




**GEOSERVICES
MARITIME PVT. LTD.**

**REPORT ON TOPOGRAPHIC & BATHYMETRIC SURVEY
FOR ASSESSMENT OF RESERVOIR CAPACITY & SEDIMENTATION IN DHAROI
RESERVOIR, GUJARAT, INDIA UNDER NATIONAL HYDROLOGY PROJECT**

**GMPL REPORT NUMBER: P-SUR-BATHY-009-2020-21-WRD-DHAROI
SURVEY PERIOD: 3 JAN TO 9 FEB 2021**

Prepared for:	Water Resources Investigation Division, Ahmedabad (Govt. Of Gujarat)	
Client Reference:	Executive Engineer Water resources investigation Division Ahmedabad.	

LOCATION MAP

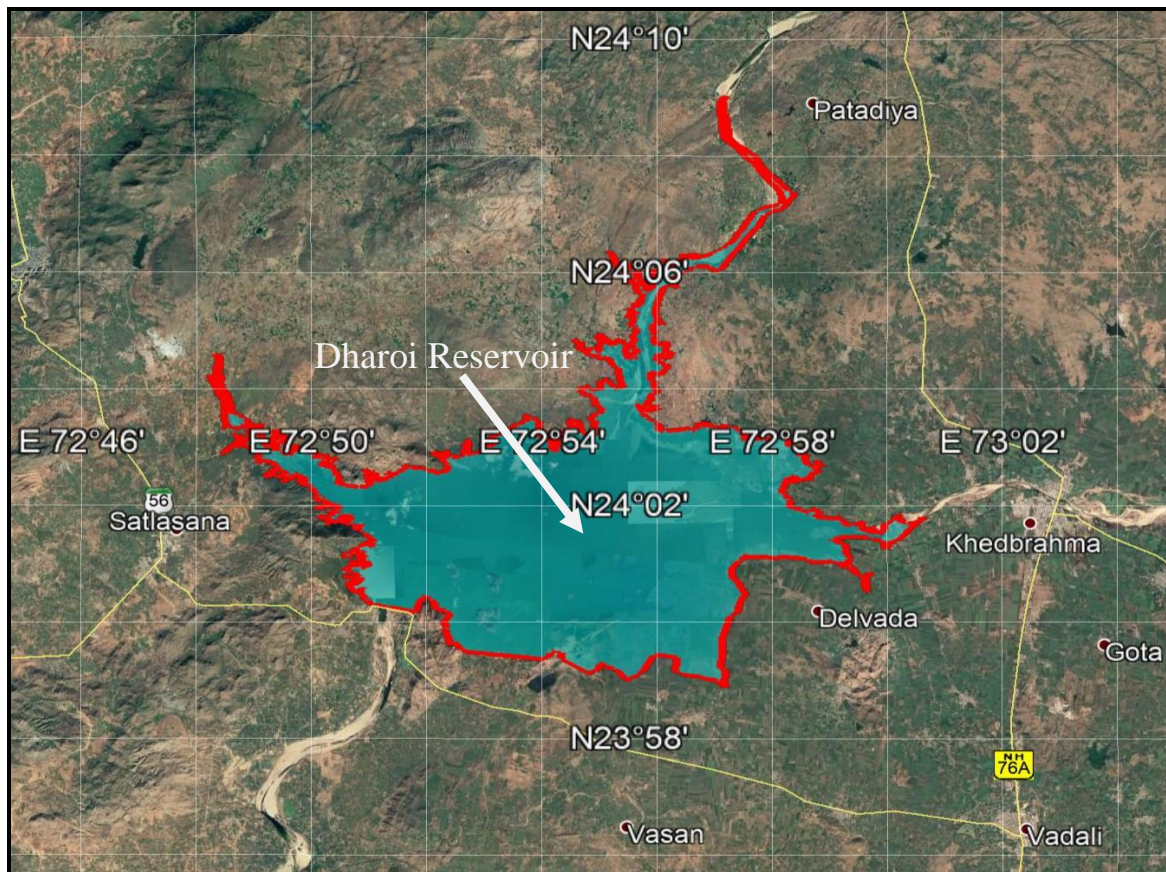


Figure 1.1-1 LOCATION MAP

LOCATION MAP SHOWING SURVEY AREA “DHAROI RESERVOIR”, GUJARAT, INDIA

DOCUMENT ARRANGEMENT

REPORT OF SURVEY WITH CHART / DRAWING

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1 INTRODUCTION, OBJECTIVE & SCOPE OF WORK

1.1 General

Water Resources Investigation Division (WRD) has awarded the contract to Geoservices Maritime Pvt Ltd (GMPL), Navi Mumbai for carrying out Topographic and Bathymetric Survey at Dharoi Reservoir, Gujarat. The survey services provided by GMPL comprise of the provision of well-qualified survey personnel and equipment in order to obtain, interpret and report on acquired topographic & bathymetric survey data at the client specified locations.

This report contains the results of survey as against the scope of work and the methodology adopted to achieve the specifications and schedule of the survey work undertaken at Dharoi Reservoir.

