample No.	Clay (%)	Silt (%)	Sand (%)	Gravel (%)
BM-8	4.6	18.6	72.50	4.3

GRAIN SIZE DISTRIBUTION CURVES



Grain size (mm)	*<0.002*	*0.002-0.075*	*0.075-4.75*	*>4.75*
Sample No.	**Clay (%)**	**Silt (%)**	**Sand (%)**	**Gravel (%)**
BM-09	9.61	41.50	36.00	12.89

*Silt & Clay

Annexure-12 Water Sample Report:

RESULTS OF EXAMINATION OF SAMPLES OF WATER

SITE- RIVER KUMARI

PARAMETER – Ph Value at 25°C

SL.NO	DATE	DEPTH	LOCATION	PARAMETER	WATER SAMPLE RESULTS	PERMISSIBLE LIMITS IS:456-2000
1	04-11-2015	0.3D	NEAR BM -01		7.6	
2	04-11-2015	0.3D	NEAR BM-01		7.5	
3	04-11-2015	0.5D	NEAR BM-01		7.6	
4	04-11-2015	D	NEAR BM-01		7.6	
5	04-11-2015	0.5D	NEAR BM-02		6.9	
6	04-11-2015	0.5D	NEAR BM-02		6.4	
7	04-11-2015	D	NEAR BM-02		6.4	
8	04-11-2015	0.3D	NEAR BM-02		6.4	
9	05-11-2015	0.3D	NEAR BM-03		7.0	
10	05-11-2015	0.5D	NEAR BM-03		7.0	
11	05-11-2015	0.3D	NEAR BM-04		7.4	
12	05-11-2015	0.3D	NEAR BM-04		7.4	
13	05-11-2015	D	NEAR BM-04	pH at 25°C	7.4	6.5-8.5
14	05-11-2015	0.5D	NEAR BM-04		7.4	
15	06-11-2015	0.5D	NEAR BM-05		7.1	
16	06-11-2015	0.3D	NEAR BM-05		7.1	
17	06-11-2015	0.3D	NEAR BM-06		7.0	
18	06-11-2015	D	NEAR BM-06		7.0	
19	06-11-2015	0.5D	NEAR BM-06		7.1	
20	07-11-2015	0.3D	NEAR BM-07		7.2	
21	07-11-2015	0.5D	NEAR BM-07		7.1	
22	07-11-2015	D	NEAR BM-07		7.2	
23	07-11-2015	0.3D	NEAR BM-08		7.0	
24	07-11-2015	0.5D	NEAR BM-08		7.1	
25	08-11-2015	D	NEAR BM-09		6.9	
26	08-11-2015	0.5D	NEAR BM-09		6.9	
27	08-11-2015	0.3D	NEAR BM-09		6.9	

Note: - The positions of the Water samples have been shown at Para no-2.20 (b), page no-29

PARAMETER – Sediment Concentration(mg/l)						
SL.NO	DATE	DEPTH	LOCATION	PARAMETER	WATER SAMPLE RESULTS	PERMISSIBLE LIMITS IS:456-2000
1	04-11-2015	0.3D	NEAR BM -01		30	
2	04-11-2015	0.3D	NEAR BM-01		30	
3	04-11-2015	0.5D	NEAR BM-01		30	
4	04-11-2015	D	NEAR BM-01		30	
5	04-11-2015	0.3D	NEAR BM-02		20	
6	04-11-2015	0.5D	NEAR BM-02		20	
7	04-11-2015	0.5D	NEAR BM-02		20	
8	04-11-2015	D	NEAR BM-02		20	
9	05-11-2015	0.3D	NEAR BM-03		20	
10	05-11-2015	0.5D	NEAR BM-03		20	
11	05-11-2015	0.3D	NEAR BM-04		20	
12	05-11-2015	0.3D	NEAR BM-04		20	
13	05-11-2015	0.5D	NEAR BM-04		20	
14	05-11-2015	D	NEAR BM-04		40	
15	06-11-2015	0.3D	NEAR BM-05		20	
16	06-11-2015	0.5D	NEAR BM-05		30	
17	06-11-2015	0.3D	NEAR BM-06		30	
18	06-11-2015	0.5D	NEAR BM-06		30	
19	06-11-2015	D	NEAR BM-06		30	
20	07-11-2015	0.3D	NEAR BM-07	Sediment Concentration (mg/l)	30	2000 (mg/l)
21	07-11-2015	0.5D	NEAR BM-07		20	
22	07-11-2015	D	NEAR BM-07		20	
23	07-11-2015	0.3D	NEAR BM-08		20	
24	07-11-2015	0.5D	NEAR BM-08		20	
25	08-11-2015	D	NEAR BM-09		40	
26	08-11-2015	0.3D	NEAR BM-09		40	
27	08-11-2015	0.5D	NEAR BM-09		40	

