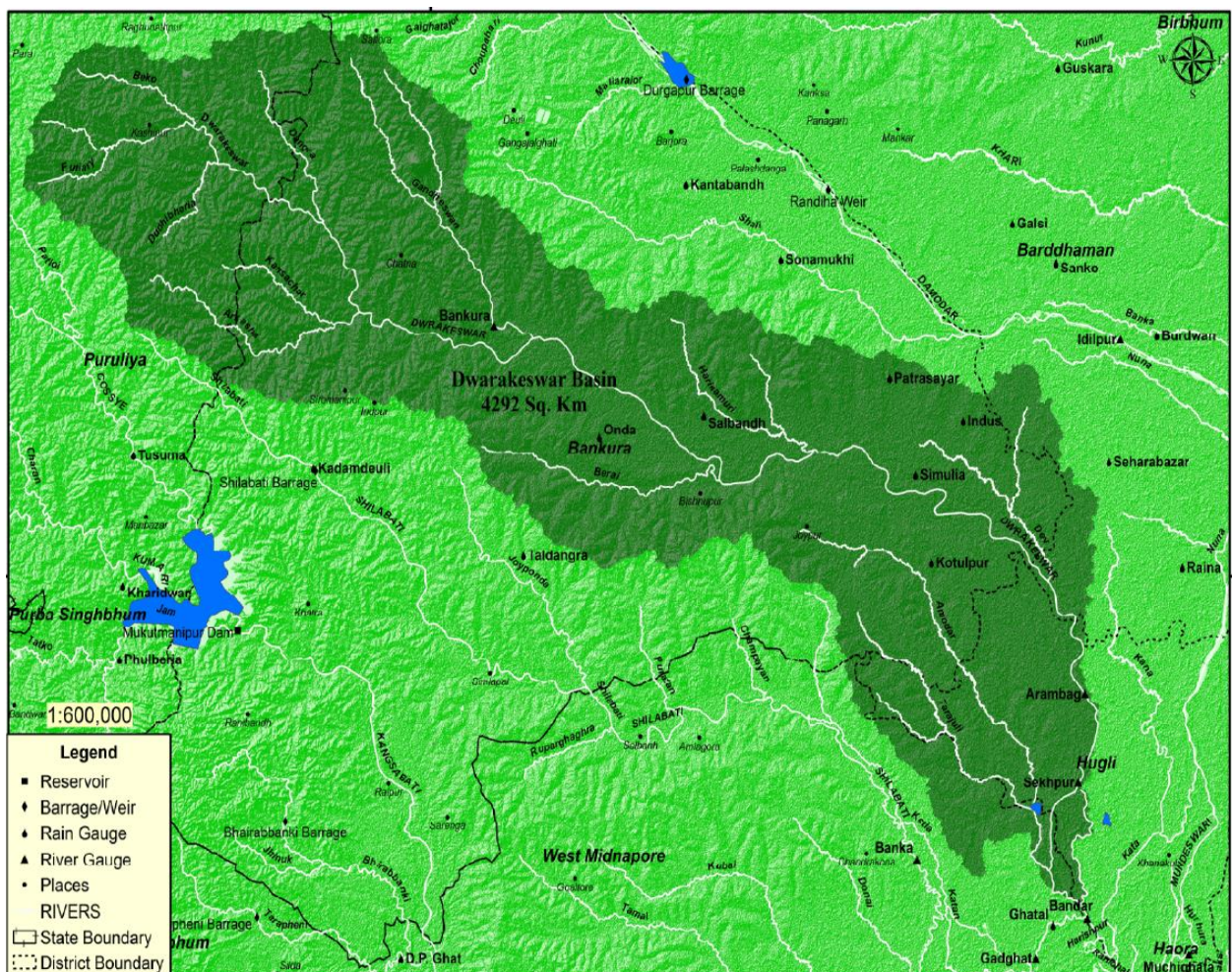**Consultancy Services for preparation of Two Stage Detailed Project Report (DPR) of National Waterway 35, Cluster-I: Dwarakeswar River**

FINAL FEASIBILTY REPORT

Inland Waterway Authority of India

Cluster – I : Dwarakeswar River
Final Feasibility Report
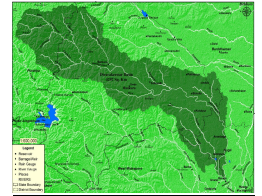**Revision 0**
November 2016

Consultancy Services for preparation of Two Stage Detailed Project Report (DPR) of National Waterway 35, Cluster-I: Dwarakeswar River

FINAL FEASIBILITY REPORT

Project IWAI Cluster-I, Dwarakeswar River

Owner IWAI, Ministry of Shipping

Consultant Egis India Consulting Engineers

Authors			Project No:		
			PT/EIPTIWB003		
Project Team : Team Leader + 7-Experts					
			Report No:		
			PT/EIPTIWB003/2016/FR/003		
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0	Feasibility Report	Nov 2016	DM	AK	JKP
Revision	**Description**	**Date**	**Prepared By**	**Checked By**	**Approved By**
Version : **Final**	**Report**		**Classification**: Restricted		
Distribution			**Digital**	**Number of copies**	
IWAI				3	

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IWAI	Inland Waterways Authority of India
IWT	Inland Water Transportation
MOS	Ministry of Shipping
NW	National Waterway
DPR	Detailed Project Report
WW	Waterway
AtoN	Aid to Navigation
VC	Vertical Clearance
HC	Horizontal Clearance

ACKNOWLEDGEMENT

SALIENT FEATURES

Sl. No.	Particulars	Details				
1.	Name of Consultant	Egis India Consulting Engineers Pvt. Ltd.				
2.	Cluster number	Cluster I				
3.	Waterway stretch (from. To, total length)	**Dwarakeswar River (National Waterway 35)** (From Bridge near Abantika Lat 23° 6'54.76"N, Long 87°18'46.99"E to confluence of Dwarakeswar and Silai rivers at Pratappur Lat 22°40'16.94"N, Long 87°46'42.57"E); Total Length: 113 Km				
4.	**Navigability status**					
a)	Tidal & non tidal portions (from ... to, length, average tidal variation)	Tidal portion: 0 – 6.5 Km Non-tidal: 6.5 - 113 km Tidal variation: 0.7 m.				
b)	**LAD status** Survey period (.. to ..) < 1.0 m (km) 1.m to 1.5 m (km) 1.5 m to 2.0 m (km) > 2.0 m (km)		0 – 30 Km	30-60 Km	60 -90 Km	90 – 113 Km	Total Km
		Survey Period	12th Jan to 23rd Jan 2016				
		< 1.0 m	20.37	26.04	29.94	23.00	**99.35**
		1 to 1.5 m (km)	3.38	2.09	0.00	0.00	**5.47**
		1.5 to 2.0 m (km)	2.90	1.10	0.00	0.00	**4.01**
		> 2.0 m (km)	3.34	0.77	0.06	0.00	**4.17**

Sl. No.	Particulars	Details
c)	**Cross structures** i) Dams, wires, barrages etc (number, with navigation locks or not). ii) Bridges, Power cables etc [number, HC (... to ...). VC (.. to ..)]	i) Dams, Weirs, Barrages, Locks = 2 numbers of Sand check dams. ii) Bridges = 2 numbers, HC (8.0 m), VC (8.0 m to 6.0 m) iii) Power Cable = 4 numbers (VC = 7.0 m to 4.0 m) *Vertical clearance is above HFL on the basis of visual assessment.
d)	Avg. discharge & no. of days	Request for discharge data was made to CWC, however the same is still awaited. Shall be provided in DPR Stage.
e)	Slope (1 in ..)	Approximate slope of waterway is 1 in 2500.
f)	Consultants inference	➢ The waterway has a tidal stretch of 6.5 Km from Ghatal towards upstream with a maximum tidal variation of about 0.7 m. This portion is feasible for year round navigation. ➢ The horizontal and vertical clearance of existing cross-structures is in the range of 8 m and 6m - 8m respectively. ➢ 4.17 Km stretch of waterway have draft more than 2.0 m, 4.01 Km stretch have draft of 1.50 m to 2.0 m, 5.47 km have draft of 1.0 m to 1.50 m and remaining 99.35 km stretch of waterway have less than 1.0 m draft with respect to chart datum. ➢ Taking in to account the tidal effect, the LAD of 1.0 m can be increased to 1.2 m in the tidal stretch. ➢ Considering the length of the river, availability of numerous minor and major industries and connectivity with rail and road network with 5km reach across the bank , the river has huge economic potential for development as a Waterway ➢ The capacity of the waterway can be enhanced by constructing check dams and lockgates, however the same shall be appraised only during Stage-2 of the studies on the basis of detail investigations. ➢ The waterway has a huge potential considering its connectivity with Rupnarayan Waterway and thereby with National waterway -1 and Haldia Port.

Sl. No.	Particulars	Details
5.	**Traffic potential**	
a)	Present IWT operations, ferry services, tourism, cargo, if any	Localised passenger ferry services were operational in the tidal stretch of waterway.
b)	Important industries within 50 km	Kolaghat Thermal Power Plant located 35.0 Km downstream of Dwarakeswar waterway on Rupnarayan Waterway.
6.	Consultant's recommendation for going ahead with Stage-II (DPR preparation)	Dwarakeswar waterway is recommended for Stage – II DPR preparation in view of the following potential advantages: a) Connectivity of the waterway with proposed NW 86 & 92. b) Connectivity with NW-1, Haldia and Kolkata port including their hinterland through NW -86. c) Increasing cargo potential. d) Reduction in existing traffic load on rail and road infrastructure. In view of the above, it is recommended to develop the Dwarakeswar waterway for Cargo and Passenger ferry services.

1.0   CONTEXT

IWAI, Ministry of Shipping, Government of India is exploring the potential of additional waterways across the country for year round commercial navigation, for this it is planned to conduct a Feasibility Study and recommending thereafter the possibility of Composite and Integrated development of National waterways to achieve navigation and to develop water transport facilities across India. Upon completion of feasibility study, IWAI will select the stretches having potential for navigation to undertake a Detailed Project Report. The DPR stage would include detailed hydro-graphic surveys and investigation, traffic survey, proposed location for terminals and cost assessment etc.

There are 106 new waterways has been identified and declared as national waterways as per "The National Waterway Act, 2016", No. 17 of 2016, published in the Gazette of India, Part – II- Section 1 no. 18, New Delhi, Saturday, March 26/2016/Chaitra 6, 1938 (Saka), by Ministry of Law and Justice (Legislative Department).

Out of these 106 waterways, IWAI had invited international online bids for preparation of 2 stage Detailed Project Report (DPR) for National waterways, in a set of 8 Clusters from Cluster I to VIII through Tender No. IWAI/PR/40NW/2015/I. Egis Consulting Engineers was awarded the work for Cluster I and Cluster III respectively.

This feasibility report provides the technical viability of throughout the year inland navigation in the waterways, by taking into account the constraints and other functions of the rivers/canals such as water conveyance, tidal effects, floods, draughts, existing structures etc.

As stated above, 7 rivers out of 106 National waterways are clubbed in Cluster – I of two stages DPR studies for inland waterways project. The detail descriptions of these 7 waterways are presented in **Table 1**. The total length of stretches of 7 rivers under Cluster – I is 820 km. Among these 7 waterways, 5 are connected to the National Waterway 1 between Farakka to Haldia.

Table 1: National Waterways of Cluster - 1

S. No	River	National Waterway No.	Length (km)	Description
1.	Ajoy River	National Waterway 7	96	From Bridge on Morgram-Panagarh State Highway No 14 at Illambazar Lat 23°36'56.10"N, Long 87°31'58.07"E to confluence of river Ajay with river Bhagirathi at Katwa Lat 23°39'23.33"N, Long 88° 7'56.72"E
2.	Damodar River	National Waterway 29	130	From Krishak Setu, Bardhman on State Highway No 8 at Lat 23°12'39.83"N, Long 87°50'53.85"E to confluence with Hooghly river near Purbba Basudebpur at Lat 22°21'0.58"N, Long 88° 5'19.31"E
3.	Dwarakeswar River	National Waterway 35	113	From Bridge near Abantika Lat 23° 6'54.76"N, Long 87°18'46.99"E to confluence of Dwarakeswar and Silai rivers at Pratappur Lat 22°40'16.94"N, Long 87°46'42.57"E.
4.	Ichamati River	National Waterway 44	64	From Bridge on Border Main Road at Gobra near Bangladesh Border at Lat 22°53'49.64"N, Long 88°53'48.87"E to near Bangladesh Border at Bansjhari Mallikpur Lat 22°39'6.71"N, Long 88°55'35.35"E.
5.	Rupnarayan River	National Waterway 86	72	From confluence of Dwarakeswar and Silai rivers at Pratappur Lat 22°40'16.94"N, Long 87°46'42.57"E to confluence with Hooghly river at Geonkhali Lat 22°12'41.58"N, Long 88° 3'13.99"E
6.	Silabati River	National Waterway 92	26	From Barrage near Shimulia village at Lat 22°34'53.20"N, Long 87°38'30.54"E to confluence of Dwarakeswar and Silai rivers at Pratappur Lat 22°40'16.94"N, Long 87°46'42.57"E.
7.	Subarnarekha River	National Waterway 96	314	From Chandil Dam at Lat 22°58'29.39"N, Long 86° 1'14.03"E to confluence with Bay of Bengal at Lat 21°33'28.75"N, Long 87°22'58.60"E.

The detailed layout plan of the above waterways is shown in Drawing No. PT/EIPTIWB003/2016/FR/0001 submitted with Volume – III (Drawings) and provided in **Figure 1**.
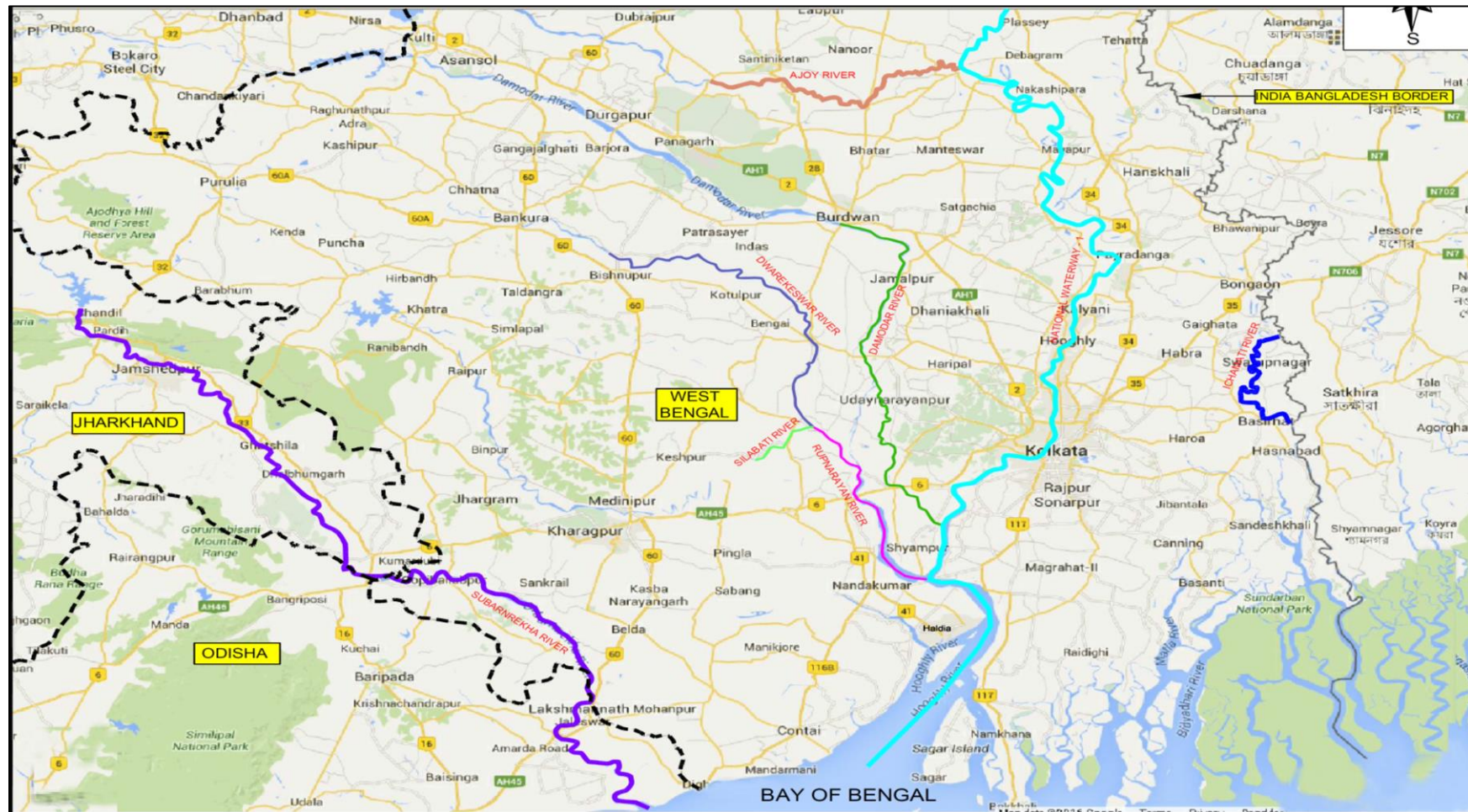
Figure 1: Layout Map of Cluster 1 National Waterways

2.0   OBJECTIVE

Government of India intends to explore the potential of additional waterways across the country for year round commercial navigation, for this it is planned to conduct a Feasibility Study and recommending thereafter the possibility of Composite and Integrated development of National waterways to achieve navigation and to develop water transport facilities across India. The whole of study comprises of two stages, feasibility and DPR as Stage-I and Stage-II as presented below.

Stage-1

1A.   Reconnaissance Survey

1B.   Collection and review of available data

1C.   Feasibility Report

Stage-2

2A.   Hydrographic Survey & hydro-morphological survey

2B.   Traffic Survey & Techno economic feasibility

2C.   Preparation of Detailed Project Report

The current scope for stage-I is executed as per following framework as per **Figure 2** .
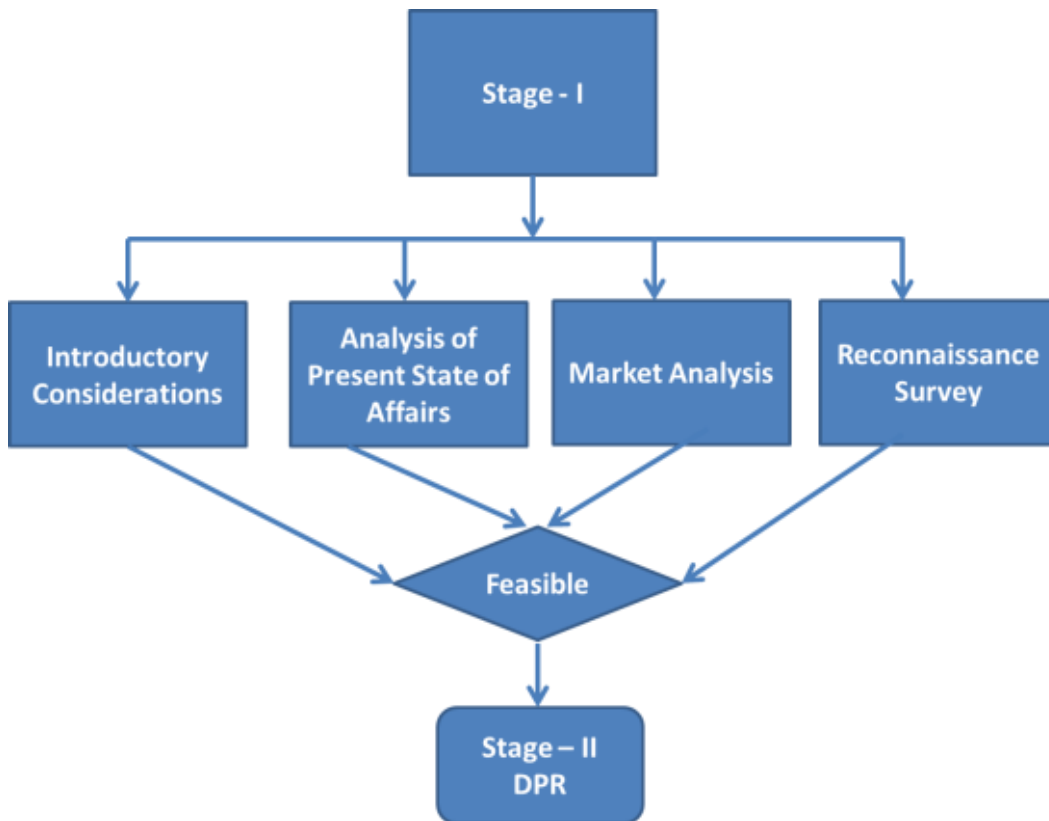
Figure 2: Framework of Studies

3.0   REPORT STRUCTURE

This report comprises of Feasibility Study for Dwarakeswar River (Length- 113 Km). The report is arranged in following main chapters,

I.   **Introductory Consideration**: This section comprises of,
    1)   Name of the river/canal;
    2)   Length of the river/canal;
    3)   State/ District through which river passes;
    4)   Map;
    5)   Characteristics of River;
        a.   River Course: Background/Historical information, Origin, End
        b.   Tributaries/ Network of Rivers/ Basin
    6)   Methodology Adopted to undertake the Study;
        a.   Primary Data
        b.   Secondary Data

II.   **Analysis of Present State of Affairs**: This section comprises of,
    1)   Existing Dams, Barrages and Locks;
    2)   Existing Bridges and Crossings over River;
    3)   Other Cross structures, High Tension Lines, pipe-lines, cables;
    4)   Hindrances/ Encroachment to the Waterway;
    5)   Details of Protected Area- Wildlife, Defence;
    6)   NH/SH/MDR along and/or in vicinity;
    7)   Railway Line and Stations in the vicinity.

III.   **Reconnaissance Survey**: This section provides the,
    1)   Methodology adopted including resources and equipment;
    2)   Description of Bench marks, reference levels, chart and sounding datum;
    3)   Details of collected water levels, discharge data, HFL and FSL;
    4)   Details and description of bathymetric and topographic survey including observations;
    5)   Detail about Soil, Water and Bank characteristics.

IV.   **Market Analysis**: This section comprises of,
    1)   Land use pattern along Waterway;
    2)   Crop/Agriculture in the region;

3) Availability of Bulk/Construction Material;

4) Existing industries along waterway;

5) Details of existing Jetties and Terminals;

6) Preliminary traffic identified;

7) Existing cargo movement;

8) Prominent City/ Town/ Places of worship/ Historical places for tourism;

9) Availability of passenger ferry services;

10) Available and probable water sport/recreational facilities.

V.   **Observation and Inferences**: This section comprises of,

1) Observation on Waterway, Length, LAD, Cross-Structures;

2) Water availability for different periods and depths;

3) Cargo/Passenger/Tourism/RO-RO facility;

4) Suitability of waterway for navigation;

5) Proposed alternative methods for making waterway feasible;

6) SWOT analysis;

7) Way forward for Stage – 2 DPR studies.

In addition to the above, following digital data and charts shall also be submitted along with this report:

I.   **Bathymetric Survey**: Hypack software output files with RAW, EDIT, SORT, TIDE extensions;

II.   **Topographic Survey**: csv and xyz extension files;

III.   **Survey Charts**: Geo-coded dxf and dwg files in scale as per width in AutoCAD formats;

4.0   INTRODUCTORY CONSIDERATIONS

The Consultant discussed here, the introductory considerations for feasibility and the scope of the assignment in subsequent phase of DPR for feasible stretches.

The present feasibility report provides the technical feasibility of Dwarakeswar River, declared as National Waterway 35, clubbed under Cluster – I, as stated in earlier sections. The detail description of waterway analysed in this feasibility report are described in subsequent paragraphs.

4.1   DETAILS OF NATIONAL WATERWAY 35 (DWARAKESWAR RIVER)

Details of the waterway are as follows:

Table 2: Description of River

Sl. No	Name of the River	Local Name	Length of waterway (km)	State/District through which river passes
1.	Dwarakeswar River	• Dhalkisor • Dhalkishore	113	**State: West Bengal** *Purulia district* *Bankura district* *Bardhaman District* *Hooghly District*

4.2   CHARACTERISTICS OF DWARAKESWAR RIVER

Characteristics of Dwarakeswar River considered for waterway is described in subsequent paragraph.

River Course: It originates from Tilboni hill in Purulia district and enters Bankura district near Chhatna, West Bengal. The river cuts across the Bankura district flowing past the district headquarters and enters the south-eastern tip of Bardhaman District. It then passes through Hooghly District. The Silai joins it near Ghatal and the two together is known as Rupnarayan River, which flows into the Hooghly River near Gadiara in Howrah District.

Catchment Area: The total catchments area of the Dwarakeswar river system is 4292 Sq. Kms

Tributaries: Gandheswari River is a tributary, 32 kilometres of the Dwarakeswar River and flows in Bankura district. Similarly Beko, Arkasha, Berai, Shankari are other tributaries of Dwarakeswar River system.

