



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
GANOL RIVER (NW- 39) (49.143 km)
FROM “FROM BANGLADESH BORDER AT MANKACHAR TO BRIDGE NEAR DOLBARI”**”

Survey Period from 10.12.15 to 12.01.16



**FINAL REPORT ON HYDROGRAPHICAL SURVEY OF GANOL
RIVER, MEGHALAYA**

REPORT SUBMISSION DATE- 13.09.2018

SUBMITTED BY:

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FINAL FEASIBILITY REPORT ON
“DETAILED HYDROGRAPHY SURVEY IN GANOL
RIVER IN MEGHALAYA (49.143 KMS)



Acknowledgement

Precision Survey Consultancy (PSC), Salap, Howrah 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-IX (Ganol River) from Bangladesh Border at Mankachar to Bridge near Dolbari (49.143 Km)**.

We would like to use this opportunity to pen down our profound gratitude and appreciations to **Ms. Nutan Guha Biswas, IAS, Chairperson, IWAI** for spending their valuable time and guidance for completing this project of “Detailed Hydrography and Topography survey in Ganol River.” PSC would also like to thank **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)**.

PSC wishes to express their gratitude to **Cdr. Ashish Arya, Hydrographic Chief, IWAI, Cdr. P.K. Srivastava, Ex. Hydrographic Chief, IWAI** for his guidance and inspiration for this project. PSC would also like to thank **Shri Rajiv Singhal, A.H.S., IWAI** for invaluable support and suggestions provided throughout the survey period. PSC 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.



FINAL FEASIBILITY REPORT ON
“DETAILED HYDROGRAPHY SURVEY IN GANOL
RIVER IN MEGHALAYA (49.143 KMS)



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



**FINAL FEASIBILITY REPORT ON
“DETAILED HYDROGRAPHY SURVEY IN GANOL
RIVER IN MEGHALAYA (49.143 KMS)**



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**FINAL FEASIBILITY REPORT ON
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Salient Features of Ganol River

Sl	Particulars	Details																																										
1.	Name of the Consultant	Precision Survey consultancy																																										
2.	Region /Cluster number & State(s)	Region IX, Meghalaya																																										
3.	a) Waterway name b) NW # c) Total Stretch and length of declared NW (from ... to..., length...km) d) Survey Period (... to ...)	a) Ganol River b) NW-39 c) From Bangladesh Border near Mankachar (Chainage- 0.00 km) to Bridge near Dolbari (Chainage- 49.143 km) d) 10 th December, 2015 to 12 th January, 2016																																										
4.	Tidal & non tidal portions (from... to, length, tidal variation at every 10km)	There are no Tidal influence or portions found in this zone of River.																																										
5.	LAD (Least Available Depth) status	<u>Observed Depth</u>																																										
		<table border="1" style="width: 100%; border-collapse: collapse; margin-bottom: 10px;"> <thead> <tr style="background-color: #f4a460;"> <th>Sub-Stretch-1 (0 -10 km)</th> <th>Sub-Stretch- 2 (10 -20 km)</th> <th>Sub-Stretch - 3 (20-30 km)</th> <th>Sub-Stretch-4 (30-40 km)</th> <th>Sub-Stretch-5 (40-49.143 km)</th> <th>Total</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">10.00</td> <td style="text-align: center;">10.00</td> <td style="text-align: center;">10.00</td> <td style="text-align: center;">10.00</td> <td style="text-align: center;">9.143</td> <td style="text-align: center;">49.143</td> </tr> <tr> <td style="text-align: center;">0</td> <td style="text-align: center;">0</td> <td style="text-align: center;">0</td> <td style="text-align: center;">0</td> <td style="text-align: center;">0</td> <td style="text-align: center;">0</td> </tr> <tr> <td style="text-align: center;">0</td> <td style="text-align: center;">0</td> <td style="text-align: center;">0</td> <td style="text-align: center;">0</td> <td style="text-align: center;">0</td> <td style="text-align: center;">0</td> </tr> <tr> <td style="text-align: center;">0</td> <td style="text-align: center;">0</td> <td style="text-align: center;">0</td> <td style="text-align: center;">0</td> <td style="text-align: center;">0</td> <td style="text-align: center;">0</td> </tr> <tr> <td style="text-align: center;">0</td> <td style="text-align: center;">0</td> <td style="text-align: center;">0</td> <td style="text-align: center;">0</td> <td style="text-align: center;">0</td> <td style="text-align: center;">0</td> </tr> <tr> <td style="text-align: center;">Total = 10.0</td> <td style="text-align: center;">Total =10.0</td> <td style="text-align: center;">Total =10.0</td> <td style="text-align: center;">Total = 10.0</td> <td style="text-align: center;">Total= 9.143</td> <td style="text-align: center;">Total-49.143</td> </tr> </tbody> </table>	Sub-Stretch-1 (0 -10 km)	Sub-Stretch- 2 (10 -20 km)	Sub-Stretch - 3 (20-30 km)	Sub-Stretch-4 (30-40 km)	Sub-Stretch-5 (40-49.143 km)	Total	10.00	10.00	10.00	10.00	9.143	49.143	0	0	0	0	0	0	0	0	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 = 10.0	Total= 9.143	Total-49.143
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<p>6. Cross structures i) Dams, weirs, barrages etc (total number; with navigation locks or not) ii) Bridges, Power cables etc [total number; range of horizontal and vertical clearances w.r.t H.F.L /MHWS]</p>	<p>i) There is no Dam, weir or Barrage found in this zone of river. ii) Wooden Bridge- 4 (Four), RCC Bridge- 6 (Six), Bamboo Bridge – 3 (Three)</p> <table border="1" data-bbox="627 517 1361 672"> <thead> <tr> <th>Clearance w.r.t H.F.L</th> <th>Min (m)</th> <th>Max (m)</th> </tr> </thead> <tbody> <tr> <td>Horizontal Clearance (m)</td> <td>4.137</td> <td>39.800</td> </tr> <tr> <td>Vertical Clearance w.r.t. H.F.L (m)</td> <td>1.008</td> <td>7.855</td> </tr> </tbody> </table> <p>iii) Electric Line-10(Ten), H.T.line-1 (one)</p> <table border="1" data-bbox="627 775 1361 929"> <thead> <tr> <th>Clearance w.r.t H.F.L</th> <th>Min (m)</th> <th>Max (m)</th> </tr> </thead> <tbody> <tr> <td>Horizontal Clearance (m)</td> <td>32.79</td> <td>330.23</td> </tr> <tr> <td>Vertical Clearance w.r.t. H.F.L (m)</td> <td>4.0</td> <td>8.953</td> </tr> </tbody> </table>	Clearance w.r.t H.F.L	Min (m)	Max (m)	Horizontal Clearance (m)	4.137	39.800	Vertical Clearance w.r.t. H.F.L (m)	1.008	7.855	Clearance w.r.t H.F.L	Min (m)	Max (m)	Horizontal Clearance (m)	32.79	330.23	Vertical Clearance w.r.t. H.F.L (m)	4.0	8.953																																																		
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9.	i) Present IWT operations ii) Ferry services, tourism, cargo, if any	As follows There is no Ferry service available in this zone of river. There is no cargo available in this zone of river. Morichbari Reserve is located in this zone of river approximately 18.10 km From the waterways.
10	Approx. distance of Rail & Road from waterway	Nearest Railway station- Dhubri (Approx distance-15.28 km) near the Brahmaputra Bank side. Name of National Highway close to the River-NH-51, NH-127B Name of SH-2, SH-6, SH- 12
11	Any other information / comment	



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Section-1: Introductory Considerations

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

Ganol is mainly known as Kalu River which is flown from the west Garo hills towards the Goalpara district. Its source start from Tura peak and runs towards the west through Damalgre, Garobadha and Rangapani before it enters Goalpara district. The chief tributaries of the river are Dilni and Rongram rivers. The Basin area of the river is maily Plain area. This River is not so much wide. The Bank of the river includes villages, agricultural land, small forest area etc. The rest portion of land is the agriculture field and the farmers beside the river bank totally depend upon this river for farming. Near Bangladesh, Assam and Meghalaya Border which are the basin area of Ganol River, having a great economical and agricultural impact.



Figure 1-Site Map of Ganol River



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1.2 Tributaries / Network of River/ Basin

The major tributaries of this river are –

- i) Dilni River
- ii) Rongram River

1.3 State / District through which river passes

The River passes through west Garo hills district of Meghalaya and Goalpara district of Assam.

1.4 Project Site Location Map

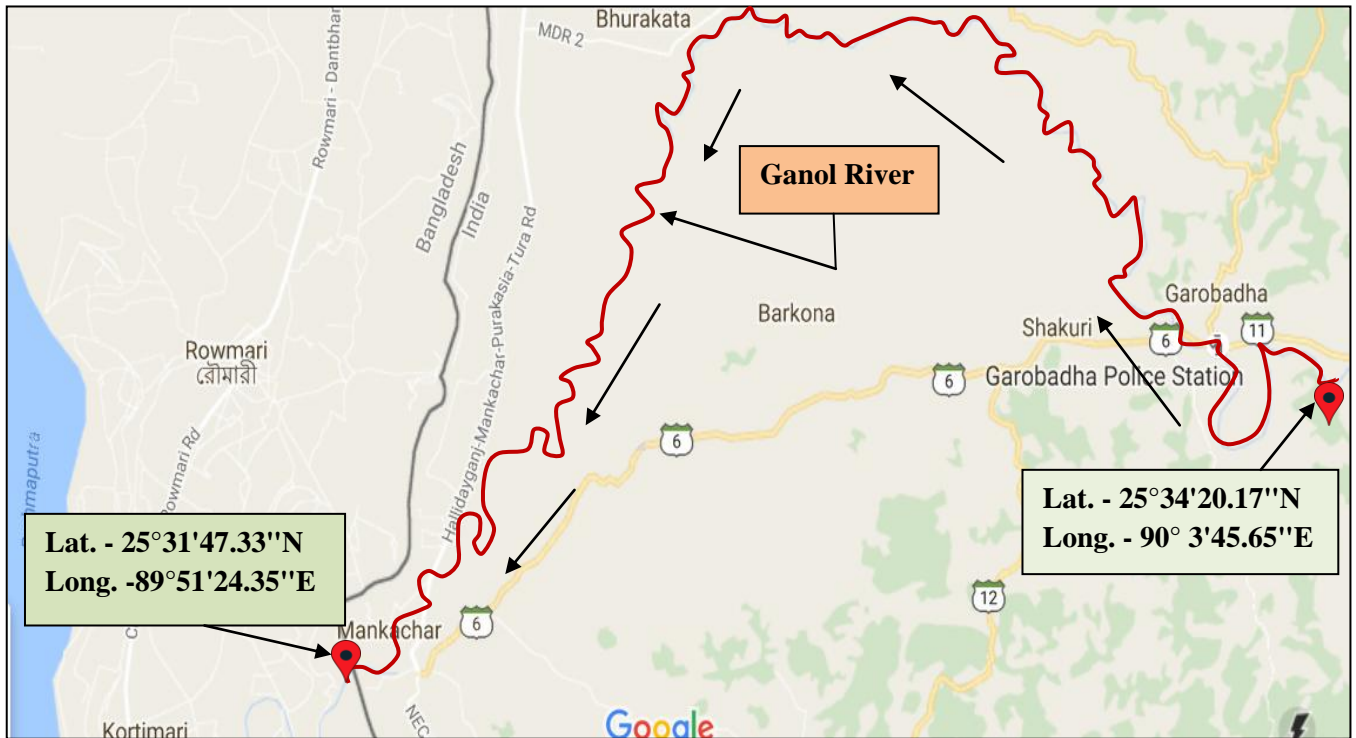


Figure 2-Project Site location Map of Ganol River



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1.5 Site Map:-



Figure 3-Site Map of Ganol River



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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 has been 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 30cm X 30cm X 150cm.
- The pillar extends 60.cms above ground level with inscription “IWAJ”, “PSC” and BM No. can be seen on the face of the pillar.
- The main objective of the Study was to recommend the strategy and programs for the development of the Ganol River waterway and to provide an appropriate economic and organizational framework for restoring trade and navigation (cargo and passengers) on the Ganol River with an aim to do as follows:
 - Improve public and private investments into transport on the Ganol River, in accordance with adequate economic and financial analysis;
 - Propose enhancement of coordination of activities regarding inland navigation and to set up priorities of public interests;
 - Obtain an integrated approach considering water management, energy production, flood control and environmental aspects in the Ganol River basin and Propose improvement of the infrastructure.



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Section-2: Methodology Adopted to undertake Study

2.1 Methodology Adopted including Resources and equipment used and calibration

➤ Equipment:-

Followings equipments were employed for the Bathymetry and Topography 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

Table 1-Detail Equipment list

- **Conduct of survey work**

- **Topographic Survey**

The Topographic Survey of Ganol River has been carried out from “Bangladesh Border near at Mankachar (Lat. - 25°31'47.33"N, Long.-89°51'24.35"E) to Bridge near Dolbari (Lat. - 25°34'20.17"N, Long. - 90°03'45.65"E).” The length of Topography survey has been carried out from From Bangladesh Border near Mankachar (Chainage- 0.00 km) to Bridge near Dolbari (Chainage- 49.143 km).

- The Topographic survey was 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.

- **Bathymetry Survey**

- The Bathymetry survey was not possible in this zone of river due to insufficient layer of water.



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

For the Topography Survey, the Horizontal / Vertical control has been carried out from BM-1 by GPS observation of 24 hrs, situated near the Mankachar Village is used for the entire Survey work. Its value is 33.113 m w.r.t. MSL has been considered for calculating the vertical levels. Total 6 no. of BM have been established along the 49.143 km stretch of the Ganol River with the reference of BM-1 which was fixed near at Mankachar village The value of the BM-1 is:-

Location Name	Geographic position		UTM position		Elevation (m)
	Latitude (N)	Longitude (E)	Northing	Easting	
Mankachar Village	25°31'53.29"	89°52'0.58"	788110.956	2826907.728	33.113 m. w.r.t M.S.L

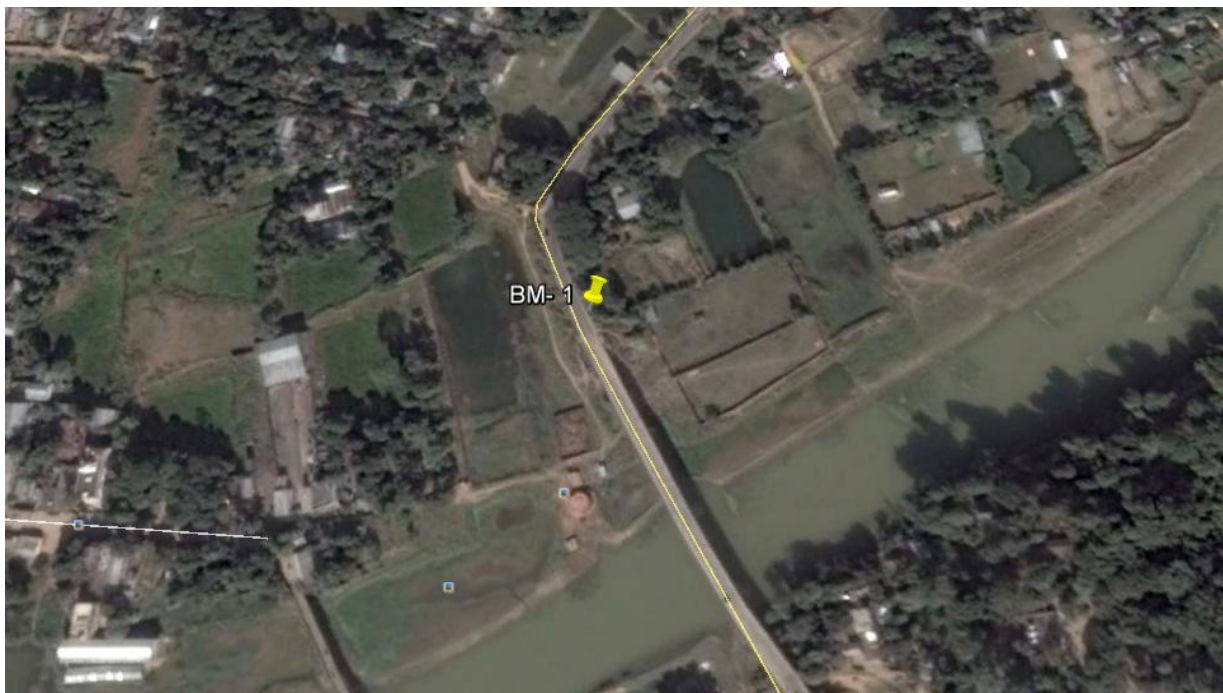


Figure 4- Reference level of Ganol River



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

There is no tidal influence found in this part of the region of Assam.

2.4 Methodology to fix Chart Datum / Sounding Datum-

The six year data of CWC Gauge was provided by IWAI. Average of last six years min. Water level has been adopted as Sounding Datum.

For dry patches, Lowest M.S.L value is used as Sounding Datum (S.D) at every km.

IWAI has provided the Sounding Datum at Garobadha, Mankachar and at the confluence with Brahmaputra River. The same was used to arrive the sounding datum values at BM pillars and tide gauges.

Sl. No	Place	Sounding Datum w.r.t MSL (Provided by IWAI)
1	Garobadha (Chainage-39.566 km)	31.830 meter
2	Mankachar (Chainage-1.155 km)	19.120 meter
3	Confluence with Brahmaputra River (Chainage- 0.00 km)	19.120 meter

2.5 Six years minimum Water Levels to arrive at Chart Datum (CD) / Sounding Datum (SD).

The Minimum water level (C.D) levels of the Ganol River are –

Garobadha (Chainage-39.566 km) - C.D- 31.830 meter

Mankachar (Chainage-1.155 km) – C.D-19.120 meter

Confluence with Brahmaputra River (Chainage- 0.00 km) - 19.120 meter

2.6 Transfer of Sounding Datum table for tidal rivers / canals

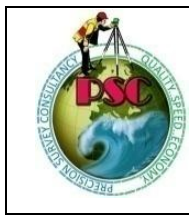
There is no Tidal influence or Tidal effects found in this zone of river.

2.7 Table Indicating tidal variation at different observation points (say at every 10 Km)

There is no Tidal influence or Tidal effects found in this zone of river.

2.8 Salient Features of Dam, Barrages, Weirs, Anicut, Locks, Aqueducts etc

There are no Dams, Barrage, Weirs, Anicut, Locks, Aqueducts found in this zone of river.