PARAMETER –Sulphates as SO_4 (mg/l)						
SL. NO	DATE	DEPTH	LOCATION	PARAMETER	WATER SAMPLE RESULTS	PERMISSIBLE LIMITS IS:456-2000
1	04-11-2015	0.3D	NEAR BM -01		25	
2	04-11-2015	0.3D	NEAR BM-01		25	
3	04-11-2015	0.5D	NEAR BM-01		26	
4	04-11-2015	D	NEAR BM-01		25	
5	04-11-2015	0.3D	NEAR BM-02		22	
6	04-11-2015	0.5D	NEAR BM-02		22	
7	04-11-2015	0.5D	NEAR BM-02		22	
8	04-11-2015	D	NEAR BM-02		21	
9	05-11-2015	0.3D	NEAR BM-03		28	
10	05-11-2015	0.5D	NEAR BM-03		27	
11	05-11-2015	0.3D	NEAR BM-04		25	
12	05-11-2015	0.3D	NEAR BM-04		24	
13	05-11-2015	0.5D	NEAR BM-04		24	
14	05-11-2015	D	NEAR BM-04		25	
15	06-11-2015	0.3D	NEAR BM-05		24	
16	06-11-2015	0.5D	NEAR BM-05		24	
17	06-11-2015	0.3D	NEAR BM-06		30	
18	06-11-2015	0.5D	NEAR BM-06		27	
19	06-11-2015	D	NEAR BM-06		29	
20	07-11-2015	0.3D	NEAR BM-07	Sulphates as SO_4 (mg/l)	22	400 (mg/l)
21	07-11-2015	0.5D	NEAR BM-07		21	
22	07-11-2015	D	NEAR BM-07		20	
23	07-11-2015	0.3D	NEAR BM-08		24	
24	07-11-2015	0.5D	NEAR BM-08		24	
25	08-11-2015	0.3D	NEAR BM-09		28	
26	08-11-2015	0.5D	NEAR BM-09		28	
27	08-11-2015	D	NEAR BM-09		28	

PARAMETER – Chloride as Cl (mg/l)						
SL.NO	DATE	DEPTH	LOCATION	PARAMETER	WATER SAMPLE RESULTS	PERMISSIBLE LIMITS IS:456-2000
1	04-11-2015	0.3D	NEAR BM -01		8	
2	04-11-2015	0.3D	NEAR BM-01		8	
3	04-11-2015	0.5D	NEAR BM-01		9	
4	04-11-2015	D	NEAR BM-01		8	
5	04-11-2015	0.5D	NEAR BM-02		5	
6	04-11-2015	0.5D	NEAR BM-02		5	
7	04-11-2015	D	NEAR BM-02		5	
8	04-11-2015	0.3D	NEAR BM-02		5	
9	05-11-2015	0.3D	NEAR BM-03		8	
10	05-11-2015	0.5D	NEAR BM-03		9	
11	05-11-2015	0.3D	NEAR BM-04		13	
12	05-11-2015	0.3D	NEAR BM-04		13	
13	05-11-2015	D	NEAR BM-04		13	
14	05-11-2015	0.5D	NEAR BM-04		13	
15	06-11-2015	0.5D	NEAR BM-05		9	
16	06-11-2015	0.3D	NEAR BM-05		9	
17	06-11-2015	0.3D	NEAR BM-06		19	
18	06-11-2015	0.5D	NEAR BM-06		19	
19	06-11-2015	D	NEAR BM-06		18	
20	07-11-2015	0.3D	NEAR BM-07		8	
21	07-11-2015	D	NEAR BM-07		8	
22	07-11-2015	0.5D	NEAR BM-07	Chloride as Cl (mg/l)	8	**2000 mg/l for concrete not containing embedded steel and 500 mg/l for reinforced concrete work.**
23	07-11-2015	0.3D	NEAR BM-08		10	
24	07-11-2015	0.5D	NEAR BM-08		8	
25	08-11-2015	D	NEAR BM-09		17	
26	08-11-2015	0.5D	NEAR BM-09		18	
27	08-11-2015	0.3D	NEAR BM-09		17	

Annexure-13 Calibration Certificate:-

PAN INDIA CONSULTANTS PVT. LTD.