The section of the Dwarakeswar River under feasibility study for inland waterway is presented in Drawing No. PT/EIPTIWB003/2016/FR/0004A and is also presented as **Figure 3**. The detail layout maps of the waterway are shown in Drawing No. PT/EIPTIWB003/2016/FR/0004.
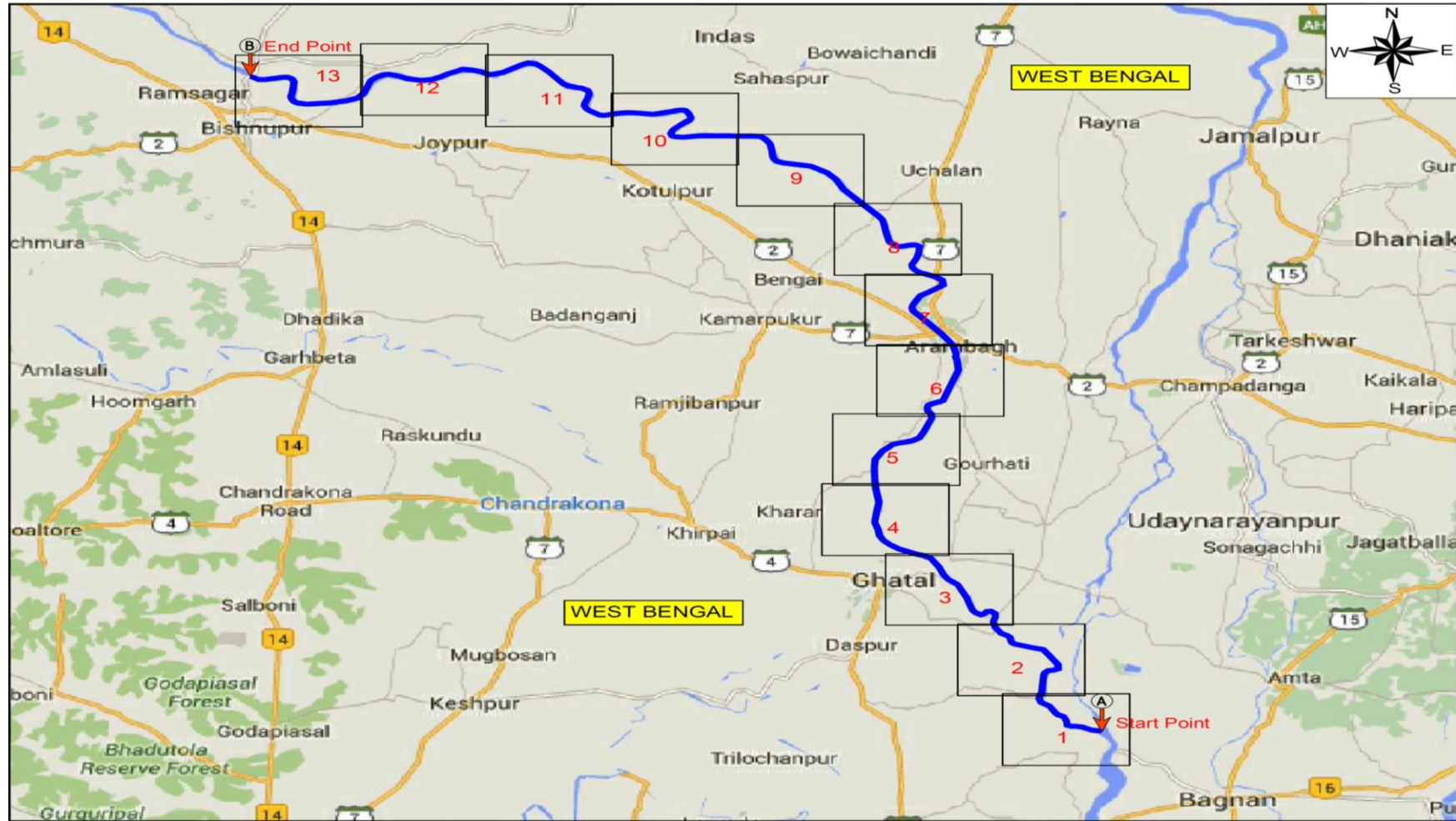
Figure 3: Layout Map of Dwarakeswar River Waterway

4.3   METHODOLOGY ADOPTED TO UNDERTAKE STUDY

A detail description on Feasibility & DPR methodology and the expected outcome in fulfilling the assignment is presented.

The feasibility study shall be carried out in accordance with TOR in the following steps:

1.   Conducting Reconnaissance survey as detailed in Chapter 5.
2.   Collection and review of available primary and secondary data as detailed in Chapter 6 and 7.

On the basis of detailed analysis of collected primary and secondary data, throughout the year navigability potential of the waterway is assessed and submitted in the feasibility report.

4.3.1   Classification of Waterways

The classification of waterways by Inland Waterway Authority of India is discussed below and shall be adopted in the study.

1.   The waterways shall be classified in the following categories for safe plying of self-propelled vessels up to 2000 tonne Dead Weight Tonnage (DWT) and tug-barge formation in push-tow units of carrying capacity up to 8000 tonne, namely:

    a.   **Class I** - Waterways with the following configuration of navigable channel:-
        i.   Rivers: Minimum of 1.2 meter depth, 30 meter bottom width, 300 meter bend radius, 4 meter vertical clearance and 30 meter horizontal clearance between piers, and
        ii.   Canals: Minimum of 1.5 meter depth, 20 meter bottom width, 300 meter bends radius, 4 meter vertical clearance and 20 meter horizontal clearance between piers.

    b.   **Class II -** Waterways with the following configuration of navigable channel:-
        i.   Rivers: Minimum of 1.4 meter depth, 40 meter bottom width, 500 meter bend radius, 5 meter vertical clearance and 40 meter horizontal clearance between piers, and
        ii.   Canals: Minimum of 1.8 meter depth, 30 meter bottom width, 500 meter bend radius, 5 meter vertical clearance and 30 meter horizontal clearance between piers.

      c.   **Class III -** Waterways with the following configuration of navigable channel:-

        i.   Rivers: Minimum of 1.7 meter depth, 50 meter bottom width, 700 meter bend radius, 7 meter vertical clearance and 50 meter horizontal clearance between piers, and

        ii.   Canals: Minimum of 2.2 meter depth, 40 meter bottom width, 700 meter bend radius, 7 meter vertical clearance and 40 meter horizontal clearance between piers.

      d.   **Class IV -** Waterways with the following configuration of navigable channel:-

        i.   Rivers: Minimum of 2.0 meter depth, 50 meter bottom width, 800 meter bend radius, 10 meter vertical clearance and 50 meter horizontal clearance between piers, and

        ii.   Canals: Minimum of 2.5 meter depth, 50 meter bottom width, 800 meter bend radius, 10 meter vertical clearance and 50 meter horizontal clearance between piers.

      e.   **Class V** -   Waterways with the following configuration of navigable channel:-

        i.   Rivers: Minimum of 2.0 meter depth, 80 meter bottom width, 800 meter bend radius, 10 meter vertical clearance and 80 meter horizontal clearance between piers.

      f.   **Class VI** - Waterways with the following configuration of navigable channel:-

        i.   Rivers: Minimum of 2.75 meter depth, 80 meter bottom width, 900 meter bend radius, 10 meter vertical clearance and 80 meter horizontal clearance between piers, and

        ii.   Canals: Minimum of 3.5 meter depth, 60 meter bottom width, 900 meter bend radius, 10 meter vertical clearance and 60 meter horizontal clearance between piers.

      g.   **Class VII** -Waterways with the following configuration of navigable channel:-

        i.   Rivers: Minimum of 2.75 meter and above depth, 100 meter and above bottom width, 900 meter bends radius, 10 meter vertical clearance and 80 meter horizontal clearance between piers.

2.   Vertical clearance for power cables or telephone lines or cables for any transmission purpose for all the classes of waterways mentioned above shall be as follows:

    a.   Low voltage transmission lines including telephone lines   -   16.5 meters

    b.   High voltage transmission lines, not exceeding 110 kilo volt   -   19.0 meters

    c.   High voltage transmission line, exceeding 110 kilo volt   -   19.0 meters

                                     +1 cm extra for each additional kilovolt

3.   In case of underwater pipelines, power cables and other cables, norms to be followed shall be decided as per the site conditions and navigational requirement.

Provided that this classification shall be effective for:

a.   Minimum depth of channel should normally be available for about 330 days of the year.

b.   Vertical clearance at cross structure over the waterway should be available at least in central 75% portion of each of the spans in entire width of the waterway.

Reference level for vertical clearance in different types of channel shall be:

a.   For rivers, over Navigational High Flood Level (NHFL), this is the highest flood level at a frequency of 5% in any year over a period of last twenty years.

b.   For tidal canals, over the highest high water level.

c.   For other canals, over designed full supply level.

4.3.2   Measures to Improve the Depth

The basic parameters considered for the fairway design are:

- Depth
- Width
- Side slopes
- Bends

As explained above, as the classification of waterways in India is based on the experience gained in various waterways, the characteristic features of the design waterways based on studies carried out by IWAI are furnished below and the same shall be followed.

Fairway Design

The fairway depth should be good enough to ensure steerability of the vessel and to prevent bottom feel. To meet this requirement, the minimum depth that is needed in a channel would commonly be the sum of the draught (draft) of the vessel and other tolerance factors. The tolerance factors to be considered are listed as:

- Factor of keel clearance to avoid touching of the vessel to the ground and minimum free water below the keel for maintaining control on manoeuvring,
- Wave tolerance for the heaving and pitching of the vessel due to wave motion,

- Squat, increase of draft due to ship motion,

- Tolerance for siltation and dredging,

- Increase of draught due to trim and heaving due to unequal loading and steering manoeuvre respectively, and

- Tolerance for the change of draught during the transition from salt water to fresh water.

The keel clearance factor is the prime concern of the all tolerance factors considered. As per the standards laid down by German Code of practice (EAU 80), a 0.3 m layer of water column below the keel of the loaded ship is sufficient for free manoeuvrability of the vessel.

IWAI's experience in inland waterways in India and sub-continent (Bangladesh and Myanmar) shows that the under keel clearance for free manoeuvrability of the vessel varies between 0.2 and 0.5 m depending upon the soil characteristics of the channel bed and other parameters.

Width of a Channel

The total width of a navigation waterway (W) in general is expressed in terms of a beam of a vessel (B). The design width for the proposed two-way navigation can be obtained as:

$$W = BM + BM1 + C + 2C1$$

Where: W = Navigation channel width for two-way navigation.

BM = Maneuvering zone for the design vessel which takes into account the directional stability of vessel.

BM1 = Maneuvering zone for the upcoming vessel which takes into account the directional stability of vessel.

C = Width of separating zone.

C1 = Width of the security area, between the maneuvering zone and the channel side which is accounted for environmental and human factors including bank suction.

Values recommended by various authorities for the above equation vary within wide limits. Some of the recommended values are presented here:

BM = 1.3 B to 3.0 B

BM = BM1

C = 0.5 B to 1.0 B

C1 = 0.3 B to 1.5 B

Where, B = Beam of a design vessel.

Based on the experience and recommendations of experts on Inland Waterways, the factors considered for the present design are:

$$BM = 1.8 \, B$$
$$BM = BM1$$
$$C = 0.5 \, B$$
$$C1 = 0.5 \, B$$

The designed channel width = 1.8B+1.8B+0.5B+2x0.5B for two way navigation at draft level = 5.1B. The bottom width of the channel for two-way navigation for the design vessel can generally be considered as 5 x B.

Slopes

The selection of slope is in accordance with the soil characteristics of the bed and banks, width of the waterway etc. The adopted channel slope shall be 1:5

Width Allowance at Bends

In bends, the width of the fairway should be more than the width of the canal that is designed for a straight reach to allow for a drift of the vessel in a curved portion of the waterway. It means that the vessel occupies a greater width in bends than in a straight stretch of the waterway. The drift of the vessel depends on the radius of the bend, the speed of the vessel, wind forces, the flow pattern and the loading of the vessel. The drift angle is larger for vessels traveling in the downstream than the upstream direction. The drift angle is inversely proportional to the bend radius 'R', that is, the larger the radius the smaller the value of drift angle. Unloaded ships normally subjected to more drift and consequently take up a greater width in bends than loaded ships and therefore the proposed allowance at the keel level of the unloaded ships is larger than the loaded ships.

Dredging of Navigational Channel

The dredging quantities for the above design channel shall be worked out based on the bathymetric surveys carried out. The system and different type of navigation marks shall be proposed in the DPR are given as follows:

- Lateral marks, to mark the left and right sides of the navigation route to be followed by navigator;
- Bifurcation marks, to mark the middle ground between the navigation channel, bifurcated channel and isolated dangers in the middle of the navigational channel;

- Shore marks;
- Bank wise marks, to indicate the channel at point where it approaches a bank;
- Crossing marks, to indicated crossing and alignment of the channel from one bank to another;
- Marks of prohibited areas, to indicate no permission of entry;
- Sound signal marks, to indicate use of horning or other sound signals;
- Marks for traffic control, to control up bound or down bound vessel in one way or sequence passage or to prohibit navigation;
- Marks on bridges, to indicate the passage through bridges;
- Depth indicator marks, to indicate shallow areas ahead in the navigation channel;
- Width indicator marks, to indicate the narrow stretches ahead in the navigational channel;
- River training marks, to indicate the ongoing river training works in the river to the navigators.

4.3.3 IWT Terminal Planning

The terminal planning and design includes selection of suitable sites in the vicinity of cargo potential considering all the relevant technical variables such as choosing the type of berthing facility and providing of covered/open storage facility, cargo handling systems and other ancillary facilities required for efficient terminal operation. Based on the projected traffic, the selection of various facilities shall be planned. The cost estimate including capital and operating costs shall be estimated for each of the proposed system considering the design. These above aspects are briefly explained in the following subsequent sections.

Planning Considerations

The terminal facilities proposed for this project shall include the following:

i)   Berthing Facilities for vessels;
ii)   Cargo Storage Facilities;
iii)   Cargo Handling Facilities;
iv)   Other ancillary Facilities.

Terminal Facilities

The type of cargo handling system required at the terminal is generally dependent on the type of cargo, the annual volume required to be handled and the size of the vessels. The various type of cargo foreseen to be handled at the proposed IWT Terminals are primarily grouped into:

i)   Incoming Cargo, and

ii)   Outgoing Cargo.

These above two groups are further subdivided into bulk, bagged and other miscellaneous general cargo for the purpose of planning the cargo handling equipment. The quantum and other cargo compositions shall be based on the traffic study. The same may be classified as below:

- Bulk Cargo - Construction materials such as Sand, stone, bricks, Marble, Iron steel, Machinery – Light, Heavy and ODC, Mineral Ore such as coal, lime stone, iron, fly ash, copper ore etc., bamboo, etc.
- Bagged Cargo - Cement, Fertilizer, wine and beverages, acids, cereals, cash crops, wheat, rice, Bajra, gram, pulses, cotton, etc.
- Misc. General Cargo – Consumer goods, animals, oil cake, edible oil, refined oil, paper products, jute products, etc
- Ferry – Passenger vessels for Tourists

4.3.4   Identification of IWT Terminals

Site selection is the most important as it decides the investment for establishing the terminal facilities. Hence, proper consideration has to be given to select the most optimum location which will minimise the capital investment and other recurring cost during operation. The selection of suitable site shall be carried out with the view of following considerations:

- Water availability near the terminal land throughout the year especially during lean season;
- Stable river channel with sufficient depth;
- Favourable hydraulic conditions for berthing and cargo handling;
- Availability of terminal land for infrastructure, cargo storage and handling;
- Traffic potential and cargo characteristics; and
- Navigational safety.

The proposed IWT Terminals shall be planned with the following infrastructure facilities for operation:

i)   Steel Gangway resting on a floating pontoon. The detailed engineering & design of gangway arrangement shall be carried out during the construction stage. The preliminary layout drawing shall be proposed in the DPR;

ii)   Administration Building and Bank protection arrangement;

iii)   Covered Storage Shed/Transit Shed;

iv)   Open storage area;

v)   Security Shed;

vi)   Forklift Trucks, Pay loaders & Dumper tracks; and

vii)   Weigh Bridge, Watch and ward, Compound wall, Firefighting arrangement, Electrical & PH Facilities including DG.

The terminal shall be proposed with suitable mooring facilities, firefighting water line, water supply pipeline, power line for shore connection to barges, fenders etc. Preliminary planning and master plan shall be prepared in the DPR stage as per the relevant IS codes. It is envisaged and proposed that to the extent possible, all shore/river bank based buildings / godown are prefabricated, pre-engineered type conforming to the best standards in vogue in logistic / supply chain industry.

Other Alternatives to Improve for Navigation

Based on our earlier study for Ganga River between the reach from Allahabad to Ghazipur, there are many methods available to improve river navigation. Bandalling work – it has to follow closely falling stage of river, closing minor channels and diverting river flow in single channel to increase depth in the navigable channel in mainly due done by bandalling. In some reaches this method becomes successful but some river stretches remain shallow and need other training measures including dredging. Channelization of river and Construction of barrages at suitable locations, creating ponding conditions with required depth and navigational locks for ships and vessel movement shall be studied. The examination of various options/measures to improve the water depth shall be studied. The most suitable method for development shall be identified with consideration on the likely morphological, sediment transport, and dredging aspects of different options. This task is expected to be fed back into from the financial and economic analysis providing refinement to the proposed development until a recommended solution is reached. The most appropriate type of river development including drudging option along the river shall be identified and likely impacts of these developments on river flow depths as well as sedimentation and morphology shall be investigated. This analysis will constitute an iterative process in which problems relating to LAD will be addressed to find more successful solutions where necessary. This will however, not be an open-ended process as the assessment of techno-economic feasibility updation only requires an indication of the likely costs of building and maintaining the structures which are shown to support achievement of LAD as intended.

4.3.5   Rapid EIA

Suitable Rapid Environmental Impact Assessment shall be performed and report shall be included in final DPR. The Rapid EIA Studies can be broadly divided in to three phases.

•   The first phase involves identification of significant environmental components in the area where the project is located and assessing their baseline (pre-project or existing) status within

the study zone. In case of existing projects, environmental performance of existing manufacturing / pollution control plants is also required to be covered.

- The second phase involves prediction of impacts on various identified significant environmental parameters due to proposed project.
- The third phase includes the evaluation of final impacts and delineation of an Environmental Management Plan to mitigate adverse impacts on the quality of surrounding environment.

4.3.6   Concept Design and Cost Estimates

Preliminary Design shall be performed for all the structures /developmental works proposed as per the above analysis and mathematical model studies carried out conforming to relevant IS Codes. Design drawings shall be prepared and submitted based on the preliminary design. Bill of quantities and cost estimates shall be prepared for all the proposed structures / developmental works. Based on the cargo potential and other considerations necessary for locating an IWT terminal, extent of land required for setting up of IWT terminals and other suitable locations shall be identified. Preliminary topographic survey shall be carried out and layout plan for all suggested locations shall be prepared clearly indicating all facilities e.g jetty, approach to jetty, bank protection, covered and open storage, roads, office, sentry hut, boundary wall, bank protection, bunkering facility, water facility, turning circle for IWT vessels location of depth contours of 2m and 2.5m in the river near the terminal sites. Preliminary engineering design and drawings for setting up of terminals with related facilities including mechanical loading/ unloading at the proposed sites shall be prepared. Also inter modal cargo transfer facilities required at these terminals shall be indicated.

4.3.7   Financial and Economic Analysis

Financial and economic analysis through FIRR and EIRR of the project including SWOT analysis shall be carried out for the project. For the Financial Internal Rate of Return shall be computed as follows:

- Costs shall be calculated as total capital investment for the Project components, net rate of interest charges during construction and operations & maintenance costs for the Project;
- Income flows shall be calculated based on gross revenues of projected goods to be transported through private operators with permissible assumptions such as project life etc.;
- Economic Internal Rate of Return shall be computed taking into account the following factors;
- The assumed life of the project as per norms;
- Costs shall be calculated as Government contribution and other sources. A standard conversion factor shall be used to reduce financial costs to economic costs;

- Benefits shall be estimated as Government revenues, calculated as net profit share, royalties and tax;
- Social Benefits like fuel saving, reduction in environment pollution and carbon emission, accident reduction, decongestion of rail and roads, etc.

The financial viability and sustainability of this project depend upon the adaptation to the prevailing context in which they operate. In working out the Financial Viability and sustainability, the following factors shall be considered.

- budgeting and cost accounting systems,
- resource mobilization for capital investments,
- cost recovery and operational financing,
- cost reduction and control.

The Profitability projections and financial analysis for each of the project components shall be worked out in detail and presented in the report. The financial statements shall be prepared on the basis of the suitable assumptions. The cost benefit analysis for the proposed project shall be calculated. The Net Present Value (NPV) with interest and depreciation, IRR and preliminary expenses shall be suitably considered and estimated. Break-even analysis shall be performed and presented in the report.

4.3.8   Implementation & Monitoring Mechanism

Project financial structuring shall be worked out in detail which will examine the sources and composition of funding for the project. The Project financial structuring can involve a combination of equity, grant, debt and finance from private participation (and in some cases, contribution from user communities). The scope and options for possible debt and private sector financing shall be reviewed elaborately and presented in the report. The suitable monitoring mechanism shall be evolved.

5.0 COLLECTION AND REVIEW OF DATA

5.1 PRIMARY DATA

In order to collect primary data and to access the latest hydro-morphological condition of the waterways reconnaissance survey was done. Following aspects had been covered in the reconnaissance survey as per TOR:

a) Single line longitudinal survey (Bathymetric survey or Topographic survey) in the deepest depths or lowest height lands, with the help of DGPS using Automatic Hydrographic Survey System. Bathymetric surveys in the national waterways are to be carried out in the deepest route. Deepest route can be accessed by taking two or three longitudinal line soundings at equal interval. Topographic survey, if required, is to be taken up at lowest ground levels, which can be decided on visual assessment.

b) Details (horizontal and vertical clearances above High Flood Level of bridges, aqueducts, electric lines, telephone lines, pipe lines, cables en-route are to be collected and indicated on the chart and also included in the report along with their co-ordinates and location. Details about Barrages, Dams, Locks en-route are also to be collected horizontal and vertical clearance is to be given as approximate on visual assessment.

c) Photographs are required to be submitted in the report.

d) Topographical features of the Inland Waterways.

e) Typical physical features along the alignment i.e. land use pattern:

f) Preliminary identification of stretches having year round flow and critical depth for navigational purpose.

g) Inventory of major aspects including Inland Waterway width, Terrain, Bridges and structures across the Inland Waterways (Type, size and location), urban areas (location extent). Geologically sensitive areas environmental features. Hydrological features

h) Critical areas requiring detailed investigations and

i) Requirements for carrying out supplementary investigations

j) Soil (textural classifications) (only visual inspection at every 10km) and drainage conditions.

k) Type and extent of existing utility services along the alignment.

All the above details are collected during field survey as well as by interaction with the concerned authorities from 12th January to 23rd January 2016 by the Consultant.

5.2 REVIEW OF SECONDARY DATA

Dwarakeswar River (also known as Dhalkishore) is a major river in the western part of West Bengal. It originates from Tilboni hill in Purulia district and enters Bankura district near Chhatna. Its main tributary Gandheswari rising from Bankura district meets Dwarakeswar near Bankura town. After receiving contributions from other streams like Arkasha, Berai, Shankari etc. Dwarakeswar enters into Hooghly district and joins with Shilabati near Ghatal of Paschim Medinipur district to form river Rupnarayan, which finally outfalls into the Hooghly River near Gadiara of Howrah district. There is proposal of "Dwarakeswar-Gandheswari Reservoir Project" for this basin.

Dwarakeswar Sub-basin

Status of River gauges in Dwarakeswar Sub-basin is given as below:

Gauge Station	District	Danger Level (DL) (m amsl)	Extreme Danger Level (EDL) (m amsl)
Arambag	Hooghly	17.22	17.83

Source: Annual Flood Report 2014
DL is considered as HFL for assessing the Minimum Vertical Clearance

The most remarkable identity of Dwarakeswar River (200.5km long) is that, it consists of transitional characteristics of both flash floods it its upper catchments, monsoonal flood in the middle and tidal effect in its lower confluence simultaneously. Dwarakeswar River is a major river in the western part of West Bengal. It originates from extended part of Chotanagpur plateau (geographical extension 86°31'E to 87°02'E) in Purulia District and ended in the alluvial tract of West Medinipur (22°42'30"N to 23°31'N) of West Bengal. The monthly mean temperature at summer is 32.55°C and in winter is 18.98°C. The average rainfall is 117.76 mm per year. The diurnal range of temperature varies from 4°C to 9°C. The upper catchments are suffering from acute scarcity of drinking water during the months of April to May. Upper part is overcrowded by the dug well (8 to 11 well in each 200m linear distance), middle and lower stretch of the river are overcrowded by the deep tube well irrigation (up to the depth of 50 m).

Flash Flood and Upper Catchments of Dwarakeswar river: The incident of flash flood of the plateau river is not new one but this type thrice combination is unique. The incident of flash occur just in the beginning (with in the 3 to 6 days of monsoon) of monsoon (month of June). Here flash flood is not devastating one. But it creates problem of domestic animal and causes bank erosion near Joypur Block of Bankura District. This incident confines within its upper catchments up to Joypur Block of Bankura District.

Monsoonal Flood and Middle Catchments of Dwarakeswar river: The incident of monsoonal flood is very common in the mid of monsoon (during the months of August) particularly in Arambagh and Khanakul Blocks of Hooghly district. The entire flood incident occurs here in the day of late August to September. In those day, due to tidal effect in the lower catchments (which is 150 km away from the Bay of Bengal and it meets the river Bhagirathi) the huge amount of rainwater in river basin gets a backward onrush. Simultaneously its upper catchments consist of 12° to 21° slopes where as the slope in the middle portion is 7°-12°. That is the reason the water in the middle part does not get back to its upper catchments. The upper catchment's water level getting higher and higher and its lower potion give backward onrush of water. The middle portion of the river gets flooded. That is the reason of monsoonal flood in its middle portion.
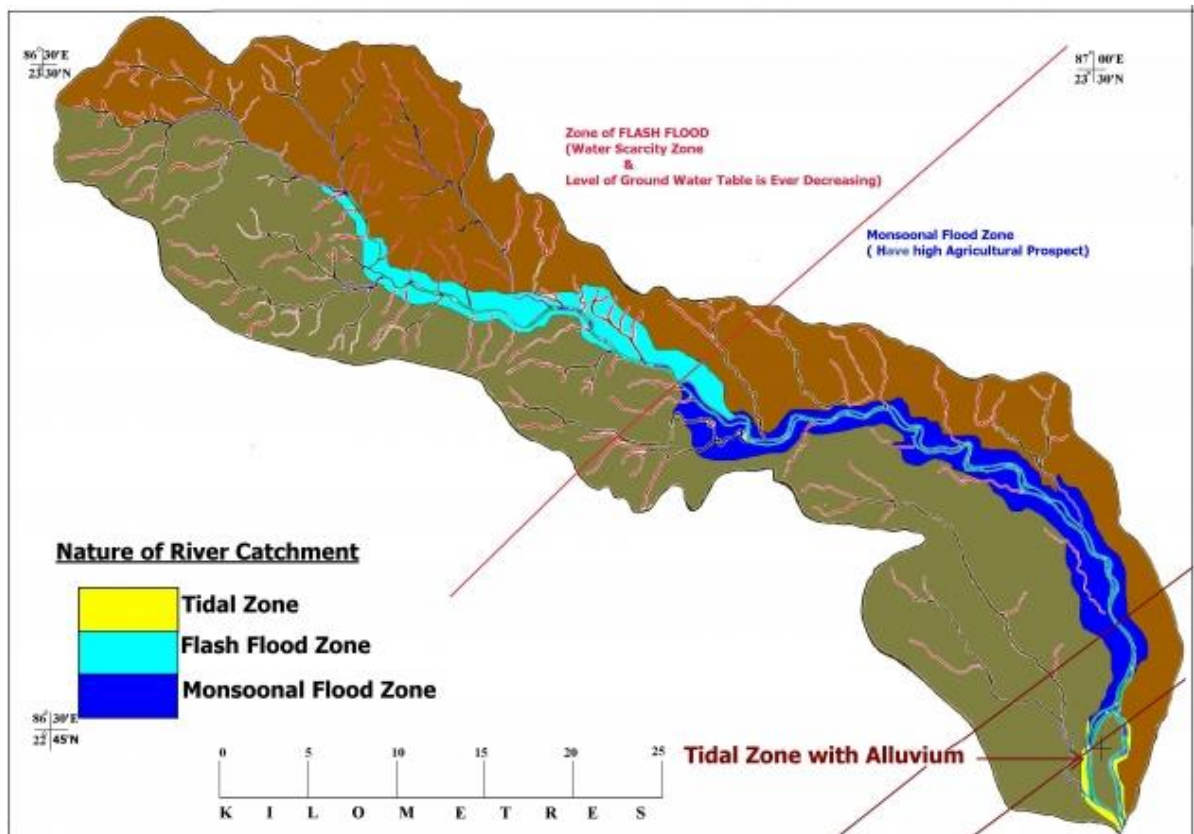
Tidal Flood and Middle Catchments of Drarekeshwar river: During the period of high tide (months of monsoon), the river Rupnarayan gets backward rush of tidal water near Gadhiyara (Meeting point of Rupnarayan and Bhagirathi) and that backward on rush of tidal water push back the river water of Dwarakeswar near Ghatal. During the each monsoon in each lunar cycle day, the lower catchments of Dwarakeswar is flooded by tidal effect and the middle portion get flooded partially by release of flash flood water from upper catchments and due to the backward on rush of tidal water from its lower part simultaneously. Here it is important to mention that river Dwarakeswar comes

from an area which has a chronic drought history with scanty of rainfall and flows through the area which has chronic flood history. This river does not meet to Bay of Bengal independently. It meets river Hooghly 240 km (150 miles) away from the Bhagirathi's estuary. Its meeting point is quite far from the estuary of the river Bhagirathi but in spite of that this area is tidal. This thrice combination (flash flood in upper catchments with the zone of scanty of rainfall, middle is the zone of monsoonal flood and the lower confluence is dominated by tidal effect) of this river of plateau region which does not meet Bay of Bengal independently is unique in character. This thrice combination Dwarakeswar gives a unique identity and it is very rare phenomenon. Due to this behaviour of the river, Dwarakeswar River Basin is called as a combination of Flash Flood Zone, Monsoonal Flood Zone & Tidal Zone.