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2.9 Description of erected Bench Mark Pillars:-

BM No	Location	Chainage (km)	Latitude (N)	Longitude (E)	Easting	Northing	BM Height above MSL (m)	BM Height above SD (m)
BM-1	Mankachar village	1.152	25°31'53.29"	89°52'0.58"	788110.956	2826907.728	33.113	13.993
BM-2	Chirakhowa Kuther Ghat village	18.984	25°33'15.19"	89°52'42.89"	791825.553	2835647.785	26.195	2.495
BM-3	Chirakhowa village	25.350	25°34'40.32"	89°54'8.77"	795781.476	2837265.053	29.358	3.508
BM-4	Boomatia village	30.776	25°36'31.71"	89°59'46.49"	799056.009	2836655.961	31.318	3.618
BM-5	Gandhipara Koch	39.565	25°34'46.99"	90° 0'58.94"	803026.339	2832588.101	41.608	6.068
BM-6	Boiragipara village	44.863	25°34'46.87"	90° 2'0.56"	804747.339	2832624.875	42.683	3.813

Table 2 Bench Mark Details

2.10 Details of collected Water level of different gauge stations:-

Chainage (km)	Gauge station	Location	Easting	Northing	Latitude (N)	Longitude (E)	WL w.r.t M.S.L (m)
1.155	GS-1	Mankachar village	788183.13	2826825.1	25°31'50.57"	89°52'3.13"	20.195
18.988	GS-2	Chirakhowa Kutherghat	791831.99	2835650.6	25°36'34.53"	89°54'20.59"	23.982
25.353	GS-3	Chirakhowa village	795813.66	2837317.3	25°37'25.79"	89°56'44.50"	26.093
30.78	GS-4	Boomatia village	799382.16	2836895.1	25°37'9.50"	89°58'51.97"	28.215
39.566	GS-5	Gandhipara Koch	802934.3	2832540.1	25°34'45.50"	90° 0'55.61"	32.081
44.866	GS-6	Ambari village	805677.61	2832219.7	25°34'33.05"	90° 2'33.53"	36.045
48.75	GS-7	Dolbari village	807711.32	2831929.4	25°34'22.11"	90° 3'46.10"	39.190

Table 3 Water level data of different Gauge stations



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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 +ve indicates above MSL -ve indicates below MSL	E	F = (E- WL data in MSL)	G = (E- Topo levels in MSL)
1	Gauge Station - 1	1.155	0.0-0.6		19.120	-1.075	Ganol Reduced Topo.xyz
2	Gauge Station -2	18.988	0.6-10.1		23.700	-0.282	
3	Gauge Station – 3	25.353	10.1-22.2		25.850	-0.243	Submitted in Soft Copy
4	Gauge Station – 4	30.780	22.2-28.1		27.700	-0.515	
5	Gauge Station – 5	39.566	28.1-35.2		31.830	-0.251	
6	Gauge Station – 6	44.866	35.2-42.2		35.540	-0.505	
7	Gauge Station - 7	48.750	42.2-49.143		38.870	-0.320	
8	Confluence	0.00		19.120		-0.975	

Table 4-Chart Datum / Sounding Datum & Reduction Detail

2.12 Average Bed Slope:-

Reach		River / Canal Bed Level Change (m)	Distance (km)	Slope (m/km)	Slope (cm/km)
From	To				
0	1.155	4.58	1.155	0.252	25.22
1.156	18.988	2.15	17.832	8.294	829.40
18.989	25.353	1.85	6.364	3.440	344.00
25.354	30.78	4.13	5.426	1.314	131.38
30.781	39.566	3.71	8.785	2.368	236.79
39.567	49.143	3.33	9.576	2.876	287.57
Total			49.138	Avg-3.09	Avg-309.06

Table 5-Average Bed Slope

2.13 Details of Dam/Barrage/Weirs/Anicut etc. w.r.t MSL:-

There are no Dams, Barrage, weirs, Anicut found in this river zone.

2.14 Details of Locks:-

There are no locks found in this river zone.

2.15 Details of Aqueducts:-

There are no aqueducts found in this zone of river.



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2.16 Details of existing Bridges and Crossing over waterway:-

There are total 13 no of Bridges located in this zone of river. Under these bridges, RCC Bridges, Wooden bridges, Bamboo bridges are located in this zone of river. Wooden bridges and Bamboo Bridges are not permanent in this zone of river and these bridges may collapse in the rainy season. So these bridges are not permanent but temporary. As a result, these types of bridges have no clearance.

Sl. No	Structure Name	Chainage (km)	Location	Position				Length (m)	Width (m)	No. Of Piers	Horizontal Clearance (m)	Vertical Clearance w.r.t H.F.L (m)	Remarks
				Latitude (N)	Longitude (E)	Easting	Northing						
1	RCC Bridge	0.00	Mankachar Village	25°31'49.310"	89°51'23.998"	787090.9038	2826762.5491	170.97	4.86	3	39.800	3.995	Complete
2	Wooden Bridge	0.966	Kalobazar village	25°31'46.529"	89°51'58.048"	788043.7873	2826697.4182	110.0	3.9	10	7.500	6.655	Complete
3	RCC Bridge	1.120	Mankachar village	25°31'48.528"	89°52'3.268"	788188.2667	2826762.1051	175.57	8.120	5	35.400	7.855	Complete
4	Bamboo Bridge	13.621	Rangapani village	25°34'35.984"	89°54'12.087"	791673.5730	2831995.4396	32.606	1.87	-	-	-	Temporary
5	RCC Bridge	18.975	Chirakhowa Kutherghat	25°36'34.16"	89°54'21.34"	791852.1510	2835639.1840	29.38	2.64	5	4.137	1.008	Complete
6	Wooden Bridge	22.019	Dorua village	25°37'17.809"	89°55'16.685"	793367.3721	2837016.9424	83.120	3.6	-	-	-	Temporary
7	Bamboo Bridge	24.320	Chirakhowa village	25°37'33.871"	89°56'19.978"	795122.9496	2837550.5369	83.585	1.5	-	-	-	Temporary
8	Bamboo Bridge	25.348	Chirakhowa village	25°37'25.948"	89°56'43.902"	795796.1039	2837321.4729	67.00	1.97	-	-	-	Temporary
9	Wooden Bridge	26.031	Kalapani village	25°37'20.956"	89°57'5.593"	796404.9365	2837181.2520	58.72	3.81	4	11.850	2.550	Complete
10	RCC Bridge	27.447	Shalinbari village	25°37'39.053"	89°57'47.435"	797560.3012	2837764.4767	71.05	8.05	3	25.500	5.704	Complete
11	RCC Bridge	31.652	Boomatia village	25°37'1.003"	89°59'20.296"	800178.5311	2836651.3286	61.97	4.14	5	8.300	3.072	Complete
12	RCC Bridge	39.580	Gandhipara Koch village	25°34'45.136"	90°00'55.377"	802927.7313	2832528.5219	126.87	11.71	3	28.00	6.106	Complete
13	Wooden Bridge	45.590	Ambari village	25°34'38.157"	90°02'24.805"	805429.6875	2832370.6962	67.81	2.75	5	9.600	3.840	Complete

Table 6-Bridge Details

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

There are no cross structures, pipe lines or under water cables found in this zone of river.



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

Sl No	Type of 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	Electric line	0.00	Mankachar village	25°31'46.171"	89°51'26.177"	787153.8410	2826667.2340	4	97.05	6.00	Complete
2	Electric line	1.120	Mankachar village	25°31'48.251"	89°52'2.907"	788178.3540	2826753.3660	4	175.57	8.28	Complete
3	Electric line	18.100	Daruakawahagi village	25°36'8.686"	89°54'25.898"	791996.6020	2834857.7578	4	69.21	7.00	Complete
4	Electric line	18.426	Daruakawahagi village	25°36'17.612"	89°54'24.094"	791940.2090	2835131.4380	4	32.79	6.00	Complete
5	Electric line	19.046	Chirakhowa Kutherghat	25°36'36.348"	89°54'19.066"	791787.2100	2835705.1690	4	52.5	6.00	Complete
6	Electric line	22.015	Dorua village	25°37'17.509"	89°55'15.938"	793346.7240	2837007.2410	4	93.8	5.00	Complete
7	Electric line	26.100	Kalapani village	25°37'18.749"	89°57'7.978"	796473.0220	2837114.8040	4	112.06	8.00	Complete
8	Electric line	31.860	Boomati village	25°36'54.493"	89°59'24.257"	800293.6326	2836453.3920	4	104.3	5	Complete
9	H.T.Line	36.420	Puthimari village	25°35'47.119"	90°00'37.629"	802388.8310	2834425.5465	8	330.23	8.953	Complete
10	Electric line	45.460	Ambari village	25°34'39.573"	90°02'20.013"	805294.8940	2832411.2160	4	127.18	5	Complete
11	Electric line	45.677	Ambari village	25°34'34.136"	90°02'26.847"	805489.5610	2832248.1930	4	74.4	4	Complete

Table 7- High Tension / Electrical Line



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2.19 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 (Cu.m/sec)
		Easting (m)	Northing (m)	Latitude (N)	Longitude (E)		0.5 D			
1	25.350	800196.0566	2836696.5521	25°37'02.458"	89°59'20.96"	0.300	0.11	0.11	110.02	12.10
2	31.662	795796.3034	2837289.9362	25°37'24.924"	89°56'43.884"	0.400	0.15	0.15	77.97	11.69

Table 8- Details Current Meter List

2.20-a. Soil Sample Locations:-

Sample No.	Chainage (km)	Easting (m)	Northing (m)	Latitude (N)	Longitude (E)	Depth (m)
1	1.152	788182.0337	2826811.282	25°31'50.129"	89°52'03.083"	0.300
2	18.984	791835.1242	2835649.732	25°36'34.514"	89°54'20.738"	0.400
3	39.565	802952.9477	2832522.868	25°34'44.934"	90°00'56.275"	0.300
4	44.863	804718.526	2832411.67	25°34'40.016"	90°01'59.383"	0.325

Table 9-Soil Sample Location

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	1.152	788182.0337	2826811.282	25°31'50.129"	89°52'03.083"	0.300	0.15
2	18.984	791835.1242	2835649.732	25°36'34.514"	89°54'20.738"	0.400	0.2
3	39.565	802952.9477	2832522.868	25°34'44.934"	90°00'56.275"	0.300	0.15
4	44.863	804718.526	2832411.67	25°34'40.016"	90°01'59.383"	0.325	0.1625

Table 10- Water Sample Location



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Section-3: Detailed Hydrographic Survey- Stretch Wise

3.1 From Chainage 0.00 Km to Chainage 10.00 Km (Mankachar Village to Khas Beel Village)

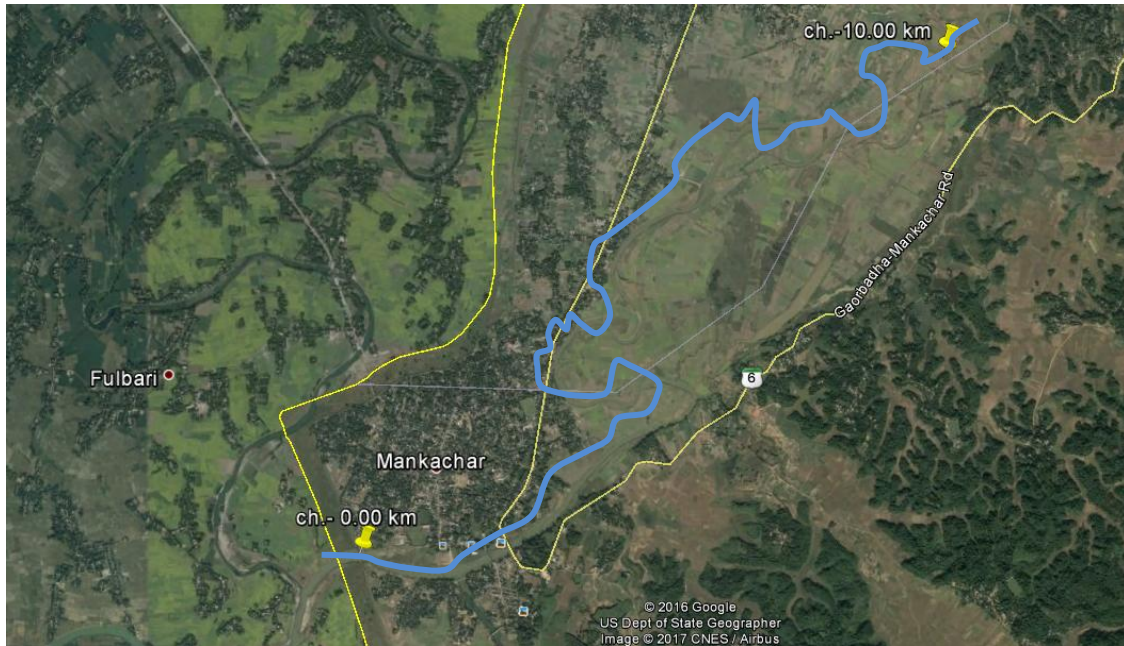


Figure 5- Chainage 0.00 km to 10.00 km

The River width of Ganol River from chainage 0.00 km to chainage 10.00 km is approximately 56.38 meter to 65 meter. The average width portion of the river is 25 meter.

During the survey it was noticed that two RCC Bridges have been situated near at chainage of 0.00 km and 1.120 km respectively. The RCC Bridge position are (Lat. - $25^{\circ}31'49.310''N$, Long. - $89^{\circ}51'23.998''E$), (Lat. - $25^{\circ}31'48.528''N$, Long.- $89^{\circ}52'3.268''E$). Two wooden bridges have been also situated near at chainage of 0.700 km and 0.966 km respectively. The bridges position are (Lat. - $25^{\circ}31'42.591''N$, Long.- $89^{\circ}51'50.044''E$), (Lat.- $25^{\circ}31'46.529''N$, Long.- $89^{\circ}51'58.048''E$) respectively. Joddanga village, Mankachar village, Khas beel village, Fulbari village are situated left bank side of the river and Thakurarbari village, Chamaibil village, Chandan Nokat village, Sagarkona village are situated right bank side of the river. Two wooden Bridges have been also situated near at chainage of 0.7 km and 0.965 km respectively. BM-1 has been situated near at chainage of 1.152 km. Both side paddy lands are also found during the survey. Two electric lines have been also located near at chainage of 0.00 km and 1.120 km respectively at Mankachar village.



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Class	Chainage (km)		Observed				Reduced w.r.t. Sounding Datum			
	From	To	Min. dept h (m)	Max. dept h (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Min. Dept h (m)	Max. Depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)
I	0.00	10.00	0.03	0.3	10000	415858.95	-0.3	0	10000	537145.93
II	0.00	10.00	0.012	0.3	10000	633416.27	-0.3	0	10000	789358.48
III	0.00	10.00	0.004	0.4	10000	957320.49	-0.3	0	10000	1150769.24
IV	0.00	10.00	0.004	0.3	10000	1154872.06	-0.3	0	10000	1356845.57



Figure 6- RCC Bridge (Chainage -0.000 km)



Figure 7- RCC Bridge (Chainage- 1.120 km)



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Figure 8- Wooden Bridge (Chainage – 0.700 km)



Figure 9- Wooden Bridge (Chainage- 0.966 km)



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3.2 From Chainage 10.00 Km to Chainage 20.00 Km (Khas Beel Village to Chirakhowa Bengervita Village)

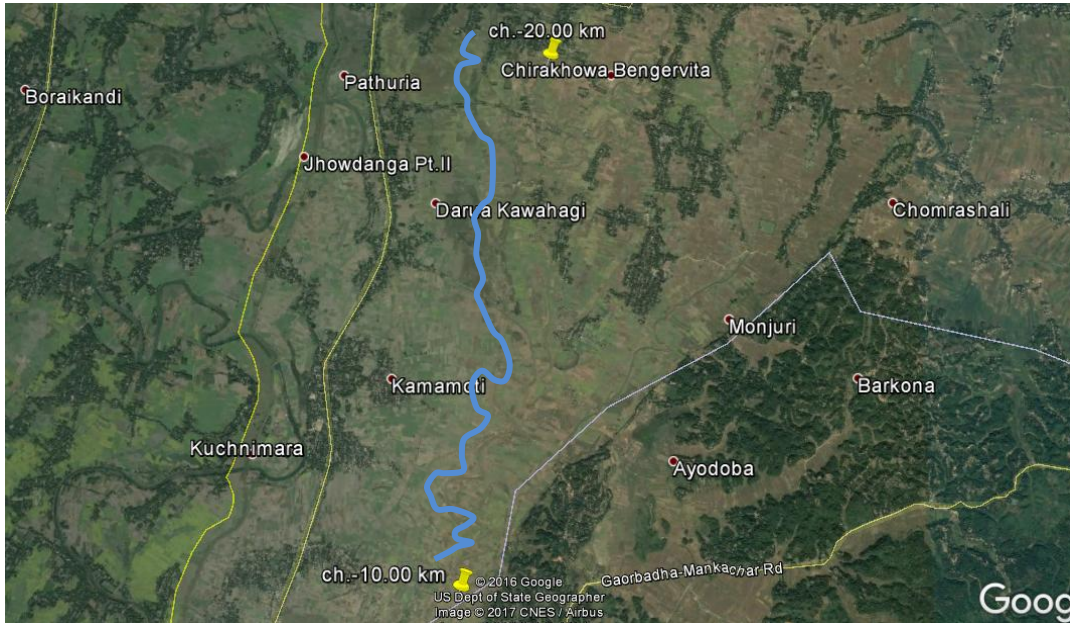


Figure 10- Chainage 10.00 km to Chainage 20.00 km

The River width of Ganol River from chainage 10.00 km to 20.00 km is approximately 42 m to 21 m. The average width portion of the river is 18 m.

During the survey it was noticed that BM-2 has been situated near at chainage of 18.984 km left bank side of the river. Daruakawahagi village, Konnamoti village, Kawahagi village, Jordanga Pt.II village, Khas Bill village, Kuchnimara village, Daruakawahagi village, Borai Kandi village, Domartola village, pathuria village are situated left bank side of the river and Niz chirakhowa village, Bansali village, Ayodoba village, barkona village, Monjuri village, Chirakhowa bengervita village, Chirakhowa Maishghuma village, Chirakhowa Kutherghat village, chirakhowa Tetlibari village are situated right bank side of the river. A Bamboo bridge and a RCC Bridge have been situated near at chainage of 13.621 km and 18.675 km respectively. The Bridges positions are (Lat. - 25°34'35.984"N, Long.- 89°54'12.087"E), (Lat.- 25°36'34.16"N, Long.- 89°54'21.34"E) respectively. Three electric lines have been situated near at chainage of 18.100km, 18.426 km and 19.046 km.

Class	Chainage (km)		Observed				Reduced w.r.t. Sounding Datum			
	From	To	Min. dept h (m)	Max. dept h (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Min. Dept h (m)	Max. Depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)
I	10.00	20.00	0.03	0.3	10000	417158.55	-0.3	0	10000	538825.31
II	10.00	20.00	0.002	0.3	10000	635202.08	-0.3	0	10000	791486.51
III	10.00	20.00	0.002	0.4	10000	958308.78	-0.3	0	10000	1145813.16
IV	10.00	20.00	0.001	0.4	10000	1156085.81	-0.3	0	10000	1358059.69



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Figure 11-Bamboo Bridge (Chainage- 13.621 km)



Figure 12- RCC Bridge (Chainage-18.675 km)



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3.3 From Chainage 20.00 Km to Chainage 30.00 Km (Chirakhowa Bengervita Village to Dhapgurikuraltanga Village)

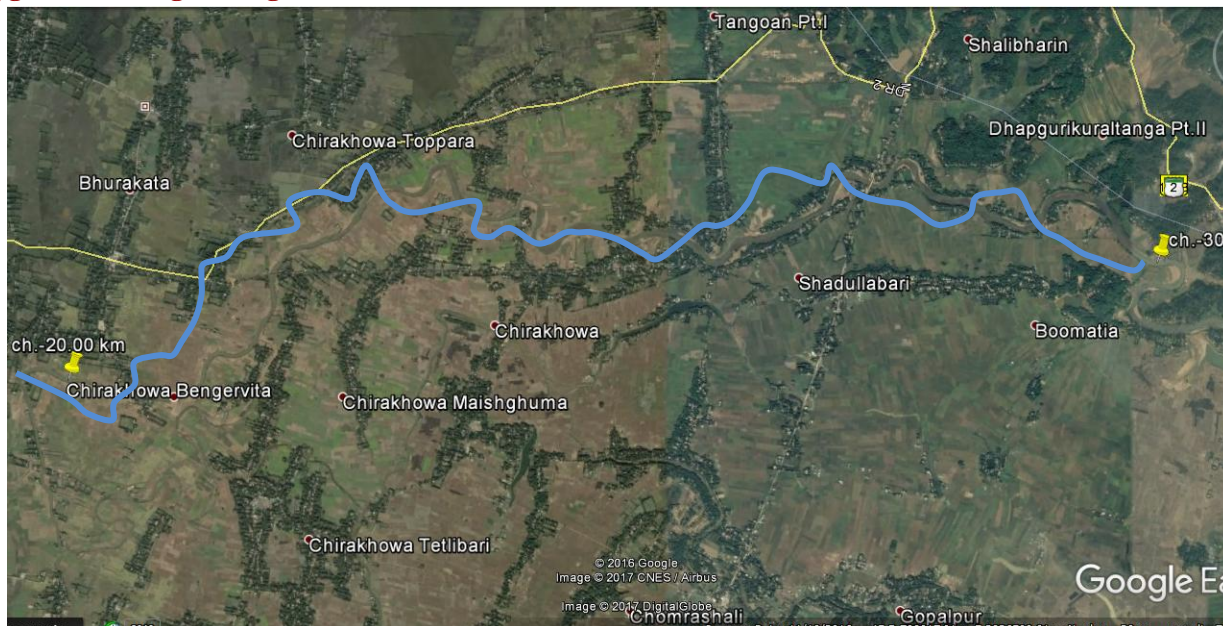


Figure 13- Chainage 20.00 km to 30.00 km

The River width of Ganol River from chainage 20.00 km to 30.00 km is approximately 15m to 43.88m. The average width portion of the river is 17 m.