1.1.1 LIST OF ABBREVIATIONS USED

CM	Central Meridian
DGPS	Differential Global Positioning System
CSRS	Canadian Spatial Reference System
FRL	Full Reservoir Level
GMPL	Geoservices Maritime Private Limited
GPS	Global Positioning System
HDOP	Horizontal Dilution of Precision
KHz	Kilohertz
HSE	Health Safety Environment
MSL	Mean Sea Level
m	metre
M Cu. m	Million Cubic metre
Sq. Km	Square Kilometre
MDDL	Minimum Draw Down Level
m/s	meter per second
ms	milliseconds
MWL	Maximum Water Level
QA/QC	Quality Assurance / Quality Control
Rev	Revision
RTK	Real Time Kinematic
SBES	Single Beam Echo Sounder
TBM	Temporary Bench Mark
UTM	Universal Transverse Mercator
WGS 84	World Geodetic System 1984
WRD	Water Resources Investigation Division

1.1.2 Units

- UTM grid coordinates and all linear measurements expressed in metres (m).
- Angular values expressed in degrees (°).
- Time and dates expressed as “09:00 on 24 Jan 2021”.

1.2 Objective

The client’s objectives were:



- i) To estimate and study the sedimentation behaviour of reservoir in different zones including horizontal zones throughout the reservoir as well as vertical zones namely dead storage, live storage and flood storage if any.
- ii) To upgrade Elevation-Area-Capacity table and curves of the reservoir at regular intervals.
- iii) To emphasize on the importance of conducting hydrographic surveys at regular intervals for better operation and water management of the reservoir.

1.3 Scope of Work

The Scope of work for Geoservices Maritime Pvt Ltd was to mobilise, install, interface, operate all survey systems and provide all required survey personnel to undertake Topographic and Bathymetric survey services at Dharoi Reservoir.

The detailed scope of work was:

- i) To measure the water depth of the Dharoi Reservoir at with respect to MSL.
- ii) Line spacing shall be 25 m with continues echo sounding.
- iii) Reservoir for water level changes during survey shall be tabulated.
- iv) Data processing using HYPACK software shall be used.
- v) Topographic survey shall be conducted from FRL water level with reasonable overlap with hydrographic survey.
- vi) The area not covered under Hydrographic survey up to Maximum Water Level (MWL) shall be surveyed by taking levels at 25 m interval (25 m x 25 m grid).
- vii) To carry out the data processing and interpretation of data and preparing of results, charts and drawings.
- viii) Estimation of Sedimentation in the Reservoir shall be calculated if previous data is available.
- ix) Gross and Live storage capacity of the Reservoir at every 10 m interval shall be provided.
- x) Cross Sections showing the bed profile at 100 m interval shall be prepared.
- xi) L-Section of the Reservoir may be prepared with lowest bed level at every survey line.

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2 SALIENT FEATURES OF DHAROI RESERVOIR

DHAROI RESERVOIR PROJECT		
I	LOCATION	
	Coordinates	Latitude 24°00'00" N Longitude 72°52'00" E
	River	Sabarmati
	Village	Dharoi
	Taluka	Satlasana
	District	Mehsana
	State	Gujarat
	Nearest Railway Station	Taranga Railway Station
	Purpose	Irrigation & Water Supply
II	HYDROLOGY	
	Catchment Area	5540 Sq. Km
	Mean Annual Rainfall	633 mm
III	DAM	
	Dam Type	Earthen & Masonary
	Length of the top of the dam	1207 m
IV	RESERVOIR	
	MDDL	175.88 m
	FRL	189.59 m
	HFL/MWL	192.24 m
	Gross Storage Capacity	907.88 M Cu. m
	Dead Storage Capacity	131.99 M Cu. m
	Live Storage Capacity	775.89 M Cu. m
	Area at FRL	107.45 Sq. km
V	SPILLWAY	
	Type	Ogee
	Length of Spillway	219.46 m
	Maximum Discharge	21662 m ³ /s
	Type, Nos. and Size of Gates	Radial , 12, (14.95 m x 10.67m)
VI	POWER PLANT	
	Type	Hydro power
	Hydraulic Head	31.7 m
	Maximum discharge	31 m ³ /s
	Capacity	1.4 MW
VII	CANAL	
	Length of canal	44 km (Right), 29.52km (Left)
	Capacity	20 m ³ /s (Right), 5 m ³ /s (Left)
	Gross command area	81754 ha (Right), 15670 ha (Left)
	Culturable command area	70454 ha (Right), 12145 ha (Left)

Table 2-1 SALIENT FEATURES OF RESERVOIR

3 EXECUTIVE SUMMARY OF RESULTS

GMPL had mobilised their survey team, equipment and Survey Boats “Aqua Marina 1 & 2” which were deployed in the Dharoi Reservoir survey area from 3 Jan to 9 Feb 2021 to acquire bathymetric survey data and Topographic data as per mutually agreed scope and relevant survey specifications.

TRIMBLE DGPS system, Odom Hydrotrac / Sonarmite Echo sounder (215 kHz) were utilised to acquire the bathymetric data within the Dharoi Reservoir area. A value of 1500 m/s was used as the average velocity of sound in water, which was applied in the setup during acquisition. The data so obtained was then processed and contouring was done using Hypack software. Pentax RTK /Geomax Auto level and Tripod were used for topographic survey in the area.

Topographic and bathymetric data was reduced to Mean Sea Level (MSL). All the data is plotted on scale of 1:5000 for Dharoi reservoir area.