6.0 ANALYSIS OF PRESENT STATE OF AFFAIRS

6.1 EXISTING DAMS, BARRAGE & LOCKS

Two numbers of Sand check dams are located en-route the waterway alignment on Dwarakeswar River. The details of the check dams are provided in **Table 3** as below. Photographs of the check dams are provided in **Annexure 4**.

Table 3: Details of Sand Check Dams located along the alignment

Sl. No.	Location	Chainage (Km)	Northing	Easting
1.	Paschim Raypur	20.9	579448.40	2522369.00
2.	Pyarinagar	36.1	578437.40	2534611.00

6.2 EXISTING BRIDGES ALONG THE WATERWAY

The existing bridges and crossings encountered during survey are listed in **Table 4**.

Table 4: Details of existing Major Road bridges en-route Dwarakeswar Waterway

Sl. No	Location	Chainage (km)	Easting	Northing	Vertical Clearance w.r.t HFL (m)	Horizontal Clearance b/w piers (m)
1.	Kalipur to Paschim Shibpur	33.42	579538.00	2531191.00	8.00 m	8.00 m
2.	Samroghat (Mathuratapal Bridge)	74.34	560823.00	2552853.00	6.00 m	8.00 m

Vertical Clearances are on the basis of visual assessment s per Ref No. 2, page 2 of 27, replies to Pre-bid queries raised by Prospective bidders in Pre-bid meeting held on 23.04.2015, wherein it was clarified by IWAI that, "In Stage –I, horizontal and vertical clearance is to be given as approximate on visual assessment."

It can be inferred from the above table that the horizontal clearance is **8.0 m**. Similarly the maximum and minimum vertical clearance is in the range of **8.0 m and 6.0 m** respectively.

6.3 EXISTING HIGH TENSION LINES AND OTHER CROSS STRUCTURES

During the survey high tension lines are observed at certain chainages and the same is presented in the following **Table 5**.

Table 5: Details of Existing High Tension Lines

Sl. No	Location	Chainage (km)	Easting	Northing	Vertical Clearance w.r.t HFL (m)
1	Dhulepur	27.4	581128.90	2527545.00	6.00 M
2	Dhulepur	27.9	581115.40	2527484.00	7.00 M
3	Dhulepur	28.2	581079.60	2527272.00	4.00 M
4	Beli	34.6	579126.50	2521956.00	4.00 M

6.4 HINDRANCES/ ENCROACHMENT ALONG THE WATERWAY

Hindrances/encroachments for waterway are defined as any natural or manmade structure, which can cause obstruction or danger to navigation. In order to start navigation in the waterway, these structures are either to be removed or taken care adequately. These hindrances/encroachments are may be rock outcrop from the river bed, wooden or sand bridges, etc. Major hindrances/encroachments identified en-route the Dwarakeswar waterway are Wooden/ Bamboo bridges which are to be dismantled or re-located as per the navigational requirements. The list of these hindrances is provided in **Table 6**.

Table 6: Details of Wooden/ Bamboo bridges located along the Waterway

Sl No	Location	Chainage (Km)	Easting	Northing
1	Chanditala	4.3	577472.50	2509956.00
2	Lalkundu	6.5	575828.70	2510431.00
3	Lalkundu	7.2	575885.30	2511076.00
4	Jagatpur	19.2	579043.60	2520482.00
5	Ballabhbati	28.7	580905.40	2528843.00
6	Pashchim Shibpur	30.6	580225.40	2530267.00
7	Malakarpota	61.4	566021.50	2550348.00

6.5   FOREST AREA / PROTECTED AREA / DEFENCE AREA

Dwarakeswar waterway flows through the following districts comprising of forest area as detailed in **Table 7**.

Table 7: Forest Cover in Project districts

Districts	Geographical Area (Km^2)	Forest Cover (Km^2)			Total Forest	% of GA
		Very Dense	Moderate Dense	Open Forest		
Bankura	6882	212	379	673	1264	18.37
Bardhman	7024	60	88	168	316	4.50
Hooghly	3149	0	14	146	160	5.08

Source: India State Forest Report, 2015
Note: *(i) **Very Dense Forest:** All lands having tree canopy cover > 70%.*
          *(ii) **Moderate Dense Forest:** Tree canopy cover between 40%-70%.*
          *(iii) **Open Forest:** Tree canopy cover between 10%-40%*

No protected/restricted area is located along the Waterway.

6.6   ROAD AND RAIL INFRASTRUCTURE

Dwarakeswar waterway is well connected with rail and road network. The details of Railway station located within 5.0 Km radius of the proposed waterway are presented in **Table 8** below.

Table 8: Railway station within 5.0 Km radius of Dwarakeswar Waterway

Sl. No.	Railway Station (within 5.0 km radius)
1.	Arambag Railway Station
2.	Bishnupur Railway Station

Detail of major roads connecting to the Dwarakeswar waterway is provided in **Table 9**.

Table 9: Major Road crossing or within 5.0 Km radius of Dwarakeswar Waterway

National/State Highway	Other Major Roads
a) National Highway 60	a) Bandra Road
b) State Highway 2	b) Arambagh Barddhaman Road
c) State Highway 7	c) Balsi to Jamkurui Road

7.0 RECONNAISSANCE SURVEY

Egis, India carried out the reconnaissance survey as required for the feasibility studies and detailed as per TOR as below:

- Single line longitudinal survey (Bathymetric survey or Topographic survey) in the deepest depths or lowest height lands, with the help of DGPS using Automatic Hydrographic Survey System.
- Horizontal and vertical clearances above High Flood Level of bridges, aqueducts, electric lines, telephone lines, pipe lines, cables en-route are to be charted.
- Details about Barrages and Dams en-route are also to be reported.
- Topographical features of the Inland Waterways are to be reported.
- Typical physical features along the alignment i.e. land use pattern are to be reported
- Stretches having year round flow and critical depth for navigational purpose are to be reported.
- Preliminary Traffic on the Inland Waterways is to be identified.
- Inventory of major aspects including Inland Waterway width, Terrain, Bridges and structures across the Inland Waterways (Type, size and location) will be reported.
- Urban areas (location extent) are to be reported.
- Geologically sensitive areas environmental features are to be reported
- Hydrological features are to be reported.
- Critical areas requiring detailed investigations are to be reported.
- Requirements for carrying out supplementary investigations are to be reported.
- Visual inspection of Soil (textural classifications) are to be reported
- Major Drainage conditions are to be reported.
- Type and extent of existing utility services along the alignment are to be identified.
- Identification of various agencies of the govt. from whom the concerned project clearances for implementation are to be sought.

7.1 DETAIL METHODOLOGY FOR SURVEY

The surveyor deployed a team of personnel to carry out the reconnaissance survey; the detailed methodology is described in following sub sections.

7.1.1 Resource for Survey Work

Off shore Key Personal:

- Project in-charge: 1 no.
- Senior Surveyor: 4 nos.
- Survey Engineer: 3 nos.

On shore Key Personal:

- Project manager: 1 no.
- Survey manager: 2 nos.
- Reports Coordinator: 1 no.

Survey Equipment and Software:

Table 10: List of Equipment Mobilised for Survey

Sl. No.	Survey Equipment/Systems Used for the Data Acquisition	
	Equipment/System	**Description/Make/Model**
1.	Software / Navigation	HYPACK 2015 computer acquisition and data logging Software
2.	Positioning System	Trimble SPS 351(DGPS) & 855 RTK DGPS (One Base & Two Rover)
3.	Single beam Echo Sounder	Sonar Mite
4.	Tidal Observation	Valeport Automatic Tide Gauge/ Manual Tide Gauge
5.	Levelling	Sokkia B40 Auto Level
6.	Total Station	Trimble TS 635
7.	Data Acquisition System	Dell laptop/ HP laptop

Survey Vessel

Considering the geographical and topographical feature, length of river, shallow and dry patch, inaccessibility to survey area, due to insufficient water for regular boat, inflatable Zodiac Boat "Aqua Marina-1", "Aqua Marina 2" were used to carry out bathymetric survey. The names and specifications of the survey boats are provided in **Table 11**.

Table 11: Details of Survey Boats Used

Name of the Boat	Length (m)	Width (m)	Draft (m)
Aqua Marina - 1	3.0	1.5	0.020
Aqua Marina – 2	2.5	1.29	0.020

7.1.2   Geodetic Parameters

The geodetic parameters used for survey were as follows:-

Global Positioning System Geodetic Parameters	
Datum:	World Geodetic System 1984 (WGS84)
Spheroid:	World Geodetic System 1984
Semi major axis:	a = 6 378 137.000 m
Inverse Flattening:	$^1/_f$ = 298.257 223 563
Local Datum Geodetic Parameters	
Datum:	World Geodetic System 1984 (WGS84)
Spheroid:	World Geodetic System 1984
Semi major axis:	a = 6 378 137.000 m
Inverse Flattening:	$^1/_f$ = 298.257 223 563

Datum Transformation Parameters from WGS84 to WGS84					
Shift dX:	0.0 m	Rotation rX:	0.000 arcsec	Delta Scale :	0.0000 ppm
Shift dY:	0.0 m	Rotation rY:	0.000 arcsec		
Shift dZ:	0.0 m	Rotation rZ:	0.000 arcsec		

Local Projection and Grid Parameters [2]	
Map Projection:	Universal Transverse Mercator
Grid System:	UTM Zone 45 N
Central Meridian:	087° 00' 00" West
Latitude of Origin:	0° 00' 00" North
False Easting:	500 000 m
False Northing:	0.0000
Scale factor on Central Meridian:	0.9996
Units:	metres

Notes:
1) Hypack navigation software always uses WGS84 geodetic parameters as a primary datum for any geodetic calculations.
2) This is the right-handed coordinate frame rotation convention used by the Hypack navigation software.

7.1.3 Survey Data Processing

General

The survey data was logged in HYPACK On-line Survey Software, and was processed using the HYPACK Processing, AUTOCAD and Spectra Precision Survey Office. The data was processed, checked and verified to ensure good quality data. Single Beam (SB) Editor was used for the automated and manual processing of logged data sets.

Navigation and Positioning

The DGPS Receiver Antenna was mounted exactly above the echo sounder transducer. The echo sounder transducer was mounted on the side of the boat, without any offset to ensure accuracy in the position of soundings. The bar-checks were carried out before/after each sounding session. Transducer draft was measured and recorded, and the same was used while processing. On all such occasions the error observed was zero or near zero. Therefore, no corrections were necessary.

Bathymetry

HYPACK Processing suite was used to import quality check and process the navigation, bathymetry and tidal data. The data was filtered, cleaned, and combined to create geographically positioned bathymetric data set.

7.2 DESCRIPTION OF BENCH MARKS/ REFERENCE LEVELS

Due to non-availability of any permanent BM near the project area during reconnaissance survey, benchmarks was established by DGPS observation for 12 hours using Trimble SPS 855 positioning system and post processing through AUSPOS and Spectra Precision Survey Office to get the value of the TBMs with respect to MSL. The final co-ordinates of the BM and height above MSL and other details are provided in **Table 12** as below.

Table 12 : Temporary Benchmark Dwarakeswar River

Sl. No.	TBM	Latitude	Longitude	Easting	Northing	Chainage (km)	CD w.r.t MSL (m)	Ht above MSL in m
1.	Bondar (TBM – 1)	22°40'15.51"N	87°46'45.15"E	580048.36	2507307.57	0.00	1.00	1.860
2.	Baghanala (TBM – 2)	22°43'47.10"N	87°44'16.47"	575773.26	2513792.31	10.222	3.32	3.329
3.	Paschin Raypur (TBM – 3)	22°48'42.11"N	87°46'22.83"E	579330.26	2522882.31	21.433	6.375	8.451
4.	Daulatpur (TBM – 4)	22°54'40.75"N	87°45'38.61"E	578012.73	2533904.43	35.286	8.04	12.918
5.	Lakshmanhati (TBM – 5)	23°02'06.25"N	87°40'08.64"E	568550.19	2547558.61	56.638	20.25	24.413

7.3   LEVELLING OF TEMPORARY TIDE POLES

Five temporary bench marks were established in between the course of survey at different places by using Trimble RTK SPS 855. Auto level SOKIA B-30 was used to establish the zero of the tide gauge with reference the TBMs. The observed readings in Auto Level are provided in **Annexure 1**. The water levels observed on the tide poles during reconnaissance survey are provided in **Annexure 2**. The CD/SD adopted for obtaining reduced depth along the waterway is given in **Figure 4**.
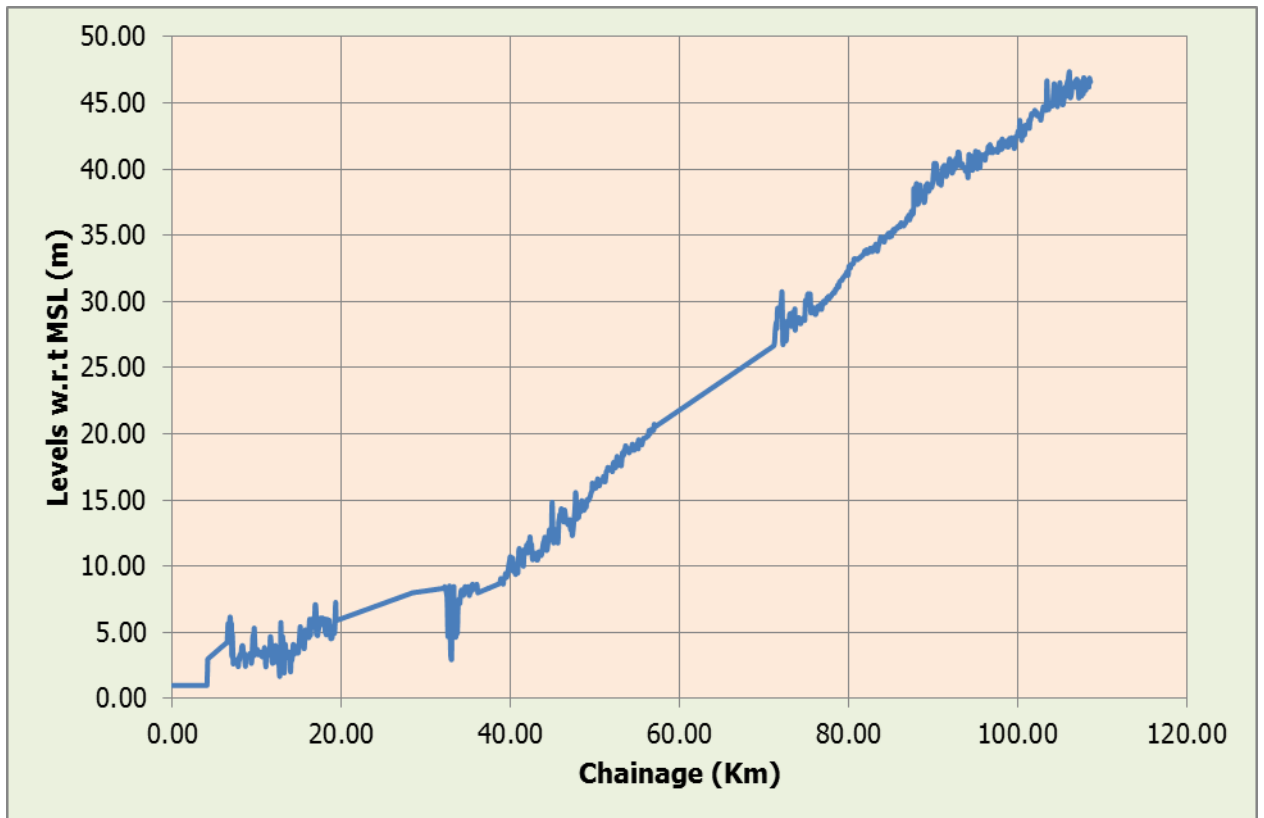
Figure 4: Graph showing Chart Datum/Sounding Datum w.r.t. MSL along Dwarekeswar River

7.4   HYDROGRAPHIC SURVEY

Single line longitudinal survey (Bathymetric survey or Topographic survey) in the deepest depths or lowest height lands, with the help of DGPS using Automatic Hydrographic Survey System has been carried out for the length as shown in **Table 13**. Total length of the Dwarakeswar Waterway as per TOR is 113.0 km.

Table 13: Survey Length of Waterway

Total Surveyed Length of Waterway	Length of Bathymetric Survey	Length of Topographic Survey
113 Km	37.10 Km	75.90 Km

7.5   WATER DEPTH

Water depths along the waterway have been observed during Reconnaissance survey as per the scope of works and requirement for feasibility studies. Single line longitudinal bathymetric/topographic

survey has been carried out for obtaining the water depth along the deepest route or lowest height lands of waterway. The observed depth are then corrected by applying a reduction factor as provided above for different stretches to calculate the reduced water depths available for navigation. The reduced water depths at every 10 km interval are presented in **Table 14**. Detailed water depths along the Dwarakeswar waterway is also provided in **Annexure 3**.

Table 14: Water Depth along the Waterway

Chainage (Km)	Draft Variation		Length of River (Km) with following draft			
	Max. Available (m)	Min. Available (m)	<1m	1.0 -1.5m	1.5 -2.0 m	>2.0m
0 – 10	1.52	0.00	9.79	0.00	0.21	0.00
10 – 20	2.33	0.97	9.62	0.24	0.04	0.20
20 – 30	5.73	0.73	1.06	3.14	2.65	3.14
30 – 40	3.94	0.34	6.09	2.04	1.10	0.77
40 – 50	Topographic Survey done for full stretch		10.00	0.00	0.00	0.00
50 – 60	1.11	0.11	9.94	0.06	0.00	0.00
60 – 70	2.81	0.07	9.94	0.00	0.00	0.06
70 – 80	0.22	0.03	10.00	0.00	0.00	0.00
80 – 90	Topographic Survey done for full stretch		10.00	0.00	0.00	0.00
90 – 100			10.00	0.00	0.00	0.00
100 – 110			10.00	0.00	0.00	0.00
110 – 113			10.00	0.00	0.00	0.00
Total			**99.35**	**5.47**	**4.01**	**4.17**

It can be inferred from the above table that **4.17 Km stretch of waterway have draft more than 2.0 m, 4.01 Km stretch have draft of 1.50 m to 2.0 m, 5.47 km have draft of 1.0 m to 1.50 m and remaining 99.35 km stretch of waterway have less than 1.0 m draft with respect to chart datum** respectively.

7.6 SOIL CHARACTERISTICS

On the basis of visual assessment done during longitudinal survey, the characteristics of soil on both banks of the waterway are provided in **Table 15**.

Table 15: Soil Characteristics along Dwarakeswar Waterway

S. No.	Chainage (km)	Latitude	Longitude	Easting (m)	Northing (m)	Analysis
1.	110.0	22°40'16.30N	87°46'51.27E	580222.88	2507332.50	Muddy Sand
2.	100.0	22°43'40.51N	87°44'15.09E	575734.82	2513589.50	Muddy Sand
3.	90.0	22°48'1.27N	87°46'5.91E	578854.33	2521623.99	Sand
4.	80.0	22°52'27.63N	87°47'13.50E	580737.79	2529825.03	Sand
5.	70.0	22°56'34.26N	87°45'30.99E	577777.65	2537394.01	Sand
6.	60.0	23°00'21.19N	87°43'15.68E	573889.66	2544352.94	Sand
7.	50.0	23°03'35.33N	87°39'28.89E	567406.80	2550292.70	Sand
8.	40.0	23°05'2.67N	87°36'14.69E	561869.63	2552954.83	Sand
9.	30.0	23°06'15.48N	87°31'54.54E	554460.07	2555164.97	Sand
10.	20.0	23°07'2.29N	87°26'57.92E	546017.88	2556576.01	Sand
11.	10.0	23°05'25.56N	87°22'11.78E	537886.69	2553578.65	Sand
12.	0.0	23°06'54.32N	87°18'47.50E	532069.42	2556294.52	Sand

7.7 TIDAL WATERWAY SECTION

It is seen from the data collected during Reconnaissance survey that out of 113 Km of the Dwarakeswar Waterway, 6.50 Km stretch upstream of the river confluence with Rupnarayan and Silabati river is having tidal influence. The tidal variation of 0.7 m is observed.

8.0   MARKET ANALYSIS

Preliminary market analysis has been done on the basis of reconnaissance survey, Consultants site visit, available secondary informations and published literature at the feasibility stage of the project.

8.1   LAND USE PATTERN

Land use pattern along the Dwarakeswar River can be characterized as Agricultural and Residential as presented in **Table 16**.

Table 16: Land Use Pattern along Waterway

Length (km)	Agricultural		Residential	
	Length (km)	%	Length (km)	%
113	110.74	98%	2.26	2%

8.2   CROPS /AGRICULTURE PRODUCTS

Dwarakeswar waterway is located along the following districts of West Bengal, namely;

- Bankura
- Bardhaman
- Hooghly

The details of cropping system in the above listed districts are as follows:

Bankura: Rice is the main crop of this district. Though the district is prone to drought, it can raise surplus food production in years of good rainfall. Besides rice, the major crops are Potato, wheat, Vegetables, Mustard, Summer Til etc. Like rice, the district is also surplus in Potato & Vegetable production. The district is lagging behind in the production of Pulses & Oilseeds. However, special emphasis is started giving in production of Oilseeds & Pulses by introducing new varieties of Pulse Crops like Arhar, Lentil, Gram, Khesari, Kalai, Moong etc. Ground Nut and Sunflower have also been introduced in Rabi season to meet up the gap between demand and production of Oilseed crops. Broccoli and Capsicum are also cultivated by farmers of this district to meet up the demand of the local people.

Table 17: Average Production and Productivity of major crops in Bankura district (2004-09)

Name of Crop	Kharif		Rabi		Summer		Total	
	Production ('000 t)	Productivity (kg/ha)	Production ('000 t)	Productivity (kg/ha)	Production ('000 t)	Productivity (kg/ha)	Production ('000 t)	Productivity (kg/ha)
Major Field Crops								
Rice	49.17	2602	906.33	2770	152.83	2636	1108.33	2744
Wheat	-	-	11.03	2073	-	-	11.03	2073
Pulses	-	-	0.32	671	-	-	0.32	671
Oilseeds	-	-	25.35	705	-	-	25.35	705
Potato	-	-	682.78	19489	-	-	682.78	19489
Maize	1.44	2352	-	-	-	-	1.44	2352
Major Horticultural Crops								
Cucurbits	-	-	-	-	-	-	161.43	13703
Brinjal	-	-	-	-	-	-	194.85	19504
Okra	-	-	-	-	-	-	64.29	11180
Cauliflower	-	-	-	-	-	-	145.65	27429
Cabbage	-	-	-	-	-	-	155.33	32495

Source: Agriculture Contingency Plan

Bardhhaman: Bardhhaman is the only district in the state of West Bengal that is fortunate both in industry and agriculture. On an average about 58 percent of the total population belongs to the agricultural population while the non-agricultural sector accounts for the remaining 42 percent.

The eastern, northern, southern and central areas of the district are extensively cultivated but the soil of the western portion being of extreme lateritic type is unfit for cultivation except in the narrow valleys and depressions having rich soil and good moisture. The cultivation in the district has improved since 1953 with the implementation of the irrigation projects undertaken by the Damodar Valley Corporation. Up to 1953 the cultivation was entirely dependent on the monsoon, and irrigation facilities were rather inadequate and more or less primitive. The position has since been changed and an all-round agricultural development has become possible. Though agriculture is largely regulated by

rainfall as in the other districts of the state, the developing irrigation system has been very helpful in minimizing the effects of the vagaries of nature.