During the survey it was noticed that one RCC Bridge, two wooden bridges and two bamboo bridges have been situated near at chainage of 27.447 km, 22.019 km, 26.031 km, 24.320 km and 25.348 km respectively. kalapani village, Shadullabari village, Boomatia village are situated right bank side of the river and Chirakhowa Bengervita village, Bhurakata village, Chirakhowa Toppara village, Pipulbari pt I village, Tangoan pt I village, Laxmisarif village are situated left bank side of the river. BM-3 has been situated near at chainage of 25.350 km. The RCC bridge’s position is (Lat. - 25°37'39.053"N, Long.- 89°57'47.435"E). Two wooden Bridges position are (Lat. - 25°37'17.809"N, Long. - 89°55'16.685"E), (Lat.- 25°37'20.956"N, Long.- 89°57'5.593"E). The Bamboo Bridges position are (Lat. - 25°37'33.871"N, Long.- 89°56'19.978"E), (Lat.- 25°37'25.948"N, Long.- 89°56'43.902"E). Three electric lines have been also situated near at chainage of 22.015 km, 26.100 km and 27.435 km 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	20.00	30.00	0.01	0.3	10000	422989.12	-0.3	0	10000	546356.04
II	20.00	30.00	0.005	0.3	10000	644274.33	-0.3	0	10000	802890.36
III	20.00	30.00	0.002	0.3	10000	973501.08	-0.3	0	10000	1176086.29
IV	20.00	30.00	0.001	0.4	10000	1174583.33	-0.3	0	10000	1379967.53



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Figure 14- RCC Bridge (Chainage -27.447 km)



Figure 15- Wooden Bridge (Chainage – 22.019 km)



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Figure 16- Wooden Bridge (Chainage – 26.031 km)



Figure 17- Bamboo Bridge (Chainage-24.320 km)



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3.4 From Chainage 30.00 Km to Chainage 40.00 Km (Dhappgurikuraltanga Village to Gandhipara Koch Village)

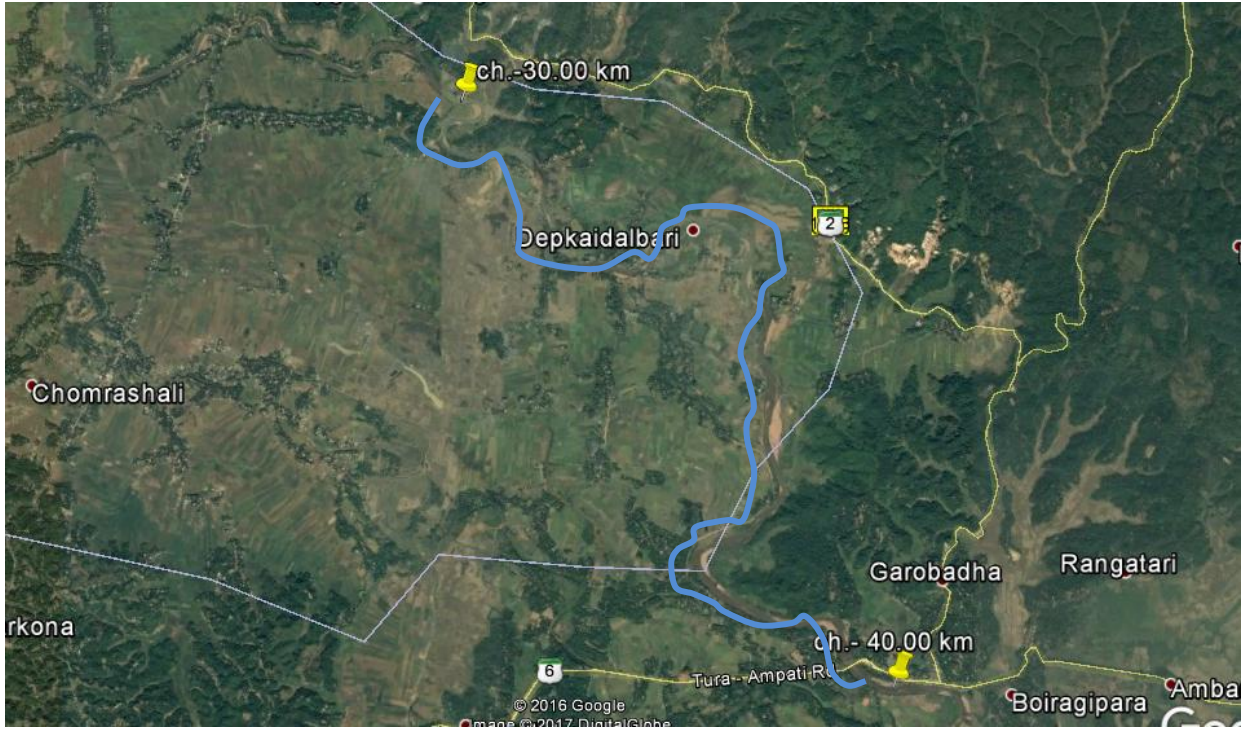


Figure 18-Chainage 30.00 km to Chainage 40.00 km

The River width of Ganol River from chainage 30.00 km to 40.00 km is approximately 54.6 metre to 80.92 metre. The average width portion of the river is 40 metre.

During the survey it was noticed that Two RCC Bridges have been located near at chainage of 31.652 km and 39.580 km. The RCC Bridges position are (Lat. - 25°37'39.053"N, Long. - 89°57'47.435"E), (Lat.- 25°37'1.003"N, Long.- 89°59'20.296"E) respectively. BM-4 and BM-5 have been situated near at chainage of 30.776 km and 39.565 km respectively. Bandorpanikha village, Jogipara village, Margaon Gatha village, Gopalpur village, Boomatia village, Thakuranbari village, Shakuri village are situated right bank side of the river and Dhappgurikuraltanga ptI village, Depkaidalbari village, Tiksalı village, Puthimari village, Gandhipara Garo village, Maljanggre village, Gandhipara hajong village, rangatari village, Balapara village are situated left bank side of the river. One electric line and one H.T.line are located near at chainage 31.860 km and 36.420 km respectively.

Class	Chainage (km)		Observed				Reduced w.r.t. Sounding Datum			
	From	To	Min. dept h (m)	Max. dept h (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Min. Dept h (m)	Max. Depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)
I	30.00	40.00	0.01	0.3	10000	423203.67	-0.3	0	10000	546633.27
II	30.00	40.00	0.002	0.3	10000	644601.87	-0.3	0	10000	803299.41
III	30.00	40.00	0.003	0.3	10000	973839.51	-0.3	0	10000	1170495.98
IV	30.00	40.00	0.001	0.4	10000	1174618.01	-0.3	0	10000	1379768.82



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Figure 19 - RCC Bridge (Chainage-31.652 km)



Figure 20- RCC Bridge (Chainage-39.580 km)



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3.5 From Chainage 40.00 Km to Chainage 49.143 Km (Gandhipara Koch Village to Dolbari Village)

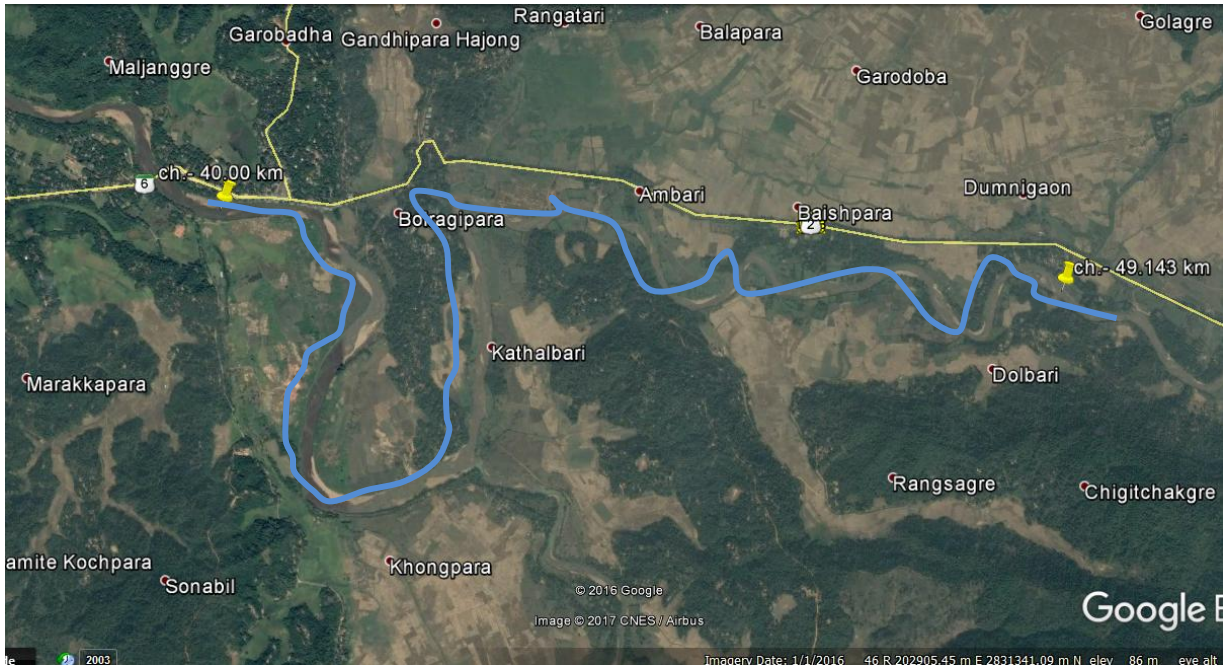


Figure 21- Chainage- 40.00 km to Chainage- 49.143 km

The river width of Ganol River from chainage 40.00 km to 49.143 km is approximately 80.25m to 76.06m. The average width portion of the river is 41m.

During the survey it was noticed that one wooden Bridge has been situated near at chainage of 45.590 km. The Bridge position is (Lat.- 25°34'38.157"N, Long.- 90°02'24.805"E) BM-6 has been situated near at chainage of 44.863 km. Two irrigation canals are found near at chainage of 44 km and 45.8 km respectively. A Wooden bridge is situated near at chainage of 46.5 km. Gandhipara Koch, Boiragipara, Kathalbari, Dumnigaon, Baishpara, Balapara, Rangatari, Garodoba villages are situated left bank side of the river and Marakapara, Monabari, Sonabil, Sonamite Kochpara, khongpara, Lutubari, saphoka, Tokonchi, Dolbari, kathalbari, Rangsagre, Rangsakonavillages 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	49.143	0.01	0.3	10000	373885.51	-0.3	0.0	10000	482932.3
II	40.00	49.143	0.002	0.3	10000	569483.69	-0.3	0.0	10000	709686.51
III	40.00	49.143	0.002	0.3	10000	860717.67	-0.3	0.0	10000	1034674.5
IV	40.00	49.143	0.001	0.4	10000	1038314.59	-0.3	0.0	10000	1219904.57



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Figure 22- Wooden Bridge (Chainage- 45.590 km)



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- **Bathymetry Survey**

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

The layer of water in the Ganol River is not sufficient for carrying out the Bathymetric survey. The length of the Bathymetry survey is 0.00 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 Bangladesh Border near at Monkachar to Bridge near Dolbari. The length of the Topography survey is Chainage 0.00 km to Chainage 49.143 km.

- a) **Prominent Dams / Barrage:-**

There are no Dams, Barrage found in this zone of River.

- b) **Tidal stretch, tidal range. Pondage stretch / length of Dam, Barrages, Weirs, Anicut, Locks:-**

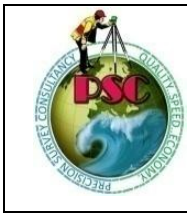
There are no Dams, Barrages, weirs, Anicut; Locks are found in this zone of river.

- c) **Conditions of banks (protected, un-protected):-**

Ganol River annually bears the brunt of floods and where embankment construction and repairing seems like permanent affair. Displacement of people living on the banks of rivers due to river bank erosion is another major issue here. The tributaries continue to erode the banks rapidly. The River banks are constantly being changed by means of flood of very high magnitude, channel widening, and change in channel pattern and of river bank erosion. To protect the shore and its properties various methods are in use like, geobags filling with sand, porcupine (triangle shaped concrete structure), sand bags and boulder bags called Gabions are in use to strengthen the embankments. The Embankment and the Boulder pitching are needful some places for protecting the banks of the river and also prevent the soil erosion. Beside this, the bank of the river includes with agricultural land, Ferry Ghats, electrical lines, RCC Bridge, wooden Bridge etc. Ferry ghats, electrical lines and Bridges area are well protected by Boulder pitching. From chainage 1 km to 10 km, the Bituminous road has been covered right side of the river bank and also covered from chainage 39.500 km to 47 km.

- d) **Hindrances - Hyacinth, rocks, rapid waterfalls, steep gradient, forest, wild-life sanctuary, security issues. Obstruction (if any) for navigation, e.g. fishing stakes:-**

Nokrek National park is located 30 km far from the river side of Ganol. Besides, Tura Peak, Balpakram National park, Siju Bird Sanctuary, Selbagre Hoolock Gibbon Reserve at Chandigre have been located in this zone of river. Besides, dense forest has been also located in this zone of river which defence with another states. Wildlife animals like Tiger, wild Elephant, wild Bear, wild snake, Birds have been located in Nokrek National Park area.



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e) Details of Protected Area- Wildlife, Defence, Atomic Power Plants and any other issue attached to it:-

Near the bank side of the Ganol River, the wild life like Nokrek National Park (about to 30 km), Balpakram National Park, Siju Bird Sanctuary, Tura peak have been located in this zone of river. So the Forest side and Wildlife area have become Unapproachable and also defence its own states from another states or country. Hoolock Gibon Reserve at Selbagre and Rombagre Falls, a Fish Sanctuary are also situated in this zone of river.

f) NH/SH/MDR along and/or within 5 km from the waterways:-

NH- 51, NH- 127B are the two major communications way near the river side. Besides, SH- 2, SH-6, SH- 11 and SH-12 are also communicative way for the local villagers.

g) Railway Line and Stations in the vicinity:-

No Railway line or stations have been situated in this zone of river.

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

The major portion of the land is occupied by agriculture. Major crops are Rice, Tea, Mustard, Maize etc have been cultivated in this zone of river. The right bank mostly occupied with scattered forest area and agriculture. The most important forest products are timber, bamboo and firewood. The land is also used for Jhum cultivation.

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

The Major crops along the river are Rice and Maize. Besides, the Horticulture crops are Orange, Lemon, Pineapple, Guava, Litchi, Banana, Jackfruit etc have been cultivated in this zone of river. Beside this, Non-traditional crops like Tea, Cashew nut, Oilseeds, Tomato, Mushroom, wheat etc. have been cultivated in this zone of river. Besides, Jhum cultivation is still practised in this zone of river.

j) Availability of Bulk / Construction Material:-

The cement factories and the brick fields are available in this stretch of river. Besides, sand is also available from the river side. These materials are useful for the Building construction or industrial hub. Coal, Limestone, Uranium and Sillimanite have been found in this zone of river.

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

Meghalaya is an industrially backward state. The Number of industries like cement, wood is lightly available in this zone of river. Apart from that, there are a number of small-scale industries like bakeries furniture making, steel fabrication tyre retreading, spice etc have been located in this zone of river.



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l) Existing Ghats, Jetties and Terminals (with conditions and facilities). Existing navigation facilities (if any):-

There are no Jetty services available in this zone of river.

m) Existing Cargo Movement:-

There is no cargo available in this zone of river.

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

Nokrek National park is the famous historical places in this zone of river. Tura Peak, Rongbang Falls, Pelga Falls, Chibragre, Chenga-Benga lake are the famous tourist spot in this zone of river. Mankachar, Dolbari, Ambari, Garobandha, Chirakhowa Bengervita etc. famous places in this zone of river.

o) Village / colonies along the sub-stretch and approx. Population:-

Mankachar, Jordanga pt I, Khas Beel, Rangapani, Chirakhowa, Shadullabari, Depkaidalbari, Thakuranbari, Gandhipara Koch, Garobadha, Ambari, Dolbari etc. villages have been located in this zone of river.

p) Availability of Passenger Ferry Services and Recreational Facilities:-

There are no Ferry services available in this zone of river.

q) Available and probable Water Sport Recreational Facilities:-

There are no water sport recreational facilities available in this zone of river.

r) Fishing activities:-

Ganol River is the lifeline of the people of its important places for fishing culture. Ganol provides diverse habitat in its downstream for living biota such as stream, riparian zones and wetlands etc. Ganol has some of the richest riverine fisheries in India. The river has over fish species and forms an important component of livelihood and nutritional security in the downstream stretches in Meghalaya. The wetlands are ecologically and economically important for the local people. Fishing in this zone of River is very famous among the people.

s) Sand mining:-

Illegal river sand mining across the country is on the rise for past many years in India, which results in adverse impact on river system and dependent communities. In Ganol gravel mining was noticed during the survey period. Besides this, sand is also exported to other states as it becomes demandful for making Building or Industries.

t) Tributaries:-

The major tributaries of this river are -

- i) Dilni
- ii) Rongram



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u) Details of Irrigation Canals and Outlets:-

The Irrigation Canal and Outlets have been found near at chainage of 0.723 km, 10.400 km and 43.256 km right bank side of the river and 24.300 km, 34.000 km, 35.145 km and 44.765 km in the left bank side of the river.

v) Details of Nalas. Polluted water discharge in to the rivers and treatment plants (if any):-

No Nalas are found in this zone of river.

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

In Recent time's man avoid to drinking the water of the river but the water is essential for cultivation which is the main occupation for the villagers of this region. The water is mainly used for irrigation purposes. Besides, the water is also used for industrial hubs. With the help of the irrigation system, the cultivation can easily accessible. Irrigation Canals supply the sufficient water for the cultivation. Ferry services are also available in this stretch of river. Besides, washing cloth, swimming etc. have become available in this zone of river.



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Section 4: Terminals

There is no existing terminal found in this zone of river.

4.1 Details of Land use, owner etc.:-

The Bank of the river Ganol is used mainly for cultivation. The Farmers are cultivated their crops with using this fertile land and grows a huge amount of crops like Rice, Maize etc. every year. Besides, some portions of the land are surrounded by small industries and Forests. Nokrek National Park, Balpakram National park, Siju Bird Sanctuary have been also situated in this zone of river. Though boulder pitching is found in some places but in the Monsoon period, Flood and erosion has been affected both side of the river bank.