Four (4) hours of DGPS observation was carried out at Bench Mark location (OBS DHAROI), which was on the top of Dam. Nine (9) Temporary Bench Marks were established to cover whole reservoir area.

The values depicted in the charts are the elevation with respect to MSL.

- The Minimum elevation within Dharoi reservoir is 162.83 m above MSL and
- The Maximum depth within Dharoi reservoir is 24.1 m.
- Area covered by bathymetric survey is 86 Sq. Km.
- Area covered by topographic survey is 37.81 Sq. Km.

According to recent survey, total area of reservoir at FRL 189.59 m is 105.071 Sq. Km, corresponding storage capacity is 819.513 M Cu. m, and Dead storage at 175.88 m is 74.020 M Cu. m.

The comparison between 1976 and 2021(45 years) data results in a rate of siltation (silt index) of 3.545 Ham/100 Sq. Km/year. Annual percentage loss of gross storage capacity, live storage capacity and dead storage capacity is 0.216%, 0.087% and 0.976 % respectively for FRL 189.59 m.

The comparison of 2006 and 2021 data with respect to 1976 impounding data at FRL 189.59 m results in silt index of 5.517 Ham/100 Sq. Km/year and 3.545 Ham/100 Sq. Km/year respectively.

4 RESOURCES FOR SURVEY WORK

4.1 Personnel

Following staff were involved during the survey work.

Offshore Survey Personnel	
Name	Function
Amit Singh	Party Chief
Jomon	Surveyor
Abhijith Cherapi	Land Surveyor
Samraj Dwivedi	Survey Engineer
Abhijith KS	Land Surveyor
Shejir	Surveyor
Pruthvi Raj	Surveyor
Ashish Patil	Survey Engineer
Onshore Project Management and Data QC	
Sudhir Walia	Project Manager
KSN Murthy	Survey Manager
Dhaval Patel	Data Processor

Table 4.1-1 LIST OF PERSONNEL

4.2 Details of Equipment used

Following equipment and survey sensors were mobilised for the Topographic and Bathymetric survey data acquisition carried out at Dharoi reservoir. The equipment setup and configuration diagram has been presented in Figure 4.1.

Survey Equipment/Systems Used for the Data Acquisition	
Equipment/System	Description/Make/Model
Software / Navigation	HYPACK Navigation and Data Acquisition Software
Positioning	TRIMBLE DGPS
Single Beam Echo Sounder	Odom Hydrotrac / Sonarmite Echo sounder with Accessories
RTK	Pentax RTK system
Auto Level	Geomax Auto Level & Tripod
Survey Boats	“Aqua Marine 1 & 2” with OBM
Laptop	Dell Laptops
Power Supply	12v Battery & Inverter

Table 4.2-1 LIST OF EQUIPMENT USED FOR SURVEY

4.3 Survey Vessel

Survey Boats ‘Aqua Marine 1 & 2’ was utilised for carrying out the bathymetric survey.

4.3.1 Survey Boat Specifications

Survey Boat ‘Aqua Marine 1 & 2’ Specifications	
Length overall	3.56m
Breadth moulded	1.88m
Draft	0.50m

Table 4.3-1 SURVEY BOAT SPECIFICATIONS - ‘Aqua Marine 1 & 2’

4.3.2 Survey Boat Offset Diagram

The location of the various survey sensors on the survey boat ‘Aqua Marine 1 & 2’ is given in the vessel-offset diagram on the chart accompanying this report.