SALES DEPARTMENT

CORPORATE ADDRESS : 105, PHASE IV, UDYOG VIHAR, GURGAON-122015, HARYANA, INDIA
PHONES : +91 124 4300950, 4013954, FAX : +91 124 2346646, 2342880, CIN - U74899DL1985PTC021177
e-mail : paie@panindiagroup.com, paie@vsnl.com, www.panindiagroup.com

CALIBRATION CERTIFICATE

CUSTOMER NAME	:	PRECISION SURVEY CONSULTANCY
ADDRESS	:	Po: Salap (Jatin Xerox Center) Dist: Howrah Pin: 711409
INSTRUMENT	:	DGPS EQUIPMENTS
SERIES	:	SPS 855
SERIAL NUMBER	:	5431R03128, 5340K46115
CALIBRATION DATE	:	15/12/2014
VALIDITY	:	14/12/2015

THIS IS TO CERTIFY THAT THE ABOVE INSTRUMENT WAS CHECKED AND CALIBRATED IN ACCORDANCE WITH THE APPLICABLE FACTORY PROCEDURES.

For PAN INDIA CONSULTANTS PVT. LTD.

AUTHORISED SIGNATORY

REGD. OFFICE : OFFICE NO. 1, D-4, COMMERCIAL AREA, VASANT KUNJ, NEW DELHI-110070, INDIA
PHONES : +91 11 26137657, 26137659, 26899952, 26899962, 26132214 FAX : +91 11 26138633
e-mail : nmspl@panindiagroup.com URL : www.panindiagroup.com

Table 24- Calibration Certificate of DGPS

PAN INDIA CONSULTANTS PVT. LTD.

SALES DEPARTMENT

CORPORATE ADDRESS : 105, PHASE IV, UDYOG VIHAR, GURGAON-122015, HARYANA, INDIA
PHONES : +91 124 4300950, 4013954, FAX : +91 124 2346646, 2342880, CIN - U74899DL1985PTC021177
e-mail : paie@panindiagroup.com, paie@vsnl.com, www.panindiagroup.com

CALIBRATION CERTIFICATE

CUSTOMER NAME	:	PRECISION SURVEY CONSUTLANCY
ADDRESS	:	P.O. –SALAP (Jatin Xerox Center) Dist. –Howrah Pin: 711 409
INSTRUMENT	:	ECHO –SOUNDER
SERIES	:	500MF
SERIAL NUMBER	:	B5MF0560
CALIBRATION DATE	:	28/04/2015
VALIDITY	:	27/04/2016

THIS IS TO CERTIFY THAT THE ABOVE INSTRUMENT WAS CHECKED AND CALIBRATED IN ACCORDANCE WITH THE APPLICABLE FACTORY PROCEDURES.

For **PAN INDIA CONSULTANTS PVT. LTD.**

AUTHORISED SIGNATORY

REGD. OFFICE : OFFICE NO. 1, D-4, COMMERCIAL AREA, VASANT KUNJ, NEW DELHI-110070, INDIA
PHONES : +91 11 26137657, 26137659, 26899952, 26899962, 26132214 FAX : +91 11 26138633
e-mail : nmspl@panindiagroup.com URL : www.panindiagroup.com

Table 25- Calibration Certificate of Eco Sounder

SOUTH

SOUTH PRECISION INSTRUMENT PVT. LTD.
FA - 229 B, Ground Floor, Mansarover Garden, New Delhi-110015
Ph. : 011- 45544114, 65568870 Fax: 011- 45530854 Mob.: 9999999255

Calibration Certificate

SOUTH Precision Instrument Pvt. Ltd. Calibration laboratory certifies that the instrument has been inspected, tested and calibrated in accordance with the documented procedures using measuring and test equipment, which are traceable to national standards and of the international accepted standard.

We hereby certify that the instrument mentioned below meet the specification and result of the traceability is carried out in accordance to our company's standard.

INSTRUMENT TYPE	:	GPS RTK
MODEL	:	S-86T
MAKE	:	SOUTH
INSTRUMENT SR. NO.	:	S86951117129438GEM W1286752342GM
CALIBRATION DATE	:	10/02/2015
VALID UPTO	:	09/02/2016
ISSUED TO	:	PRECISION SURVEY CONSULTANCY

For SOUTH PRECISION INSTRUMENT PVT. LTD.

For SOUTH PRECISION INSTRUMENT PVT. LTD.