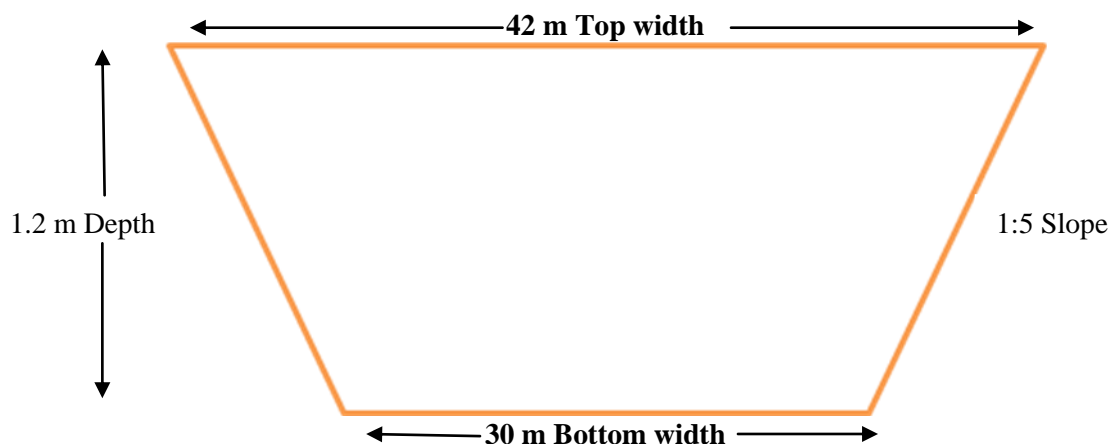
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Section 5: Fairway development:-

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

Class-I: - (Channel design: - Bottom width- 30 meter, Top width- 42 meter)



Location		Chainage (km)		As per Observed Soundings						As per Reduced Soundings					
From	To	From	To	Min. depth (m)	Max depth (m)	Length of Shoal (m)	Avg Depth of Cut (m)	Dredging Qty. (Cubic Meter)	Cumulative Dredging Qty (Cubic Meter)	Min. Depth (m)	Max Depth (m)	Length of Shoal (m)	Avg Depth of Cut (m)	Dredging Qty. (Cubic Meter)	Cumulative Dredging Qty (Cubic Meter)
Mankachar	Khas Beel	0	10	0.03	0.3	10000	1.26	415859	415858.95	-0.3	0	10000	1.626	537145.93	537145.93
Khas Beel	Chirakhowa Bengervita	10	20	0.03	0.3	10000	1.26	417158.6	833017.5	-0.3	0	10000	1.631	538825.31	1075971.24
Chirakhowa Bengervita	Dhagpurikur altanga	20	30	0.01	0.3	10000	1.28	422989.1	1256006.62	-0.3	0	10000	1.654	546356.04	1622327.28
Dhagpurikur altanga	Gandhipara Koch	30	40	0.01	0.3	10000	1.28	423203.7	1679210.29	-0.3	0	10000	1.655	546633.27	2168960.55
Gandhipara Koch	Dolbari	40	49.143	0.01	0.3	10000	1.13	373885.5	2053095.8	-0.3	0	10000	1.462	482932.3	2651892.85
Total						50000		2053096.8		Total		50000		2651892.85	

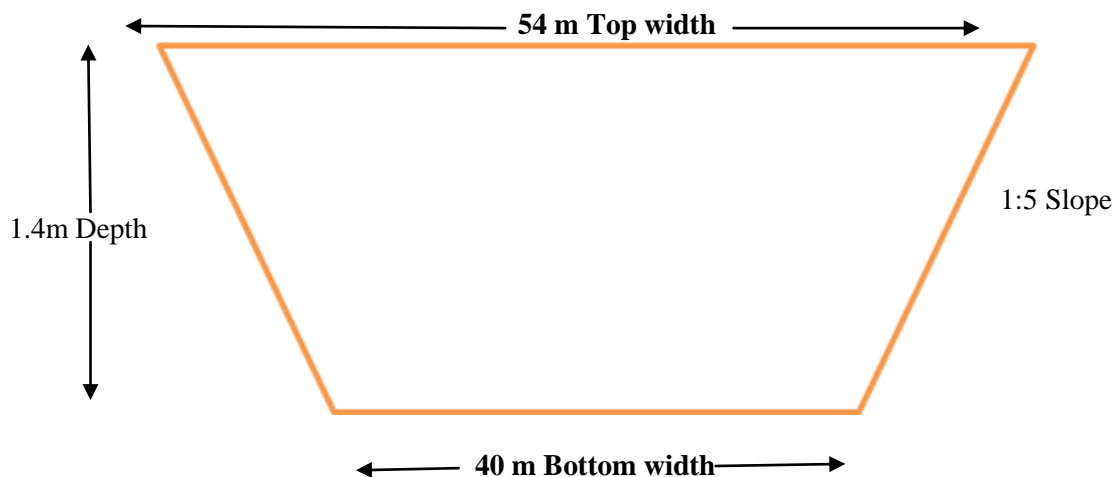
Table 11- Minimum & Maximum depth of Class-I



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Class-II: - (Channel design: - Bottom width- 40 meter, Top width- 54 meter)



Location		Chainage (km)		As per Observed Soundings						As per Reduced Soundings					
From	To	From	To	Min. depth (m)	Max depth (m)	Length of Shoal (m)	Avg Depth of Cut (m)	Dredging Qty. (Cubic Meter)	Cumulative Dredging Qty (Cubic Meter)	Min. Depth (m)	Max Depth (m)	Length of Shoal (m)	Avg Depth of Cut (m)	Dredging Qty. (Cubic Meter)	Cumulative Dredging Qty (Cubic Meter)
Mankachar	Khas Beel	0	10	0.012	0.3	10000	1.44	633416.27	633416.27	-0.3	0	10000	1.79	789358.48	789358.48
Khas Beel	Chirakhowa Bengervita	10	20	0.002	0.3	10000	1.44	635202.08	1268618.4	-0.3	0	10000	1.80	791486.51	1580845
Chirakhowa Bengervita	Dhappgurikuraltanga	20	30	0.005	0.3	10000	1.46	644274.33	1912892.7	-0.3	0	10000	1.82	802890.36	2383735.4
Dhappgurikuraltanga	Gandhipara Koch	30	40	0.002	0.3	10000	1.46	644601.87	2557494.6	-0.3	0	10000	1.82	803299.41	3187034.8
Gandhipara Koch	Dolbari	40	49.143	0.002	0.3	10000	1.29	569483.69	3126978.24	-0.3	0	10000	1.61	709686.51	3896721.27
Total						50000		3126978.24		Total		50000		3896721.27	

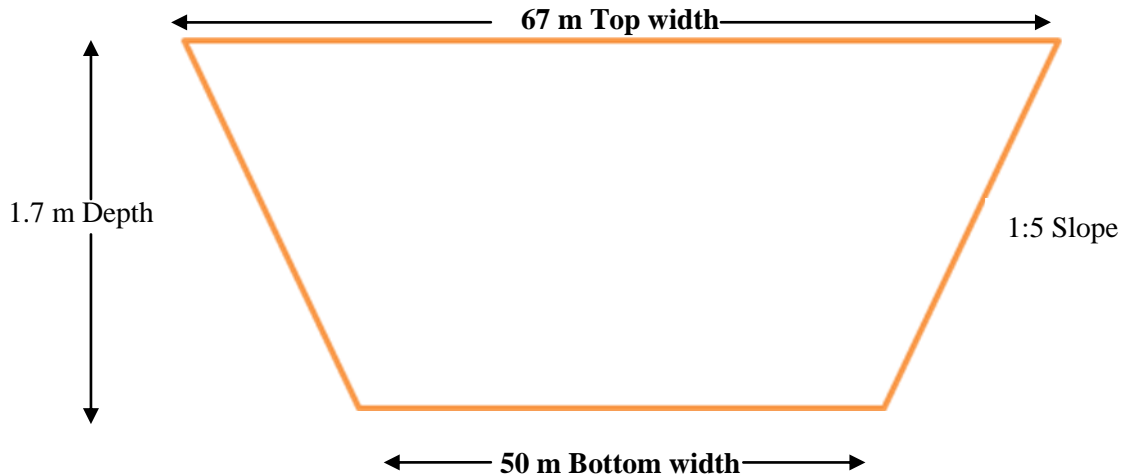
Table 12- Minimum & Maximum depth of class-II



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Class-III: - (Channel design: - Bottom width- 50 meter, Top width- 67 meter)



Location		Chainage (km)		As per Observed Soundings						As per Reduced Soundings					
From	To	From	To	Min. depth (m)	Max depth (m)	Length of Shoal (m)	Avg Depth of Cut (m)	Dredging Qty. (Cubic Meter)	Cumulative Dredging Qty (Cubic Meter)	Min. Depth (m)	Max Depth (m)	Length of Shoal (m)	Avg Depth of Cut (m)	Dredging Qty. (Cubic Meter)	Cumulative Dredging Qty (Cubic Meter)
Mankachar	Khas Beel	0	10	0.004	0.4	10000	1.74	957320.49	957320.49	-0.3	0	10000	2.09	1150769.2	1150769.2
Khas Beel	Chirakhowa Bengervita	10	20	0.002	0.4	10000	1.74	958308.78	1915629.3	-0.3	0	10000	2.08	1145813.2	2296582.4
Chirakhowa Bengervita	Dhappurikur altanga	20	30	0.002	0.3	10000	1.77	973501.08	2889130.4	-0.3	0	10000	2.14	1176086.3	3472668.7
Dhappurikur altanga	Gandhipara Koch	30	40	0.003	0.3	10000	1.77	973839.51	3862969.9	-0.3	0	10000	2.13	1170496	4643164.7
Gandhipara Koch	Dolbari	40	49.143	0.002	0.3	10000	1.56	860717.67	4723687.53	-0.3	0	10000	1.88	1034674.5	5677839.17
Total						50000		4723687.53		Total		50000		5677839.17	

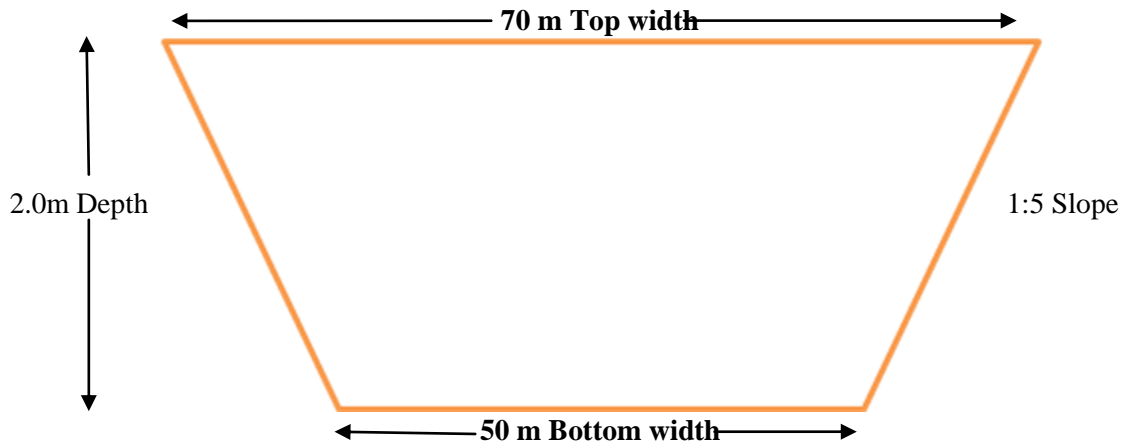
Table 13- Minimum & Maximum depth of class-III



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Class-IV: - (Channel design: - Bottom width- 50 meter, Top width- 70 meter)



Location		Chainage (km)		As per Observed Soundings						As per Reduced Soundings					
From	To	From	To	Min. depth (m)	Max depth (m)	Length of Shoal (m)	Avg Depth of Cut (m)	Dredging Qty. (Cubic Meter)	Cumulative Dredging Qty. (Cubic Meter)	Min. Depth (m)	Max Depth (m)	Length of Shoal (m)	Avg Depth of Cut (m)	Dredging Qty. (Cubic Meter)	Cumulative Dredging Qty. (Cubic Meter)
Mankachar	Khas Beel	0	10	0.004	0.3	10000	2.10	1154872.1	1154872.1	-0.3	0	10000	2.47	1356845.6	1356845.6
Khas Beel	Chirakhowa Bengervita	10	20	0.001	0.4	10000	2.10	1156085.8	2310957.9	-0.3	0	10000	2.47	1358059.7	2714905.3
Chirakhowa Bengervita	Dhapgurik uraltanga	20	30	0.001	0.4	10000	2.14	1174583.3	3485541.2	-0.3	0	10000	2.51	1379967.5	4094872.8
Dhapgurik uraltanga	Gandhipara Koch	30	40	0.001	0.4	10000	2.14	1174618	4660159.2	-0.3	0	10000	2.51	1379768.8	5474641.6
Gandhipara Koch	Dolbari	40	49.143	0.001	0.4	10000	1.89	1038314.6	5698473.8	-0.3	0	10000	2.22	1219904.6	6694546.2
Total						50000		5698473.8		Total		50000		6694546.2	

Table 14- Minimum & Maximum depth of class-IV



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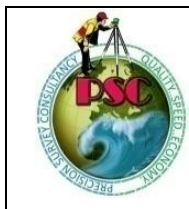
Section 6: Conclusion

The surveyed stretch of Ganol River is 49.143 km in length and was not explored for any navigational possibility in earlier time. There is a good scope for navigational aspect of the waterways. As much as 13 numbers of Bridges including RCC, Wooden and Bamboo are communicated in this zone of river for daily passengers and also for tourists. There are number of major industries existed in the nearby area, hence a large and consistent amount of cargo movement is expected through this river. The right bank of the river is moderately connected with roads and other infrastructures than the left bank. However, there is a good scope for developing tourism along the entire stretch of Ganol. The river bed of Ganol River is mainly sandy in nature with isolated incident of small scale and conventional sand/Gravel mining by the local peoples. The river banks of entire stretch are covered with vegetation and beyond that cultivation is prominent. Encroachment was observed in many parts of the river banks. The water flow of the river is not obstructed from top to bottom of the entire stretch. The average water velocity during the survey period is around 0.80 m/s. The cargo transportation is connected with RCC Bridge, wooden bridge, Bamboo Bridge, Bamboo Bridges etc. No Railway line has been found in this zone of river. Nokrek national park, Siju Bird Sanctuary, Chibragre, Pelga Falls, Rongbang Falls, Chenga- Benga Lake are famous wildlife sanctuary cum tourist spot located in this zone of river. Mankachar, Ambari, Garobadha etc. villages are located in this zone of river.

The Cargo transportation is well connected with NH-51, NH-127B which is the strong cargo transportation system in this zone of river. Besides, SH- 2, SH- 6, SH-11 and SH- 12 are also situated in this zone of river. But there were lots of possibility to improve the cargo transportation by Rail and roads.

6.1 Dredging volume:-

Class Details	As per Observed Soundings (Cubic Meter)	As per Reduced Soundings (Cubic Meter)
Class I	2053095.80	2651892.85
Class II	3126978.24	3896721.27
Class III	4723687.53	5677839.17
Class IV	5698473.80	6694546.20



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Annexure:-

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

The Chart Datum value of Garobadha, Mankachar and Confluence with Brahmaputra River has been provided by IWA 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)		As per Observed Soundings					As per Reduced Soundings				
From	To	Min. depth (m)	Max. depth (m)	Length of Shoal (m)	Dredging Qty. (Cubic Meter)	Cumulative Dredging Qty. (Cubic Meter)	Min. Depth (m)	Max. Depth (m)	Length of Shoal (m)	Dredging Qty. (Cubic Meter)	Cumulative Dredging Qty. (Cubic Meter)
0	1	0.05	0.3	1000	38655.59	38655.59	-0.3	0	1000	49929.82	49929.82
1	2	0.05	0.3	1000	43154.23	81809.82	-0.3	0	1000	55740.42	105670.24
2	3	0.05	0.3	1000	40520.67	122330.49	-0.3	0	1000	52339.09	158009.33
3	4	0.05	0.3	1000	41892.48	164222.97	-0.3	0	1000	54110.73	212120.06
4	5	0.04	0.2	1000	42578.54	206801.51	-0.3	0	1000	54996.07	267116.13
5	6	0.1	0.3	1000	42250.07	249051.58	-0.3	0	1000	54572.63	321688.76
6	7	0.05	0.3	1000	42919.87	291971.45	-0.3	0	1000	55437.8	377126.56
7	8	0.03	0.3	1000	41554.01	333525.46	-0.3	0	1000	53673.34	430799.9
8	9	0.03	0.3	1000	42188.88	375714.34	-0.3	0	1000	54493.46	485293.36
9	10	0.05	0.3	1000	40144.61	415858.95	-0.3	0	1000	51852.57	537145.93
10	11	0.05	0.3	1000	42175.44	458034.39	-0.3	0	1000	54477.02	591622.95
11	12	0.03	0.3	1000	40248.18	498282.57	-0.3	0	1000	51986.42	643609.37
12	13	0.04	0.3	1000	41874.49	540157.06	-0.3	0	1000	54087.01	697696.38
13	14	0.03	0.3	1000	40920.47	581077.53	-0.3	0	1000	52855.27	750551.65
14	15	0.03	0.3	1000	42598.74	623676.27	-0.3	0	1000	2722.92	753274.57
15	16	0.04	0.3	1000	39923.78	663600.05	-0.3	0	1000	103867.24	857141.81
16	17	0.03	0.3	1000	42782.77	706382.82	-0.3	0	1000	55260.95	912402.76
17	18	0.03	0.2	1000	42835.13	749217.95	-0.3	0	1000	55328.22	967730.98
18	19	0.03	0.3	1000	41705.36	790923.31	-0.3	0	1000	53869.24	1021600.22
19	20	0.1	0.3	1000	42094.19	833017.5	-0.3	0	1000	54371.02	1075971.24
20	21	0.01	0.3	1000	42945.48	875962.98	-0.3	0	1000	55471.02	1131442.26



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Class-I											
Chainage (km)		As per Observed Soundings					As per Reduced Soundings				
From	To	Min. depth (m)	Max. depth (m)	Length of Shoal (m)	Dredging Qty. (Cubic Meter)	Cumulative Dredging Qty. (Cubic Meter)	Min. Depth (m)	Max. Depth (m)	Length of Shoal (m)	Dredging Qty. (Cubic Meter)	Cumulative Dredging Qty. (Cubic Meter)
21	22	0.05	0.3	1000	42247.53	918210.51	-0.3	0	1000	54569.33	1186011.59
22	23	0.1	0.3	1000	42729.76	960940.27	-0.3	0	1000	55191.66	1241203.25
23	24	0.1	0.3	1000	41847.5	1002787.8	-0.3	0	1000	54052.04	1295255.29
24	25	0.1	0.3	1000	41343.91	1044131.7	-0.3	0	1000	53402.41	1348657.7
25	26	0.01	0.3	1000	42698.96	1086830.6	-0.3	0	1000	55151.94	1403809.64
26	27	0.1	0.3	1000	42205.51	1129036.2	-0.3	0	1000	54515.38	1458325.02
27	28	0.02	0.3	1000	41651.99	1170688.1	-0.3	0	1000	53799.87	1512124.89
28	29	0.01	0.3	1000	42624.26	1213312.4	-0.3	0	1000	55056.42	1567181.31
29	30	0.03	0.3	1000	42694.22	1256006.6	-0.3	0	1000	55145.97	1622327.28
30	31	0.04	0.3	1000	41092.76	1297099.4	-0.3	0	1000	53078.05	1675405.33
31	32	0.02	0.3	1000	42791.03	1339890.4	-0.3	0	1000	55271.1	1730676.43
32	33	0.02	0.3	1000	42305.63	1382196	-0.3	0	1000	54644.74	1785321.17
33	34	0.02	0.3	1000	41945.96	1424142	-0.3	0	1000	54179.77	1839500.94
34	35	0.01	0.3	1000	42377.86	1466519.9	-0.3	0	1000	54737.32	1894238.26
35	36	0.01	0.3	1000	42317.69	1508837.6	-0.3	0	1000	54659.37	1948897.63
36	37	0.02	0.3	1000	42684.8	1551522.4	-0.3	0	1000	55133.97	2004031.6
37	38	0.02	0.3	1000	42483.8	1594006.2	-0.3	0	1000	54874.87	2058906.47
38	39	0.01	0.3	1000	42675.81	1636682	-0.3	0	1000	55122.66	2114029.13
39	40	0.02	0.3	1000	42528.33	1679210.3	-0.3	0	1000	54931.42	2168960.55
40	41	0.02	0.3	1000	42513.15	1721723.4	-0.3	0	1000	54912.28	2223872.83
41	42	0.03	0.3	1000	42614.44	1764337.9	-0.3	0	1000	55042.9	2278915.73
42	43	0.02	0.3	1000	42776.34	1807114.2	-0.3	0	1000	55252.93	2334168.66
43	44	0.01	0.3	1000	42979.32	1850093.5	-0.3	0	1000	55514.88	2389683.54
44	45	0.02	0.3	1000	42327.74	1892421.3	-0.3	0	1000	54672.36	2444355.9
45	46	0.02	0.3	1000	42587.41	1935008.7	-0.3	0	1000	55008.18	2499364.08
46	47	0.03	0.3	1000	42466.54	1977475.2	-0.3	0	1000	54852.58	2554216.66
47	48	0.03	0.3	1000	42215.6	2019690.8	-0.3	0	1000	54528.14	2608744.8
48	49.143	0.02	0.3	1000	33404.97	2053095.8	-0.3	0	1000	43148.05	2651892.85
Total				49000	2053095.8	Total				49000	2651892.85