Rice is the most important crop of the district and in the alluvial plains to the east little else is grown. The rice grown with its numerous varieties can broadly grouped under the three primary classes distinguished from one another by distinct characteristics and there are: The Aus or autumn, the Aman or winter and the Boro or the summer rice. Paddy covers maximum of the gross cropped area. Among commercial crops Jute, Mesta and Sugarcane, potato, oil seeds are cultivated in marginal area

Table 18: Average Production and Productivity of major crops in Bardhhaman district (2004-08)

Name of Crop	Kharif		Rabi		Summer		Total	
	Production ('000 t)	Productivity (kg/ha)	Production ('000 t)	Productivity (kg/ha)	Production ('000 t)	Productivity (kg/ha)	Production ('000 t)	Productivity (kg/ha)
Major Field Crops								
Rice	48.1	3069	1231.1	2953	642.5	3129	1921.7	3021
Wheat	-	-	6.7	2313	-	-	6.7	2313
Pulses	-	-	1.2	849	-	-	1.2	849
Oilseeds	-	-	43.1	850	-	-	43.1	850
Jute	233.0	3019	-	-	-	-	233.0	3019
Potato	-	-	1058.0	21674	-	-	1058.0	21674

Source: Agriculture Contingency Plan

Hooghly: Hooghly is an agriculturally prosperous district of West Bengal. The land use pattern of the district demonstrates a high proportion of net sown area as percentage of total reported area. About 70% of its population depend on agriculture and represents an important and remarkable place in the field of agriculture in West Bengal.

Due to massive population explosion and continuous increase of pressure on land, the farmers of this district are engaged in cultivation of all the major crops utilising the fullest potentiality of land and natural resources. Though rice is the prime crop of the district, the agricultural economy largely depends on potato, jute, vegetables and orchard and the cropping intensity of the district has been escalated to 220%.

Vegetable is a price crop in the blocks of Haripal, Singur, Chanditala, Polba and Dhaniakhali being grown in a relay system throughout the year. Though potato is cultivated in all the blocks of this district in Dhaniakhali, Arambagh, Goghat, Pursurah, Haripal, Polba-Dadpur, Tarakeswar, Pandua and Singur contributed much of its production of this district.

Table 19: Hooghly district-Average Production and Productivity of major crops (2004-09)

Name of Crop	Kharif		Rabi		Summer		Total	
	Production ('000 t)	Productivity (kg/ha)	Production ('000 t)	Productivity (kg/ha)	Production ('000 t)	Productivity (kg/ha)	Production ('000 t)	Productivity (kg/ha)
Major Field Crops								
Rice	19.24	2665	16.83	2712	304.72	2953	340.79	8330
Potato	-	-	1960.34	20889	-	-	1960.34	20889
Wheat	-	-	1.38	2110	-	-	1.38	2110
Oilseeds	-	-	40.86	1127	-	-	40.86	1127
Pulses	-	-	1.278	758	-	-	1.278	758
Maize	0.46	2531	-	-	-	-	0.46	2531

Source: Agriculture Contingency Plan

8.3   AVAILABILITY OF PASSENGER FERRY SERVICES

Locally organised passenger ferry services are located at some places along the waterway during Reconnaissance survey. The ferry service locations along Dwarakeswar waterway are given in **Table 20**.

Table 20: Existing Ferry locations along Dwarakeswar River

Sl. No	Location	Chainage (km)	Easting	Northing
1.	Daschim Raypur	21.5	579389.10	2522954.00
2.	Dighara	24.5	580268.10	2524799.00
3.	Birampur	36.6	578845.70	2534980.00
4.	Mandra	38.0	579267.30	2536203.00

8.4 EXISTING JETTIES AND TERMINALS

The ferry services operational along the waterway is locally operated and used for passenger and small cargo transports like fish, vegetables, agricultural goods, bricks and locally made tiles only.

As observed during the survey, temporary structures made of wooden planks, stones are used for embarking/disembarking purposes. And no permanent structural RCC jetty is located along the waterway.

8.5 HISTORICAL AND TOURIST PLACE ALONG DWARAKESWAR WATERWAY

Prominent places located along Dwarakeswar waterway are:

Bishnupur is an important tourist spot of Bankura district. This place has a historical importance as it was the capital of Mallabhum. It is very famous for terracotta temples and Baluchari sarees. It is popular for classical music dalmadal and painting. There are approximately 16 temples, most of which are made in the decade of Mallaraja. Important temples of Bishnupur are Jor Mandir, Rasmancha, Radhamadhab Temple, Kalachand Temple, Madan Mohan Temple, Radha-Gobinda Temple and Shyam Ray Temple.

Joyrambati is a holy place as it was the birthplace of Sree Sree Maa Sarada Devi. Temple of Singha Bahani Devi and Mayerepukur are also visiting sites

8.6 AVAILABILITY OF CONSTRUCTION MATERIAL

Major construction materials available along the Dwarakeswar waterway are Sand, Bricks and Tiles.

8.7 INDUSTRIES ALONG THE WATERWAY

Pottery industry is the major livelihood of the people living along Dwarakeswar waterway, due to presence of fireclay. Haldia is a centre of industrial activity with its chemical and oil factories situated on the banks of the river. The confluence point of Dwarakeswar and Silabati River known as Ghatal, is famous for textile, paper, tin and bronze industries. Arambagh, the head office of Hooghly districts, is famous for its poultries and paper industries. Besides these, rubber industry is also found in some pockets of the catchment.

Most of the people living along the banks of waterway depend upon agriculture. Kharif and Rabi, both types of crops are cultivated here along with Bittle tree cultivation.

The likely exportable items are follows:

1) Tobacco Products,
2) Construction material like bricks and sand.
3) Fresh water Fish and poultry,
4) Agriculture products including Bittle,
5) Tin and Bronze products,
6) Textile,
7) Paper,
8) Rubber products,
9) Copper and Aluminium

8.8   EXISTING WATER SPORT AND RECREATIONAL ACTIVITIES AND FUTURE PROBABILITY

Water recreational activities are currently not available along the waterway. However, the waterway has huge potential to be developed for water sports and recreational activities especially in the tidal stretch.

8.9   ESTIMATED CARGO MOVEMENT

Dwarakeswar waterway has huge potential for economic development considering its connectivity with various industrial and commercial places along its way. It's connection with Rupnarayan and thereafter with Hooghly River, including Haldia port add to its commercial advantage.

Forecasted cargo potential has been estimated on the basis of last 13 year growth pattern of Cargo movement from 2002-2003 to 2014 – 2015 for National waterway-1, as provided in the IWAI Annual reports (Refer **Table 21**). Linear correlation between existing and declared National Waterways has been done, to estimate the forecasted cargo potential. In Stage-I of the study a base figure of 0.0 tonnes cargo movement is assumed for estimating the forecasted figures as shown in **Figure 5**.

Table 21: Cargo Movement in National Waterway – 1 from 2002 – 2015

Sl. No.	Year	Cargo Movement for NW-1 (tonnes)
1.	2002-03	632,037
2.	2003-04	786,159
3.	2004-05	887,328
4.	2005-06	1,001,450

Sl. No.	Year	Cargo Movement for NW-1 (tonnes)
5.	2006-07	1,317,387
6.	2007-08	1,497,964
7.	2008-09	1,348,385
8.	2009-10	1,811,070
9.	2010-11	1,871,178
10.	2011-12	3,309,839
11.	2012-13	2,716,437
12.	2013-14	3,349,138
13.	2014-15	5,050,209
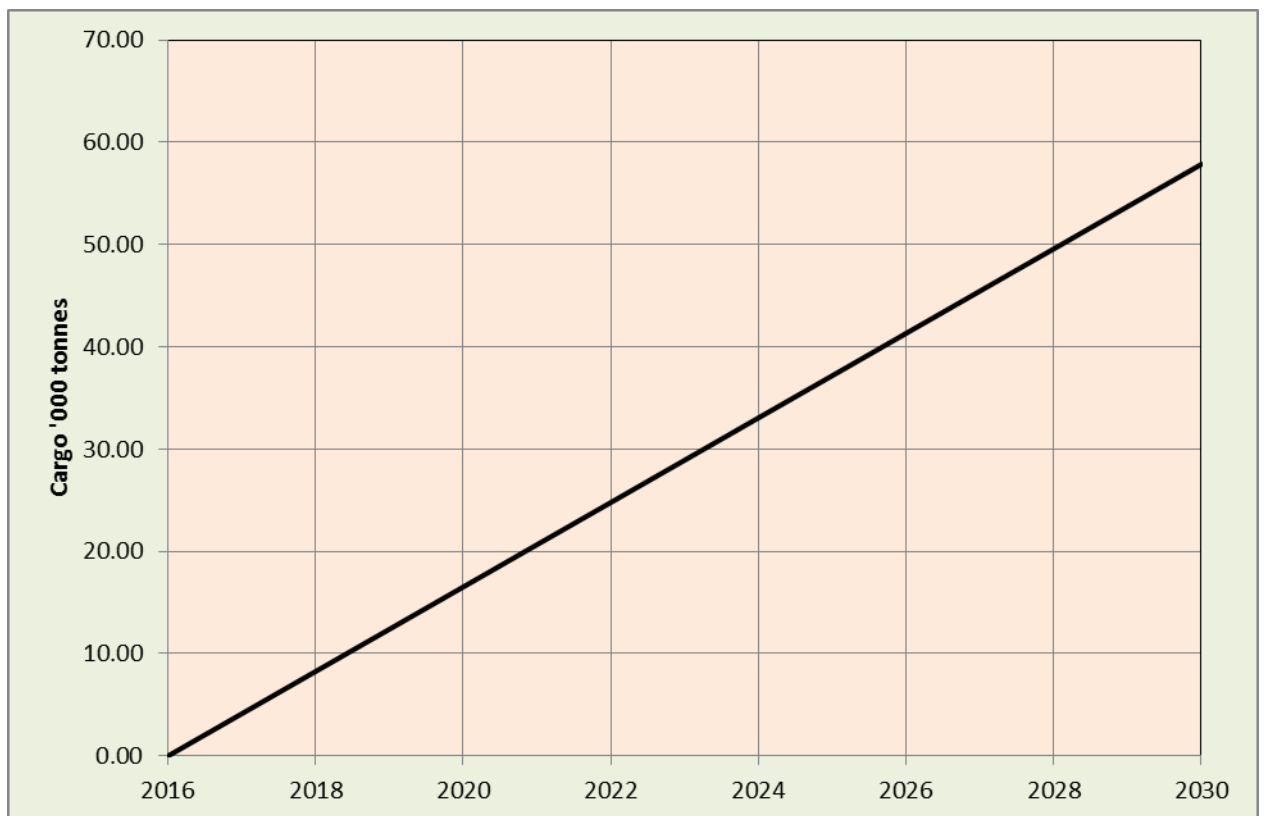
Figure 5: Forecasted Cargo Potential

Prima facie Dwarakeswar waterway has huge economical potential for development of Inland waterway. Not only there is existing traffic but also the development of waterway will trigger new traffic. Extent of development and prioritisation of inland waterways will be prepared in subsequent phase of the DPR study.

9.0 OBSERVATION AND INFERENCE

On the basis of reconnaissance survey as well as primary and secondary data collected from IWAI, central and state government departments and other stakeholders, following observations and inferences are made on the Dwarakeswar Waterway (National Waterway 35).

9.1 WATERWAY

Dwarakeswar River originates from Tilboni hill in Purulia district and enters Bankura district near Chhatna of West Bengal. The river cuts across the Bankura district flowing past the district headquarters and enters the south-eastern tip of Bardhaman District. It then passes through Hooghly District. The Silabati River joins it near Ghatal and the two together is known as Rupnarayan River, which flows into the Hooghly River near Gadiara in Howrah District. The total catchments area of the Dwarakeswar river system is 4292 sq. Km. The important tributaries of Dwarakeswar River system are Gandheswari, Beko, Arkasha, Berai, Shankar. The river has a tidal stretch of 8.0 Km towards upstream of Ghatal, with maximum tidal variation of about 0.7 m.

9.2 LEAST AVAILABLE DEPTH (LAD)

LAD of the Dwarakeswar waterway is estimated on the basis of applying exceedance probability approach on the reduced water depth. Reduced water depth is calculated after applying corrections on the water depths observed during single line hydrographic survey with reference to Chart/Sounding datums. Navigable stretch available for least available depth (LAD) of <1.0 m, 1.0 m to 1.5 m, 1.5 m to 2.0 m and >2.0 m for the waterway is presented in **Table 22**.

Table 22: Waterway length with varying LAD

Features	Results
Waterway Length	113.0 Km
Length with Topographic Survey	75.90 Km
Length with Bathymetric Survey	37.10 Km
Maximum available draft	5.73 m
Minimum available draft	0.00 m
Waterway length with <1.0 m draft (includes length with topographic survey)	99.35 Km

Features	Results
Waterway length with 1.0 – 1.5 m draft	5.47 Km
Waterway length with 1.5 – 2.0 m draft	4.01 Km
Waterway length with >2.0 m draft	4.17 Km

By taking into account the tidal advantage of 0.7 m in the tidal stretch of waterway. The available draft in this stretch can be conveniently raised above 1.2 m from 1.0 m.

9.3 CROSS - STRUCTURES

During reconnaissance survey, details of cross-structures have been collected and their minimum horizontal and vertical clearance has been evaluated on the basis of visual assessment as shown in Table 23 below. The detailed list of cross-structures is provided in **Table 4** and **Table 5**.

Table 23: Minimum Horizontal and Vertical Clearance along Waterways

Surveyed Length (km)	Dams/ Barrages/Locks	Bridges/ Crossing	Min Ver. /Hor. Clearance (m)	High-Tension Lines	Min Ver. Clearance (m)
113	Not Available	2	6.0 / 8.0	6	4.0

Vertical clearance is with reference to the HFL.
Horizontal Clearance is the minimum distance between the bridge piers.

9.4 SWOT ANALYSIS

SWOT analysis is a technique commonly used to assist in identifying strategic direction for an organization or practice. It helps to make an assessment of internal environment and scrutiny of external environment, with an objective to take maximum benefits by having an appropriate proposition. It is preferred for the present work as it yields useful information about the future viability of the considered inland waterway system. The predictive capabilities in the technique come about from the consideration of system's strengths and weaknesses in the context of the development of Inland Waterway System, which may present opportunities and threats.

	INTERNAL		
P	**STRENGTH**	**WEAKNESS**	**N**
O **S** **I**	➢ Commitment of Govt. of India for Developing Inland Waterways Sector. ➢ Environmental friendly mode of Transport ➢ Increase in Infrastructure Facilities as alternative mode of transport. ➢ Comparatively high level of transport safety. ➢ Reliable services under predictable weather conditions. ➢ Low transport costs (per km) for bulk shipments. ➢ Long term effective cost control measures (O&M). ➢ Capable of bringing down decongestion from the Road Transport. ➢ Availability of tidal window, which provides additional draft for navigation.	➢ Huge Initial Investment ➢ High Maintenance Cost ➢ High tariff structure for Inland Transport. ➢ Limited knowledge of IWT among shippers. ➢ Dependence on inter-modality for door-to door services. ➢ Substantial cost differentials w.r.t other transports. ➢ Dredging capability of GoI is 16% of National requirement. ➢ Availability of water throughout the year.	**E** **G** **A**
T **I** **V** **E**	➢ Trigger new traffic in the hinterland ➢ Boost International and National trade of commodities. ➢ Improvement of the capacity/quality of the Infrastructure. ➢ Integration of Ports with Roads & Railways. ➢ Enhance inter-modality. ➢ Implementation of infrastructure links. ➢ Improved Supply-Demand logistic chains ➢ Creation of reliable employment for the people. ➢ Connectivity with Rupnarayan waterway and thereby with National waterway 1 and Haldia port.	➢ Lack of Skilled Man-power. ➢ Environmental policy restrictions on transport infrastructure policies. ➢ Limited financial means. ➢ Fast growing economic sectors often road oriented: low IWT affinity. ➢ Priority of investments in road/ rail infrastructure as per the present scenario. ➢ Land Acquisition ➢ Sand mining from river bed.	**T** **I** **V** **E**
	OPPORTUNITY	**THREAT**	
	EXTERNAL		

Figure 6: SWOT Analysis

The strengths and weaknesses of a system are determined by the internal elements, whereas external forces dictate opportunities and threats. Strengths can be defined as any available resource that can be used to improve its performance. Weaknesses are flaws/shortcomings of any system that may cause to lose a competitive advantage, efficiency or resources. Sometimes it is recommended to identify opportunities and threats first in order to more quickly ring to light the system's strengths and weaknesses. Many of the threats are based on weaknesses. Further, SWOT analysis helps in categorizing the key internal and external factors that are important to achieving the objective. With regards to assessing the feasibility of the waterway for navigation, this exercise will help us identify the important factors to be considered while designing the future action for DPR study in Stage 2 and strategic plan for its development.

9.5   SUMMARY

The salient features of the feasibility study for 113 km stretch of Dwarakeswar waterway are,

- The waterway has a tidal stretch of 6.5 Km from Ghatal towards upstream with a maximum tidal variation of about 0.7 m. This portion is feasible for year round navigation.
- The horizontal and vertical clearance of existing cross-structures is in the range of 8 m and 6m - 8m respectively.
- 4.17 Km stretch of waterway have draft more than 2.0 m, 4.01 Km stretch have draft of 1.50 m to 2.0 m, 5.47 km have draft of 1.0 m to 1.50 m and remaining 99.35 km stretch of waterway have less than 1.0 m draft with respect to chart datum.
- Taking in to account the tidal effect, the LAD of 1.0 m can be increased to 1.2 m in the tidal stretch.
- Considering the length of the river, availability of numerous minor and major industries and connectivity with rail and road network with 5km reach across the bank , the river has huge economic potential for development as a Waterway
- The capacity of the waterway can be enhanced by constructing check dams and lockgates, however the same shall be evaluated only during Stage-2 of the studies on the basis of detail investigations.
- The waterway has a huge potential considering its connectivity with Rupnarayan Waterway and thereby with National waterway -1 and Haldia Port.
- Not only there is existing traffic but also the development of waterway will trigger new traffic.

9.6 CRITICAL AREAS REQUIRING DETAILED INVESTIGATIONS

Critical areas along the waterways, requiring detailed investigations during Stage – II, are identified on the basis of draft availability, location of hindrances, areas requiring clearances etc. On the basis of above, following locations require detailed investigations during stage –II of the study:

Table 24: Locations along the waterway requiring detail investigation in Stage-II

Sl No	Location	Chainage (Km)	Easting	Northing
1	Chanditala	4.3	577472.50	2509956.00
2	Lalkundu	6.5	575828.70	2510431.00
3	Lalkundu	7.2	575885.30	2511076.00
4	Jagatpur	19.2	579043.60	2520482.00
5	Ballabhbati	28.7	580905.40	2528843.00
6	Pashchim Shibpur	30.6	580225.40	2530267.00
7	Malakarpota	61.4	566021.50	2550348.00

In addition to the above, the length of the waterway having flow depth of less than 1 m w.r.t Chart Datum also requires detail investigation during DPR stage studies.

9.7 SURVEY AND INVESTIGATIONS REQUIRED FOR STAGE – II STUDIES

Following survey and investigations are required to be done during Stage – II studies:

i) Hydrographic and Hydro morphological Survey, as per TOR, comprising of:

a) Erection of bench mark pillars and water level gauges and observing reading.
b) Detailed bathymetric and topographic survey.
c) Current velocity and discharge measurement.
d) Collection of water and bottom samples and testing.
e) Collection of topographical features.

ii) Traffic Survey.
iii) Geo-tech investigation on proposed locations for Jetties and Terminal structures.
iv) Environmental impact assessment (EIA).

9.8 WAY FORWARD: WATERWAY DEVELOPMENT

The combining knowledge on the physical constraints, actual and future uses of the river and the valley, economic potential and needs, or absence thereof, allows the characterization of the river for development as a waterway. The reconnaissance survey data collected with regard to physical constraints can be turned into cost to make a river navigable. Although several challenges do exist to make Dwarakeswar River as National waterway, but with respect to long-term economic interest of the nation the financial investment is advisable.

Economic Interest / Financial Investment	Local	Regional	National	International
Low				
Moderate			Dwarakeswar Waterway	
High				
Very High				

Dwarakeswar waterway is recommended for Stage – II DPR preparation in view of the following potential advantages:

a)   Connectivity of the waterway with proposed NW 86 & 92.
b)   Connectivity with NW-1, Haldia and Kolkata port including their hinterland through NW -86.
c)   Increasing cargo potential.
d)   Reduction in existing traffic load on rail and road infrastructure.

In view of the above, it is recommended to develop the Dwarakeswar waterway for Cargo and Passenger ferry services.

Annexure 1: Levelling Results

LEVELLING BETWEEN TEMPORARY BENCH MARK 1 & TIDE POLE

BS	FS	HI	RL	REMARK
1.248		3.108	1.86	TBM 1
	1.945		1.163	TIDE POLE

BS	FS	HI	RL	REMARK
1.549		2.712	1.163	TIDE POLE
	0.852		1.86	TBM 1

LEVELLING BETWEEN TEMPORARY BENCH MARK 2 & TIDE POLE

BS	FS	HI	RL	REMARK
0.173		4.502	3.329	TBM 2
0.664	2.039	2.127	2.463	CP 1
0.309	1.916	1.52	2.211	CP 2
	1.11		1.41	TIDE POLE

BS	FS	HI	RL	REMARK
4.344		2.754	1.41	TIDE POLE
2.082	0.557	3.279	2.197	CP 3
2.048	0.806	4.521	2.473	CP 4
	1.192		3.329	TBM 2

LEVELLING BETWEEN TEMPORARY BENCH MARK 3 & TIDE POLE

BS	FS	HI	RL	REMARK
0.512		8.963	8.451	TBM 3
	2.008		6.955	TIDE POLE

BS	FS	HI	RL	REMARK
1.83		8.785	6.955	TIDE POLE
	0.335		8.45	TBM 3

LEVELLING BETWEEN TEMPORARY BENCH MARK 4 & TIDE POLE

BS	FS	HI	RL	REMARK
1.294		14.212	12.918	TBM 4
0.845	2.936	12.121	11.276	CP 1
0.58	3.073	9.628	9.048	CP 2
	0.697		8.931	TIDE POLE

BS	FS	HI	RL	REMARK
0.594		9.525	8.931	TIDE POLE
3.667	0.479	12.713	9.046	CP 4
1.405	0.733	13.385	11.98	CP 5
	0.464		12.921	TBM 4

LEVELLING BETWEEN TEMPORARY BENCH MARK 5 & TIDE POLE

BS	FS	HI	RL	REMARK
0.134		24.547	24.413	TBM 1
	4.254		20.293	TIDE POLE

BS	FS	HI	RL	REMARK
4.683		25.156	20.473	TIDE POLE
	0.743		24.413	TBM 1

Annexure 2: Observed Water levels at Tide Poles

Bondar TBM - 1		
Time (IST) in hh:mm & Hts are in Mtrs. Water Level are w.r.t. MSL.		
TIME	DATE	WATER LEVEL
15:45	12-Jan-16	1.881
16:00	12-Jan-16	2.041
16:15	12-Jan-16	2.191
16:30	12-Jan-16	2.351

Bondar TBM -1		
Time (IST) in hh:mm & Hts are in Mtrs. Water Level are w.r.t. MSL.		
TIME	DATE	WATER LEVEL
15:00	13-Jan-16	1.107
15:15	13-Jan-16	1.077
15:30	13-Jan-16	1.197
15:45	13-Jan-16	1.397
16:00	13-Jan-16	1.617
16:15	13-Jan-16	1.747
16:30	13-Jan-16	1.927
16:45	13-Jan-16	2.092
17:00	13-Jan-16	2.228
17:15	13-Jan-16	2.317

Baghanala TBM - 2		
Time (IST) in hh:mm & Hts are in Mtrs. Water Level are w.r.t. MSL.		
TIME	DATE	WATER LEVEL
15:45	14-Jan-16	0.499
16:00	14-Jan-16	0.499
17:00	14-Jan-16	0.499
18:00	14-Jan-16	0.499
19:00	14-Jan-16	0.499

| Paschin Raypur TBM -3 | | |
| Time (IST) in hh:mm & Hts are in Mtrs. Water Level are w.r.t. MSL. | | |
TIME	DATE	WATER LEVEL
10:45	18-Jan-16	5.903
14:00	18-Jan-16	5.903
17:00	18-Jan-16	5.903

| Daulatpur TBM -4 | | |
| Time (IST) in hh:mm & Hts are in Mtrs. Water Level are w.r.t. MSL. | | |
TIME	DATE	WATER LEVEL
9:30	19-Jan-16	7.471
11:00	19-Jan-16	7.461
13:00	19-Jan-16	7.461
15:00	19-Jan-16	7.461
15:45	19-Jan-16	7.461

| Lakshmanhati TBM 5 | | |
| Time (IST) in hh:mm & Hts are in Mtrs. Water Level are w.r.t. MSL. | | |
TIME	DATE	WATER LEVEL
10:45	20-Jan-16	20.473
12:00	20-Jan-16	20.473
14:00	20-Jan-16	20.473
14:30	20-Jan-16	20.473

Annexure 3: Water Depth along Dwarakeswar Waterway

(Start Chainage - 0.0 Km is at confluence of Dwarakeswar and Silai/Silabati River at Pratappur)

(End Chainage – 113.0 Km is at bridge near Abantika)

White Cell shows	Stretch with Bathymetric Survey, showing depth (m)
Highlighted Cell shows	Stretch with Topographic Survey, showing elevation (m amsl)

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
0.06	2.30	1.00	2.58	1.58	0.72
0.13	2.29	1.00	2.59	1.59	0.70
0.21	2.02	1.00	2.59	1.59	0.43
0.30	1.72	1.00	2.61	1.61	0.11
0.30	1.73	1.00	2.61	1.61	0.12
0.30	1.74	1.00	2.61	1.61	0.13
0.40	1.50	1.00	2.62	1.62	0.00
0.40	1.50	1.00	2.62	1.62	0.00
0.40	1.50	1.00	2.62	1.62	0.00
0.50	1.40	1.00	2.63	1.63	0.00
0.50	1.41	1.00	2.63	1.63	0.00
0.60	1.33	1.00	2.65	1.65	0.00
0.60	1.33	1.00	2.65	1.65	0.00
0.60	1.33	1.00	2.65	1.65	0.00
0.70	1.29	1.00	2.66	1.66	0.00
0.70	1.28	1.00	2.67	1.67	0.00
0.80	1.43	1.00	2.67	1.67	0.00
0.80	1.42	1.00	2.67	1.67	0.00
0.90	1.41	1.00	2.68	1.68	0.00
1.00	1.34	1.00	2.69	1.69	0.00
1.00	1.34	1.00	2.69	1.69	0.00
1.10	1.63	1.00	2.70	1.70	0.00
1.10	1.62	1.00	2.70	1.70	0.00
1.10	1.61	1.00	2.70	1.70	0.00
1.20	1.87	1.00	2.71	1.71	0.16
1.20	1.88	1.00	2.71	1.71	0.17