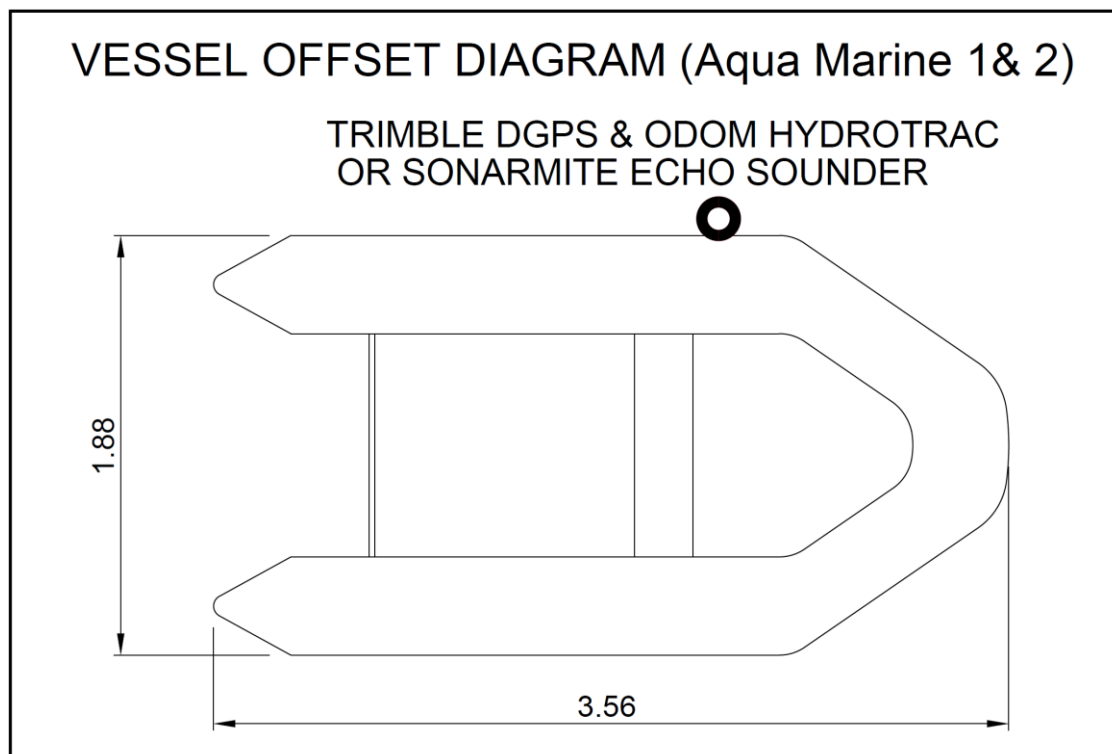


Figure 4.3-1 SURVEY BOAT ‘ AQUA MARINE 1 & 2 ’ OFFSET DIAGRAM

5 DETAILED METHODOLOGY OF SURVEY

5.1 Mobilisation

The bathymetric survey equipment were mobilised on board “Aqua Marine 1 & 2” on 5 Jan 2021. After successful installation, testing and calibrations of survey equipment, the team proceeded for Data acquisition.

Pentax RTK, Geomax auto level, Tripod and necessary supporting equipment/tools were mobilised for Topographic survey.

All survey equipment was installed and configured for bathymetric Survey on board “Aqua Marine 1 & 2” as per figure given below.

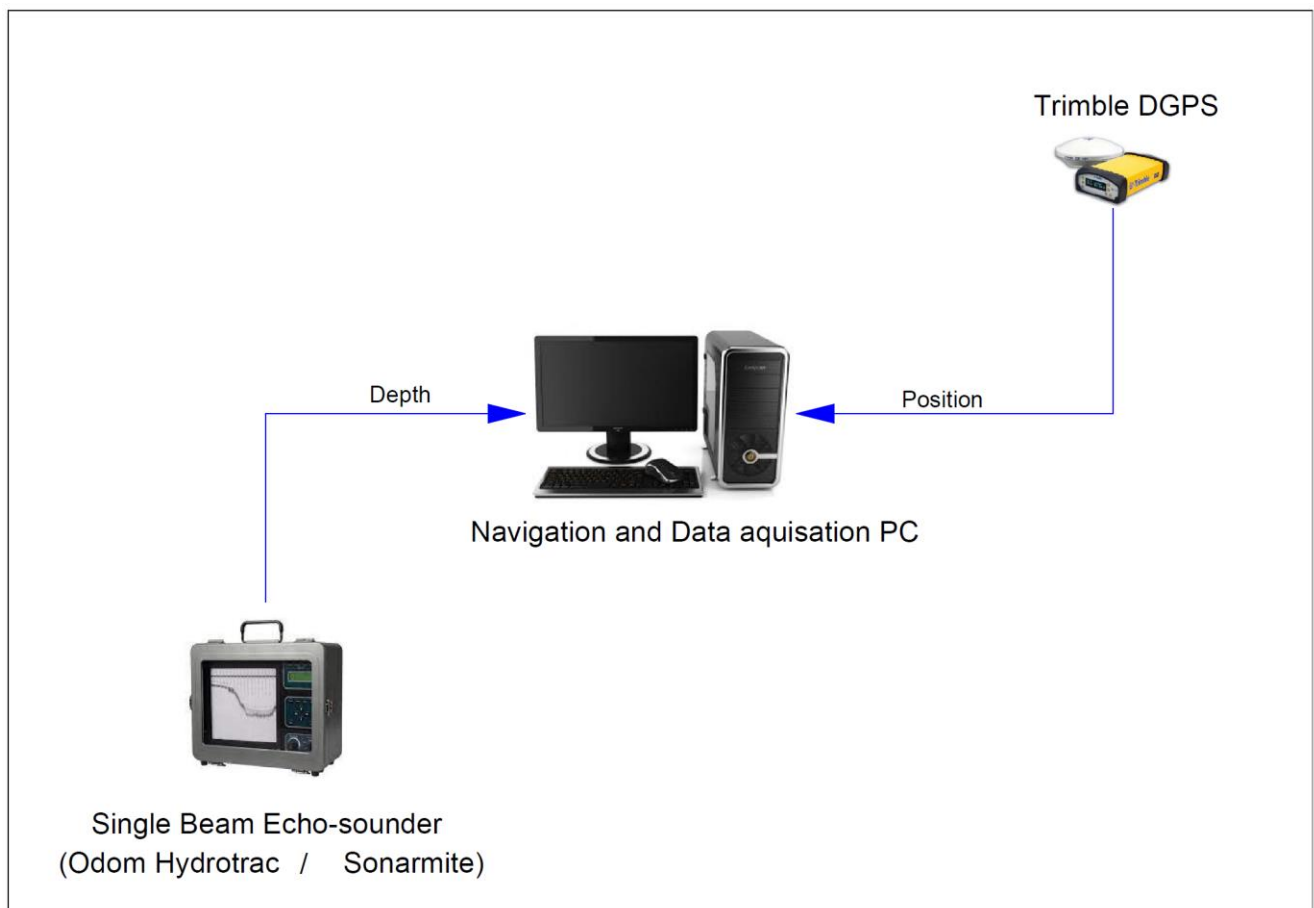


Figure 5.1-1 SBES SURVEY EQUIPMENT CONFIGURATION DIAGRAM ON BOARD

5.2 Geodesy

The survey operations were conducted in WGS 84 spheroid, Universal Transverse Mercator projection system based on following Geodetic parameters:-