Table 15- Dredging calculation for class-I



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Class-II:-

Class-II											
Chainage (km)		As per Observed Soundings					As per Reduced Soundings				
From	To	Min. depth (m)	Max. depth (m)	Length of Shoal (m)	Dredging Qty. (Cubic Meter)	Cumulative Dredging Qty. (Cubic Meter)	Min. Depth (m)	Max. Depth (m)	Length of Shoal (m)	Dredging Qty. (Cubic Meter)	Cumulative Dredging Qty. (Cubic Meter)
0	1	0.027	0.3	1000	58878.63	58878.63	-0.3	0	1000	73374.19	73374.19
1	2	0.029	0.3	1000	65730.5	124609.13	-0.3	0	1000	81913.04	155287.23
2	3	0.042	0.3	1000	61720.02	186329.15	-0.3	0	1000	76915.41	232202.64
3	4	0.019	0.3	1000	63809.05	250138.2	-0.3	0	1000	79518.34	311720.98
4	5	0.012	0.3	1000	64851.65	314989.85	-0.3	0	1000	80817.3	392538.28
5	6	0.093	0.3	1000	64354.32	379344.17	-0.3	0	1000	80198.04	472736.32
6	7	0.032	0.3	1000	65373.18	444717.35	-0.3	0	1000	81467.1	554203.42
7	8	0.019	0.3	1000	63292.51	508009.86	-0.3	0	1000	78874.69	633078.11
8	9	0.019	0.3	1000	64259.92	572269.78	-0.3	0	1000	80080.22	713158.33
9	10	0.025	0.3	1000	61146.49	633416.27	-0.3	0	1000	76200.15	789358.48
10	11	0.013	0.3	1000	64242.2	697658.47	-0.3	0	1000	80058.68	869417.16
11	12	0.029	0.3	1000	61207.58	758866.05	-0.3	0	1000	76228.31	945645.47
12	13	0.039	0.3	1000	63780.13	822646.18	-0.3	0	1000	79482.09	1025127.6
13	14	0.029	0.3	1000	62328.53	884974.71	-0.3	0	1000	77673.17	1102800.7
14	15	0.019	0.3	1000	64882.77	949857.48	-0.3	0	1000	80855.9	1183656.6
15	16	0.009	0.3	1000	60712.44	1010569.9	-0.3	0	1000	75610.63	1259267.3
16	17	0.007	0.3	1000	65165.45	1075735.4	-0.3	0	1000	81209.04	1340476.3
17	18	0.002	0.3	1000	65244.29	1140979.7	-0.3	0	1000	81306.61	1421782.9
18	19	0.006	0.3	1000	63523.97	1204503.6	-0.3	0	1000	79163.13	1500946
19	20	0.097	0.3	1000	64114.72	1268618.4	-0.3	0	1000	79898.95	1580845
20	21	0.009	0.3	1000	65413.11	1334031.5	-0.3	0	1000	81517.15	1662362.1
21	22	0.005	0.3	1000	64349.48	1398380.9	-0.3	0	1000	80192.18	1742554.3
22	23	0.092	0.3	1000	65083.71	1463464.7	-0.3	0	1000	81106.88	1823661.2
23	24	0.093	0.3	1000	63739.16	1527203.8	-0.3	0	1000	79431.13	1903092.3
24	25	0.096	0.3	1000	62973.49	1590177.3	-0.3	0	1000	78477.63	1981570
25	26	0.007	0.3	1000	65036.26	1655213.6	-0.3	0	1000	81047.31	2062617.3
26	27	0.093	0.3	1000	64285.64	1719499.2	-0.3	0	1000	80112.47	2142729.7
27	28	0.009	0.3	1000	63440.96	1782940.2	-0.3	0	1000	79059.27	2221789
28	29	0.009	0.3	1000	64923.33	1847863.5	-0.3	0	1000	80907.54	2302696.6
29	30	0.006	0.3	1000	65029.19	1912892.7	-0.3	0	1000	81038.8	2383735.4



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Class-II											
Chainage (km)		As per Observed Soundings					As per Reduced Soundings				
From	To	Min. depth (m)	Max. depth (m)	Length of Shoal (m)	Dredging Qty. (Cubic Meter)	Cumulative Dredging Qty. (Cubic Meter)	Min. Depth (m)	Max. Depth (m)	Length of Shoal (m)	Dredging Qty. (Cubic Meter)	Cumulative Dredging Qty. (Cubic Meter)
30	31	0.002	0.3	1000	62590.71	1975483.4	-0.3	0	1000	78000.31	2461735.7
31	32	0.005	0.3	1000	65175.79	2040659.2	-0.3	0	1000	81221.73	2542957.4
32	33	0.005	0.3	1000	64438.76	2105097.9	-0.3	0	1000	80303.5	2623260.9
33	34	0.005	0.3	1000	63890.55	2168988.5	-0.3	0	1000	79620.25	2702881.1
34	35	0.002	0.3	1000	64547.49	2233536	-0.3	0	1000	80438.29	2783319.4
35	36	0.002	0.3	1000	64454.86	2297990.8	-0.3	0	1000	80323.04	2863642.5
36	37	0.002	0.3	1000	65014.95	2363005.8	-0.3	0	1000	81021.31	2944663.8
37	38	0.007	0.3	1000	64710.51	2427716.3	-0.3	0	1000	80642.04	3025305.8
38	39	0.009	0.3	1000	65002.2	2492718.5	-0.3	0	1000	81005.77	3106311.6
39	40	0.002	0.3	1000	64776.05	2557494.6	-0.3	0	1000	80723.17	3187034.8
40	41	0.016	0.3	1000	64754.3	2622248.9	-0.3	0	1000	80696.07	3267730.8
41	42	0.003	0.3	1000	64906.55	2687155.4	-0.3	0	1000	80885.78	3348616.6
42	43	0.003	0.3	1000	65155.84	2752311.2	-0.3	0	1000	81197.12	3429813.7
43	44	0.003	0.3	1000	65464.76	2817776	-0.3	0	1000	81581.69	3511395.4
44	45	0.005	0.3	1000	64469.91	2882245.9	-0.3	0	1000	80341.83	3591737.3
45	46	0.009	0.3	1000	64867	2947112.9	-0.3	0	1000	80836.78	3672574
46	47	0.003	0.3	1000	64683.06	3011796	-0.3	0	1000	80607.77	3753181.8
47	48	0.003	0.3	1000	64300.3	3076096.3	-0.3	0	1000	80130.61	3833312.4
48	49.143	0.012	0.3	1000	50881.97	3126978.24	-0.3	0	1000	63408.86	3896721.27
Total				49000	3126978.24		Total		49000	3896721.27	

Table 16- Dredging calculation for class-II



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Class-III:-

Class-III											
Chainage (km)		As per Observed Soundings					As per Reduced Soundings				
From	To	Min. depth (m)	Max. depth (m)	Length of Shoal (m)	Dredging Qty. (Cubic Meter)	Cumulative Dredging Qty. (Cubic Meter)	Min. Depth (m)	Max. Depth (m)	Length of Shoal (m)	Dredging Qty. (Cubic Meter)	Cumulative Dredging Qty. (Cubic Meter)
0	1	0.024	0.3	1000	88988.77	88988.77	-0.3	0	1000	106974.15	106974.15
1	2	0.028	0.3	1000	99345.93	188334.7	-0.3	0	1000	119424.33	226398.48
2	3	0.034	0.3	1000	93284.28	281618.98	-0.3	0	1000	112137.74	338536.22
3	4	0.018	0.3	1000	96414.34	378033.32	-0.3	0	1000	115865.83	454402.05
4	5	0.004	0.3	1000	98014.58	476047.9	-0.3	0	1000	117823.6	572225.65
5	6	0.086	0.3	1000	97264.77	573312.67	-0.3	0	1000	116922.92	689148.57
6	7	0.024	0.4	1000	98804.89	672117.56	-0.3	0	1000	118774.11	807922.68
7	8	0.018	0.3	1000	95662.03	767779.59	-0.3	0	1000	114995.85	922918.53
8	9	0.018	0.3	1000	97122.28	864901.87	-0.3	0	1000	116751.22	1039669.8
9	10	0.02	0.3	1000	92418.62	957320.49	-0.3	0	1000	111099.49	1150769.2
10	11	0.006	0.3	1000	97096.94	1054417.4	-0.3	0	1000	116721.36	1267490.6
11	12	0.028	0.3	1000	91857.24	1146274.7	-0.3	0	1000	110361.11	1377851.7
12	13	0.038	0.4	1000	96107.9	1242382.6	-0.3	0	1000	115465.98	1493317.7
13	14	0.028	0.4	1000	94218.67	1336601.2	-0.3	0	1000	113266.97	1606584.7
14	15	0.018	0.3	1000	98062.5	1434663.7	-0.3	0	1000	117881.71	1724466.4
15	16	0.008	0.3	1000	90952.53	1525616.3	-0.3	0	1000	109213.89	1833680.3
16	17	0.004	0.3	1000	98491.22	1624107.5	-0.3	0	1000	118397.12	1952077.4
17	18	0.002	0.3	1000	98609.73	1722717.2	-0.3	0	1000	118539.53	2070616.9
18	19	0.002	0.3	1000	96010.76	1818728	-0.3	0	1000	115415.36	2186032.3
19	20	0.094	0.3	1000	96901.29	1915629.3	-0.3	0	1000	110550.13	2296582.4
20	21	0.008	0.3	1000	98866.06	2014495.3	-0.3	0	1000	118883.82	2415466.2
21	22	0.002	0.3	1000	97258.44	2111753.8	-0.3	0	1000	122814.11	2538280.3
22	23	0.084	0.3	1000	98227.61	2209981.4	-0.3	0	1000	118024.55	2656304.9
23	24	0.086	0.3	1000	96334.12	2306315.5	-0.3	0	1000	115803.81	2772108.7
24	25	0.092	0.3	1000	95180.45	2401496	-0.3	0	1000	114417.24	2886525.9
25	26	0.004	0.3	1000	98179.11	2499675.1	-0.3	0	1000	117975.86	3004501.8
26	27	0.086	0.3	1000	97161.35	2596836.4	-0.3	0	1000	116798.57	3121300.4
27	28	0.008	0.3	1000	95883.12	2692719.5	-0.3	0	1000	115261.62	3236562
28	29	0.008	0.3	1000	98126.34	2790845.9	-0.3	0	1000	112457.73	3349019.7
29	30	0.002	0.3	1000	98284.48	2889130.4	-0.3	0	1000	123648.98	3472668.7
30	31	0.006	0.3	1000	94598.93	2983729.3	-0.3	0	1000	113718.09	3586386.8
31	32	0.003	0.3	1000	98506.02	3082235.3	-0.3	0	1000	118414.91	3704801.7



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RIVER IN MEGHALAYA (49.143 KMS)**



Class-III											
Chainage (km)		As per Observed Soundings					As per Reduced Soundings				
From	To	Min. depth (m)	Max. depth (m)	Length of Shoal (m)	Dredging Qty. (Cubic Meter)	Cumulative Dredging Qty. (Cubic Meter)	Min. Depth (m)	Max. Depth (m)	Length of Shoal (m)	Dredging Qty. (Cubic Meter)	Cumulative Dredging Qty. (Cubic Meter)
32	33	0.005	0.3	1000	97393.58	3179628.9	-0.3	0	1000	117077.6	3821879.3
33	34	0.004	0.3	1000	96564	3276192.9	-0.3	0	1000	116080.31	3937959.6
34	35	0.006	0.3	1000	97557.28	3373750.2	-0.3	0	1000	117274.08	4055233.7
35	36	0.006	0.3	1000	97277.2	3471027.4	-0.3	0	1000	116881.45	4172115.1
36	37	0.003	0.3	1000	98262.74	3569290.1	-0.3	0	1000	118122.42	4290237.6
37	38	0.004	0.3	1000	97804.07	3667094.2	-0.3	0	1000	117571.22	4407808.8
38	39	0.008	0.3	1000	97973.94	3765068.1	-0.3	0	1000	117667.76	4525476.5
39	40	0.005	0.3	1000	97901.75	3862969.9	-0.3	0	1000	117688.14	4643164.7
40	41	0.012	0.3	1000	97869.62	3960839.5	-0.3	0	1000	117649.64	4760814.3
41	42	0.002	0.3	1000	98099.39	4058938.9	-0.3	0	1000	117925.83	4878740.1
42	43	0.002	0.3	1000	98477.67	4157416.5	-0.3	0	1000	118380.5	4997120.6
43	44	0.003	0.3	1000	98943.29	4256359.8	-0.3	0	1000	118940.62	5116061.3
44	45	0.006	0.3	1000	97440.33	4353800.2	-0.3	0	1000	117133.28	5233194.5
45	46	0.008	0.3	1000	98038.9	4451839.1	-0.3	0	1000	117853.21	5351047.8
46	47	0.003	0.3	1000	97762.61	4549601.7	-0.3	0	1000	117521.32	5468569.1
47	48	0.004	0.3	1000	97182.4	4646784.1	-0.3	0	1000	116823.7	5585392.8
48	49.143	0.004	0.3	1000	76903.46	4723687.5	-0.3	0	1000	92446.4	5677839.17
Total				49000	4723687.53		Total			49000	5677839.17

Table 17- Dredging calculation for class-III



**FINAL FEASIBILITY REPORT ON
“DETAILED HYDROGRAPHY SURVEY IN GANOL
RIVER IN MEGHALAYA (49.143 KMS)**



Class-IV:-

Class-IV											
Chainage (km)		As per Observed Soundings					As per Reduced Soundings				
From	To	Min. depth (m)	Max. depth (m)	Length of Shoal (m)	Dredging Qty. (Cubic Meter)	Cumulative Dredging Qty. (Cubic Meter)	Min. Depth (m)	Max. Depth (m)	Length of Shoal (m)	Dredging Qty. (Cubic Meter)	Cumulative Dredging Qty. (Cubic Meter)
0	1	0.021	0.3	1000	107378.29	107378.29	-0.3	0	1000	126169.11	126169.11
1	2	0.027	0.3	1000	119873.76	227252.05	-0.3	0	1000	140851.26	267020.37
2	3	0.026	0.3	1000	112560.86	339812.91	-0.3	0	1000	132258.79	399279.16
3	4	0.017	0.3	1000	116204	456016.91	-0.3	0	1000	136468.71	535747.87
4	5	0.004	0.3	1000	118124.56	574141.47	-0.3	0	1000	138736.18	674484.05
5	6	0.079	0.3	1000	117364	691505.47	-0.3	0	1000	137902.28	812386.33
6	7	0.016	0.3	1000	119221.34	810726.81	-0.3	0	1000	140084.39	952470.72
7	8	0.015	0.3	1000	115429.52	926156.33	-0.3	0	1000	135629.48	1088100.2
8	9	0.015	0.3	1000	117192.2	1043348.5	-0.3	0	1000	137700.23	1225800.4
9	10	0.015	0.3	1000	111523.53	1154872.1	-0.3	0	1000	131045.14	1356845.6
10	11	0.006	0.4	1000	117162.88	1272034.9	-0.3	0	1000	137665.81	1494511.4
11	12	0.027	0.3	1000	110596.38	1382631.3	-0.3	0	1000	129883.25	1624394.6
12	13	0.037	0.4	1000	115726.43	1498357.8	-0.3	0	1000	135903.15	1760297.8
13	14	0.027	0.4	1000	113692.73	1612050.5	-0.3	0	1000	133598.06	1893895.8
14	15	0.017	0.3	1000	118323.45	1730373.9	-0.3	0	1000	139029.64	2032925.5
15	16	0.007	0.3	1000	110113.63	1840487.6	-0.3	0	1000	129237.01	2162162.5
16	17	0.001	0.3	1000	118844.53	1959332.1	-0.3	0	1000	139641.82	2301804.3
17	18	0.002	0.2	1000	118986.84	2078318.9	-0.3	0	1000	139808.79	2441613.1
18	19	0.002	0.4	1000	115850.91	2194169.8	-0.3	0	1000	136124.39	2577737.5
19	20	0.091	0.4	1000	116788.03	2310957.9	-0.3	0	1000	137167.77	2714905.3
20	21	0.007	0.4	1000	119295.43	2430253.3	-0.3	0	1000	140171.69	2855077
21	22	0.002	0.3	1000	117357.11	2547610.4	-0.3	0	1000	137894.32	2992971.3
22	23	0.076	0.4	1000	118423.27	2666033.7	-0.3	0	1000	139032.2	3132003.5
23	24	0.079	0.4	1000	116240.22	2782273.9	-0.3	0	1000	136581.93	3268585.4
24	25	0.088	0.4	1000	114847.16	2897121.1	-0.3	0	1000	134944.65	3403530.1
25	26	0.001	0.3	1000	118489.55	3015610.6	-0.3	0	1000	139176.24	3542706.3
26	27	0.079	0.3	1000	117239.43	3132850	-0.3	0	1000	137755.74	3680462
27	28	0.007	0.3	1000	115694.9	3248544.9	-0.3	0	1000	135941.22	3816403.3
28	29	0.007	0.3	1000	118404.95	3366949.9	-0.3	0	1000	139125.17	3955528.4
29	30	0.002	0.3	1000	118591.31	3485541.2	-0.3	0	1000	139344.37	4094872.8



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Class-IV											
Chainage (km)		As per Observed Soundings					As per Reduced Soundings				
From	To	Min. depth (m)	Max. depth (m)	Length of Shoal (m)	Dredging Qty. (Cubic Meter)	Cumulative Dredging Qty. (Cubic Meter)	Min. Depth (m)	Max. Depth (m)	Length of Shoal (m)	Dredging Qty. (Cubic Meter)	Cumulative Dredging Qty. (Cubic Meter)
30	31	0.006	0.3	1000	114146.86	3599688.1	-0.3	0	1000	134121.79	4228994.6
31	32	0.003	0.3	1000	118860.37	3718548.4	-0.3	0	1000	139660.5	4368655.1
32	33	0.005	0.3	1000	117519.41	3836067.8	-0.3	0	1000	138084.71	4506739.8
33	34	0.001	0.4	1000	116519.03	3952586.9	-0.3	0	1000	136909.62	4643649.4
34	35	0.006	0.4	1000	117714.11	4070301	-0.3	0	1000	138313.67	4781963.1
35	36	0.006	0.4	1000	117405.8	4187706.8	-0.3	0	1000	137890.98	4919854.1
36	37	0.001	0.4	1000	118566.55	4306273.3	-0.3	0	1000	139315.31	5059169.4
37	38	0.001	0.4	1000	118013.9	4424287.2	-0.3	0	1000	138665.93	5197835.3
38	39	0.007	0.4	1000	118135.75	4542423	-0.3	0	1000	138634.5	5336469.8
39	40	0.005	0.3	1000	117736.23	4660159.2	-0.3	0	1000	138171.81	5474641.6
40	41	0.017	0.3	1000	117966.37	4778125.6	-0.3	0	1000	138556.24	5613197.9
41	42	0.002	0.3	1000	118369.65	4896495.2	-0.3	0	1000	139083.97	5752281.8
42	43	0.002	0.3	1000	118688.49	5015183.7	-0.3	0	1000	139399.44	5891681.3
43	44	0.002	0.3	1000	119389.91	5134573.6	-0.3	0	1000	140282.81	6031964.1
44	45	0.005	0.3	1000	117573.07	5252146.7	-0.3	0	1000	138147.97	6170112
45	46	0.007	0.4	1000	118297.93	5370444.6	-0.3	0	1000	138999.49	6309111.5
46	47	0.001	0.4	1000	117964.72	5488409.4	-0.3	0	1000	138607.96	6447719.5
47	48	0.004	0.4	1000	117264.81	5605674.2	-0.3	0	1000	137785.65	6585505.1
48	49.143	0.004	0.4	1000	92799.64	5698473.8	-0.3	0	1000	109041.04	6694546.2
Total				49000	5698473.8		Total		49000	6694546.2	

Table 18-Dredging calculation for class-IV



**FINAL FEASIBILITY REPORT ON
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Annexure -3: Observed Depth in 200 meter interval:-