White Cell shows	Stretch with Bathymetric Survey, showing depth (m)
Highlighted Cell shows	Stretch with Topographic Survey, showing elevation (m amsl)

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
1.29	1.36	1.00	2.72	1.72	0.00
1.30	1.35	1.00	2.72	1.72	0.00
1.39	0.98	1.00	2.73	1.73	0.00
1.40	1.03	1.00	2.73	1.73	0.00
1.50	0.61	1.00	2.74	1.74	0.00
1.50	0.61	1.00	2.74	1.74	0.00
1.60	0.52	1.00	2.75	1.75	0.00
1.60	0.56	1.00	2.75	1.75	0.00
1.63	0.79	1.00	2.75	1.75	0.00
1.63	0.87	1.00	2.75	1.75	0.00
1.70	0.89	1.00	2.76	1.76	0.00
1.70	0.89	1.00	2.76	1.76	0.00
1.80	1.41	1.00	2.77	1.77	0.00
1.80	1.41	1.00	2.58	1.58	0.00
1.90	1.23	1.00	2.59	1.59	0.00
1.90	0.42	1.00	2.59	1.59	0.00
2.00	2.15	1.00	2.61	1.61	0.54
2.00	0.46	1.00	2.61	1.61	0.00
2.08	0.40	1.00	2.61	1.61	0.00
2.11	0.42	1.00	2.62	1.62	0.00
2.18	0.35	1.00	2.62	1.62	0.00
2.21	0.54	1.00	2.62	1.62	0.00
2.30	0.41	1.00	2.63	1.63	0.00
2.31	0.46	1.00	2.63	1.63	0.00
2.40	0.48	1.00	2.65	1.65	0.00
2.50	0.76	1.00	2.65	1.65	0.00

White Cell shows	Stretch with Bathymetric Survey, showing depth (m)
Highlighted Cell shows	Stretch with Topographic Survey, showing elevation (m amsl)

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
2.50	0.76	1.00	2.65	1.65	0.00
2.50	0.76	1.00	2.66	1.66	0.00
2.55	0.86	1.00	2.67	1.67	0.00
2.60	0.94	1.00	2.67	1.67	0.00
2.70	0.62	1.00	2.67	1.67	0.00
2.70	0.62	1.00	2.68	1.68	0.00
2.80	0.38	1.00	2.69	1.69	0.00
2.80	0.36	1.00	2.69	1.69	0.00
2.89	0.48	1.00	2.70	1.70	0.00
2.91	0.38	1.00	2.70	1.70	0.00
2.99	0.41	1.00	2.70	1.70	0.00
3.01	0.35	1.00	2.71	1.71	0.00
3.12	0.47	1.00	2.71	1.71	0.00
3.20	0.55	1.00	2.72	1.72	0.00
3.20	0.56	1.00	2.72	1.72	0.00
3.30	0.97	1.00	2.73	1.73	0.00
3.30	0.97	1.00	2.73	1.73	0.00
3.40	2.09	1.00	2.74	1.74	0.35
3.50	1.59	1.00	2.74	1.74	0.00
3.50	1.58	1.00	2.75	1.75	0.00
3.60	1.91	1.00	2.75	1.75	0.16
3.60	1.88	1.00	2.75	1.75	0.13
3.69	0.47	1.00	2.75	1.75	0.00
3.72	0.41	1.00	2.76	1.76	0.00
3.80	0.36	1.00	2.76	1.76	0.00
3.80	0.36	1.00	2.77	1.77	0.00

Consultancy Services for preparation of Two Stage Detailed Project Report (DPR) of National Waterway 35, Cluster-1: Dwarakeswar River

White Cell shows	Stretch with Bathymetric Survey, showing depth (m)
Highlighted Cell shows	Stretch with Topographic Survey, showing elevation (m amsl)

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
3.93	0.37	1.00	2.77	1.77	0.00
4.00	1.71	1.00	2.78	1.78	0.00
4.00	1.71	1.00	2.78	1.78	0.00
4.06	1.49	1.00	2.79	1.79	0.00
4.10	1.62	1.00	2.79	1.79	0.00
4.10	1.54	1.00	2.80	1.80	0.00
4.10	1.53	1.00	2.81	1.81	0.00
4.18	1.11	3.000	3.50	0.50	0.61
4.21	1.04	3.019	3.52	0.50	0.54
4.25	0.75	3.038	3.54	0.50	0.25
4.29	0.72	3.062	3.56	0.50	0.22
4.29	0.70	3.063	3.56	0.50	0.20
4.40	0.58	3.121	3.62	0.50	0.08
4.50	0.34	3.178	3.68	0.50	0.00
4.50	0.36	3.178	3.68	0.50	0.00
4.60	0.35	3.232	3.73	0.50	0.00
4.60	0.35	3.232	3.73	0.50	0.00
4.71	1.15	3.292	3.79	0.50	0.65
4.79	2.02	3.335	3.83	0.50	1.52
4.82	0.57	3.350	3.85	0.50	0.07
4.90	0.46	3.397	3.90	0.50	0.00
4.91	0.48	3.402	3.90	0.50	0.00
4.94	0.34	3.422	3.92	0.50	0.00
4.98	0.39	3.439	3.94	0.50	0.00
5.01	0.38	3.457	3.96	0.50	0.00
5.04	0.58	3.475	3.97	0.50	0.08

White Cell shows	Stretch with Bathymetric Survey, showing depth (m)
Highlighted Cell shows	Stretch with Topographic Survey, showing elevation (m amsl)

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
5.06	0.39	3.487	3.99	0.50	0.00
5.08	0.44	3.497	4.00	0.50	0.00
5.12	0.55	3.516	4.02	0.50	0.05
5.15	0.76	3.535	4.03	0.50	0.26
5.18	0.62	3.551	4.05	0.50	0.12
5.21	0.57	3.566	4.07	0.50	0.07
5.24	0.42	3.583	4.08	0.50	0.00
5.25	0.49	3.591	4.09	0.50	0.00
5.26	0.39	3.596	4.10	0.50	0.00
5.27	0.40	3.602	4.10	0.50	0.00
5.29	0.54	3.613	4.11	0.50	0.04
5.33	0.98	3.634	4.13	0.50	0.48
5.37	0.61	3.656	4.15	0.50	0.11
5.41	0.42	3.676	4.17	0.50	0.00
5.44	0.40	3.696	4.19	0.50	0.00
5.47	0.38	3.714	4.21	0.50	0.00
5.51	0.43	3.731	4.23	0.50	0.00
5.55	0.39	3.755	4.25	0.50	0.00
5.59	0.32	3.776	4.27	0.50	0.00
5.61	0.34	3.787	4.29	0.50	0.00
5.62	0.36	3.792	4.29	0.50	0.00
5.65	0.38	3.811	4.31	0.50	0.00
5.69	0.67	3.833	4.33	0.50	0.17
5.72	0.74	3.849	4.35	0.50	0.24
5.75	0.55	3.865	4.36	0.50	0.05
5.79	0.43	3.886	4.39	0.50	0.00

White Cell shows	Stretch with Bathymetric Survey, showing depth (m)				
Highlighted Cell shows	Stretch with Topographic Survey, showing elevation (m amsl)				

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
5.83	0.44	3.910	4.41	0.50	0.00
5.87	0.40	3.935	4.43	0.50	0.00
5.92	0.38	3.958	4.46	0.50	0.00
5.95	0.36	3.978	4.48	0.50	0.00
5.98	0.67	3.995	4.49	0.50	0.17
6.01	0.34	4.009	4.51	0.50	0.00
6.02	0.46	4.013	4.51	0.50	0.00
6.04	0.39	4.026	4.52	0.50	0.00
6.06	0.31	4.037	4.54	0.50	0.00
6.06	0.44	4.038	4.54	0.50	0.00
6.06	0.37	4.039	4.54	0.50	0.00
6.16	0.38	4.094	4.59	0.50	0.00
6.19	0.48	4.110	4.61	0.50	0.00
6.23	0.72	4.129	4.63	0.50	0.22
6.29	0.38	4.164	4.66	0.50	0.00
6.32	0.45	4.182	4.68	0.50	0.00
6.41	0.51	4.228	4.73	0.50	0.01
6.43	0.40	4.241	4.74	0.50	0.00
6.49	0.43	4.275	4.77	0.50	0.00
6.52	0.00	4.89	0.00	Not Applicable	
6.60	0.00	5.68	0.00	Not Applicable	
6.69	0.00	4.23	0.00	Not Applicable	
6.81	0.00	6.13	0.00	Not Applicable	
6.90	0.00	5.64	0.00	Not Applicable	
6.98	0.00	5.68	0.00	Not Applicable	
7.03	0.00	3.20	0.00	Not Applicable	

White Cell shows	Stretch with Bathymetric Survey, showing depth (m)
Highlighted Cell shows	Stretch with Topographic Survey, showing elevation (m amsl)

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
7.09	0.00	4.87	0.00	Not Applicable	
7.19	0.00	2.65	0.00	Not Applicable	
7.33	0.00	2.93	0.00	Not Applicable	
7.39	0.00	2.75	0.00	Not Applicable	
7.51	0.00	2.92	0.00	Not Applicable	
7.59	0.00	2.89	0.00	Not Applicable	
7.73	0.00	2.98	0.00	Not Applicable	
7.79	0.00	2.42	0.00	Not Applicable	
7.90	0.00	3.15	0.00	Not Applicable	
7.93	0.00	2.93	0.00	Not Applicable	
7.99	0.00	3.33	0.00	Not Applicable	
8.03	0.00	3.18	0.00	Not Applicable	
8.09	0.00	3.27	0.00	Not Applicable	
8.15	0.00	3.49	0.00	Not Applicable	
8.20	0.00	3.92	0.00	Not Applicable	
8.31	0.00	4.00	0.00	Not Applicable	
8.41	0.00	3.42	0.00	Not Applicable	
8.53	0.00	3.41	0.00	Not Applicable	
8.63	0.00	2.44	0.00	Not Applicable	
8.69	0.00	3.26	0.00	Not Applicable	
8.82	0.00	3.22	0.00	Not Applicable	
8.93	0.00	3.19	0.00	Not Applicable	
8.99	0.00	3.24	0.00	Not Applicable	
9.03	0.00	3.17	0.00	Not Applicable	
9.11	0.00	3.11	0.00	Not Applicable	
9.19	0.00	3.43	0.00	Not Applicable	

White Cell shows	Stretch with Bathymetric Survey, showing depth (m)
Highlighted Cell shows	Stretch with Topographic Survey, showing elevation (m amsl)

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
9.32	0.00	2.67	0.00	Not Applicable	
9.41	0.00	3.07	0.00	Not Applicable	
9.53	0.00	4.80	0.00	Not Applicable	
9.61	0.00	3.23	0.00	Not Applicable	
9.68	0.00	5.34	0.00	Not Applicable	
9.79	0.00	3.43	0.00	Not Applicable	
9.89	0.00	3.34	0.00	Not Applicable	
10.02	0.00	3.73	0.00	Not Applicable	
10.10	0.00	3.41	0.00	Not Applicable	
10.19	0.00	3.32	0.00	Not Applicable	
10.24	0.00	3.33	0.00	Not Applicable	
10.30	0.00	3.36	0.00	Not Applicable	
10.41	0.00	3.54	0.00	Not Applicable	
10.49	0.00	3.31	0.00	Not Applicable	
10.62	0.00	3.16	0.00	Not Applicable	
10.71	0.00	3.21	0.00	Not Applicable	
10.79	0.00	3.16	0.00	Not Applicable	
10.89	0.00	3.86	0.00	Not Applicable	
10.93	0.00	3.57	0.00	Not Applicable	
11.06	0.00	2.40	0.00	Not Applicable	
11.11	0.00	3.65	0.00	Not Applicable	
11.18	0.00	3.39	0.00	Not Applicable	
11.32	0.00	3.30	0.00	Not Applicable	
11.43	0.00	3.33	0.00	Not Applicable	
11.52	0.00	3.28	0.00	Not Applicable	
11.59	0.00	4.69	0.00	Not Applicable	

White Cell shows	Stretch with Bathymetric Survey, showing depth (m)
Highlighted Cell shows	Stretch with Topographic Survey, showing elevation (m amsl)

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
11.72	0.00	3.77	0.00	Not Applicable	
11.77	0.00	2.82	0.00	Not Applicable	
11.84	0.00	2.67	0.00	Not Applicable	
11.89	0.00	2.97	0.00	Not Applicable	
12.00	0.00	3.19	0.00	Not Applicable	
12.10	0.00	2.77	0.00	Not Applicable	
12.18	0.00	4.00	0.00	Not Applicable	
12.27	0.00	3.56	0.00	Not Applicable	
12.40	0.00	3.41	0.00	Not Applicable	
12.48	0.00	2.80	0.00	Not Applicable	
12.59	0.00	2.80	0.00	Not Applicable	
12.68	0.00	1.68	0.00	Not Applicable	
12.78	0.00	2.49	0.00	Not Applicable	
12.83	0.00	5.77	0.00	Not Applicable	
12.88	0.00	3.32	0.00	Not Applicable	
12.93	0.00	3.74	0.00	Not Applicable	
12.98	0.00	4.29	0.00	Not Applicable	
13.03	0.00	4.71	0.00	Not Applicable	
13.12	0.00	3.95	0.00	Not Applicable	
13.19	0.00	3.27	0.00	Not Applicable	
13.23	0.00	1.95	0.00	Not Applicable	
13.33	0.00	4.08	0.00	Not Applicable	
13.40	0.00	3.74	0.00	Not Applicable	
13.53	0.00	3.21	0.00	Not Applicable	
13.62	0.00	3.10	0.00	Not Applicable	
13.69	0.00	3.20	0.00	Not Applicable	

White Cell shows	Stretch with Bathymetric Survey, showing depth (m)
Highlighted Cell shows	Stretch with Topographic Survey, showing elevation (m amsl)

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
13.79	0.00	3.53	0.00	Not Applicable	
13.89	0.00	3.22	0.00	Not Applicable	
13.97	0.00	2.02	0.00	Not Applicable	
14.04	0.00	3.07	0.00	Not Applicable	
14.11	0.00	2.87	0.00	Not Applicable	
14.19	0.00	3.33	0.00	Not Applicable	
14.30	0.00	4.11	0.00	Not Applicable	
14.38	0.00	3.36	0.00	Not Applicable	
14.42	0.00	3.51	0.00	Not Applicable	
14.53	0.00	3.68	0.00	Not Applicable	
14.61	0.00	3.58	0.00	Not Applicable	
14.72	0.00	3.97	0.00	Not Applicable	
14.78	0.00	3.44	0.00	Not Applicable	
14.83	0.00	3.45	0.00	Not Applicable	
14.91	0.00	3.48	0.00	Not Applicable	
14.99	0.00	4.23	0.00	Not Applicable	
15.04	0.00	4.68	0.00	Not Applicable	
15.12	0.00	5.45	0.00	Not Applicable	
15.18	0.00	4.72	0.00	Not Applicable	
15.24	0.00	4.29	0.00	Not Applicable	
15.29	0.00	4.33	0.00	Not Applicable	
15.37	0.00	4.89	0.00	Not Applicable	
15.42	0.00	4.23	0.00	Not Applicable	
15.50	0.00	4.19	0.00	Not Applicable	
15.60	0.00	3.81	0.00	Not Applicable	
15.71	0.00	5.17	0.00	Not Applicable	

White Cell shows	Stretch with Bathymetric Survey, showing depth (m)
Highlighted Cell shows	Stretch with Topographic Survey, showing elevation (m amsl)

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
15.78	0.00	4.85	0.00	Not Applicable	
15.82	0.00	4.98	0.00	Not Applicable	
15.90	0.00	4.62	0.00	Not Applicable	
16.00	0.00	4.75	0.00	Not Applicable	
16.13	0.00	4.61	0.00	Not Applicable	
16.23	0.00	6.01	0.00	Not Applicable	
16.32	0.00	4.79	0.00	Not Applicable	
16.39	0.00	5.36	0.00	Not Applicable	
16.52	0.00	5.34	0.00	Not Applicable	
16.59	0.00	5.47	0.00	Not Applicable	
16.72	0.00	6.13	0.00	Not Applicable	
16.81	0.00	5.65	0.00	Not Applicable	
16.89	0.00	7.11	0.00	Not Applicable	
16.93	0.00	7.11	0.00	Not Applicable	
16.99	0.00	6.61	0.00	Not Applicable	
17.03	0.00	4.89	0.00	Not Applicable	
17.07	0.00	5.36	0.00	Not Applicable	
17.15	0.00	4.77	0.00	Not Applicable	
17.22	0.00	4.99	0.00	Not Applicable	
17.32	0.00	5.35	0.00	Not Applicable	
17.43	0.00	5.66	0.00	Not Applicable	
17.52	0.00	6.10	0.00	Not Applicable	
17.57	0.00	5.70	0.00	Not Applicable	
17.64	0.00	6.09	0.00	Not Applicable	
17.69	0.00	5.60	0.00	Not Applicable	
17.73	0.00	6.11	0.00	Not Applicable	

White Cell shows	Stretch with Bathymetric Survey, showing depth (m)
Highlighted Cell shows	Stretch with Topographic Survey, showing elevation (m amsl)

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
17.82	0.00	5.93	0.00	Not Applicable	
17.92	0.00	5.57	0.00	Not Applicable	
18.04	0.00	6.02	0.00	Not Applicable	
18.08	0.00	5.01	0.00	Not Applicable	
18.15	0.00	5.28	0.00	Not Applicable	
18.21	0.00	4.83	0.00	Not Applicable	
18.29	0.00	5.76	0.00	Not Applicable	
18.33	0.00	5.99	0.00	Not Applicable	
18.39	0.00	5.25	0.00	Not Applicable	
18.52	0.00	5.93	0.00	Not Applicable	
18.63	0.00	5.46	0.00	Not Applicable	
18.69	0.00	5.52	0.00	Not Applicable	
18.72	0.00	4.54	0.00	Not Applicable	
18.80	0.00	4.54	0.00	Not Applicable	
18.88	0.00	4.59	0.00	Not Applicable	
18.94	0.00	5.24	0.00	Not Applicable	
19.01	0.00	5.25	0.00	Not Applicable	
19.12	0.00	4.91	0.00	Not Applicable	
19.20	0.00	5.04	0.00	Not Applicable	
19.31	0.00	7.28	0.00	Not Applicable	
19.36	1.14	5.900	5.903	0.00	1.14
19.39	1.33	5.907	5.908	0.00	1.33
19.43	2.18	5.917	5.916	0.00	2.18
19.48	2.22	5.927	5.923	0.00	2.22
19.53	1.43	5.939	5.932	-0.01	1.44
19.58	0.96	5.950	5.940	-0.01	0.97

	White Cell shows	Stretch with Bathymetric Survey, showing depth (m)
	Highlighted Cell shows	Stretch with Topographic Survey, showing elevation (m amsl)

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	**B**	**C**	**D = C - B**	**E = A-D**
19.62	2.32	5.961	5.948	-0.01	2.33
19.67	2.01	5.973	5.957	-0.02	2.03
19.73	2.17	5.986	5.967	-0.02	2.19
19.78	1.96	5.999	5.976	-0.02	1.98
19.83	1.01	6.010	5.985	-0.03	1.04
19.89	1.17	6.022	5.994	-0.03	1.20
19.93	1.40	6.032	6.001	-0.03	1.43
19.98	1.02	6.044	6.009	-0.03	1.05
20.03	1.35	6.055	6.018	-0.04	1.39
20.08	1.74	6.067	6.027	-0.04	1.78
20.13	2.42	6.078	6.035	-0.04	2.46
20.18	2.62	6.090	6.044	-0.05	2.67
20.23	3.27	6.102	6.053	-0.05	3.32
20.28	2.66	6.114	6.062	-0.05	2.71
20.33	1.82	6.126	6.070	-0.06	1.88
20.38	1.65	6.138	6.079	-0.06	1.71
20.43	1.82	6.150	6.088	-0.06	1.88
20.48	1.67	6.161	6.097	-0.06	1.73
20.53	1.69	6.172	6.105	-0.07	1.76
20.58	1.45	6.184	6.114	-0.07	1.52
20.63	1.57	6.196	6.123	-0.07	1.64
20.68	2.00	6.208	6.131	-0.08	2.08
20.73	1.25	6.219	6.140	-0.08	1.33
20.78	1.39	6.230	6.148	-0.08	1.47
20.83	1.37	6.241	6.156	-0.08	1.45
20.88	1.07	6.253	6.165	-0.09	1.16

White Cell shows	Stretch with Bathymetric Survey, showing depth (m)
Highlighted Cell shows	Stretch with Topographic Survey, showing elevation (m amsl)

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
20.92	1.31	6.263	6.172	-0.09	1.40
20.97	1.25	6.274	6.180	-0.09	1.34
21.02	1.21	6.286	6.189	-0.10	1.31
21.07	1.26	6.296	6.197	-0.10	1.36
21.11	1.14	6.307	6.205	-0.10	1.24
21.16	1.44	6.319	6.214	-0.11	1.55
21.21	3.49	6.330	6.222	-0.11	3.60
21.26	3.68	6.341	6.230	-0.11	3.79
21.31	5.01	6.353	6.239	-0.11	5.12
21.36	5.46	6.364	6.247	-0.12	5.58
21.41	5.61	6.375	6.256	-0.12	5.73
21.46	3.65	6.387	6.264	-0.12	3.77
21.51	1.37	6.398	6.273	-0.13	1.50
21.55	1.46	6.409	6.281	-0.13	1.59
21.60	1.95	6.421	6.289	-0.13	2.08
21.65	2.10	6.431	6.297	-0.13	2.23
21.70	1.89	6.443	6.306	-0.14	2.03
21.75	1.75	6.455	6.315	-0.14	1.89
21.80	1.48	6.466	6.323	-0.14	1.62
21.82	1.32	6.472	6.328	-0.14	1.46
21.84	1.38	6.477	6.331	-0.15	1.53
21.87	1.38	6.482	6.335	-0.15	1.53
21.90	2.08	6.491	6.341	-0.15	2.23
21.95	2.93	6.501	6.349	-0.15	3.08
21.99	3.93	6.511	6.356	-0.15	4.08
22.03	2.75	6.521	6.364	-0.16	2.91

White Cell shows	Stretch with Bathymetric Survey, showing depth (m)
Highlighted Cell shows	Stretch with Topographic Survey, showing elevation (m amsl)

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
22.08	1.81	6.531	6.371	-0.16	1.97
22.12	3.09	6.541	6.379	-0.16	3.25
22.16	1.98	6.551	6.386	-0.16	2.14
22.20	1.57	6.560	6.393	-0.17	1.74
22.25	1.52	6.570	6.400	-0.17	1.69
22.29	1.44	6.580	6.407	-0.17	1.61
22.33	2.12	6.589	6.414	-0.17	2.29
22.41	2.54	6.608	6.428	-0.18	2.72
22.44	1.19	6.615	6.434	-0.18	1.37
22.49	1.06	6.628	6.443	-0.18	1.24
22.51	0.80	6.632	6.446	-0.19	0.99
22.53	1.13	6.637	6.450	-0.19	1.32
22.60	3.05	6.652	6.461	-0.19	3.24
22.65	2.65	6.663	6.469	-0.19	2.84
22.69	2.76	6.674	6.477	-0.20	2.96
22.74	2.45	6.685	6.486	-0.20	2.65
22.79	1.90	6.696	6.494	-0.20	2.10
22.84	2.29	6.708	6.503	-0.21	2.50
22.89	2.77	6.719	6.511	-0.21	2.98
22.94	2.61	6.731	6.520	-0.21	2.82
22.99	2.59	6.742	6.528	-0.21	2.80
23.04	2.96	6.754	6.536	-0.22	3.18
23.08	1.98	6.765	6.545	-0.22	2.20
23.13	2.72	6.776	6.553	-0.22	2.94
23.17	2.52	6.786	6.560	-0.23	2.75
23.22	1.80	6.797	6.568	-0.23	2.03

White Cell shows	Stretch with Bathymetric Survey, showing depth (m)
Highlighted Cell shows	Stretch with Topographic Survey, showing elevation (m amsl)

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
23.27	1.61	6.808	6.576	-0.23	1.84
23.31	1.73	6.818	6.584	-0.23	1.96
23.35	1.07	6.827	6.591	-0.24	1.31
23.39	1.36	6.837	6.598	-0.24	1.60
23.44	1.85	6.847	6.606	-0.24	2.09
23.49	1.07	6.858	6.614	-0.24	1.31
23.53	1.65	6.868	6.621	-0.25	1.90
23.57	1.25	6.879	6.629	-0.25	1.50
23.62	1.58	6.889	6.636	-0.25	1.83
23.70	1.13	6.909	6.651	-0.26	1.39
23.74	0.76	6.918	6.658	-0.26	1.02
23.84	0.59	6.939	6.674	-0.27	0.86
23.84	0.46	6.940	6.675	-0.27	0.73
23.84	1.00	6.941	6.675	-0.27	1.27
23.89	0.65	6.952	6.683	-0.27	0.92
23.93	0.76	6.961	6.690	-0.27	1.03
24.01	0.71	6.979	6.703	-0.28	0.99
24.04	0.86	6.986	6.709	-0.28	1.14
24.08	1.12	6.996	6.716	-0.28	1.40
24.12	0.82	7.006	6.724	-0.28	1.10
24.21	1.00	7.027	6.739	-0.29	1.29
24.26	1.10	7.037	6.746	-0.29	1.39
24.30	1.10	7.047	6.754	-0.29	1.39
24.34	1.05	7.058	6.762	-0.30	1.35
24.39	1.08	7.067	6.769	-0.30	1.38
24.43	0.89	7.077	6.776	-0.30	1.19

White Cell shows	Stretch with Bathymetric Survey, showing depth (m)
Highlighted Cell shows	Stretch with Topographic Survey, showing elevation (m amsl)