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
Semi minor axis:	b = 6 356 752.314 245 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:	$1/f = 298.257\ 223\ 563$
Local Projection and Grid Parameters	
Map Projection:	Universal Transverse Mercator
Grid System:	UTM Zone 43 N
Central Meridian:	075° 00' 00" East
Latitude of Origin:	0° 00' 00" North
False Easting:	500 000 m
False Northing:	0 m

Table 5.2-1 GEODETIC PARAMETERS

5.3 Survey work at Field

5.3.1 Benchmark and Base station setup

The DGPS observation were made for about 4 Hours at Benchmark on Dam top and its details are given below. Nine Temporary Bench Marks were established, details of which are tabulated below:

BM Observation and T.BM. Information _ Dharoi Reservoir South Gujarat					
Location	Latitude (N)	Longitude (E)	Easting (m)	Northing (m)	Elevation (m) W.r.t MSL
BM (OBS DHAROI)	24°00'16.8305"	72°51'7.2016"	281498.070	2656410.878	195.221
T.B.M.01 at Dam Top	24°00'14.9595"	72°51'20.6335"	281876.853	2656347.523	202.111
T.B.M.02 at Pump house near Kuvavad Village	23°59'33.894"	72°57'16.5228"	291917.673	2654934.375	201.253
T.B.M.03 on	23°58'3.1964"	72°55'15.1434"	288445.468	2652194.080	206.570

Kambosani Water tank					
T.B.M.04 near Ambavada Bridge	23°59'23.6962"	72°54'16.8044"	286832.888	2654695.290	212.987
T.B.M.05 on Bridge	24°02'0.257"	73°00'52.5933"	298088.744	2659350.039	193.699
T.B.M.06	23°59'22.577"	72°54'18.6777"	286885.331	2654660.065	196.473
T.B.M.07	24°03'48.1621"	72°55'13.5837"	288558.222	2662808.488	197.156
T.B.M.08 on Thalvada bridge	24°08'0.2043"	72°57'35.3014"	292674.752	2670504.441	203.375
T.B.M.08_1 near Thalvada bridge temple.	24°08'12.5365"	72°52'42"	292869.274	2670881.12	218.268

Table 5.3-1 BENCH MARK DETAILS

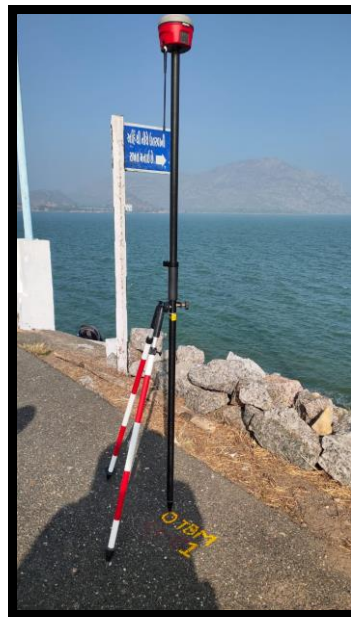


Figure 5.3-1 BASE SET UP AT TBM 1

5.3.2 Topographic and Bathymetric Survey

For topographic survey, Pentax RTK base was used for DGPS observation on OBS DHAROI. Four Hrs. of DGPS observation was carried out. Benchmark Elevation was observed to be 195.221m. RTK DGPS Base station was set up at TBM 1 (202.111 m above MSL) and configured to transmit the correction. Two rovers receiving RTK corrections from the base took spot level from water level to HFL.

For bathymetric survey, Aqua Marine boat was mobilised as shown in Figure 5.1-1. Plan line for survey was prepared parallel to dam axis and at 25 m intervals. Survey boat was run on afore mentioned plan line to acquire position as well as depth.

5.4 Survey Systems

5.4.1 TRIMBLE DGPS:

TRIMBLE DGPS system was used during survey.

- Differential correction signals received on board during survey operations continuously from the Satellite based augmentation system.
- The positioning data as well as heading data received with high reliability and integrity.

TRIMBLE DGPS was the primary positioning system currently used for all the surveys. GMPL has provided, install, operate and maintain a Differential Global Positioning System (DGPS) acceptable to the EIC, which fully covered the site of the works and was constantly in operation during the all the surveys. The age of pseudo- range correctors used in position computation was not exceeded 20 seconds; however, any horizontal positioning interpolation was never exceeded the accuracy. Horizontal Dilution of Precision (HDOP) was monitored, and was never exceeded 2 nominally. Satellite geometry alone is not a sufficient statistic for determining horizontal positioning accuracy. Other variables, including satellite pseudo range residual, were used in conjunction with HDOP to estimate horizontal accuracy. A minimum of four satellites were used to compute all positions, Horizontal and Vertical offsets between the GPS antenna and transducer(s) were observed and applied with a precision better than 0.01m. The system was consisting of master receiving reference station (Base) and DGPS Navigator unit (Rover). The navigator's units (Rover) were installed on Survey launch. The composition was consisting navigational software, track plotters, data storage facilities, echo sounders, sufficient spares to enable uninterrupted operation of the system to the accuracy specified and on-board computers.