Chainage (in meter)	Class-I		Class-II		Class-III		Class-IV	
	Observed		Observed		Observed		Observed	
	Min	Max	Min	Max	Min	Max	Min	Max
0	0.1	0.3	0.099	0.1	0.098	0.2	0.097	0.3
200	0.03	0.1	0.027	0.2	0.024	0.2	0.021	0.2
400	0.2	0.3	0.196	0.3	0.192	0.3	0.188	0.3
600	0.1	0.2	0.099	0.2	0.098	0.2	0.097	0.2
800	0.04	0.2	0.038	0.3	0.036	0.3	0.034	0.3
1000	0.05	0.2	0.045	0.2	0.04	0.3	0.035	0.3
1200	0.1	0.2	0.093	0.3	0.086	0.3	0.079	0.3
1400	0.2	0.3	0.192	0.3	0.184	0.3	0.176	0.3
1600	0.03	0.1	0.029	0.2	0.028	0.2	0.027	0.3
1800	0.05	0.2	0.047	0.2	0.044	0.3	0.041	0.3
2000	0.1	0.2	0.096	0.2	0.092	0.3	0.088	0.3
2200	0.05	0.2	0.049	0.2	0.048	0.2	0.047	0.2
2400	0.1	0.2	0.098	0.2	0.096	0.3	0.094	0.3
2600	0.1	0.2	0.095	0.3	0.09	0.3	0.085	0.3
2800	0.2	0.3	0.193	0.3	0.186	0.3	0.179	0.3
3000	0.05	0.2	0.042	0.3	0.034	0.3	0.026	0.3
3200	0.02	0.2	0.019	0.3	0.018	0.3	0.017	0.3
3400	0.1	0.2	0.097	0.3	0.094	0.3	0.091	0.3
3600	0.2	0.3	0.196	0.3	0.192	0.3	0.188	0.3
3800	0.03	0.2	0.029	0.3	0.028	0.3	0.027	0.3
4000	0.1	0.2	0.098	0.2	0.096	0.3	0.094	0.3
4200	0.04	0.2	0.035	0.3	0.03	0.3	0.025	0.3
4400	0.1	0.2	0.093	0.3	0.086	0.3	0.079	0.3
4600	0.02	0.1	0.012	0.2	0.004	0.3	0.004	0.3
4800	0.03	0.2	0.029	0.2	0.028	0.3	0.027	0.3
5000	0.1	0.2	0.097	0.2	0.094	0.3	0.091	0.3
5200	0.2	0.3	0.196	0.3	0.192	0.3	0.188	0.3
5400	0.1	0.2	0.099	0.3	0.098	0.3	0.097	0.3
5600	0.1	0.2	0.098	0.2	0.096	0.2	0.094	0.2
5800	0.2	0.3	0.195	0.3	0.19	0.3	0.185	0.3
6000	0.1	0.2	0.093	0.3	0.086	0.3	0.079	0.3
6200	0.04	0.2	0.032	0.3	0.024	0.3	0.016	0.3
6400	0.2	0.3	0.199	0.3	0.198	0.3	0.197	0.3
6600	0.1	0.2	0.097	0.2	0.094	0.3	0.091	0.3
6800	0.05	0.3	0.046	0.3	0.042	0.4	0.038	0.4
7000	0.2	0.3	0.199	0.3	0.198	0.3	0.197	0.3



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Chainage (in meter)	Class-I		Class-II		Class-III		Class-IV	
	Observed		Observed		Observed		Observed	
	Min	Max	Min	Max	Min	Max	Min	Max
7200	0.1	0.2	0.098	0.2	0.096	0.3	0.094	0.3
7400	0.03	0.2	0.025	0.3	0.02	0.3	0.015	0.3
7600	0.1	0.2	0.093	0.2	0.086	0.3	0.079	0.3
7800	0.2	0.3	0.192	0.3	0.184	0.3	0.176	0.3
8000	0.02	0.2	0.019	0.2	0.018	0.3	0.017	0.3
8200	0.2	0.3	0.197	0.3	0.194	0.3	0.191	0.3
8400	0.1	0.2	0.096	0.2	0.092	0.3	0.088	0.3
8600	0.02	0.2	0.019	0.3	0.018	0.3	0.017	0.3
8800	0.1	0.2	0.098	0.3	0.096	0.3	0.094	0.3
9000	0.03	0.2	0.025	0.2	0.02	0.2	0.015	0.3
9200	0.2	0.3	0.193	0.3	0.186	0.3	0.179	0.3
9400	0.1	0.2	0.092	0.2	0.084	0.2	0.076	0.2
9600	0.05	0.2	0.049	0.3	0.048	0.3	0.047	0.3
9800	0.2	0.3	0.197	0.3	0.194	0.3	0.191	0.3
10000	0.1	0.2	0.096	0.3	0.092	0.3	0.088	0.3
10200	0.2	0.3	0.199	0.3	0.198	0.3	0.197	0.3
10400	0.05	0.2	0.048	0.2	0.046	0.3	0.044	0.3
10600	0.1	0.2	0.095	0.2	0.09	0.3	0.085	0.4
10800	0.02	0.3	0.013	0.3	0.006	0.3	0.006	0.4
11000	0.1	0.2	0.092	0.2	0.084	0.3	0.076	0.3
11200	0.03	0.1	0.029	0.2	0.028	0.3	0.027	0.3
11400	0.1	0.2	0.097	0.2	0.094	0.3	0.091	0.3
11600	0.2	0.3	0.196	0.3	0.192	0.3	0.188	0.3
11800	0.1	0.2	0.099	0.2	0.098	0.3	0.097	0.4
12000	0.1	0.2	0.098	0.3	0.096	0.3	0.094	0.3
12200	0.2	0.3	0.195	0.3	0.19	0.3	0.185	0.3
12400	0.1	0.2	0.093	0.3	0.086	0.3	0.079	0.4
12600	0.2	0.3	0.192	0.3	0.184	0.3	0.176	0.3
12800	0.04	0.2	0.039	0.3	0.038	0.3	0.037	0.3
13000	0.2	0.3	0.197	0.3	0.194	0.4	0.191	0.4
13200	0.1	0.2	0.096	0.2	0.092	0.3	0.088	0.4
13400	0.03	0.2	0.029	0.2	0.028	0.3	0.027	0.3
13600	0.2	0.3	0.198	0.2	0.196	0.3	0.194	0.3
13800	0.1	0.2	0.095	0.2	0.09	0.2	0.085	0.3
14000	0.1	0.2	0.093	0.2	0.086	0.2	0.079	0.3
14200	0.2	0.3	0.192	0.3	0.184	0.3	0.176	0.3
14400	0.02	0.1	0.019	0.2	0.018	0.2	0.017	0.3
14600	0.1	0.2	0.097	0.3	0.094	0.3	0.091	0.3
14800	0.1	0.2	0.096	0.3	0.092	0.3	0.088	0.3
15000	0.03	0.2	0.029	0.3	0.028	0.3	0.027	0.3



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Chainage (in meter)	Class-I		Class-II		Class-III		Class-IV	
	Observed		Observed		Observed		Observed	
	Min	Max	Min	Max	Min	Max	Min	Max
15200	0.04	0.2	0.038	0.2	0.036	0.2	0.034	0.2
15400	0.1	0.2	0.095	0.2	0.09	0.3	0.085	0.3
15600	0.2	0.3	0.193	0.3	0.186	0.3	0.179	0.3
15800	0.1	0.2	0.092	0.2	0.084	0.3	0.076	0.3
16000	0.01	0.2	0.009	0.3	0.008	0.3	0.007	0.3
16200	0.01	0.3	0.007	0.3	0.004	0.3	0.001	0.3
16400	0.02	0.1	0.016	0.2	0.012	0.2	0.008	0.2
16600	0.1	0.2	0.099	0.2	0.098	0.3	0.097	0.2
16800	0.02	0.3	0.018	0.3	0.016	0.3	0.014	0.2
17000	0.03	0.2	0.025	0.2	0.02	0.2	0.015	0.2
17200	0.1	0.2	0.093	0.2	0.086	0.3	0.079	0.2
17400	0.03	0.2	0.002	0.3	0.005	0.3	0.005	0.2
17600	0.02	0.1	0.019	0.2	0.018	0.3	0.017	0.2
17800	0.02	0.2	0.017	0.2	0.014	0.2	0.011	0.2
18000	0.03	0.1	0.006	0.2	0.002	0.3	0.002	0.2
18200	0.1	0.2	0.099	0.2	0.098	0.3	0.097	0.2
18400	0.2	0.3	0.198	0.3	0.196	0.3	0.194	0.3
18600	0.1	0.2	0.095	0.3	0.09	0.3	0.085	0.4
18800	0.1	0.2	0.093	0.2	0.086	0.3	0.079	0.4
19000	0.2	0.3	0.192	0.3	0.184	0.3	0.176	0.4
19200	0.1	0.2	0.099	0.2	0.098	0.3	0.097	0.4
19400	0.1	0.2	0.097	0.2	0.094	0.3	0.091	0.4
19600	0.2	0.3	0.196	0.3	0.192	0.3	0.188	0.4
19800	0.1	0.2	0.099	0.2	0.098	0.3	0.097	0.4
20000	0.2	0.3	0.198	0.3	0.196	0.3	0.194	0.4
20200	0.1	0.2	0.095	0.2	0.09	0.3	0.085	0.4
20400	0.2	0.3	0.193	0.3	0.186	0.3	0.179	0.4
20600	0.1	0.2	0.092	0.2	0.084	0.3	0.076	0.4
20800	0.01	0.2	0.009	0.2	0.008	0.2	0.007	0.2
21000	0.1	0.2	0.097	0.2	0.094	0.3	0.091	0.3
21200	0.01	0.2	0.006	0.3	0.002	0.3	0.002	0.3
21400	0.1	0.2	0.099	0.2	0.098	0.3	0.097	0.3
21600	0.2	0.3	0.198	0.3	0.196	0.3	0.194	0.3
21800	0.05	0.2	0.005	0.3	0.002	0.3	0.002	0.3
22000	0.2	0.3	0.193	0.3	0.186	0.3	0.179	0.3
22200	0.1	0.2	0.092	0.2	0.084	0.3	0.076	0.3
22400	0.2	0.3	0.199	0.3	0.198	0.3	0.197	0.3
22600	0.1	0.2	0.097	0.2	0.094	0.3	0.091	0.3
22800	0.2	0.3	0.196	0.3	0.192	0.3	0.188	0.4
23000	0.1	0.2	0.099	0.2	0.098	0.3	0.097	0.4



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Chainage (in meter)	Class-I		Class-II		Class-III		Class-IV	
	Observed		Observed		Observed		Observed	
	Min	Max	Min	Max	Min	Max	Min	Max
23200	0.1	0.2	0.098	0.2	0.096	0.3	0.094	0.4
23400	0.2	0.3	0.195	0.3	0.19	0.3	0.185	0.4
23600	0.1	0.2	0.093	0.3	0.086	0.3	0.079	0.4
23800	0.2	0.3	0.192	0.3	0.184	0.3	0.176	0.4
24000	0.1	0.2	0.099	0.2	0.098	0.3	0.097	0.4
24200	0.2	0.3	0.197	0.3	0.194	0.3	0.191	0.4
24400	0.1	0.2	0.096	0.2	0.092	0.2	0.088	0.2
24600	0.2	0.3	0.199	0.3	0.198	0.3	0.197	0.3
24800	0.1	0.3	0.098	0.3	0.096	0.3	0.094	0.3
25000	0.2	0.3	0.195	0.3	0.19	0.3	0.185	0.3
25200	0.1	0.2	0.093	0.2	0.086	0.2	0.079	0.3
25400	0.2	0.3	0.192	0.3	0.184	0.3	0.176	0.3
25600	0.1	0.2	0.099	0.2	0.098	0.3	0.097	0.3
25800	0.01	0.2	0.007	0.3	0.004	0.3	0.001	0.3
26000	0.2	0.3	0.196	0.3	0.192	0.3	0.188	0.3
26200	0.1	0.2	0.099	0.3	0.098	0.3	0.097	0.3
26400	0.2	0.3	0.198	0.3	0.196	0.3	0.194	0.3
26600	0.2	0.3	0.195	0.3	0.19	0.3	0.185	0.3
26800	0.1	0.3	0.093	0.3	0.086	0.3	0.079	0.3
27000	0.2	0.3	0.192	0.3	0.184	0.3	0.176	0.3
27200	0.01	0.2	0.009	0.3	0.008	0.3	0.007	0.3
27400	0.02	0.3	0.017	0.3	0.014	0.3	0.011	0.3
27600	0.2	0.3	0.196	0.3	0.192	0.3	0.188	0.3
27800	0.1	0.2	0.099	0.3	0.098	0.3	0.097	0.3
28000	0.1	0.2	0.098	0.3	0.096	0.3	0.094	0.3
28200	0.2	0.3	0.195	0.3	0.19	0.3	0.185	0.3
28400	0.1	0.2	0.093	0.2	0.086	0.2	0.079	0.3
28600	0.2	0.3	0.192	0.3	0.184	0.3	0.176	0.3
28800	0.01	0.2	0.009	0.3	0.008	0.3	0.007	0.3
29000	0.1	0.2	0.097	0.3	0.094	0.3	0.091	0.3
29200	0.03	0.2	0.006	0.3	0.002	0.3	0.002	0.3
29400	0.1	0.2	0.099	0.3	0.098	0.3	0.097	0.3
29600	0.2	0.3	0.198	0.3	0.196	0.3	0.194	0.3
29800	0.1	0.2	0.095	0.3	0.09	0.3	0.085	0.3
30000	0.2	0.3	0.193	0.3	0.186	0.3	0.179	0.3
30200	0.04	0.2	0.002	0.2	0.006	0.3	0.006	0.3
30400	0.01	0.2	0.009	0.3	0.008	0.3	0.007	0.3
30600	0.1	0.2	0.097	0.3	0.094	0.3	0.091	0.3
30800	0.2	0.3	0.196	0.3	0.192	0.3	0.188	0.3
31000	0.1	0.2	0.099	0.3	0.098	0.3	0.097	0.3



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Chainage (in meter)	Class-I		Class-II		Class-III		Class-IV	
	Observed		Observed		Observed		Observed	
	Min	Max	Min	Max	Min	Max	Min	Max
31200	0.1	0.2	0.098	0.3	0.096	0.3	0.094	0.3
31400	0.02	0.2	0.005	0.3	0.003	0.3	0.003	0.3
31600	0.2	0.3	0.193	0.3	0.186	0.3	0.179	0.3
31800	0.1	0.2	0.092	0.2	0.084	0.2	0.076	0.3
32000	0.1	0.2	0.099	0.3	0.098	0.3	0.097	0.3
32200	0.1	0.2	0.097	0.3	0.094	0.3	0.091	0.3
32400	0.1	0.2	0.096	0.3	0.092	0.3	0.088	0.3
32600	0.2	0.3	0.199	0.3	0.198	0.3	0.197	0.3
32800	0.02	0.3	0.018	0.3	0.016	0.3	0.014	0.3
33000	0.02	0.2	0.005	0.2	0.005	0.2	0.005	0.3
33200	0.1	0.2	0.093	0.3	0.086	0.3	0.079	0.3
33400	0.2	0.3	0.192	0.3	0.184	0.3	0.176	0.4
33600	0.02	0.2	0.009	0.3	0.008	0.3	0.007	0.4
33800	0.03	0.2	0.007	0.2	0.004	0.3	0.001	0.4
34000	0.1	0.2	0.096	0.3	0.092	0.3	0.088	0.4
34200	0.01	0.2	0.009	0.2	0.008	0.2	0.007	0.4
34400	0.1	0.2	0.098	0.3	0.096	0.3	0.094	0.4
34600	0.1	0.2	0.095	0.2	0.09	0.2	0.085	0.4
34800	0.2	0.3	0.193	0.3	0.186	0.3	0.179	0.4
35000	0.03	0.2	0.002	0.2	0.006	0.2	0.006	0.4
35200	0.02	0.3	0.019	0.3	0.018	0.3	0.017	0.4
35400	0.1	0.2	0.097	0.3	0.094	0.3	0.091	0.4
35600	0.2	0.3	0.196	0.3	0.192	0.3	0.188	0.4
35800	0.01	0.2	0.009	0.2	0.008	0.2	0.007	0.4
36000	0.1	0.2	0.098	0.2	0.096	0.3	0.094	0.4
36200	0.2	0.3	0.195	0.3	0.19	0.3	0.185	0.4
36400	0.03	0.2	0.003	0.2	0.003	0.3	0.003	0.4
36600	0.1	0.2	0.092	0.2	0.084	0.3	0.076	0.4
36800	0.2	0.3	0.199	0.3	0.198	0.3	0.197	0.4
37000	0.02	0.2	0.007	0.2	0.004	0.3	0.001	0.4
37200	0.1	0.2	0.096	0.2	0.092	0.3	0.088	0.4
37400	0.2	0.3	0.199	0.3	0.198	0.3	0.197	0.4
37600	0.1	0.2	0.098	0.2	0.096	0.3	0.094	0.4
37800	0.2	0.3	0.195	0.3	0.19	0.3	0.185	0.4
38000	0.1	0.2	0.093	0.3	0.086	0.3	0.079	0.4
38200	0.2	0.3	0.192	0.3	0.184	0.3	0.176	0.4
38400	0.01	0.2	0.009	0.3	0.008	0.3	0.007	0.4
38600	0.02	0.2	0.017	0.3	0.014	0.3	0.011	0.4
38800	0.1	0.2	0.096	0.2	0.092	0.3	0.088	0.3
39000	0.1	0.2	0.099	0.2	0.098	0.2	0.097	0.2



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Chainage (in meter)	Class-I		Class-II		Class-III		Class-IV	
	Observed		Observed		Observed		Observed	
	Min	Max	Min	Max	Min	Max	Min	Max
39200	0.2	0.3	0.198	0.3	0.196	0.3	0.194	0.3
39400	0.02	0.2	0.005	0.2	0.005	0.2	0.005	0.3
39600	0.1	0.2	0.093	0.3	0.086	0.3	0.079	0.3
39800	0.03	0.2	0.002	0.3	0.005	0.3	0.005	0.3
40000	0.1	0.2	0.099	0.3	0.098	0.3	0.097	0.3
40200	0.1	0.2	0.097	0.2	0.094	0.3	0.091	0.3
40400	0.02	0.1	0.016	0.2	0.012	0.3	0.008	0.3
40600	0.02	0.2	0.019	0.3	0.018	0.3	0.017	0.3
40800	0.1	0.2	0.098	0.3	0.096	0.3	0.094	0.3
41000	0.2	0.3	0.195	0.3	0.19	0.3	0.185	0.3
41200	0.03	0.2	0.003	0.3	0.005	0.3	0.005	0.3
41400	0.2	0.3	0.192	0.3	0.184	0.3	0.176	0.3
41600	0.1	0.2	0.099	0.2	0.098	0.3	0.097	0.3
41800	0.2	0.3	0.197	0.3	0.194	0.3	0.191	0.3
42000	0.03	0.2	0.006	0.3	0.002	0.3	0.002	0.3
42200	0.2	0.3	0.199	0.3	0.198	0.3	0.197	0.3
42400	0.02	0.1	0.018	0.2	0.016	0.3	0.014	0.3
42600	0.1	0.2	0.095	0.2	0.09	0.3	0.085	0.3
43000	0.03	0.2	0.003	0.3	0.003	0.3	0.002	0.3
43200	0.1	0.3	0.092	0.3	0.084	0.3	0.076	0.3
43400	0.01	0.2	0.009	0.3	0.008	0.3	0.007	0.3
43600	0.1	0.2	0.097	0.2	0.094	0.3	0.091	0.3
43800	0.2	0.3	0.196	0.3	0.192	0.3	0.188	0.3
44000	0.1	0.2	0.099	0.2	0.098	0.3	0.097	0.3
44200	0.2	0.3	0.198	0.3	0.196	0.3	0.194	0.3
44400	0.03	0.2	0.005	0.2	0.006	0.3	0.005	0.3
44600	0.1	0.2	0.093	0.3	0.086	0.3	0.079	0.3
44800	0.2	0.3	0.192	0.3	0.184	0.3	0.176	0.3
45000	0.02	0.2	0.009	0.3	0.008	0.3	0.007	0.3
45200	0.2	0.3	0.197	0.3	0.194	0.3	0.191	0.3
45400	0.1	0.2	0.096	0.2	0.092	0.2	0.088	0.2
45600	0.02	0.2	0.009	0.3	0.008	0.3	0.007	0.4
45800	0.2	0.3	0.198	0.3	0.196	0.3	0.194	0.4
46000	0.1	0.2	0.095	0.2	0.09	0.3	0.085	0.4
46200	0.03	0.2	0.003	0.3	0.003	0.3	0.003	0.4
46400	0.2	0.3	0.192	0.3	0.184	0.3	0.176	0.4
46600	0.1	0.2	0.099	0.3	0.098	0.3	0.097	0.4
46800	0.03	0.2	0.007	0.2	0.004	0.2	0.001	0.4
47000	0.2	0.3	0.196	0.3	0.192	0.3	0.188	0.4
47200	0.1	0.2	0.099	0.2	0.098	0.3	0.097	0.4