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
24.47	1.07	7.087	6.783	-0.30	1.37
24.50	1.21	7.094	6.789	-0.31	1.52
24.53	0.94	7.102	6.795	-0.31	1.25
24.57	1.19	7.111	6.801	-0.31	1.50
24.62	1.47	7.120	6.808	-0.31	1.78
24.62	1.41	7.122	6.809	-0.31	1.72
24.64	1.07	7.126	6.813	-0.31	1.38
24.65	0.52	7.128	6.814	-0.31	0.83
24.73	1.05	7.147	6.828	-0.32	1.37
24.73	1.05	7.148	6.829	-0.32	1.37
24.81	1.34	7.167	6.843	-0.32	1.66
24.82	1.24	7.167	6.843	-0.32	1.56
24.91	2.51	7.189	6.860	-0.33	2.84
24.92	3.39	7.191	6.861	-0.33	3.72
25.01	1.55	7.212	6.876	-0.34	1.89
25.04	1.20	7.220	6.882	-0.34	1.54
25.10	1.50	7.234	6.892	-0.34	1.84
25.12	1.47	7.238	6.895	-0.34	1.81
25.23	1.91	7.263	6.914	-0.35	2.26
25.24	1.67	7.265	6.915	-0.35	2.02
25.31	0.96	7.282	6.929	-0.35	1.31
25.33	1.15	7.287	6.932	-0.36	1.51
25.41	1.30	7.306	6.946	-0.36	1.66
25.44	1.32	7.312	6.951	-0.36	1.68
25.52	1.14	7.330	6.964	-0.37	1.51
25.54	1.50	7.336	6.968	-0.37	1.87

White Cell shows	Stretch with Bathymetric Survey, showing depth (m)
Highlighted Cell shows	Stretch with Topographic Survey, showing elevation (m amsl)

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
25.62	1.12	7.354	6.982	-0.37	1.49
25.64	1.20	7.359	6.985	-0.37	1.57
25.72	1.89	7.377	6.999	-0.38	2.27
25.75	1.53	7.383	7.003	-0.38	1.91
25.80	1.54	7.396	7.013	-0.38	1.92
25.83	1.58	7.402	7.017	-0.38	1.96
25.91	1.01	7.421	7.032	-0.39	1.40
25.93	1.69	7.426	7.035	-0.39	2.08
26.01	2.08	7.444	7.049	-0.40	2.48
26.03	2.05	7.450	7.053	-0.40	2.45
26.09	1.51	7.463	7.063	-0.40	1.91
26.12	1.64	7.470	7.068	-0.40	2.04
26.22	2.10	7.493	7.085	-0.41	2.51
26.24	1.29	7.498	7.088	-0.41	1.70
26.33	1.57	7.517	7.103	-0.41	1.98
26.35	1.48	7.522	7.107	-0.42	1.90
26.41	2.05	7.538	7.118	-0.42	2.47
26.44	2.10	7.544	7.122	-0.42	2.52
26.52	2.20	7.564	7.137	-0.43	2.63
26.55	2.25	7.569	7.141	-0.43	2.68
26.61	2.22	7.583	7.151	-0.43	2.65
26.64	2.09	7.590	7.157	-0.43	2.52
26.70	1.81	7.605	7.168	-0.44	2.25
26.73	1.77	7.611	7.172	-0.44	2.21
26.79	1.91	7.626	7.183	-0.44	2.35
26.82	1.77	7.633	7.189	-0.44	2.21

White Cell shows	Stretch with Bathymetric Survey, showing depth (m)
Highlighted Cell shows	Stretch with Topographic Survey, showing elevation (m amsl)

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
26.93	1.78	7.658	7.208	-0.45	2.23
26.95	1.57	7.662	7.210	-0.45	2.02
27.00	1.14	7.675	7.220	-0.46	1.60
27.04	1.34	7.683	7.226	-0.46	1.80
27.11	1.79	7.700	7.238	-0.46	2.25
27.13	1.99	7.705	7.242	-0.46	2.45
27.23	1.70	7.729	7.260	-0.47	2.17
27.25	2.16	7.732	7.262	-0.47	2.63
27.30	0.85	7.744	7.271	-0.47	1.32
27.31	0.69	7.747	7.273	-0.47	1.16
27.32	0.44	7.750	7.275	-0.47	0.91
27.39	0.57	7.765	7.287	-0.48	1.05
27.41	0.59	7.770	7.290	-0.48	1.07
27.49	0.55	7.788	7.304	-0.48	1.03
27.51	0.60	7.793	7.307	-0.49	1.09
27.54	1.00	7.799	7.312	-0.49	1.49
27.61	0.66	7.815	7.324	-0.49	1.15
27.62	0.49	7.817	7.326	-0.49	0.98
27.71	0.92	7.838	7.341	-0.50	1.42
27.74	0.88	7.845	7.346	-0.50	1.38
27.80	0.72	7.859	7.357	-0.50	1.22
27.82	0.55	7.865	7.361	-0.50	1.05
27.91	1.10	7.885	7.375	-0.51	1.61
27.93	0.50	7.890	7.380	-0.51	1.01
28.00	0.63	7.907	7.392	-0.52	1.15
28.03	0.54	7.915	7.398	-0.52	1.06

White Cell shows	Stretch with Bathymetric Survey, showing depth (m)
Highlighted Cell shows	Stretch with Topographic Survey, showing elevation (m amsl)

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
28.13	0.44	7.936	7.413	-0.52	0.96
28.13	0.56	7.937	7.414	-0.52	1.08
28.19	0.55	7.951	7.425	-0.53	1.08
28.22	0.51	7.959	7.430	-0.53	1.04
28.30	0.34	7.977	7.444	-0.53	0.87
28.32	0.34	7.981	7.447	-0.53	0.87
28.35	0.57	7.988	7.452	-0.54	1.11
28.40	0.75	8.000	7.461	-0.54	1.29
28.43	0.58	8.002	7.467	-0.54	1.12
28.50	0.53	8.009	7.484	-0.52	1.05
28.53	0.44	8.012	7.491	-0.52	0.96
28.59	0.47	8.017	7.506	-0.51	0.98
28.63	0.52	8.021	7.515	-0.51	1.03
28.66	0.44	8.024	7.523	-0.50	0.94
28.71	0.87	8.028	7.535	-0.49	1.36
28.74	1.95	8.031	7.542	-0.49	2.44
28.80	0.67	8.037	7.556	-0.48	1.15
28.81	0.73	8.038	7.558	-0.48	1.21
28.82	0.56	8.038	7.560	-0.48	1.04
28.85	1.79	8.041	7.566	-0.47	2.26
28.93	1.47	8.049	7.587	-0.46	1.93
28.95	1.56	8.050	7.591	-0.46	2.02
29.00	0.42	8.055	7.603	-0.45	0.87
29.03	0.44	8.058	7.611	-0.45	0.89
29.12	1.23	8.066	7.631	-0.43	1.66
29.14	1.53	8.067	7.635	-0.43	1.96

White Cell shows	Stretch with Bathymetric Survey, showing depth (m)
Highlighted Cell shows	Stretch with Topographic Survey, showing elevation (m amsl)

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
29.14	2.05	8.068	7.637	-0.43	2.48
29.20	1.57	8.073	7.651	-0.42	1.99
29.21	1.66	8.074	7.653	-0.42	2.08
29.23	1.69	8.076	7.657	-0.42	2.11
29.30	1.19	8.082	7.673	-0.41	1.60
29.33	0.90	8.085	7.680	-0.40	1.30
29.35	1.11	8.087	7.686	-0.40	1.51
29.42	2.94	8.093	7.702	-0.39	3.33
29.43	1.46	8.095	7.705	-0.39	1.85
29.44	1.08	8.095	7.708	-0.39	1.47
29.45	0.81	8.096	7.709	-0.39	1.20
29.52	1.02	8.102	7.726	-0.38	1.40
29.52	1.02	8.103	7.726	-0.38	1.40
29.53	0.56	8.103	7.728	-0.38	0.94
29.55	0.84	8.105	7.733	-0.37	1.21
29.62	1.59	8.112	7.751	-0.36	1.95
29.63	1.39	8.113	7.752	-0.36	1.75
29.63	1.29	8.113	7.752	-0.36	1.65
29.70	1.72	8.119	7.769	-0.35	2.07
29.73	0.52	8.122	7.776	-0.35	0.87
29.81	0.51	8.130	7.796	-0.33	0.84
29.84	1.03	8.132	7.802	-0.33	1.36
29.92	0.53	8.139	7.821	-0.32	0.85
29.94	0.53	8.141	7.827	-0.31	0.84
29.97	1.03	8.145	7.835	-0.31	1.34
30.00	1.28	8.147	7.842	-0.31	1.59

White Cell shows	Stretch with Bathymetric Survey, showing depth (m)
Highlighted Cell shows	Stretch with Topographic Survey, showing elevation (m amsl)

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
30.02	0.86	8.149	7.846	-0.30	1.16
30.05	0.83	8.151	7.852	-0.30	1.13
30.10	0.99	8.156	7.865	-0.29	1.28
30.12	0.99	8.158	7.869	-0.29	1.28
30.15	0.83	8.160	7.875	-0.29	1.12
30.17	1.21	8.163	7.881	-0.28	1.49
30.19	1.26	8.164	7.886	-0.28	1.54
30.21	0.73	8.166	7.891	-0.28	1.01
30.23	1.01	8.168	7.895	-0.27	1.28
30.30	0.99	8.174	7.911	-0.26	1.25
30.32	0.47	8.177	7.918	-0.26	0.73
30.35	0.79	8.179	7.924	-0.26	1.05
30.40	1.11	8.183	7.935	-0.25	1.36
30.44	1.10	8.187	7.944	-0.24	1.34
30.51	1.37	8.194	7.962	-0.23	1.60
30.54	1.20	8.196	7.969	-0.23	1.43
30.61	1.15	8.203	7.986	-0.22	1.37
30.63	0.93	8.205	7.991	-0.21	1.14
30.65	0.91	8.206	7.994	-0.21	1.12
30.70	0.52	8.211	8.006	-0.20	0.72
30.74	0.85	8.215	8.017	-0.20	1.05
30.79	0.82	8.220	8.029	-0.19	1.01
30.84	0.47	8.225	8.042	-0.18	0.65
30.93	0.30	8.233	8.062	-0.17	0.47
30.93	0.28	8.233	8.063	-0.17	0.45
30.94	0.29	8.233	8.063	-0.17	0.46

White Cell shows	Stretch with Bathymetric Survey, showing depth (m)
Highlighted Cell shows	Stretch with Topographic Survey, showing elevation (m amsl)

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
30.94	0.31	8.233	8.063	-0.17	0.48
30.94	0.33	8.233	8.064	-0.17	0.50
30.96	0.55	8.235	8.069	-0.17	0.72
31.01	1.20	8.240	8.081	-0.16	1.36
31.10	1.11	8.248	8.102	-0.15	1.26
31.14	0.77	8.252	8.112	-0.14	0.91
31.18	0.57	8.256	8.122	-0.13	0.70
31.22	0.74	8.259	8.131	-0.13	0.87
31.28	2.69	8.265	8.146	-0.12	2.81
31.29	0.95	8.265	8.146	-0.12	1.07
31.31	0.96	8.268	8.153	-0.11	1.07
31.41	0.40	8.277	8.177	-0.10	0.50
31.45	0.45	8.280	8.185	-0.10	0.55
31.49	1.71	8.284	8.196	-0.09	1.80
31.52	1.08	8.286	8.202	-0.08	1.16
31.54	0.42	8.289	8.207	-0.08	0.50
31.56	2.60	8.291	8.213	-0.08	2.68
31.58	0.58	8.292	8.217	-0.08	0.66
31.59	0.94	8.293	8.219	-0.07	1.01
31.60	1.06	8.294	8.221	-0.07	1.13
31.69	0.46	8.303	8.244	-0.06	0.52
31.71	3.33	8.305	8.248	-0.06	3.39
31.78	0.44	8.310	8.263	-0.05	0.49
31.85	2.87	8.317	8.280	-0.04	2.91
31.87	1.44	8.319	8.286	-0.03	1.47
32.10	0.00	8.34	0.00	Not Applicable	

White Cell shows	Stretch with Bathymetric Survey, showing depth (m)
Highlighted Cell shows	Stretch with Topographic Survey, showing elevation (m amsl)

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
32.22	0.00	8.45	0.00	Not Applicable	
32.48	0.00	7.66	0.00	Not Applicable	
32.60	0.00	4.68	0.00	Not Applicable	
32.73	0.00	7.81	0.00	Not Applicable	
32.78	0.00	8.45	0.00	Not Applicable	
32.93	0.00	3.23	0.00	Not Applicable	
33.02	0.00	2.94	0.00	Not Applicable	
33.08	0.00	5.34	0.00	Not Applicable	
33.28	0.00	8.48	0.00	Not Applicable	
33.32	0.00	5.58	0.00	Not Applicable	
33.40	0.00	5.38	0.00	Not Applicable	
33.50	0.00	4.64	0.00	Not Applicable	
33.61	0.00	5.09	0.00	Not Applicable	
33.70	0.00	4.94	0.00	Not Applicable	
33.79	0.00	7.21	0.00	Not Applicable	
33.89	0.00	7.51	0.00	Not Applicable	
33.99	0.00	7.20	0.00	Not Applicable	
34.03	0.00	7.50	0.00	Not Applicable	
34.13	0.00	8.07	0.00	Not Applicable	
34.21	0.00	8.23	0.00	Not Applicable	
34.32	0.00	8.04	0.00	Not Applicable	
34.40	0.00	7.80	0.00	Not Applicable	
34.51	0.00	8.03	0.00	Not Applicable	
34.61	0.00	8.47	0.00	Not Applicable	
34.68	0.00	8.31	0.00	Not Applicable	
34.78	0.00	8.38	0.00	Not Applicable	

White Cell shows	Stretch with Bathymetric Survey, showing depth (m)
Highlighted Cell shows	Stretch with Topographic Survey, showing elevation (m amsl)

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
34.83	0.00	8.26	0.00	Not Applicable	
34.92	0.00	8.45	0.00	Not Applicable	
34.99	0.00	8.04	0.00	Not Applicable	
35.01	0.00	8.47	0.00	Not Applicable	
35.11	0.00	7.80	0.00	Not Applicable	
35.23	0.00	8.25	0.00	Not Applicable	
35.29	0.00	8.04	0.00	Not Applicable	
35.41	0.00	8.48	0.00	Not Applicable	
35.50	0.00	8.65	0.00	Not Applicable	
35.60	0.00	8.26	0.00	Not Applicable	
35.71	0.00	8.57	0.00	Not Applicable	
35.78	0.00	8.45	0.00	Not Applicable	
35.83	0.00	8.58	0.00	Not Applicable	
35.90	0.00	8.34	0.00	Not Applicable	
36.01	0.00	8.64	0.00	Not Applicable	
36.12	0.48	8.000	7.461	-0.54	1.02
36.14	0.39	8.006	7.471	-0.53	0.92
36.22	0.58	8.026	7.507	-0.52	1.10
36.25	0.69	8.034	7.522	-0.51	1.20
36.32	1.30	8.053	7.556	-0.50	1.80
36.33	1.07	8.056	7.561	-0.50	1.57
36.38	1.14	8.069	7.584	-0.48	1.62
36.43	1.15	8.084	7.610	-0.47	1.62
36.48	1.12	8.098	7.636	-0.46	1.58
36.54	1.40	8.113	7.663	-0.45	1.85
36.59	1.10	8.128	7.689	-0.44	1.54

	White Cell shows	Stretch with Bathymetric Survey, showing depth (m)			
	Highlighted Cell shows	Stretch with Topographic Survey, showing elevation (m amsl)			

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
36.63	0.44	8.138	7.708	-0.43	0.87
36.71	0.38	8.160	7.747	-0.41	0.79
36.72	0.39	8.163	7.752	-0.41	0.80
36.73	0.46	8.165	7.755	-0.41	0.87
36.75	0.52	8.171	7.766	-0.41	0.93
36.80	0.99	8.185	7.791	-0.39	1.38
36.87	0.83	8.202	7.822	-0.38	1.21
36.93	0.83	8.218	7.851	-0.37	1.20
37.00	0.73	8.239	7.887	-0.35	1.08
37.01	0.91	8.242	7.893	-0.35	1.26
37.04	0.90	8.249	7.906	-0.34	1.24
37.10	1.19	8.265	7.934	-0.33	1.52
37.16	1.39	8.280	7.961	-0.32	1.71
37.21	1.67	8.296	7.989	-0.31	1.98
37.27	1.96	8.312	8.018	-0.29	2.25
37.34	3.15	8.329	8.049	-0.28	3.43
37.40	3.67	8.346	8.078	-0.27	3.94
37.46	3.21	8.363	8.109	-0.25	3.46
37.52	2.14	8.380	8.139	-0.24	2.38
37.59	2.26	8.397	8.170	-0.23	2.49
37.65	2.37	8.415	8.201	-0.21	2.58
37.71	2.24	8.432	8.231	-0.20	2.44
37.78	1.66	8.449	8.262	-0.19	1.85
37.84	1.93	8.466	8.292	-0.17	2.10
37.90	2.11	8.483	8.323	-0.16	2.27
37.97	1.53	8.500	8.354	-0.15	1.68

	White Cell shows	Stretch with Bathymetric Survey, showing depth (m)
	Highlighted Cell shows	Stretch with Topographic Survey, showing elevation (m amsl)

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	**B**	**C**	**D = C - B**	**E = A-D**
38.02	1.60	8.515	8.380	-0.14	1.74
38.09	1.42	8.533	8.412	-0.12	1.54
38.15	1.57	8.551	8.444	-0.11	1.68
38.22	1.57	8.569	8.475	-0.09	1.66
38.28	1.64	8.586	8.506	-0.08	1.72
38.34	1.15	8.602	8.535	-0.07	1.22
38.39	1.00	8.615	8.559	-0.06	1.06
38.47	0.48	8.637	8.597	-0.04	0.52
38.48	0.50	8.639	8.601	-0.04	0.54
38.49	0.41	8.642	8.607	-0.04	0.45
38.55	0.96	8.657	8.633	-0.02	0.98
38.58	0.79	8.668	8.652	-0.02	0.81
38.60	1.12	8.671	8.659	-0.01	1.13
38.62	0.70	8.678	8.670	-0.01	0.71
38.64	0.78	8.684	8.681	0.00	0.78
38.67	0.34	8.692	8.696	0.00	0.34
38.68	0.37	8.693	8.697	0.00	0.37
38.68	0.40	8.694	8.700	0.01	0.39
38.68	0.38	8.694	8.700	0.01	0.37
38.70	0.00	8.70	0.00	Not Applicable	
38.79	0.00	8.93	0.00	Not Applicable	
38.83	0.00	9.08	0.00	Not Applicable	
38.91	0.00	9.07	0.00	Not Applicable	
39.01	0.00	9.00	0.00	Not Applicable	
39.12	0.00	8.65	0.00	Not Applicable	
39.18	0.00	9.00	0.00	Not Applicable	

White Cell shows	Stretch with Bathymetric Survey, showing depth (m)
Highlighted Cell shows	Stretch with Topographic Survey, showing elevation (m amsl)

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
39.31	0.00	9.09	0.00	Not Applicable	
39.41	0.00	9.47	0.00	Not Applicable	
39.54	0.00	9.17	0.00	Not Applicable	
39.59	0.00	9.54	0.00	Not Applicable	
39.63	0.00	9.36	0.00	Not Applicable	
39.74	0.00	9.84	0.00	Not Applicable	
39.78	0.00	10.10	0.00	Not Applicable	
39.90	0.00	10.51	0.00	Not Applicable	
39.94	0.00	10.73	0.00	Not Applicable	
40.06	0.00	10.65	0.00	Not Applicable	
40.25	0.00	10.62	0.00	Not Applicable	
40.30	0.00	9.63	0.00	Not Applicable	
40.41	0.00	9.67	0.00	Not Applicable	
40.51	0.00	9.68	0.00	Not Applicable	
40.59	0.00	9.38	0.00	Not Applicable	
40.69	0.00	9.81	0.00	Not Applicable	
40.73	0.00	9.90	0.00	Not Applicable	
40.78	0.00	10.19	0.00	Not Applicable	
40.84	0.00	9.48	0.00	Not Applicable	
40.90	0.00	10.27	0.00	Not Applicable	
41.00	0.00	11.34	0.00	Not Applicable	
41.08	0.00	11.26	0.00	Not Applicable	
41.13	0.00	10.59	0.00	Not Applicable	
41.21	0.00	10.59	0.00	Not Applicable	
41.29	0.00	10.74	0.00	Not Applicable	
41.43	0.00	10.45	0.00	Not Applicable	

White Cell shows	Stretch with Bathymetric Survey, showing depth (m)
Highlighted Cell shows	Stretch with Topographic Survey, showing elevation (m amsl)

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
41.52	0.00	10.03	0.00	Not Applicable	
41.61	0.00	11.21	0.00	Not Applicable	
41.74	0.00	11.31	0.00	Not Applicable	
41.78	0.00	11.26	0.00	Not Applicable	
41.84	0.00	11.29	0.00	Not Applicable	
41.89	0.00	11.62	0.00	Not Applicable	
41.94	0.00	11.31	0.00	Not Applicable	
41.99	0.00	11.01	0.00	Not Applicable	
42.03	0.00	11.05	0.00	Not Applicable	
42.11	0.00	11.82	0.00	Not Applicable	
42.22	0.00	11.70	0.00	Not Applicable	
42.30	0.00	12.23	0.00	Not Applicable	
42.39	0.00	11.28	0.00	Not Applicable	
42.43	0.00	11.45	0.00	Not Applicable	
42.48	0.00	11.65	0.00	Not Applicable	
42.58	0.00	10.52	0.00	Not Applicable	
42.69	0.00	10.66	0.00	Not Applicable	
42.82	0.00	10.74	0.00	Not Applicable	
42.89	0.00	11.01	0.00	Not Applicable	
43.01	0.00	10.66	0.00	Not Applicable	
43.08	0.00	10.49	0.00	Not Applicable	
43.20	0.00	10.48	0.00	Not Applicable	
43.33	0.00	11.10	0.00	Not Applicable	
43.41	0.00	11.05	0.00	Not Applicable	
43.47	0.00	10.87	0.00	Not Applicable	
43.54	0.00	10.95	0.00	Not Applicable	

White Cell shows	Stretch with Bathymetric Survey, showing depth (m)
Highlighted Cell shows	Stretch with Topographic Survey, showing elevation (m amsl)

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
43.61	0.00	10.81	0.00	Not Applicable	
43.71	0.00	11.04	0.00	Not Applicable	
43.78	0.00	11.39	0.00	Not Applicable	
43.80	0.00	11.51	0.00	Not Applicable	
43.89	0.00	11.83	0.00	Not Applicable	
43.94	0.00	11.88	0.00	Not Applicable	
43.98	0.00	11.96	0.00	Not Applicable	
44.05	0.00	12.20	0.00	Not Applicable	
44.09	0.00	12.19	0.00	Not Applicable	
44.20	0.00	11.55	0.00	Not Applicable	
44.27	0.00	11.21	0.00	Not Applicable	
44.33	0.00	11.28	0.00	Not Applicable	
44.42	0.00	11.73	0.00	Not Applicable	
44.50	0.00	12.22	0.00	Not Applicable	
44.58	0.00	12.76	0.00	Not Applicable	
44.63	0.00	12.54	0.00	Not Applicable	
44.68	0.00	12.65	0.00	Not Applicable	
44.82	0.00	12.08	0.00	Not Applicable	
44.91	0.00	14.84	0.00	Not Applicable	
44.99	0.00	12.94	0.00	Not Applicable	
45.04	0.00	12.42	0.00	Not Applicable	
45.09	0.00	11.76	0.00	Not Applicable	
45.21	0.00	12.78	0.00	Not Applicable	
45.32	0.00	12.39	0.00	Not Applicable	
45.41	0.00	12.21	0.00	Not Applicable	
45.52	0.00	12.12	0.00	Not Applicable	

White Cell shows	Stretch with Bathymetric Survey, showing depth (m)
Highlighted Cell shows	Stretch with Topographic Survey, showing elevation (m amsl)

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
45.58	0.00	11.76	0.00	Not Applicable	
45.64	0.00	12.30	0.00	Not Applicable	
45.70	0.00	13.35	0.00	Not Applicable	
45.77	0.00	13.65	0.00	Not Applicable	
45.82	0.00	13.92	0.00	Not Applicable	
45.90	0.00	13.76	0.00	Not Applicable	
45.99	0.00	14.36	0.00	Not Applicable	
46.12	0.00	13.97	0.00	Not Applicable	
46.21	0.00	13.91	0.00	Not Applicable	
46.29	0.00	13.35	0.00	Not Applicable	
46.33	0.00	13.60	0.00	Not Applicable	
46.37	0.00	14.27	0.00	Not Applicable	
46.51	0.00	13.69	0.00	Not Applicable	
46.59	0.00	13.38	0.00	Not Applicable	
46.62	0.00	13.30	0.00	Not Applicable	
46.69	0.00	13.50	0.00	Not Applicable	
46.80	0.00	13.14	0.00	Not Applicable	
46.92	0.00	13.19	0.00	Not Applicable	
47.00	0.00	13.52	0.00	Not Applicable	
47.10	0.00	12.76	0.00	Not Applicable	
47.20	0.00	12.88	0.00	Not Applicable	
47.29	0.00	12.32	0.00	Not Applicable	
47.38	0.00	12.72	0.00	Not Applicable	
47.51	0.00	13.59	0.00	Not Applicable	
47.62	0.00	14.58	0.00	Not Applicable	
47.68	0.00	15.58	0.00	Not Applicable	

White Cell shows	Stretch with Bathymetric Survey, showing depth (m)
Highlighted Cell shows	Stretch with Topographic Survey, showing elevation (m amsl)

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
47.74	0.00	15.38	0.00	Not Applicable	
47.82	0.00	13.57	0.00	Not Applicable	
47.91	0.00	14.74	0.00	Not Applicable	
48.02	0.00	13.70	0.00	Not Applicable	
48.10	0.00	14.09	0.00	Not Applicable	
48.19	0.00	14.10	0.00	Not Applicable	
48.28	0.00	14.14	0.00	Not Applicable	
48.33	0.00	14.17	0.00	Not Applicable	
48.42	0.00	14.97	0.00	Not Applicable	
48.50	0.00	14.26	0.00	Not Applicable	
48.60	0.00	14.33	0.00	Not Applicable	
48.70	0.00	14.24	0.00	Not Applicable	
48.80	0.00	14.67	0.00	Not Applicable	
48.92	0.00	14.46	0.00	Not Applicable	
49.01	0.00	15.02	0.00	Not Applicable	
49.10	0.00	14.92	0.00	Not Applicable	
49.19	0.00	15.11	0.00	Not Applicable	
49.23	0.00	15.00	0.00	Not Applicable	
49.30	0.00	15.12	0.00	Not Applicable	
49.41	0.00	15.25	0.00	Not Applicable	
49.49	0.00	15.50	0.00	Not Applicable	
49.62	0.00	15.75	0.00	Not Applicable	
49.67	0.00	16.29	0.00	Not Applicable	
49.74	0.00	15.79	0.00	Not Applicable	
49.79	0.00	16.23	0.00	Not Applicable	
49.92	0.00	16.22	0.00	Not Applicable	