5.4.2 Single beam Echo sounder

The single beam echo sounder 'Odom Hydrotrac / Sonarmite' with an accuracy of 0.01m was deployed and in principle, higher frequency of 215 kHz was operated. Echo Sounder equipment was calibrated daily before and after use, by means of a bar-check in the survey area. The calibration results were found satisfactory.

5.4.3 HYPACK Software

HYPACK is a Windows™-based software package used primarily for hydrographic surveying and data processing.

HYPACK performs all of the tasks necessary to complete Single Beam Echo sounder data acquisition /processing from beginning to end. This all-in- one module provides the surveyor with all of the tools needed to design their survey, collect data, process it, reduce it to w.r.t MSL, and generate final

products. Whether collecting hydrographic survey data or environmental data, or positioning a vessel in an engineering project, HYPACK provides the tools needed to complete the job.

This software can be interfaced simultaneously to Echo sounders and attitude sensors.

5.4.4 RTK System

Pentax RTK system consists of one Base and Rover Module was used for Topographic Survey.

- RTK DGPS Base station was set up at the BM (OBS DHAROI), made by GMPL and configured to transmit the corrections.
- Pentax RTK Rover was used for DGPS Observation on the top of Dam. 4Hrs of DGPS observation was carried out. Bench Mark elevation value of 195.221 m was provided by the client.

5.5 Data Acquisition and Quality Control

5.5.1 Online Data Quality Control

The online navigation computer was interfaced to Odom Hydrotrac or Sonarmite Echo Sounder system. Laptop connected to the Navigation network were time synchronized with the GPS (high precision) time signal allowing all data to be precisely time stamped.

Navigation

The DGPS system performed well at all times and the performance of the system was continuously monitored.

Echo Sounder

The digital output from the Odom Hydrotrac or Sonarmite Echo Sounder was satisfactory throughout the duration of the survey. The quality of obtained soundings were verified by running suitable cross lines and depths were found to be matching.

5.5.2 Data Processing

The bathymetric survey data was logged using Hypack on Navigation System. The quality of the bathymetric data acquired in the field was monitored continuously onboard the survey boat. Survey data was processed in office and handed over to the client.

5.6 Quality Assurance and HSE Procedures

GMPL has fully documented and self-audited Quality Assurance and Health, Safety and Environmental System procedures in place. The same were followed during all surveying tasks, which was undertaken by the company and its personnel.

Competent field survey staffs were deployed by GMPL to constantly monitor acquired data quality whilst the survey progressing, and was duly documented.

5.7 Demobilisation

Upon successful completion of topographic and bathymetric survey at Dharoi Reservoir with due consent from Client Representative, the survey equipment on board were demobilised on 9 Feb 2021.

5.8 SURVEY DATA PROCESSING AND INTERPRETATION METHODS

5.8.1 General

The survey data was logged and was processed using the HYPACK Software. Position and depth data were processed and checked to ensure good data quality. The same was used for the automated and manual processing of logged data sets.

5.8.2 Navigation and Positioning

The measured offsets for various survey sensors used during the survey were entered into the navigation system and post processed using Hypack processing to enable track charts to be plotted and the 'corrected' navigation files to be integrated with other sensor data at a later stage.

5.8.3 Bathymetry Data Processing and Analysis

- The SBES bathymetry survey data was logged using HYPACK and further processed.
- Corrected SBES offset position (computed from vessel antenna) was merged into single beam data for true horizontal positioning.
- Velocity value 1500 m/s was used in the survey area.
- SBES data was further corrected for the transducer draft from water level.
- The depth sounding obtained from SBES were reduced to MSL with the help of observed water level in the reservoir.
- The data was filtered, cleaned, and combined to create geographically positioned bathymetric data set that has been corrected for tides and sound speed.
- The water level were observed during the entire period of survey. The details are as follows:-

Date	Time	Water Level (meters)
05/01/2021	1000	187.49
	1800	187.49
06/01/2021	1200	187.42
	1900	187.41
07/01/2021	1300	187.41
	1900	187.40
08/01/2021	1300	187.38
	1900	187.37
09/01/2021	1000	187.33
	1700	187.32
10/01/2021	1000	187.30
	1900	187.29
11/01/2021	0900	187.27
	1800	187.26

Date	Time	Water Level (meters)
12/01/2021	0900	187.25
	1800	187.25
13/01/2021	0900	187.23
	1800	187.22
14/01/2021	1000	187.21
	1900	187.21
15/01/2021	0900	187.19
	1900	187.19
16/01/2021	1000	187.18
	1900	187.18
17/01/2021	0900	187.15
	1900	187.14
18/01/2021	0900	187.13
	1900	187.12
19/01/2021	0900	187.09
	1900	187.09
20/01/2021	1000	187.06
	1900	187.06
21/01/2021	1000	187.03
	2000	187.01
22/01/2021	0900	187.00
	1800	186.99
23/01/2021	0900	186.97
	1900	186.96
24/01/2021	0900	186.92
	1900	186.91
25/01/2021	0900	186.89
	1900	186.88
26/01/2021	1100	186.86
	1900	186.86
27/01/2021	1000	186.84
	1900	186.82
28/01/2021	1000	186.80
	1900	186.78
29/01/2021	1000	186.76
	1900	186.75
30/01/2021	1000	186.72
	1900	186.71
31/01/2021	1000	186.68
	1900	186.66
01/02/2021	0900	186.63
	1900	186.62
02/02/2021	0900	186.59
	1900	186.57
03/02/2021	1000	186.55
	1900	186.53
04/02/2021	0900	186.51
	1900	186.49
05/02/2021	0900	186.47