Authorised Signatory

Authorised Signatory

Table 26- Calibration Certificate of GPS RTK

Annexure 14- Site Picture:-

Figure 47- Gauge at Mukutmanipur Dam Site (Chainage-0.000 km)

Figure 48-Reservoir Gate (Chainage-0.000 km)

Figure 49-Damage Dam (Chainage- 57.949 km)

Figure 50- Check Dam (Chainage-74.338 km)

Figure 51- Gravels near the river bank side

Annexure 15 Survey Charts:

Sl. No.	Chart No.	Chainage (from ..... km to .... km)	Location (from .... to .....)	Scale	Size of the Chart
1	1	0.00 km to 4.00 km	Mukutmanipur Dam to Kamarkali Village	1:5000	A-1
2	2	4.00 km to 8.00 km	Kamarkali to Baddi village	1:5000	A-1
3	3	8.00 km to 11.00 km	Baddi village to Durgadi Village	1:5000	A-1
4	4	11.00 km to 13.952 km	Durgadi Village to Tontla village	1:5000	A-1
5	5	13.952 km to 18.823 km	Tontla village to Dhanda village	1:5000	A-1
6	6	18.823 km to 20.00 km	Dhanda village to Doldenrya village	1:2000	A-1
7	7	20.00 km to 21.333 km	Doldenrya village to Chalka village	1:2000	A-1
8	8	21.333 km to 23.283 km	Chalka village to Loadi village	1:2000	A-1
9	9	23.283 km to 25.000 km	Loadi village to Ichadi village	1:2000	A-1
10	10	25.000 km to 26.617 km	Ichadi village to Tetla village	1:2000	A-1
11	11	26.617 km to 28.263 km	Tetla village to Ukamgar village	1:2000	A-1
12	12	28.263 km to 30.136 km	Ukamgar village to Rangatanr village	1:2000	A-1
13	13	30.136 km to 32.00 km	Rangatanr village to Puran Dulaldi village	1:2000	A-1
14	14	32.000 km to 33.565 km	Puran Dulaldi village to Daha village	1:2000	A-1
15	15	33.565 km to 35.377 km	Daha village to Dabra village	1:2000	A-1
16	16	35.377 km to 37.607 km	Dabra village to Janra village	1:2000	A-1
17	17	37.607 km to 39.550 km	Janra village to Chaukan village	1:2000	A-1
18	18	39.550 km to 41.803 km	Chaukan village to Janra village	1:2000	A-1

Sl. No.	Chart No.	Chainage (from ..... km to .... km)	Location (from .... to .....)	Scale	Size of the Chart
19	19	41.803 km to 44.000 km	Janra village to Ajodhya village	1:2000	A-1
20	20	44.000 km to 45.892 km	Ajodhya village to Fatepur village	1:2000	A-1
21	21	45.892 km to 48.000 km	Fatepur village to Simuduri village	1:2000	A-1
22	22	48.000 km to 50.000 km	Simuduri village to Biskudra village	1:2000	A-1
23	23	50.000 km to 51.690 km	Biskudra village to Agajhor village	1:2000	A-1
24	24	51.690 km to 53.00 km	Agajhor village to Tetto village	1:2000	A-1
25	25	53.00 km to 54.569 km	Tetto village to Hesiadih village	1:2000	A-1
26	26	54.569 km to 56.177 km	Hesiadih village to Dumurdih village	1:2000	A-1
27	27	56.177 km to 58.298 km	Dumurdih village to Bagalbandh village	1:2000	A-1
28	28	58.298 km to 60.280 km	Bagalbandh village to Lanka village	1:2000	A-1
29	29	60.280 km to 62.000 km	Lanka village to Rupapatia village	1:2000	A-1
30	30	62.000 km to 63.474 km	Rupapatia village to Basudevpur village	1:2000	A-1
31	31	63.474 km to 65.311 km	Basudevpur village to Raghunathdih village	1:2000	A-1
32	32	65.311 km to 67.700 km	Raghunathdih village to Murgabera village	1:2000	A-1
33	33	67.700 km to 70.433 km	Murgabera village to Chandanpur village	1:2000	A-1
34	34	70.433 km to 72.586 km	Chandanpur village to Gobinddih village	1:2000	A-1

Sl. No.	Chart No.	Chainage (from ..... km to .... km)	Location (from .... to .....)	Scale	Size of the Chart
35	35	72.586 km to 74.470 km	Gobinddih village to Harjora village	1:2000	A-1
36	36	74.470 km to 77.000 km	Harjora village to Supurdi village	1:2000	A-1
37	37	77.000 km to 78.700 km	Supurdi village to Dumri village	1:2000	A-1
38	38	78.700 km to 80.446 km	Dumri village to Amruhasa village	1:2000	A-1

Table 27- Survey Charts