White Cell shows	Stretch with Bathymetric Survey, showing depth (m)
Highlighted Cell shows	Stretch with Topographic Survey, showing elevation (m amsl)

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
49.98	0.00	16.27	0.00	Not Applicable	
50.03	0.00	15.91	0.00	Not Applicable	
50.12	0.00	15.98	0.00	Not Applicable	
50.19	0.00	16.09	0.00	Not Applicable	
50.30	0.00	16.61	0.00	Not Applicable	
50.43	0.00	16.31	0.00	Not Applicable	
50.49	0.00	16.09	0.00	Not Applicable	
50.60	0.00	16.50	0.00	Not Applicable	
50.68	0.00	16.36	0.00	Not Applicable	
50.72	0.00	16.37	0.00	Not Applicable	
50.82	0.00	16.47	0.00	Not Applicable	
50.92	0.00	16.52	0.00	Not Applicable	
51.00	0.00	16.81	0.00	Not Applicable	
51.11	0.00	16.59	0.00	Not Applicable	
51.18	0.00	16.40	0.00	Not Applicable	
51.32	0.00	17.18	0.00	Not Applicable	
51.42	0.00	17.21	0.00	Not Applicable	
51.51	0.00	17.48	0.00	Not Applicable	
51.63	0.00	17.27	0.00	Not Applicable	
51.68	0.00	17.40	0.00	Not Applicable	
51.80	0.00	17.27	0.00	Not Applicable	
51.88	0.00	17.35	0.00	Not Applicable	
51.92	0.00	17.47	0.00	Not Applicable	
52.03	0.00	17.15	0.00	Not Applicable	
52.09	0.00	17.55	0.00	Not Applicable	
52.13	0.00	17.76	0.00	Not Applicable	

White Cell shows	Stretch with Bathymetric Survey, showing depth (m)
Highlighted Cell shows	Stretch with Topographic Survey, showing elevation (m amsl)

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
52.19	0.00	17.86	0.00	Not Applicable	
52.29	0.00	17.87	0.00	Not Applicable	
52.39	0.00	17.66	0.00	Not Applicable	
52.43	0.00	17.45	0.00	Not Applicable	
52.51	0.00	17.94	0.00	Not Applicable	
52.60	0.00	18.31	0.00	Not Applicable	
52.68	0.00	17.86	0.00	Not Applicable	
52.72	0.00	17.64	0.00	Not Applicable	
52.79	0.00	18.01	0.00	Not Applicable	
52.82	0.00	17.67	0.00	Not Applicable	
52.90	0.00	17.70	0.00	Not Applicable	
52.99	0.00	17.64	0.00	Not Applicable	
53.03	0.00	17.88	0.00	Not Applicable	
53.09	0.00	17.61	0.00	Not Applicable	
53.23	0.00	18.58	0.00	Not Applicable	
53.31	0.00	18.37	0.00	Not Applicable	
53.39	0.00	18.44	0.00	Not Applicable	
53.49	0.00	18.85	0.00	Not Applicable	
53.57	0.00	18.77	0.00	Not Applicable	
53.60	0.00	19.12	0.00	Not Applicable	
53.70	0.00	18.87	0.00	Not Applicable	
53.82	0.00	18.75	0.00	Not Applicable	
53.89	0.00	18.82	0.00	Not Applicable	
53.94	0.00	18.90	0.00	Not Applicable	
54.01	0.00	18.57	0.00	Not Applicable	
54.09	0.00	18.90	0.00	Not Applicable	

White Cell shows	Stretch with Bathymetric Survey, showing depth (m)
Highlighted Cell shows	Stretch with Topographic Survey, showing elevation (m amsl)

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
54.21	0.00	18.74	0.00	Not Applicable	
54.29	0.00	18.77	0.00	Not Applicable	
54.40	0.00	19.24	0.00	Not Applicable	
54.51	0.00	18.86	0.00	Not Applicable	
54.61	0.00	18.77	0.00	Not Applicable	
54.68	0.00	19.16	0.00	Not Applicable	
54.78	0.00	19.00	0.00	Not Applicable	
54.83	0.00	19.17	0.00	Not Applicable	
54.90	0.00	19.13	0.00	Not Applicable	
54.99	0.00	19.29	0.00	Not Applicable	
55.09	0.00	18.87	0.00	Not Applicable	
55.13	0.00	19.55	0.00	Not Applicable	
55.19	0.00	19.41	0.00	Not Applicable	
55.23	0.00	19.19	0.00	Not Applicable	
55.32	0.00	19.23	0.00	Not Applicable	
55.43	0.00	19.30	0.00	Not Applicable	
55.49	0.00	19.31	0.00	Not Applicable	
55.51	0.00	19.18	0.00	Not Applicable	
55.60	0.00	19.39	0.00	Not Applicable	
55.70	0.00	19.67	0.00	Not Applicable	
55.78	0.00	19.63	0.00	Not Applicable	
55.84	0.00	19.68	0.00	Not Applicable	
55.90	0.00	19.72	0.00	Not Applicable	
56.00	0.00	19.71	0.00	Not Applicable	
56.07	0.00	19.77	0.00	Not Applicable	
56.14	0.00	19.83	0.00	Not Applicable	

White Cell shows	Stretch with Bathymetric Survey, showing depth (m)
Highlighted Cell shows	Stretch with Topographic Survey, showing elevation (m amsl)

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
56.19	0.00	19.80	0.00	Not Applicable	
56.28	0.00	19.89	0.00	Not Applicable	
56.38	0.00	20.27	0.00	Not Applicable	
56.47	0.00	20.00	0.00	Not Applicable	
56.55	0.00	20.32	0.00	Not Applicable	
56.69	0.00	20.25	0.00	Not Applicable	
56.71	0.00	20.36	0.00	Not Applicable	
56.80	0.00	20.32	0.00	Not Applicable	
56.92	0.00	20.28	0.00	Not Applicable	
56.98	0.00	20.74	0.00	Not Applicable	
56.98	0.10	20.500	20.473	-0.03	0.13
57.02	0.10	20.517	20.490	-0.03	0.13
57.09	0.08	20.545	20.518	-0.03	0.11
57.19	0.29	20.589	20.563	-0.03	0.32
57.22	0.15	20.602	20.576	-0.03	0.18
57.27	0.17	20.626	20.600	-0.03	0.20
57.35	0.23	20.657	20.631	-0.03	0.26
57.42	0.30	20.691	20.665	-0.03	0.33
57.46	0.13	20.705	20.680	-0.03	0.16
57.48	0.10	20.717	20.692	-0.03	0.13
57.52	0.10	20.732	20.706	-0.03	0.13
57.60	0.16	20.769	20.744	-0.02	0.18
57.67	0.13	20.800	20.775	-0.02	0.15
57.74	0.17	20.827	20.803	-0.02	0.19
57.82	0.10	20.864	20.840	-0.02	0.12
57.89	0.22	20.895	20.871	-0.02	0.24

White Cell shows	Stretch with Bathymetric Survey, showing depth (m)
Highlighted Cell shows	Stretch with Topographic Survey, showing elevation (m amsl)

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
57.96	0.10	20.925	20.902	-0.02	0.12
58.02	0.10	20.950	20.927	-0.02	0.12
58.11	0.11	20.990	20.967	-0.02	0.13
58.18	0.25	21.021	20.998	-0.02	0.27
58.21	0.68	21.035	21.012	-0.02	0.70
58.23	1.09	21.043	21.021	-0.02	1.11
58.25	0.46	21.052	21.030	-0.02	0.48
58.29	0.40	21.066	21.044	-0.02	0.42
58.35	0.25	21.097	21.075	-0.02	0.27
58.43	0.21	21.131	21.110	-0.02	0.23
58.52	0.30	21.167	21.146	-0.02	0.32
58.61	0.40	21.210	21.189	-0.02	0.42
58.70	0.24	21.246	21.225	-0.02	0.26
58.78	0.14	21.281	21.261	-0.02	0.16
58.86	0.20	21.315	21.295	-0.02	0.22
58.93	0.20	21.348	21.328	-0.02	0.22
58.97	0.43	21.363	21.343	-0.02	0.45
59.02	0.28	21.384	21.364	-0.02	0.30
59.10	0.20	21.421	21.402	-0.02	0.22
59.14	0.20	21.439	21.420	-0.02	0.22
59.14	0.20	21.440	21.421	-0.02	0.22
59.19	0.36	21.462	21.443	-0.02	0.38
59.27	0.29	21.495	21.476	-0.02	0.31
59.32	0.20	21.516	21.498	-0.02	0.22
59.39	0.23	21.549	21.531	-0.02	0.25
59.43	0.30	21.565	21.547	-0.02	0.32

	White Cell shows	Stretch with Bathymetric Survey, showing depth (m)
	Highlighted Cell shows	Stretch with Topographic Survey, showing elevation (m amsl)

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
59.49	0.30	21.589	21.571	-0.02	0.32
59.53	0.30	21.609	21.592	-0.02	0.32
59.59	0.30	21.635	21.618	-0.02	0.32
59.66	0.29	21.663	21.646	-0.02	0.31
59.72	0.27	21.690	21.673	-0.02	0.29
59.77	0.22	21.714	21.697	-0.02	0.24
59.82	0.22	21.734	21.717	-0.02	0.24
59.89	0.33	21.765	21.748	-0.02	0.35
59.94	0.20	21.786	21.769	-0.02	0.22
59.98	0.20	21.805	21.789	-0.02	0.22
60.04	0.15	21.828	21.812	-0.02	0.17
60.10	0.20	21.858	21.842	-0.02	0.22
60.13	0.30	21.871	21.855	-0.02	0.32
60.18	0.30	21.890	21.874	-0.02	0.32
60.25	0.27	21.919	21.904	-0.02	0.29
60.33	0.20	21.954	21.940	-0.01	0.21
60.40	0.22	21.987	21.972	-0.01	0.23
60.47	0.30	22.019	22.005	-0.01	0.31
60.55	0.30	22.052	22.038	-0.01	0.31
60.62	0.20	22.081	22.068	-0.01	0.21
60.68	0.20	22.108	22.095	-0.01	0.21
60.75	0.30	22.137	22.124	-0.01	0.31
60.82	0.21	22.168	22.155	-0.01	0.22
60.90	0.27	22.203	22.190	-0.01	0.28
60.95	0.20	22.228	22.215	-0.01	0.21
61.04	0.19	22.263	22.251	-0.01	0.20

White Cell shows	Stretch with Bathymetric Survey, showing depth (m)
Highlighted Cell shows	Stretch with Topographic Survey, showing elevation (m amsl)

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
61.12	0.11	22.301	22.289	-0.01	0.12
61.20	0.19	22.337	22.326	-0.01	0.20
61.27	0.23	22.367	22.355	-0.01	0.24
61.28	0.47	22.371	22.360	-0.01	0.48
61.30	0.20	22.379	22.367	-0.01	0.21
61.34	0.39	22.396	22.384	-0.01	0.40
61.36	0.26	22.403	22.392	-0.01	0.27
61.40	0.21	22.421	22.411	-0.01	0.22
61.49	0.20	22.459	22.449	-0.01	0.21
61.58	0.20	22.502	22.492	-0.01	0.21
61.64	0.45	22.528	22.518	-0.01	0.46
61.64	0.32	22.528	22.518	-0.01	0.33
61.72	0.16	22.560	22.550	-0.01	0.17
61.81	0.19	22.600	22.591	-0.01	0.20
61.90	0.35	22.641	22.632	-0.01	0.36
62.00	0.30	22.682	22.673	-0.01	0.31
62.14	0.20	22.746	22.738	-0.01	0.21
62.14	0.20	22.746	22.738	-0.01	0.21
62.14	0.20	22.746	22.738	-0.01	0.21
62.19	0.40	22.768	22.760	-0.01	0.41
62.27	0.47	22.799	22.791	-0.01	0.48
62.34	0.73	22.831	22.824	-0.01	0.74
62.40	0.54	22.856	22.848	-0.01	0.55
62.46	0.35	22.883	22.876	-0.01	0.36
62.53	0.30	22.912	22.905	-0.01	0.31
62.55	0.30	22.925	22.918	-0.01	0.31

White Cell shows	Stretch with Bathymetric Survey, showing depth (m)
Highlighted Cell shows	Stretch with Topographic Survey, showing elevation (m amsl)

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
62.56	0.20	22.927	22.920	-0.01	0.21
62.59	0.13	22.940	22.934	-0.01	0.14
62.63	0.37	22.959	22.952	-0.01	0.38
62.67	0.22	22.973	22.967	-0.01	0.23
62.73	0.16	23.003	22.997	-0.01	0.17
62.80	0.20	23.032	23.027	-0.01	0.21
62.85	0.25	23.055	23.049	-0.01	0.26
62.90	0.19	23.074	23.069	-0.01	0.20
62.97	0.18	23.104	23.099	-0.01	0.19
63.04	0.11	23.137	23.132	0.00	0.11
63.11	0.27	23.167	23.162	0.00	0.27
63.15	0.20	23.183	23.178	0.00	0.20
63.20	0.16	23.207	23.203	0.00	0.16
63.24	0.25	23.221	23.217	0.00	0.25
63.30	0.61	23.248	23.244	0.00	0.61
63.35	0.50	23.273	23.269	0.00	0.50
63.40	0.38	23.291	23.288	0.00	0.38
63.44	0.61	23.309	23.306	0.00	0.61
63.48	0.26	23.326	23.323	0.00	0.26
63.53	0.20	23.347	23.344	0.00	0.20
63.57	0.25	23.368	23.365	0.00	0.25
63.63	0.31	23.395	23.392	0.00	0.31
63.72	0.46	23.430	23.428	0.00	0.46
63.76	0.19	23.451	23.448	0.00	0.19
63.84	0.26	23.484	23.482	0.00	0.26
63.94	0.40	23.526	23.524	0.00	0.40

White Cell shows	Stretch with Bathymetric Survey, showing depth (m)
Highlighted Cell shows	Stretch with Topographic Survey, showing elevation (m amsl)

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	**B**	**C**	**D = C - B**	**E = A-D**
63.96	0.21	23.535	23.533	0.00	0.21
63.96	0.38	23.535	23.534	0.00	0.38
63.96	0.29	23.535	23.534	0.00	0.29
63.98	0.10	23.545	23.544	0.00	0.10
64.06	0.07	23.578	23.577	0.00	0.07
64.15	0.23	23.619	23.618	0.00	0.23
64.23	0.26	23.653	23.652	0.00	0.26
64.28	0.43	23.677	23.677	0.00	0.43
64.31	0.41	23.688	23.688	0.00	0.41
64.38	0.22	23.721	23.721	0.00	0.22
64.45	0.30	23.748	23.748	0.00	0.30
64.52	0.34	23.779	23.780	0.00	0.34
64.60	0.30	23.814	23.815	0.00	0.30
64.66	0.23	23.843	23.844	0.00	0.23
64.72	0.20	23.866	23.867	0.00	0.20
64.76	0.20	23.884	23.886	0.00	0.20
64.83	0.16	23.917	23.919	0.00	0.16
64.90	0.15	23.947	23.949	0.00	0.15
65.05	0.40	24.010	24.012	0.00	0.40
65.05	0.30	24.010	24.012	0.00	0.30
65.05	0.30	24.010	24.013	0.00	0.30
65.05	0.31	24.010	24.013	0.00	0.31
65.08	0.40	24.022	24.024	0.00	0.40
65.15	0.35	24.054	24.057	0.00	0.35
65.23	0.29	24.089	24.092	0.00	0.29
65.28	0.26	24.110	24.113	0.00	0.26

	White Cell shows	Stretch with Bathymetric Survey, showing depth (m)
	Highlighted Cell shows	Stretch with Topographic Survey, showing elevation (m amsl)

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
65.35	0.38	24.142	24.146	0.00	0.38
65.42	0.38	24.170	24.174	0.00	0.38
65.50	0.30	24.206	24.210	0.00	0.30
65.57	0.39	24.237	24.242	0.00	0.39
65.62	0.35	24.261	24.265	0.00	0.35
65.70	0.40	24.292	24.297	0.00	0.40
65.74	0.43	24.311	24.316	0.00	0.43
65.78	0.38	24.330	24.335	0.01	0.37
65.79	0.33	24.334	24.339	0.01	0.32
65.84	0.40	24.354	24.359	0.01	0.39
65.90	0.40	24.383	24.388	0.01	0.39
65.97	0.43	24.413	24.418	0.01	0.42
65.99	0.50	24.418	24.424	0.01	0.49
66.05	0.40	24.445	24.451	0.01	0.39
66.11	0.34	24.471	24.478	0.01	0.33
66.11	0.40	24.472	24.478	0.01	0.39
66.14	0.23	24.486	24.493	0.01	0.22
66.21	0.39	24.518	24.524	0.01	0.38
66.24	0.40	24.527	24.534	0.01	0.39
66.25	0.40	24.534	24.541	0.01	0.39
66.36	0.39	24.581	24.588	0.01	0.38
66.52	0.30	24.650	24.657	0.01	0.29
66.61	0.30	24.689	24.698	0.01	0.29
66.73	0.38	24.742	24.751	0.01	0.37
66.88	0.33	24.808	24.817	0.01	0.32
66.93	0.20	24.828	24.837	0.01	0.19

	White Cell shows	Stretch with Bathymetric Survey, showing depth (m)			
	Highlighted Cell shows	Stretch with Topographic Survey, showing elevation (m amsl)			

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
67.02	0.25	24.870	24.879	0.01	0.24
67.11	0.29	24.906	24.916	0.01	0.28
67.20	0.21	24.947	24.957	0.01	0.20
67.29	0.33	24.984	24.995	0.01	0.32
67.29	0.36	24.984	24.995	0.01	0.35
67.29	0.21	24.985	24.995	0.01	0.20
67.32	0.36	24.998	25.009	0.01	0.35
67.38	0.30	25.023	25.034	0.01	0.29
67.46	0.35	25.061	25.072	0.01	0.34
67.55	0.31	25.099	25.111	0.01	0.30
67.63	0.40	25.135	25.147	0.01	0.39
67.74	0.38	25.182	25.194	0.01	0.37
67.81	0.22	25.213	25.225	0.01	0.21
67.89	0.30	25.249	25.262	0.01	0.29
67.97	0.21	25.283	25.296	0.01	0.20
68.07	0.20	25.324	25.337	0.01	0.19
68.18	2.82	25.372	25.385	0.01	2.81
68.27	0.24	25.411	25.425	0.01	0.23
68.35	0.10	25.447	25.462	0.01	0.09
68.45	0.18	25.489	25.504	0.01	0.17
68.54	0.18	25.532	25.547	0.02	0.16
68.65	0.10	25.576	25.591	0.02	0.08
68.72	0.19	25.607	25.623	0.02	0.17
68.80	0.11	25.645	25.661	0.02	0.09
68.90	0.33	25.688	25.704	0.02	0.31
68.99	0.34	25.728	25.744	0.02	0.32

White Cell shows	Stretch with Bathymetric Survey, showing depth (m)
Highlighted Cell shows	Stretch with Topographic Survey, showing elevation (m amsl)

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
69.07	0.21	25.759	25.776	0.02	0.19
69.14	0.17	25.791	25.809	0.02	0.15
69.19	0.11	25.815	25.832	0.02	0.09
69.25	0.19	25.840	25.858	0.02	0.17
69.32	0.30	25.870	25.888	0.02	0.28
69.40	0.24	25.906	25.924	0.02	0.22
69.50	0.20	25.948	25.967	0.02	0.18
69.57	0.20	25.980	25.999	0.02	0.18
69.57	0.20	25.980	25.999	0.02	0.18
69.57	0.20	25.980	25.999	0.02	0.18
69.57	0.20	25.980	25.999	0.02	0.18
69.62	0.28	26.000	26.019	0.02	0.26
69.69	0.43	26.030	26.049	0.02	0.41
69.75	0.30	26.056	26.075	0.02	0.28
69.84	0.40	26.096	26.116	0.02	0.38
69.88	0.30	26.114	26.134	0.02	0.28
69.94	0.24	26.140	26.160	0.02	0.22
70.02	0.06	26.173	26.193	0.02	0.04
70.06	0.24	26.190	26.211	0.02	0.22
70.14	0.20	26.226	26.246	0.02	0.18
70.22	0.11	26.262	26.284	0.02	0.09
70.33	0.19	26.311	26.332	0.02	0.17
70.39	0.20	26.335	26.357	0.02	0.18
70.42	0.15	26.348	26.370	0.02	0.13
70.48	0.19	26.374	26.396	0.02	0.17
70.57	0.11	26.413	26.435	0.02	0.09

White Cell shows	Stretch with Bathymetric Survey, showing depth (m)
Highlighted Cell shows	Stretch with Topographic Survey, showing elevation (m amsl)

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
70.65	0.10	26.450	26.472	0.02	0.08
70.73	0.10	26.484	26.507	0.02	0.08
70.82	0.08	26.524	26.547	0.02	0.06
70.91	0.05	26.562	26.586	0.02	0.03
70.98	0.08	26.590	26.614	0.02	0.06
71.06	0.10	26.626	26.650	0.02	0.08
71.06	0.10	26.626	26.650	0.02	0.08
71.06	0.10	26.626	26.650	0.02	0.08
71.11	0.00	26.65	0.00	Not Applicable	
71.22	0.00	26.90	0.00	Not Applicable	
71.31	0.00	27.86	0.00	Not Applicable	
71.43	0.00	28.45	0.00	Not Applicable	
71.48	0.00	27.99	0.00	Not Applicable	
71.58	0.00	29.51	0.00	Not Applicable	
71.65	0.00	29.32	0.00	Not Applicable	
71.75	0.00	29.26	0.00	Not Applicable	
71.79	0.00	28.96	0.00	Not Applicable	
71.89	0.00	29.39	0.00	Not Applicable	
72.01	0.00	30.08	0.00	Not Applicable	
72.11	0.00	30.69	0.00	Not Applicable	
72.21	0.00	26.84	0.00	Not Applicable	
72.28	0.00	27.72	0.00	Not Applicable	
72.32	0.00	27.80	0.00	Not Applicable	
72.39	0.00	27.77	0.00	Not Applicable	
72.52	0.00	27.02	0.00	Not Applicable	
72.61	0.00	27.13	0.00	Not Applicable	

White Cell shows	Stretch with Bathymetric Survey, showing depth (m)
Highlighted Cell shows	Stretch with Topographic Survey, showing elevation (m amsl)

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
72.72	0.00	28.52	0.00	Not Applicable	
72.78	0.00	28.29	0.00	Not Applicable	
72.82	0.00	28.23	0.00	Not Applicable	
72.92	0.00	28.21	0.00	Not Applicable	
72.99	0.00	28.98	0.00	Not Applicable	
73.07	0.00	29.09	0.00	Not Applicable	
73.11	0.00	28.43	0.00	Not Applicable	
73.23	0.00	28.16	0.00	Not Applicable	
73.30	0.00	29.14	0.00	Not Applicable	
73.41	0.00	28.85	0.00	Not Applicable	
73.48	0.00	28.87	0.00	Not Applicable	
73.52	0.00	29.12	0.00	Not Applicable	
73.58	0.00	29.29	0.00	Not Applicable	
73.63	0.00	29.45	0.00	Not Applicable	
73.66	0.00	27.87	0.00	Not Applicable	
73.71	0.00	28.16	0.00	Not Applicable	
73.77	0.00	28.29	0.00	Not Applicable	
73.84	0.00	28.35	0.00	Not Applicable	
73.90	0.00	28.36	0.00	Not Applicable	
73.99	0.00	28.65	0.00	Not Applicable	
74.03	0.00	28.55	0.00	Not Applicable	
74.08	0.00	28.80	0.00	Not Applicable	
74.21	0.00	28.55	0.00	Not Applicable	
74.30	0.00	28.33	0.00	Not Applicable	
74.42	0.00	28.55	0.00	Not Applicable	
74.47	0.00	28.55	0.00	Not Applicable	

White Cell shows	Stretch with Bathymetric Survey, showing depth (m)
Highlighted Cell shows	Stretch with Topographic Survey, showing elevation (m amsl)

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
74.54	0.00	28.64	0.00	Not Applicable	
74.60	0.00	28.69	0.00	Not Applicable	
74.71	0.00	28.83	0.00	Not Applicable	
74.79	0.00	28.60	0.00	Not Applicable	
74.88	0.00	30.12	0.00	Not Applicable	
74.99	0.00	30.03	0.00	Not Applicable	
75.04	0.00	29.86	0.00	Not Applicable	
75.09	0.00	29.75	0.00	Not Applicable	
75.11	0.00	30.47	0.00	Not Applicable	
75.19	0.00	30.61	0.00	Not Applicable	
75.31	0.00	30.55	0.00	Not Applicable	
75.34	0.00	30.46	0.00	Not Applicable	
75.44	0.00	30.58	0.00	Not Applicable	
75.51	0.00	29.16	0.00	Not Applicable	
75.55	0.00	29.14	0.00	Not Applicable	
75.63	0.00	29.27	0.00	Not Applicable	
75.68	0.00	29.14	0.00	Not Applicable	
75.79	0.00	29.52	0.00	Not Applicable	
75.84	0.00	29.23	0.00	Not Applicable	
75.89	0.00	29.29	0.00	Not Applicable	
75.91	0.00	29.54	0.00	Not Applicable	
75.98	0.00	29.41	0.00	Not Applicable	
76.03	0.00	29.03	0.00	Not Applicable	
76.11	0.00	29.08	0.00	Not Applicable	
76.22	0.00	29.40	0.00	Not Applicable	
76.32	0.00	29.60	0.00	Not Applicable	

White Cell shows	Stretch with Bathymetric Survey, showing depth (m)
Highlighted Cell shows	Stretch with Topographic Survey, showing elevation (m amsl)