Date	Time	Water Level (meters)
	1900	186.44
06/02/2021	1200	186.41
	1900	186.40
07/02/2021	1200	186.37
	1900	186.35
08/02/2021	1200	186.32
	1900	186.31
09/02/2021	1200	186.28
	1900	186.26

Table 5.8-1 WATER LEVELS

5.8.4 Topographic Data Processing and Analysis

The topographic survey data was cleaned and converted into xyz format. The converted data was merged with the bathymetric data using TIN module of Hypack software and Gridded data (25 x 25 m) was created. This data was used for volume calculations.

5.8.5 Preparation of Drawings

Seventeen drawings has been prepared for Dharoi Reservoir, the details of which are presented in the table below:

Sr. No	Drawing Name	Description	Hard Copy format	Soft Copy format
1	P-SUR-009-Dharoi-Bathy-01	Bathymetry chart part 01	1:5000	PDF & CAD
2	P-SUR-009-Dharoi-Bathy-02	Bathymetry chart part 02	1:5000	PDF & CAD
3	P-SUR-009-Dharoi-Bathy-03	Bathymetry chart part 03	1:5000	PDF & CAD
4	P-SUR-009-Dharoi-Bathy-04	Bathymetry chart part 04	1:5000	PDF & CAD
5	P-SUR-009-Dharoi-Bathy-05	Bathymetry chart part 05	1:5000	PDF & CAD
6	P-SUR-009-Dharoi-Bathy-06	Bathymetry chart part 06	1:5000	PDF & CAD
7	P-SUR-009-Dharoi-Bathy-07	Bathymetry chart part 07	1:5000	PDF & CAD
8	P-SUR-009-Dharoi-Bathy-08	Bathymetry chart part 08	1:5000	PDF & CAD
9	P-SUR-009-Dharoi-Bathy-09	Bathymetry chart part 09	1:5000	PDF & CAD
10	P-SUR-009-Dharoi-Bathy-10	Bathymetry chart part 10	1:5000	PDF & CAD
11	P-SUR-009-Dharoi-Bathy-11	Bathymetry chart part 11	1:5000	PDF & CAD
12	P-SUR-009-Dharoi-Bathy-12	Bathymetry chart part 12	1:5000	PDF & CAD
13	P-SUR-009-Dharoi-Contour-01	Contour chart	1:25000	PDF & CAD
14	P-SUR-009-Dharoi-Overview-01	Overview Map of Reservoir	Paper size A3	PDF & CAD
15	Area Capacity Curve Dharoi - 2021	Area Capacity curve of Reservoir	Paper size A3	PDF & CAD
16	Dharoi Cross Sections	179 Cross Section at 100 m interval	Only soft copy	CAD
17	Dharoi L-Section	L-Section of Reservoir	Paper size A3	CAD

Table 5.8-2 LIST OF CHARTS

PDF formatted chart has been attached along the report. Native CAD formatted drawing has been provided as softcopy in CD / Hard Disc.

6 DETAILED TOPOGRAPHIC AND BATHYMETRIC SURVEY RESULTS

6.1 General

Kindly refer to drawings in conjunction with the following:

Topographic and bathymetric data was reduced to the water level w.r.t MSL. All the data is plotted on scale of 1:5000 for Dharoi reservoir.

The values depicted in the charts are the depths with respect to MSL.

- The Minimum elevation within Dharoi reservoir is 162.83 m above MSL and
- The Maximum depth within Dharoi reservoir is 24.1 m.

6.2 Capacity and Area Calculation:

Hypack software's TIN (Triangulated Irregular Network) MODEL was used to calculate capacity and area of the reservoir at intervals of 10 cm. In addition, volume was also calculated using prismatic formula as given below:

$$V = h/3 \{A_1 + A_2 + \text{Square Root}(A_1 * A_2)\}$$

where V is volume in M Cu. m between two levels,

h is difference between two level and

A1 & A2 is area in Sq. Km of successive levels

Level (m)	Dead Storage Capacity (M Cu. M)	Live Storage Capacity (M Cu. M)	Gross Storage Capacity using TIN (M Cu. M)	Gross Storage Capacity using Prismatic formula (M Cu. M)	Spread Area (Sq. Km)	Remarks
162.80	0.000	0.000	0.000	0.000	0.000	
162.90	0.000	0.000	0.000	0.000	0.000	
163.00	0.000	0.000	0.000	0.000	0.000	
163.10	0.000	0.000	0.000	0.000	0.000	
163.20	0.000	0.000	0.000	0.000	0.000	
163.30	0.000	0.000	0.000	0.000	0.000	
163.40	0.000	0.000	0.000	0.000	0.000	
163.50	0.000	0.000	0.000	0.000	0.000	
163.60	0.000	0.000	0.000	0.000	0.001	
163.70	0.000	0.000	0.000	0.000	0.001	
163.80	0.000	0.000	0.000	0.000	0.002	
163.90	0.001	0.000	0.001	0.001	0.003	
164.00	0.001	0.000	0.001	0.001	0.004	
164.10	0.001	0.000	0.001	0.001	0.007	
164.20	0.002	0.000	0.002	0.003	0.015	
164.30	0.005	0.000	0.005	0.005	0.029	
164.40	0.008	0.000	0.008	0.009	0.049	
164.50	0.015	0.000	0.015	0.015	0.079	
164.60	0.025	0.000	0.025	0.025	0.123	
164.70	0.039	0.000	0.039	0.040	0.174	
164.80	0.061	0.000	0.061	0.061	0.255	
164.90	0.092	0.000	0.092	0.092	0.372	