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RIVER IN MEGHALAYA (49.143 KMS)**



Chainage (in meter)	Class-I		Class-II		Class-III		Class-IV	
	Observed		Observed		Observed		Observed	
	Min	Max	Min	Max	Min	Max	Min	Max
47400	0.1	0.2	0.098	0.3	0.096	0.3	0.094	0.4
47600	0.02	0.1	0.015	0.2	0.01	0.2	0.005	0.4
47800	0.03	0.2	0.003	0.3	0.005	0.3	0.005	0.4
48000	0.02	0.3	0.012	0.3	0.004	0.3	0.004	0.4
48200	0.1	0.2	0.099	0.2	0.098	0.2	0.097	0.3
48400	0.2	0.3	0.197	0.3	0.194	0.3	0.191	0.3
48600	0.1	0.2	0.096	0.2	0.092	0.2	0.088	0.3
48800	0.2	0.3	0.199	0.3	0.198	0.3	0.197	0.3
49143	0.1	0.2	0.098	0.2	0.096	0.2	0.094	0.2

Table 19- Observed depth in 200 meter intervals



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Annexure -4: Reduced Depth in 200 meter interval:-

Chainage (in meter)	Class-I		Class-II		Class-III		Class-IV	
	Reduced		Reduced		Reduced		Reduced	
	Min	Max	Min	Max	Min	Max	Min	Max
0.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
200.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
400.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
600.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
800.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
1000.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
1200.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
1400.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
1600.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
1800.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
2000.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
2200.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
2400.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
2600.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
2800.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
3000.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
3200.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
3400.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
3600.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
3800.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
4000.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
4200.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
4400.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
4600.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
4800.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
5000.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
5200.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
5400.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
5600.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
5800.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
6000.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
6200.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
6400.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
6600.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
6800.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
7000.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
7200.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0



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Chainage (in meter)	Class-I		Class-II		Class-III		Class-IV	
	Reduced		Reduced		Reduced		Reduced	
	Min	Max	Min	Max	Min	Max	Min	Max
7400.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
7600.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
7800.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
8000.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
8200.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
8400.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
8600.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
8800.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
9000.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
9200.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
9400.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
9600.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
9800.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
10000.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
10200.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
10400.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
10600.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
10800.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
11000.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
11200.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
11400.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
11600.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
11800.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
12000.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
12200.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
12400.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
12600.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
12800.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
13000.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
13200.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
13400.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
13600.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
13800.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
14000.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
14200.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
14400.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
14600.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
14800.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
15000.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0



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Chainage (in meter)	Class-I		Class-II		Class-III		Class-IV	
	Reduced		Reduced		Reduced		Reduced	
	Min	Max	Min	Max	Min	Max	Min	Max
15200.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
15400.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
15600.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
15800.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
16000.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
16200.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
16400.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
16600.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
16800.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
17000.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
17200.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
17400.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
17600.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
17800.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
18000.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
18200.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
18400.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
18600.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
18800.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
19000.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
19200.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
19400.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
19600.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
19800.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
20000.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
20200.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
20400.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
20600.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
20800.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
21000.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
21200.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
21400.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
21600.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
21800.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
22000.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
22200.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
22400.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
22600.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
22800.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0



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Chainage (in meter)	Class-I		Class-II		Class-III		Class-IV	
	Reduced		Reduced		Reduced		Reduced	
	Min	Max	Min	Max	Min	Max	Min	Max
23000.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
23200.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
23400.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
23600.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
23800.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
24000.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
24200.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
24400.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
24600.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
24800.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
25000.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
25200.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
25400.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
25600.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
25800.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
26000.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
26200.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
26400.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
26600.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
26800.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
27000.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
27200.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
27400.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
27600.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
27800.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
28000.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
28200.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
28400.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
28600.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
28800.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
29000.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
29200.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
29400.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
29600.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
29800.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
30000.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
30200.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
30400.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
30600.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0



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Chainage (in meter)	Class-I		Class-II		Class-III		Class-IV	
	Reduced		Reduced		Reduced		Reduced	
	Min	Max	Min	Max	Min	Max	Min	Max
30800.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
31000.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
31200.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
31400.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
31600.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
31800.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
32000.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
32200.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
32400.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
32600.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
32800.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
33000.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
33200.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
33400.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
33600.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
33800.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
34000.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
34200.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
34400.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
34600.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
34800.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
35000.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
35200.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
35400.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
35600.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
35800.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
36000.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
36200.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
36400.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
36600.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
36800.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
37000.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
37200.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
37400.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
37600.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
37800.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
38000.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
38200.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
38400.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0



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Chainage (in meter)	Class-I		Class-II		Class-III		Class-IV	
	Reduced		Reduced		Reduced		Reduced	
	Min	Max	Min	Max	Min	Max	Min	Max
38600.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
38800.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
39000.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
39200.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
39400.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
39600.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
39800.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
40000.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
40200.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
40400.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
40600.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
40800.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
41000.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
41200.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
41400.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
41600.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
41800.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
42000.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
42200.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
42400.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
42600.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
42800.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
43000.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
43200.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
43400.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
43600.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
43800.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
44000.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
44200.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
44400.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
44600.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
44800.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
45000.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
45200.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
45400.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
45600.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
45800.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
46000.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
46200.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0



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Chainage (in meter)	Class-I		Class-II		Class-III		Class-IV	
	Reduced		Reduced		Reduced		Reduced	
	Min	Max	Min	Max	Min	Max	Min	Max
46400.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
46600.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
46800.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
47000.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
47200.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
47400.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
47600.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
47800.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
48000.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
48200.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
48400.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
48600.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
48800.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0
49143.000	-0.3	0	-0.3	0	-0.3	0	-0.3	0

Table 20- Reduced depth in 200 meter interval



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Annexure -5: 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
02.01.16	Gauge Station - 1	1.155	24 hrs	0.25	19.945	20.195	19.120	-1.075
02.01.16	Gauge Station -2	18.988	24 hrs	0.29	23.692	23.982	23.700	-0.282
03.01.16	Gauge Station – 3	25.353	24 hrs	0.32	25.773	26.093	25.850	-0.243
05.01.16	Gauge Station – 4	30.78	24 hrs	0.38	27.835	28.215	27.700	-0.515
08.01.16	Gauge Station – 5	39.566	24 hrs	0.46	31.621	32.081	31.830	-0.251
08.01.16	Gauge Station – 6	44.866	24 hrs	0.53	35.515	36.045	35.540	-0.505
09.01.16	Gauge Station - 7	48.75	24 hrs	0.59	38.6	39.19	38.870	-0.320

Table 21- Details of Collected water level of Different gauge stations

Annexure -6: Details of Bathymetric surveys carried out:-

The layer of water in the river Ganol is not sufficient for carrying out the Bathymetry survey.

Annexure -7: Bank Protection along the Bank:-

The bank of the river is generally protected by embankment and Boulder pitching. Boulder pitching and embankment have been protected both side in this river side. Besides, Nokrek National Park, Tura peak, Balpakram National park, Siju Bird sanctuary, Selbagre Hoolock Gibbon reserve at chandigre and dense forest side are also protected the bank of the river. However, in the rainy season, flood damages the crops (paddy field), wooden and Bamboo bridges etc. Due to this, the State Government has to incur heavy non plan expenditure for repairing of roads and bridges every year. To counteract the flood menace, permanent measures for protecting paddy fields, cultivation lands and habitats are necessary. As such, enhanced allocation is required for flood control projects.

Annexure -8: Details of Features across the Bank:-

The bank of the river includes with villages, agricultural field, RCC Bridges, Irrigation canals and outlets, Wooden Bridges, Bamboo Bridges, Electric lines, Forest 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. West Garo Hills, Tura peak, Nokrek National park have been situated in this zone of river and protected the river side. Dolbari, Mankachar, Garobadha, Gandhipara Koch etc. villages have been located in this zone of river.



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Annexure -9: 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.

The Horizontal control for Bathymetry surveys: - DGPS is receiving corrections from Beacons.

Establishment of Vertical Control:-

Vertical control has been carried out from BM-1 by GPS observation of 24 hrs, situated near the Mankachar Village is used for the entire Survey work. Its value is 33.113 m. w.r.t. MSL has been considered for calculating the vertical levels. Total 6 no. of BM have been established along the 49.143 kms stretch of the Ganol River with the reference of BM-1 which was fixed near at Mankachar village.

Topography Survey:-

The survey was commenced on 10th December, 2015 and completed on 12th January, 2016. Then the days was winter season and the climate become sunny which reached about 15° 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 R 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.



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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 with stand 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 23-Topography Survey Instrument



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○ **Bathymetry Survey:-**

The bathymetry survey was carried out using Bathy 500 portable shallow water Echo sounder 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 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 24- Bathymetry Survey Instrument



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Annexure -10: Photographs of Equipments:-

Following equipments were employed for the Bathymetry and Topography 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:-

The bathymetric survey was conducted using one motorized boat. This boat was also used to collect water sample, current velocity, soil sample etc.

- **Positioning System:-**
- **1 no Trimble DGPS system (SPS361)**



Figure 25 DGPS System Instrument



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○ **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 26 Echo Sounder Instrument

○ **Current Meter:-**

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

● **Calibration**

The equipments used for the survey were calibrated by the equipment supplier. The equipment calibration certificates are placed at *Annexure* to this report.



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Annexure -11: Bench Mark Forms:-

BM Name	Easting (m)	Northing (m)	Latitude (N)	Longitude (E)	RL (m)
BM-1	788110.956	2826907.728	25°31'53.29"	89°52'0.58"	33.113
Pillar Established by: - Precision Survey Consultancy. Surveyor – Mr. Debasis Mondal					
Date of Establishment – 15.12.2015					
Station Description :-					
Benchmark - 1 is located near Mankachar village, close to the RCC bridge (SH-12).					
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 “IWA”, “PSC” and BM no. can be seen on the face of the pillar.					
The measurements of the bench mark pillar from notable locations / edges as follows:					
South-west from Ampati-Mankachar Road - 0.40km.					
West From Gorabadha-Mankachar Road- 0.39km.					
Life of Station : 15 Yrs		Datum: - WGS 84		ZONE : 45 R	

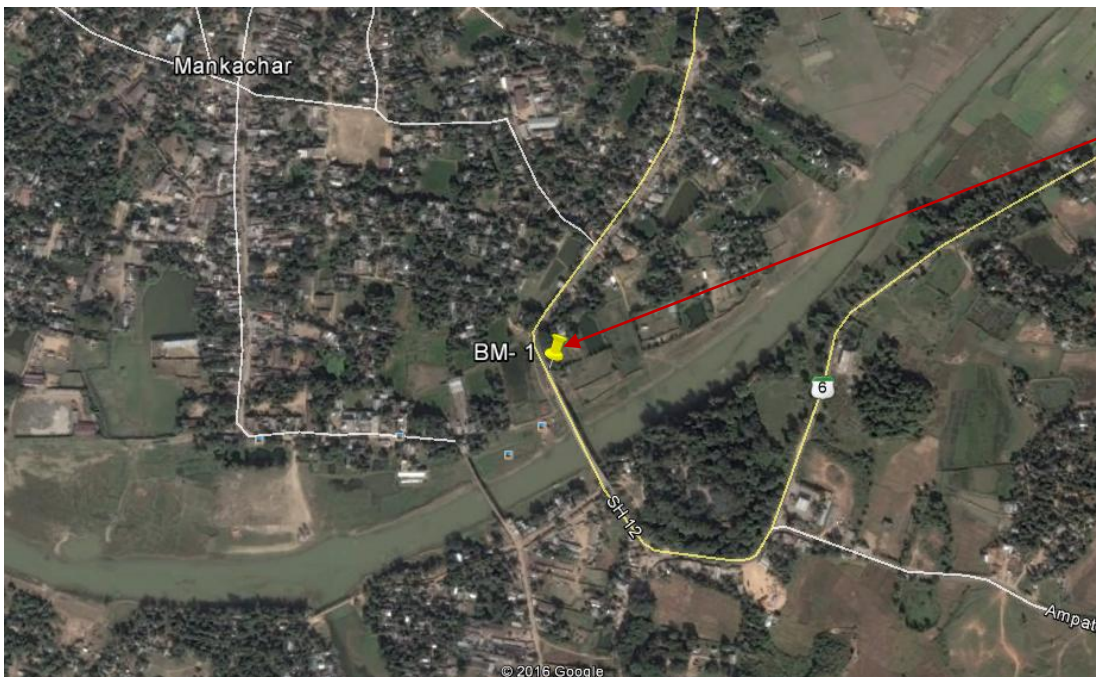


Figure 27 BM Form & Google image view of BM-1



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BM Name	Easting (m)	Northing (m)	Latitude (N)	Longitude (E)	RL (m)
BM-2	791825.553	2835647.785	25°33'15.19"	89°52'42.89"	26.195
Pillar Established by: - Precision Survey Consultancy. Surveyor – Mr. Debasis Mondal Date of Establishment – 18.12.2015					
Station Description :-					
Benchmark -2 is located near Chirakhowa Kutherghat village near the earthen road in the left side.					
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 “IWA”, “PSC” and BM no. can be seen on the face of the pillar.					
The measurements of the bench mark pillar from notable locations / edges as follows:					
North from Road - 1.82 km.					
East From Road- 1.40 km.					
Life of Station : 15Yrs		Datum: - WGS 84		ZONE : 45 R	



Figure 28- BM Form & Google image view of BM-2



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BM Name	Easting (m)	Northing (m)	Latitude (N)	Longitude (E)	RL (m)
BM-3	795781.476	2837265.053	25°34'40.32"	89°54'8.77"	29.358
Pillar Established by: - Precision Survey Consultancy. Surveyor – Mr. Debasis Mondal Date of Establishment – 25.12.2015					
Station Description :-					
Benchmark -3 is located near at Chirakhowa village.					
The BM is denoted by a “.” mark engraved on a plate. The plate is fixed on a 5 cm diameter GI pipe. The GI pipe is cemented with construction pillar of 30cmX30cmX150cm. The pillar extends 60.cms above ground level. Inscription “IWAI”, “PSC” and BM No. can be seen on the face of the pillar.					
The measurements of the bench mark pillar from notable locations / edges as follows:					
West From Bamboo Bridge – 0.01km. North From Road side – 1.02 km					
Life of Station : 15Yrs	Datum: - WGS 84			ZONE : 45 R	



Figure 29- BM Form & Google image view of BM-3



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BM Name	Easting (m)	Northing (m)	Latitude (N)	Longitude (E)	RL (m)
BM-4	799056.009	2836655.961	25°36'31.71"	89°59'46.49"	31.318
Pillar Established by: - Precision Survey Consultancy. Surveyor – Mr. Debasis Mondal					
Date of Establishment – 27.12.2015					
Station Description :-					
Benchmark – 4 is located near Boomatia 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 “IWA”, “PSC” and BM No. can be seen on the face of the pillar.					
The measurements of the bench mark pillar from notable locations / edges as follows:					
North from 127 B -1.18 km.					
Life of Station : 15Yrs		Datum: - WGS 84		ZONE : 45 R	



Figure 30- BM Form & Google image view of BM-4



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BM Name	Easting (m)	Northing (m)	Latitude (N)	Longitude (E)	RL (m)
BM-5	803026.339	2832588.101	25°34'46.99"	90° 0'58.94"	41.608
Pillar Established by: - Precision Survey Consultancy. Surveyor – Mr. Debasis Mondal Date of Establishment – 03.01.2016					
Station Description :-					
Benchmark- 5 is located near at Gandhipara Koch village, close to the SH-6 (Tura-Ampati Road)					
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 “IWAIR”, “PSC” and BM No. can be seen on the face of the pillar.					
The measurements of the bench mark pillar from notable locations / edges as follows:					
West from Garobadha Bus stop--0.72 km.					
South from SH-6 – 0.24 km.					
Life of Station : 15Yrs		Datum: - WGS 84		ZONE : 45 R	



Figure 31- BM Form & Google image view of BM-5



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BM Name	Easting (m)	Northing (m)	Latitude (N)	Longitude (E)	RL (m)
BM-6	804747.339	2832624.875	25°34'46.87"	90° 2'0.56"	42.683
Pillar Established by: - Precision Survey Consultancy. Surveyor – Mr. Debasis Mondal					
Date of Establishment – 03.01.2016					
Station Description :-					
Benchmark-6 is located near at village, close to the Garobadha- Tura Road.					
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”, “PSC” and BM No. can be seen on the face of the pillar.					
The measurements of the bench mark pillar from notable locations / edges as follows:					
East from Garobadha Bus stop- 1.08 km.					
West from Dolbari – 3.26 km.					
Life of Station : 15Yrs		Datum: - WGS 84		ZONE : 45 R	

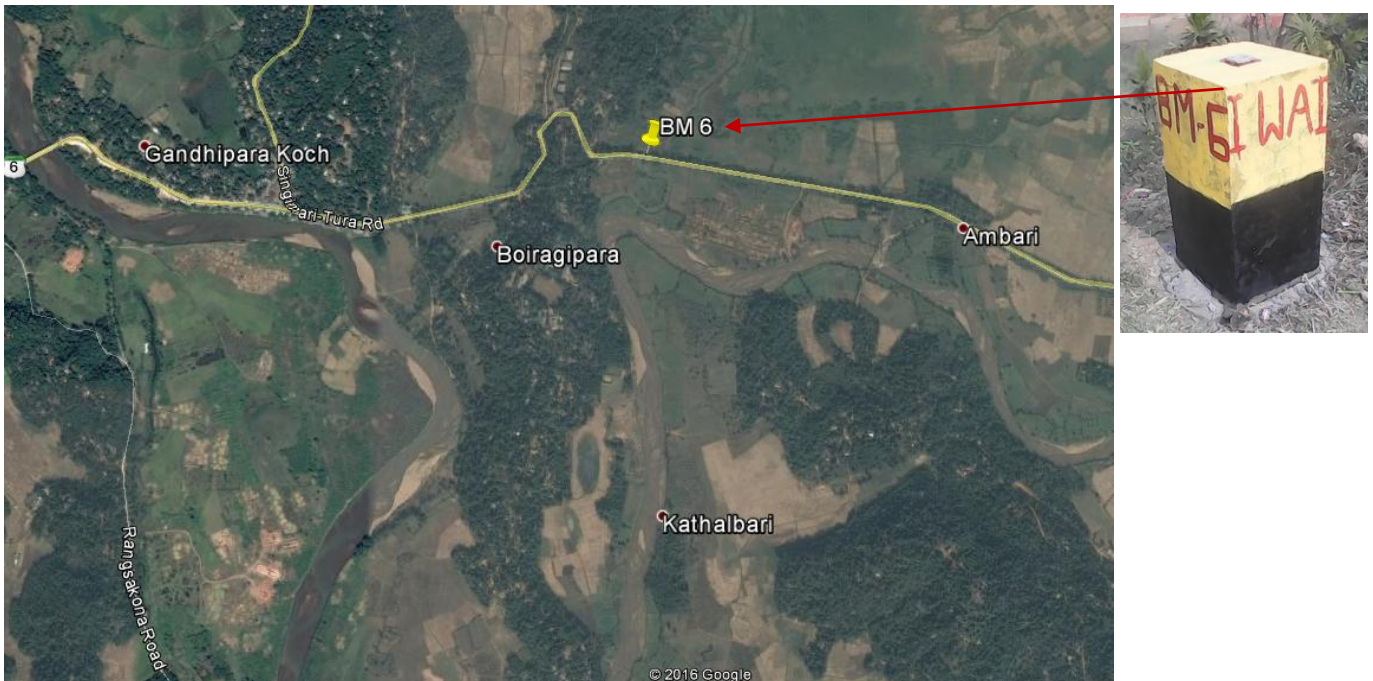


Figure 32- BM Form & Google image view of BM 6



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Annexure -12: Levelling Calculations:

Leveling from GS-1 to BM-1

BS	IS	FS	RISE (+)	FALL (-)	RL	REMARKS
0.488					33.113	BM-1
0.347		2.925		2.437	30.676	
0.582		2.457		2.110	28.566	
0.325		2.748		2.166	26.400	
0.458		2.489		2.164	24.236	
0.672		2.797		2.339	21.897	
		2.374		1.702	20.195	GS-1

Leveling from GS-2 to BM-2

BS	IS	FS	RISE (+)	FALL (-)	RL	REMARKS
0.452					26.195	BM-2
0.834		1.685		1.233	24.962	
		1.814		0.980	23.982	GS-2

Leveling from GS-3 to BM-3

BS	IS	FS	RISE (+)	FALL (-)	RL	REMARKS
0.488					29.358	BM-3
0.585		1.640		1.152	28.206	
0.612		1.865		1.280	26.926	
		1.445		0.833	26.093	GS-3



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Leveling from GS-4 to BM-4

BS	IS	FS	RISE (+)	FALL (-)	RL	REMARKS
0.957					31.318	BM-4
0.764		1.865		0.908	30.410	
0.377		1.600		0.836	29.574	
		1.736		1.359	28.215	GS-4

Leveling from GS-5 to BM-5

BS	IS	FS	RISE (+)	FALL (-)	RL	REMARKS
0.458					41.608	BM-5
0.682		2.485		2.027	39.581	
0.575		2.188		1.506	38.075	
0.317		1.985		1.410	36.665	
0.775		2.371		2.054	34.611	
0.385		1.858		1.083	33.528	
		1.832		1.447	32.081	GS-5

Leveling from GS-6 to BM-6

BS	IS	FS	RISE (+)	FALL (-)	RL	REMARKS
0.654					42.683	BM-6
0.432		2.840		2.186	40.497	
0.545		1.892		1.460	39.037	
0.386		1.988		1.443	37.594	
		1.935		1.549	36.045	GS-6

Table 22- Leveling Calculation of Ganol River



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Annexure -13: Soil Sample:-

RESULT OF TEST OF SOIL SAMPLES

SITE: GANOL RIVER

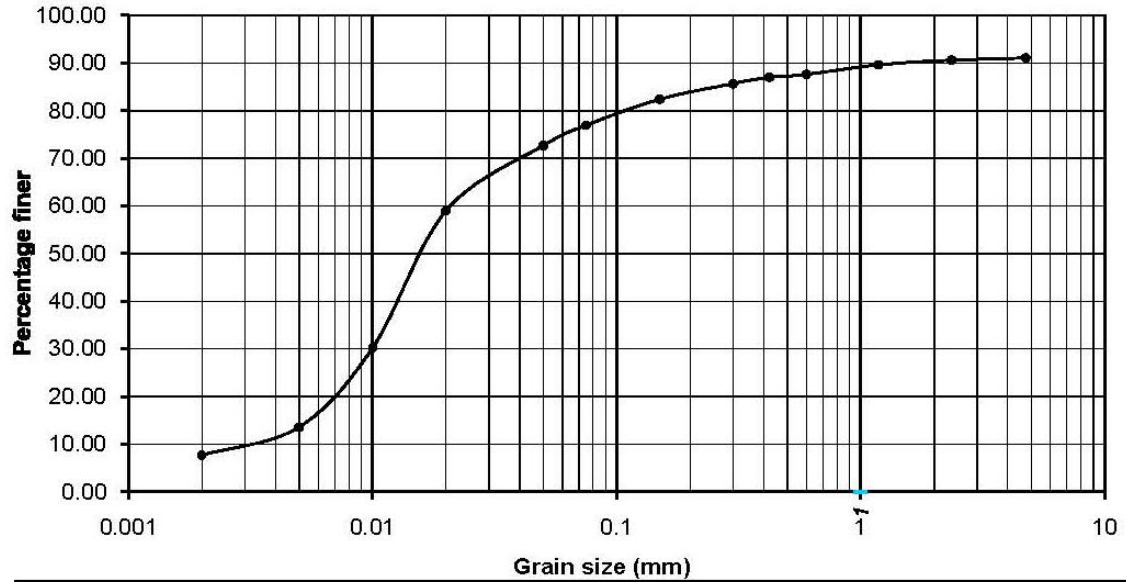
RESULTS OF TEST OF SOIL SAMPLES										
SITE - GANOL RIVER										
PHYSICAL ANALYSIS OF SOIL										
Sl.No.	B.M	GRAVEL (%)	SAND (%)	SILT+CLAY (%)	SPECIFIC GRAVITY	pH VALUE	SILT (%)	CLAY (%)	Cu	Cc
1	1	8.98	26.87	64.15	2.63	7.2	56.50	7.65	6.25	1.56
2	2	7.02	32.65	60.33	2.63	7.2	52.00	8.33	6.42	1.68
3	5	6.00	60.00	34.00	2.64	7.4	26.00	8.00	5.31	1.34
4	6	8.00	55.50	36.50	2.64	7.4	30.00	6.50	3.78	1.88



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GRAIN SIZE DISTRIBUTION CURVES



—●— B.M - 01

Grain size (mm)	<0.002	0.002-0.075	0.075-4.75	>4.75
Sample No.	Clay (%)	Silt (%)	Sand (%)	Gravel (%)
B.M - 01	7.7	56.5	26.9	9.0

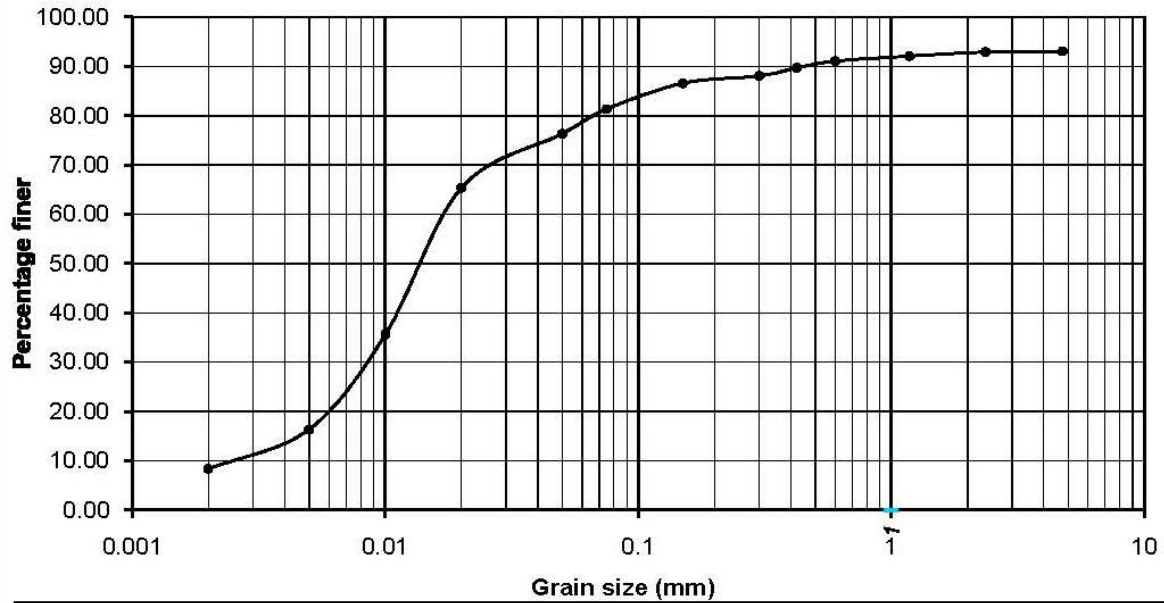
*Silt & Clay



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GRAIN SIZE DISTRIBUTION CURVES



—●— B.M - 02

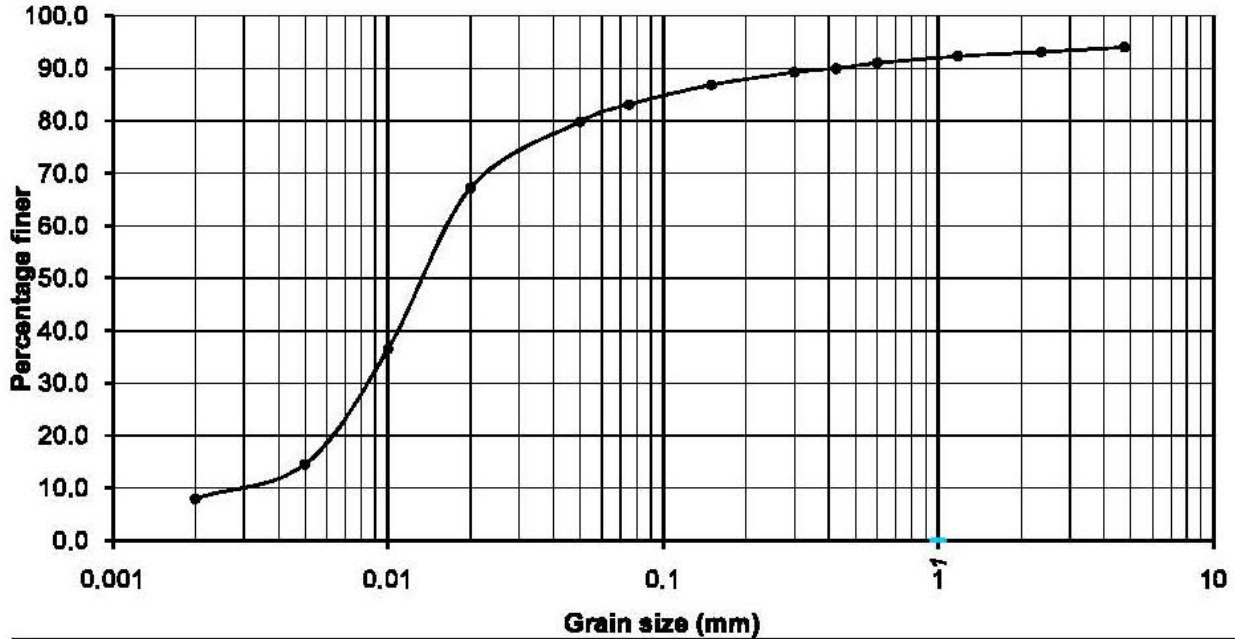
Grain size (mm)	<0.002	0.002-0.075	0.075-4.75	>4.75
Sample No.	Clay (%)	Silt (%)	Sand (%)	Gravel (%)
B.M - 02	8.3	52.0	32.7	7.0
*Silt & Clay				



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GRAIN SIZE DISTRIBUTION CURVES



—●— B.M - 05

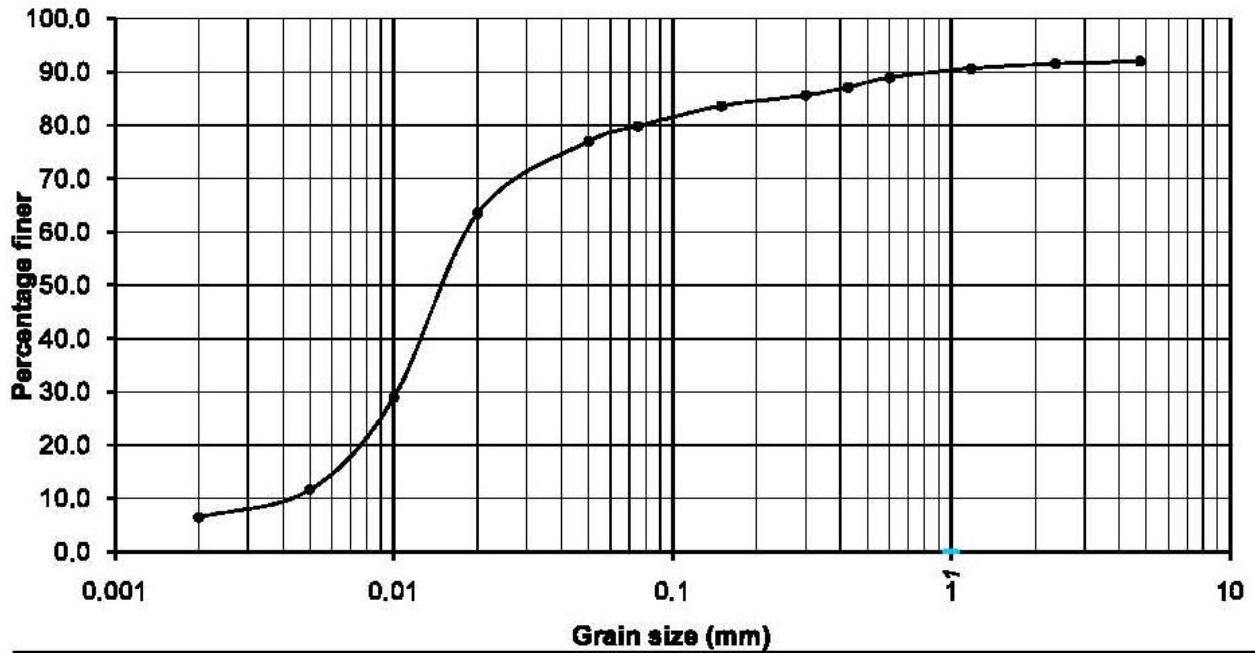
Grain size (mm)	<0.002	0.002-0.075	0.075-4.75	>4.75
Sample No.	Clay (%)	Silt (%)	Sand (%)	Gravel (%)
B.M - 05	8.0	26.0	60.0	6.0
*Silt & Clay				



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GRAIN SIZE DISTRIBUTION CURVES



—●— B.M - 06

Grain size (mm)	<0.002	0.002-0.075	0.075-4.75	>4.75
Sample No.	Clay (%)	Silt (%)	Sand (%)	Gravel (%)
B.M - 06	6.5	30.0	55.5	8.0
*Silt & Clay				



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Annexure -14: Water Sample:-

<u>RESULTS OF EXAMINATION OF SAMPLES OF WATER</u>						
SITE- RIVER GANOL						
PARAMETER – pH Value at 25°C						
SL.NO	B.M	DATE	LOCATION	PARAMETER	WATER SAMPLE RESULTS	PERMISSIBLE LIMITS IS:456-2000
1	1	8.2.2016	Upper	pH Value at 25°C	6.6	6.5 - 8.5
			Middle		6.5	
			Bottom		6.4	
2	2	8.2.2016	Upper		6.6	
			Middle		6.5	
			Bottom		6.3	
3	5	9.2.2016	Upper		6.5	
			Middle		6.4	
			Bottom		6.3	
4	6	9.2.2016	Upper		6.5	
			Middle		6.5	
			Bottom		6.4	



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RESULTS OF EXAMINATION OF SAMPLES OF WATER

SITE- RIVER GANOL

PARAMETER – Chloride as Cl (mg/l)

SL.NO	B.M	DATE	LOCATION	PARAMETER	WATER SAMPLE RESULTS	PERMISSIBLE LIMITS IS:456-2000
1	1	8.2.2016	Upper	Chloride as Cl (mg/l)	5	2000 mg/l for concrete not containing embedded steel and 500 mg/l for reinforced concrete work.
			Middle		4	
			Bottom		4	
2	2	8.2.2016	Upper		4	
			Middle		3	
			Bottom		4	
3	5	9.2.2016	Upper		5	
			Middle		2	
			Bottom		3	
4	6	9.2.2016	Upper		3	
			Middle		2	
			Bottom		4	



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RESULTS OF EXAMINATION OF SAMPLES OF WATER

SITE- RIVER GANOL

PARAMETER – Sulphates as SO₄ (mg/l)

SL.NO	B.M	DATE	LOCATION	PARAMETER	WATER SAMPLE RESULTS	PERMISSIBLE LIMITS IS:456-2000
1	1	8.2.2016	Upper	Sulphates as SO ₄ (mg/l)	44	400(mg/l)
			Middle		82	
			Bottom		89	
2	2	8.2.2016	Upper		45	
			Middle		83	
			Bottom		88	
3	5	9.2.2016	Upper		44	
			Middle		82	
			Bottom		87	
4	6	9.2.2016	Upper		43	
			Middle		81	
			Bottom		87	



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RESULTS OF EXAMINATION OF SAMPLES OF WATER

SITE- RIVER GANOL

PARAMETER – Sediment Concentration(mg/l)


SL.NO	B.M	DATE	LOCATION	PARAMETER	WATER SAMPLE RESULTS	PERMISSIBLE LIMITS IS:456-2000
1	1	8.2.2016	Upper	Sediment Concentration(mg/l)	45	2000(mg/l)
			Middle		55	
			Bottom		140	
2	2	8.2.2016	Upper		42	
			Middle		52	
			Bottom		135	
3	5	9.2.2016	Upper		40	
			Middle		50	
			Bottom		132	
4	6	9.2.2016	Upper		40	
			Middle		48	
			Bottom		130	



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Annexure -15: 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	:	Vichitra SP-45, KWIC Bankra, P.S.- Domjur, Dist. -Howrah, Pin: 711 403 (W.B)
INSTRUMENT	:	DGPS EQUIPMENT
SERIES	:	SPS-361
SERIAL NUMBER	:	5308K59587
CALIBRATION DATE	:	05/04/2015
VALIDITY	:	04/05/2016

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, 26889952, 26889962, 26132214 FAX : +91 11 26138633
e-mail : nmspl@panindiagroup.com URL : www.panindiagroup.com

Figure 33- Calibration Certificate of DGPS



FINAL FEASIBILITY REPORT ON
“DETAILED HYDROGRAPHY SURVEY IN GANOL
RIVER IN MEGHALAYA (49.143 KMS)



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 : 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

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Figure 34- Calibration Certificate of Echo Sounder



FINAL FEASIBILITY REPORT ON
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RIVER IN MEGHALAYA (49.143 KMS)



SOUTH

SOUTH PRECISION INSTRUMENT PVT. LTD.
FA - 229 B, Ground Floor, Mansarovar 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.

Authorized Signatory

Authorized Signatory

Figure 35- Calibration Certificate of GPS-RTK



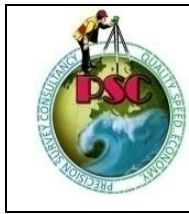
**FINAL FEASIBILITY REPORT ON
“DETAILED HYDROGRAPHY SURVEY IN GANOL
RIVER IN MEGHALAYA (49.143 KMS)**



Annexure -16: Site Picture:-



Figure 36- Topography Site Instrument



**FINAL FEASIBILITY REPORT ON
“DETAILED HYDROGRAPHY SURVEY IN GANOL
RIVER IN MEGHALAYA (49.143 KMS)**



Annexure -17: Survey Charts:

LIST OF SURVEY CHARTS OF GANOL RIVER (NW-39)								
Sl. No.	Chart No.	Location	Chainage (From.....km. To.....km.)	Chart Datum And Water Level w.r.t M.S.L			Value of Reduction	Remarks
				Chainage (km)	CD (m)	WL (m)		
1.	P_01	Mankachar to Jordanga Pt.I	0.0 km to 6.850 km	1.155	19.120	20.195	-1.075	GS:- 1
				18.988	23.700	23.982	-0.282	GS:- 2
2.	P_02	Jordanga Pt.I to Rangapani	6.850 km to 15.900 km	18.988	23.700	23.982	-0.282	GS:- 2
				25.353	25.850	26.093	-0.243	GS:- 3
3.	P_03	Rangapani to Chirakhowa Maishghuma	15.900 km to 21.650 km	25.353	25.850	26.093	-0.243	GS:- 3
4.	P_04	Chirakhowa Maishghuma to Shadullabari	21.650 km to 26.900 km	30.780	27.700	28.215	-0.515	GS:- 4
5.	P_05	Shadullabari to Depkaidalbari	26.900 km to 33.100 km	30.780	27.700	28.215	-0.515	GS:- 4
				39.566	31.830	32.081	-0.251	GS:- 5
6.	P_06	Depkaidalbari to Gandhipara Koch	33.100 km to 39.350 km	39.566	31.830	32.081	-0.251	GS:- 5
				44.866	35.540	36.045	-0.505	GS:- 6
7.	P_07	Gandhipara Koch to Amrari	39.350 km to 45.200 km	44.866	35.540	36.045	-0.505	GS:- 6
				48.750	38.870	39.190	-0.320	GS:- 7
8.	P_08	Amrari to Dumnigaon	45.200 km to 49.143 km	48.750	38.870	39.190	-0.320	GS:- 7

Table 23- Survey Charts of Ganol River

Note: Scale: - 1:5000 in each survey Chart

Survey period: - 10th December, 2015 to 12th January, 2016

★ **G.S:-** Gauge Station