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
76.43	0.00	29.67	0.00	Not Applicable	
76.48	0.00	29.42	0.00	Not Applicable	
76.60	0.00	29.76	0.00	Not Applicable	
76.68	0.00	29.71	0.00	Not Applicable	
76.73	0.00	29.83	0.00	Not Applicable	
76.77	0.00	29.41	0.00	Not Applicable	
76.89	0.00	29.92	0.00	Not Applicable	
76.93	0.00	29.78	0.00	Not Applicable	
77.00	0.00	30.04	0.00	Not Applicable	
77.12	0.00	29.88	0.00	Not Applicable	
77.18	0.00	29.90	0.00	Not Applicable	
77.24	0.00	29.93	0.00	Not Applicable	
77.31	0.00	30.05	0.00	Not Applicable	
77.41	0.00	30.28	0.00	Not Applicable	
77.49	0.00	30.22	0.00	Not Applicable	
77.62	0.00	30.41	0.00	Not Applicable	
77.70	0.00	30.24	0.00	Not Applicable	
77.80	0.00	30.40	0.00	Not Applicable	
77.94	0.00	30.43	0.00	Not Applicable	
77.98	0.00	30.56	0.00	Not Applicable	
78.03	0.00	30.54	0.00	Not Applicable	
78.09	0.00	30.60	0.00	Not Applicable	
78.19	0.00	30.73	0.00	Not Applicable	
78.28	0.00	30.65	0.00	Not Applicable	
78.39	0.00	30.84	0.00	Not Applicable	
78.42	0.00	30.94	0.00	Not Applicable	

White Cell shows	Stretch with Bathymetric Survey, showing depth (m)
Highlighted Cell shows	Stretch with Topographic Survey, showing elevation (m amsl)

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
78.49	0.00	30.88	0.00	Not Applicable	
78.53	0.00	30.97	0.00	Not Applicable	
78.60	0.00	30.99	0.00	Not Applicable	
78.70	0.00	31.27	0.00	Not Applicable	
78.80	0.00	31.10	0.00	Not Applicable	
78.89	0.00	31.46	0.00	Not Applicable	
78.99	0.00	31.55	0.00	Not Applicable	
79.09	0.00	31.62	0.00	Not Applicable	
79.19	0.00	31.61	0.00	Not Applicable	
79.23	0.00	31.67	0.00	Not Applicable	
79.33	0.00	31.84	0.00	Not Applicable	
79.41	0.00	31.85	0.00	Not Applicable	
79.51	0.00	31.97	0.00	Not Applicable	
79.62	0.00	32.04	0.00	Not Applicable	
79.71	0.00	32.16	0.00	Not Applicable	
79.82	0.00	32.29	0.00	Not Applicable	
79.92	0.00	31.99	0.00	Not Applicable	
80.02	0.00	32.68	0.00	Not Applicable	
80.19	0.00	32.54	0.00	Not Applicable	
80.22	0.00	32.73	0.00	Not Applicable	
80.32	0.00	32.85	0.00	Not Applicable	
80.40	0.00	32.80	0.00	Not Applicable	
80.49	0.00	32.87	0.00	Not Applicable	
80.58	0.00	32.94	0.00	Not Applicable	
80.64	0.00	33.24	0.00	Not Applicable	
81.06	0.00	33.18	0.00	Not Applicable	

White Cell shows	Stretch with Bathymetric Survey, showing depth (m)
Highlighted Cell shows	Stretch with Topographic Survey, showing elevation (m amsl)

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
81.10	0.00	33.24	0.00	Not Applicable	
81.20	0.00	33.29	0.00	Not Applicable	
81.30	0.00	33.29	0.00	Not Applicable	
81.39	0.00	33.34	0.00	Not Applicable	
81.43	0.00	33.42	0.00	Not Applicable	
81.48	0.00	33.42	0.00	Not Applicable	
81.54	0.00	33.47	0.00	Not Applicable	
81.61	0.00	33.46	0.00	Not Applicable	
81.72	0.00	33.59	0.00	Not Applicable	
81.77	0.00	33.62	0.00	Not Applicable	
81.82	0.00	33.71	0.00	Not Applicable	
81.89	0.00	33.84	0.00	Not Applicable	
81.94	0.00	33.68	0.00	Not Applicable	
82.01	0.00	33.72	0.00	Not Applicable	
82.08	0.00	33.93	0.00	Not Applicable	
82.12	0.00	33.65	0.00	Not Applicable	
82.21	0.00	33.70	0.00	Not Applicable	
82.31	0.00	33.69	0.00	Not Applicable	
82.40	0.00	33.80	0.00	Not Applicable	
82.49	0.00	33.81	0.00	Not Applicable	
82.53	0.00	34.04	0.00	Not Applicable	
82.62	0.00	33.90	0.00	Not Applicable	
82.71	0.00	33.92	0.00	Not Applicable	
82.78	0.00	33.77	0.00	Not Applicable	
82.92	0.00	34.12	0.00	Not Applicable	
83.02	0.00	33.99	0.00	Not Applicable	

White Cell shows	Stretch with Bathymetric Survey, showing depth (m)
Highlighted Cell shows	Stretch with Topographic Survey, showing elevation (m amsl)

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
83.09	0.00	34.05	0.00	Not Applicable	
83.19	0.00	34.35	0.00	Not Applicable	
83.23	0.00	34.19	0.00	Not Applicable	
83.31	0.00	34.26	0.00	Not Applicable	
83.38	0.00	33.80	0.00	Not Applicable	
83.51	0.00	34.22	0.00	Not Applicable	
83.62	0.00	34.42	0.00	Not Applicable	
83.69	0.00	34.62	0.00	Not Applicable	
83.79	0.00	34.89	0.00	Not Applicable	
83.91	0.00	34.72	0.00	Not Applicable	
84.02	0.00	34.64	0.00	Not Applicable	
84.11	0.00	34.70	0.00	Not Applicable	
84.19	0.00	34.50	0.00	Not Applicable	
84.31	0.00	34.90	0.00	Not Applicable	
84.43	0.00	34.95	0.00	Not Applicable	
84.50	0.00	35.00	0.00	Not Applicable	
84.59	0.00	35.04	0.00	Not Applicable	
84.69	0.00	35.16	0.00	Not Applicable	
84.79	0.00	34.86	0.00	Not Applicable	
84.88	0.00	35.22	0.00	Not Applicable	
84.93	0.00	35.08	0.00	Not Applicable	
84.99	0.00	35.09	0.00	Not Applicable	
85.04	0.00	34.93	0.00	Not Applicable	
85.10	0.00	35.18	0.00	Not Applicable	
85.19	0.00	35.33	0.00	Not Applicable	
85.31	0.00	35.47	0.00	Not Applicable	

White Cell shows	Stretch with Bathymetric Survey, showing depth (m)
Highlighted Cell shows	Stretch with Topographic Survey, showing elevation (m amsl)

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
85.41	0.00	35.29	0.00	Not Applicable	
85.50	0.00	35.52	0.00	Not Applicable	
85.60	0.00	35.53	0.00	Not Applicable	
85.71	0.00	35.52	0.00	Not Applicable	
85.79	0.00	35.68	0.00	Not Applicable	
85.83	0.00	35.60	0.00	Not Applicable	
85.91	0.00	35.65	0.00	Not Applicable	
86.00	0.00	35.77	0.00	Not Applicable	
86.07	0.00	35.66	0.00	Not Applicable	
86.14	0.00	35.71	0.00	Not Applicable	
86.18	0.00	35.96	0.00	Not Applicable	
86.21	0.00	35.89	0.00	Not Applicable	
86.30	0.00	35.86	0.00	Not Applicable	
86.41	0.00	35.91	0.00	Not Applicable	
86.48	0.00	35.78	0.00	Not Applicable	
86.52	0.00	35.72	0.00	Not Applicable	
86.64	0.00	35.97	0.00	Not Applicable	
86.69	0.00	35.89	0.00	Not Applicable	
86.82	0.00	36.17	0.00	Not Applicable	
86.91	0.00	36.36	0.00	Not Applicable	
87.01	0.00	36.28	0.00	Not Applicable	
87.09	0.00	36.54	0.00	Not Applicable	
87.19	0.00	36.17	0.00	Not Applicable	
87.29	0.00	36.55	0.00	Not Applicable	
87.34	0.00	36.41	0.00	Not Applicable	
87.39	0.00	36.82	0.00	Not Applicable	

White Cell shows	Stretch with Bathymetric Survey, showing depth (m)
Highlighted Cell shows	Stretch with Topographic Survey, showing elevation (m amsl)

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
87.44	0.00	36.71	0.00	Not Applicable	
87.49	0.00	36.81	0.00	Not Applicable	
87.60	0.00	36.61	0.00	Not Applicable	
87.69	0.00	37.36	0.00	Not Applicable	
87.71	0.00	38.57	0.00	Not Applicable	
87.79	0.00	37.35	0.00	Not Applicable	
87.91	0.00	38.49	0.00	Not Applicable	
88.02	0.00	38.89	0.00	Not Applicable	
88.12	0.00	37.34	0.00	Not Applicable	
88.20	0.00	37.37	0.00	Not Applicable	
88.31	0.00	37.76	0.00	Not Applicable	
88.42	0.00	38.83	0.00	Not Applicable	
88.51	0.00	38.01	0.00	Not Applicable	
88.60	0.00	38.30	0.00	Not Applicable	
88.69	0.00	38.30	0.00	Not Applicable	
88.73	0.00	38.09	0.00	Not Applicable	
88.81	0.00	38.24	0.00	Not Applicable	
88.91	0.00	37.48	0.00	Not Applicable	
89.02	0.00	37.90	0.00	Not Applicable	
89.10	0.00	38.76	0.00	Not Applicable	
89.19	0.00	38.78	0.00	Not Applicable	
89.30	0.00	38.93	0.00	Not Applicable	
89.39	0.00	38.70	0.00	Not Applicable	
89.41	0.00	38.33	0.00	Not Applicable	
89.50	0.00	38.37	0.00	Not Applicable	
89.58	0.00	38.81	0.00	Not Applicable	

White Cell shows	Stretch with Bathymetric Survey, showing depth (m)
Highlighted Cell shows	Stretch with Topographic Survey, showing elevation (m amsl)

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
89.63	0.00	38.69	0.00	Not Applicable	
89.71	0.00	38.82	0.00	Not Applicable	
89.79	0.00	38.62	0.00	Not Applicable	
89.90	0.00	38.92	0.00	Not Applicable	
89.99	0.00	39.55	0.00	Not Applicable	
90.04	0.00	39.86	0.00	Not Applicable	
90.09	0.00	40.45	0.00	Not Applicable	
90.20	0.00	40.33	0.00	Not Applicable	
90.29	0.00	40.45	0.00	Not Applicable	
90.41	0.00	40.09	0.00	Not Applicable	
90.51	0.00	39.32	0.00	Not Applicable	
90.58	0.00	39.10	0.00	Not Applicable	
90.62	0.00	38.91	0.00	Not Applicable	
90.69	0.00	38.95	0.00	Not Applicable	
90.74	0.00	39.29	0.00	Not Applicable	
90.78	0.00	38.98	0.00	Not Applicable	
90.82	0.00	39.00	0.00	Not Applicable	
90.88	0.00	38.90	0.00	Not Applicable	
90.93	0.00	38.81	0.00	Not Applicable	
90.98	0.00	39.27	0.00	Not Applicable	
91.09	0.00	39.94	0.00	Not Applicable	
91.13	0.00	40.16	0.00	Not Applicable	
91.22	0.00	40.12	0.00	Not Applicable	
91.30	0.00	40.30	0.00	Not Applicable	
91.40	0.00	39.75	0.00	Not Applicable	
91.52	0.00	39.46	0.00	Not Applicable	

White Cell shows	Stretch with Bathymetric Survey, showing depth (m)
Highlighted Cell shows	Stretch with Topographic Survey, showing elevation (m amsl)

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
91.61	0.00	39.83	0.00	Not Applicable	
91.69	0.00	40.32	0.00	Not Applicable	
91.82	0.00	40.39	0.00	Not Applicable	
91.91	0.00	40.79	0.00	Not Applicable	
91.98	0.00	40.64	0.00	Not Applicable	
92.03	0.00	40.43	0.00	Not Applicable	
92.12	0.00	40.62	0.00	Not Applicable	
92.19	0.00	39.72	0.00	Not Applicable	
92.24	0.00	40.09	0.00	Not Applicable	
92.29	0.00	39.74	0.00	Not Applicable	
92.33	0.00	40.25	0.00	Not Applicable	
92.42	0.00	40.28	0.00	Not Applicable	
92.53	0.00	40.37	0.00	Not Applicable	
92.58	0.00	40.06	0.00	Not Applicable	
92.63	0.00	40.72	0.00	Not Applicable	
92.74	0.00	40.84	0.00	Not Applicable	
92.82	0.00	40.25	0.00	Not Applicable	
92.91	0.00	41.30	0.00	Not Applicable	
93.04	0.00	41.26	0.00	Not Applicable	
93.09	0.00	40.92	0.00	Not Applicable	
93.20	0.00	40.30	0.00	Not Applicable	
93.28	0.00	40.22	0.00	Not Applicable	
93.39	0.00	40.24	0.00	Not Applicable	
93.42	0.00	40.42	0.00	Not Applicable	
93.49	0.00	40.22	0.00	Not Applicable	
93.58	0.00	40.14	0.00	Not Applicable	

White Cell shows	Stretch with Bathymetric Survey, showing depth (m)
Highlighted Cell shows	Stretch with Topographic Survey, showing elevation (m amsl)

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
93.67	0.00	40.14	0.00	Not Applicable	
93.73	0.00	40.10	0.00	Not Applicable	
93.78	0.00	39.87	0.00	Not Applicable	
93.90	0.00	40.06	0.00	Not Applicable	
94.00	0.00	40.01	0.00	Not Applicable	
94.10	0.00	39.39	0.00	Not Applicable	
94.21	0.00	41.12	0.00	Not Applicable	
94.29	0.00	40.98	0.00	Not Applicable	
94.40	0.00	41.03	0.00	Not Applicable	
94.52	0.00	40.95	0.00	Not Applicable	
94.61	0.00	39.93	0.00	Not Applicable	
94.71	0.00	40.40	0.00	Not Applicable	
94.83	0.00	40.56	0.00	Not Applicable	
94.91	0.00	40.73	0.00	Not Applicable	
94.99	0.00	41.36	0.00	Not Applicable	
95.04	0.00	41.23	0.00	Not Applicable	
95.12	0.00	41.04	0.00	Not Applicable	
95.19	0.00	40.05	0.00	Not Applicable	
95.23	0.00	40.48	0.00	Not Applicable	
95.29	0.00	40.54	0.00	Not Applicable	
95.33	0.00	41.30	0.00	Not Applicable	
95.38	0.00	41.00	0.00	Not Applicable	
95.50	0.00	40.11	0.00	Not Applicable	
95.59	0.00	40.93	0.00	Not Applicable	
95.72	0.00	40.91	0.00	Not Applicable	
95.81	0.00	41.10	0.00	Not Applicable	

White Cell shows	Stretch with Bathymetric Survey, showing depth (m)
Highlighted Cell shows	Stretch with Topographic Survey, showing elevation (m amsl)

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
95.90	0.00	40.78	0.00	Not Applicable	
96.02	0.00	41.02	0.00	Not Applicable	
96.11	0.00	40.68	0.00	Not Applicable	
96.21	0.00	41.13	0.00	Not Applicable	
96.30	0.00	41.27	0.00	Not Applicable	
96.40	0.00	41.22	0.00	Not Applicable	
96.48	0.00	41.71	0.00	Not Applicable	
96.60	0.00	41.62	0.00	Not Applicable	
96.72	0.00	41.87	0.00	Not Applicable	
96.78	0.00	41.26	0.00	Not Applicable	
96.82	0.00	41.36	0.00	Not Applicable	
96.89	0.00	41.28	0.00	Not Applicable	
96.92	0.00	41.61	0.00	Not Applicable	
97.02	0.00	41.25	0.00	Not Applicable	
97.08	0.00	41.39	0.00	Not Applicable	
97.22	0.00	41.48	0.00	Not Applicable	
97.30	0.00	41.45	0.00	Not Applicable	
97.40	0.00	41.46	0.00	Not Applicable	
97.53	0.00	41.53	0.00	Not Applicable	
97.60	0.00	41.28	0.00	Not Applicable	
97.65	0.00	41.50	0.00	Not Applicable	
97.76	0.00	41.88	0.00	Not Applicable	
97.81	0.00	42.03	0.00	Not Applicable	
97.90	0.00	41.49	0.00	Not Applicable	
98.00	0.00	41.82	0.00	Not Applicable	
98.09	0.00	41.52	0.00	Not Applicable	

White Cell shows	Stretch with Bathymetric Survey, showing depth (m)
Highlighted Cell shows	Stretch with Topographic Survey, showing elevation (m amsl)

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
98.13	0.00	42.27	0.00	Not Applicable	
98.22	0.00	42.09	0.00	Not Applicable	
98.27	0.00	41.86	0.00	Not Applicable	
98.39	0.00	41.90	0.00	Not Applicable	
98.48	0.00	41.91	0.00	Not Applicable	
98.53	0.00	41.72	0.00	Not Applicable	
98.59	0.00	42.12	0.00	Not Applicable	
98.62	0.00	41.83	0.00	Not Applicable	
98.73	0.00	42.05	0.00	Not Applicable	
98.78	0.00	42.06	0.00	Not Applicable	
98.83	0.00	41.67	0.00	Not Applicable	
98.90	0.00	42.21	0.00	Not Applicable	
98.98	0.00	42.15	0.00	Not Applicable	
99.03	0.00	42.34	0.00	Not Applicable	
99.09	0.00	41.86	0.00	Not Applicable	
99.18	0.00	42.09	0.00	Not Applicable	
99.27	0.00	42.38	0.00	Not Applicable	
99.33	0.00	42.21	0.00	Not Applicable	
99.38	0.00	42.14	0.00	Not Applicable	
99.41	0.00	42.29	0.00	Not Applicable	
99.51	0.00	41.76	0.00	Not Applicable	
99.59	0.00	41.59	0.00	Not Applicable	
99.70	0.00	42.44	0.00	Not Applicable	
99.79	0.00	42.46	0.00	Not Applicable	
99.91	0.00	42.52	0.00	Not Applicable	
99.99	0.00	42.82	0.00	Not Applicable	

White Cell shows	Stretch with Bathymetric Survey, showing depth (m)				
Highlighted Cell shows	Stretch with Topographic Survey, showing elevation (m amsl)				

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
100.11	0.00	42.95	0.00	Not Applicable	
100.18	0.00	42.92	0.00	Not Applicable	
100.22	0.00	43.70	0.00	Not Applicable	
100.27	0.00	43.25	0.00	Not Applicable	
100.31	0.00	43.18	0.00	Not Applicable	
100.43	0.00	42.20	0.00	Not Applicable	
100.48	0.00	42.63	0.00	Not Applicable	
100.52	0.00	42.95	0.00	Not Applicable	
100.58	0.00	42.48	0.00	Not Applicable	
100.63	0.00	43.24	0.00	Not Applicable	
100.70	0.00	43.12	0.00	Not Applicable	
100.79	0.00	42.60	0.00	Not Applicable	
100.90	0.00	43.34	0.00	Not Applicable	
100.99	0.00	43.25	0.00	Not Applicable	
101.04	0.00	43.07	0.00	Not Applicable	
101.12	0.00	43.23	0.00	Not Applicable	
101.21	0.00	43.26	0.00	Not Applicable	
101.31	0.00	43.71	0.00	Not Applicable	
101.35	0.00	43.09	0.00	Not Applicable	
101.45	0.00	43.82	0.00	Not Applicable	
101.49	0.00	43.70	0.00	Not Applicable	
101.61	0.00	44.20	0.00	Not Applicable	
101.67	0.00	44.05	0.00	Not Applicable	
101.74	0.00	44.14	0.00	Not Applicable	
101.80	0.00	44.13	0.00	Not Applicable	
101.90	0.00	44.18	0.00	Not Applicable	

White Cell shows	Stretch with Bathymetric Survey, showing depth (m)
Highlighted Cell shows	Stretch with Topographic Survey, showing elevation (m amsl)

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
101.99	0.00	44.46	0.00	Not Applicable	
102.12	0.00	44.20	0.00	Not Applicable	
102.18	0.00	44.13	0.00	Not Applicable	
102.22	0.00	44.31	0.00	Not Applicable	
102.30	0.00	44.03	0.00	Not Applicable	
102.33	0.00	44.16	0.00	Not Applicable	
102.45	0.00	44.11	0.00	Not Applicable	
102.50	0.00	44.16	0.00	Not Applicable	
102.61	0.00	44.03	0.00	Not Applicable	
102.70	0.00	43.70	0.00	Not Applicable	
102.81	0.00	44.12	0.00	Not Applicable	
102.87	0.00	44.31	0.00	Not Applicable	
102.94	0.00	44.49	0.00	Not Applicable	
103.02	0.00	44.75	0.00	Not Applicable	
103.11	0.00	44.46	0.00	Not Applicable	
103.22	0.00	44.72	0.00	Not Applicable	
103.31	0.00	44.45	0.00	Not Applicable	
103.37	0.00	44.75	0.00	Not Applicable	
103.43	0.00	46.67	0.00	Not Applicable	
103.49	0.00	45.73	0.00	Not Applicable	
103.58	0.00	44.50	0.00	Not Applicable	
103.64	0.00	44.53	0.00	Not Applicable	
103.69	0.00	44.89	0.00	Not Applicable	
103.73	0.00	44.76	0.00	Not Applicable	
103.78	0.00	44.72	0.00	Not Applicable	
103.81	0.00	44.90	0.00	Not Applicable	

White Cell shows	Stretch with Bathymetric Survey, showing depth (m)
Highlighted Cell shows	Stretch with Topographic Survey, showing elevation (m amsl)

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
103.92	0.00	45.00	0.00	Not Applicable	
103.98	0.00	44.77	0.00	Not Applicable	
104.03	0.00	44.76	0.00	Not Applicable	
104.10	0.00	44.83	0.00	Not Applicable	
104.21	0.00	45.84	0.00	Not Applicable	
104.30	0.00	46.45	0.00	Not Applicable	
104.38	0.00	45.11	0.00	Not Applicable	
104.49	0.00	45.41	0.00	Not Applicable	
104.53	0.00	45.20	0.00	Not Applicable	
104.59	0.00	45.01	0.00	Not Applicable	
104.68	0.00	44.73	0.00	Not Applicable	
104.73	0.00	45.35	0.00	Not Applicable	
104.81	0.00	45.38	0.00	Not Applicable	
104.92	0.00	46.36	0.00	Not Applicable	
104.97	0.00	46.55	0.00	Not Applicable	
105.02	0.00	45.86	0.00	Not Applicable	
105.06	0.00	45.05	0.00	Not Applicable	
105.14	0.00	45.76	0.00	Not Applicable	
105.20	0.00	45.33	0.00	Not Applicable	
105.29	0.00	44.87	0.00	Not Applicable	
105.40	0.00	45.05	0.00	Not Applicable	
105.43	0.00	45.27	0.00	Not Applicable	
105.53	0.00	46.09	0.00	Not Applicable	
105.57	0.00	46.20	0.00	Not Applicable	
105.61	0.00	46.01	0.00	Not Applicable	
105.69	0.00	45.51	0.00	Not Applicable	

White Cell shows	Stretch with Bathymetric Survey, showing depth (m)
Highlighted Cell shows	Stretch with Topographic Survey, showing elevation (m amsl)

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
105.74	0.00	45.56	0.00	Not Applicable	
105.77	0.00	46.25	0.00	Not Applicable	
105.80	0.00	46.46	0.00	Not Applicable	
105.91	0.00	46.69	0.00	Not Applicable	
105.97	0.00	46.57	0.00	Not Applicable	
106.00	0.00	47.10	0.00	Not Applicable	
106.10	0.00	47.35	0.00	Not Applicable	
106.18	0.00	45.43	0.00	Not Applicable	
106.32	0.00	45.67	0.00	Not Applicable	
106.40	0.00	46.27	0.00	Not Applicable	
106.51	0.00	46.20	0.00	Not Applicable	
106.60	0.00	46.32	0.00	Not Applicable	
106.68	0.00	46.49	0.00	Not Applicable	
106.72	0.00	46.52	0.00	Not Applicable	
106.77	0.00	46.65	0.00	Not Applicable	
106.84	0.00	46.19	0.00	Not Applicable	
106.93	0.00	46.78	0.00	Not Applicable	
106.99	0.00	46.81	0.00	Not Applicable	
107.12	0.00	46.33	0.00	Not Applicable	
107.21	0.00	45.39	0.00	Not Applicable	
107.24	0.00	45.86	0.00	Not Applicable	
107.29	0.00	46.48	0.00	Not Applicable	
107.34	0.00	46.35	0.00	Not Applicable	
107.40	0.00	46.23	0.00	Not Applicable	
107.52	0.00	45.53	0.00	Not Applicable	
107.59	0.00	46.32	0.00	Not Applicable	

White Cell shows	Stretch with Bathymetric Survey, showing depth (m)
Highlighted Cell shows	Stretch with Topographic Survey, showing elevation (m amsl)

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
107.63	0.00	46.69	0.00	Not Applicable	
107.69	0.00	46.19	0.00	Not Applicable	
107.73	0.00	45.70	0.00	Not Applicable	
107.78	0.00	46.92	0.00	Not Applicable	
107.84	0.00	46.80	0.00	Not Applicable	
107.90	0.00	46.67	0.00	Not Applicable	
108.00	0.00	45.99	0.00	Not Applicable	
108.05	0.00	46.17	0.00	Not Applicable	
108.15	0.00	46.37	0.00	Not Applicable	
108.19	0.00	46.70	0.00	Not Applicable	
108.25	0.00	46.38	0.00	Not Applicable	
108.29	0.00	46.44	0.00	Not Applicable	
108.39	0.00	46.22	0.00	Not Applicable	
108.39	0.00	46.20	0.00	Not Applicable	
108.45	0.00	46.88	0.00	Not Applicable	
108.52	0.00	46.73	0.00	Not Applicable	
108.59	0.00	46.61	0.00	Not Applicable	

Annexure 4: Photographs along Dwarakeswar Waterway

SAND CHECK DAM ALONG WATERWAY

SAND CHECK DAM ALONG WATERWAY

SAND CHECK DAM & SAND MINING Along Waterway

MAJOR ROADWAY BRIDGE CHAINAGE 41.9 Km

HIGH TENSION LINE CHAINAGE 84.1 Kм

FULLY DRY PATCH CHAINAGE 22.0 Kм

WOODEN BRIDGE CHAINAGE 84.3 Kм

DRY PATCH CHAINAGE 89.0 Km

BAMBOO BRIDGE CHAINAGE 93.8 Km

WATER COLUMN DUE TO SAND MINING CHAINAGE 35.0 Km

WATER COLUMN DUE TO SAND MINING CHAINAGE 36.0 Kм