Level (m)	Dead Storage Capacity (M Cu. M)	Live Storage Capacity (M Cu. M)	Gross Storage Capacity using TIN (M Cu. M)	Gross Storage Capacity using Prismoidal formula (M Cu. M)	Spread Area (Sq. Km)	Remarks
165.00	0.136	0.000	0.136	0.137	0.526	
165.10	0.198	0.000	0.198	0.198	0.708	
165.20	0.278	0.000	0.278	0.278	0.897	
165.30	0.376	0.000	0.376	0.376	1.062	
165.40	0.490	0.000	0.490	0.490	1.214	
165.50	0.619	0.000	0.619	0.618	1.357	
165.60	0.761	0.000	0.761	0.761	1.486	
165.70	0.915	0.000	0.915	0.914	1.590	
165.80	1.080	0.000	1.080	1.079	1.696	
165.90	1.254	0.000	1.254	1.253	1.797	
166.00	1.439	0.000	1.439	1.438	1.892	
166.10	1.632	0.000	1.632	1.631	1.983	
166.20	1.835	0.000	1.835	1.834	2.076	
166.30	2.048	0.000	2.048	2.047	2.179	
166.40	2.271	0.000	2.271	2.270	2.273	
166.50	2.503	0.000	2.503	2.502	2.364	
166.60	2.744	0.000	2.744	2.742	2.454	
166.70	2.993	0.000	2.993	2.992	2.543	
166.80	3.252	0.000	3.252	3.251	2.634	
166.90	3.520	0.000	3.520	3.519	2.730	
167.00	3.798	0.000	3.798	3.797	2.826	
167.10	4.086	0.000	4.086	4.085	2.928	
167.20	4.384	0.000	4.384	4.383	3.035	
167.30	4.693	0.000	4.693	4.692	3.141	
167.40	5.012	0.000	5.012	5.011	3.252	
167.50	5.343	0.000	5.343	5.342	3.368	
167.60	5.686	0.000	5.686	5.685	3.480	
167.70	6.039	0.000	6.039	6.038	3.584	
167.80	6.403	0.000	6.403	6.402	3.693	
167.90	6.778	0.000	6.778	6.776	3.801	
168.00	7.163	0.000	7.163	7.162	3.905	
168.10	7.559	0.000	7.559	7.557	4.007	
168.20	7.964	0.000	7.964	7.963	4.111	
168.30	8.381	0.000	8.381	8.380	4.220	
168.40	8.808	0.000	8.808	8.807	4.325	
168.50	9.246	0.000	9.246	9.245	4.426	
168.60	9.694	0.000	9.694	9.692	4.531	

Level (m)	Dead Storage Capacity (M Cu. M)	Live Storage Capacity (M Cu. M)	Gross Storage Capacity using TIN (M Cu. M)	Gross Storage Capacity using Prismoidal formula (M Cu. M)	Spread Area (Sq. Km)	Remarks
168.70	10.152	0.000	10.152	10.151	4.636	
168.80	10.621	0.000	10.621	10.620	4.747	
168.90	11.102	0.000	11.102	11.100	4.864	
169.00	11.594	0.000	11.594	11.593	4.985	
169.10	12.099	0.000	12.099	12.097	5.106	
169.20	12.615	0.000	12.615	12.614	5.227	
169.30	13.144	0.000	13.144	13.143	5.351	
169.40	13.685	0.000	13.685	13.684	5.472	
169.50	14.239	0.000	14.239	14.237	5.593	
169.60	14.804	0.000	14.804	14.803	5.715	
169.70	15.381	0.000	15.381	15.380	5.824	
169.80	15.969	0.000	15.969	15.967	5.929	
169.90	16.567	0.000	16.567	16.565	6.030	
170.00	17.175	0.000	17.175	17.173	6.133	
170.10	17.793	0.000	17.793	17.792	6.235	
170.20	18.422	0.000	18.422	18.420	6.330	
170.30	19.060	0.000	19.060	19.058	6.428	
170.40	19.707	0.000	19.707	19.706	6.522	
170.50	20.364	0.000	20.364	20.362	6.615	
170.60	21.030	0.000	21.030	21.028	6.709	
170.70	21.706	0.000	21.706	21.704	6.801	
170.80	22.390	0.000	22.390	22.389	6.893	
170.90	23.084	0.000	23.084	23.083	6.989	
171.00	23.788	0.000	23.788	23.787	7.085	
171.10	24.501	0.000	24.501	24.500	7.181	
171.20	25.225	0.000	25.225	25.223	7.284	
171.30	25.958	0.000	25.958	25.957	7.386	
171.40	26.702	0.000	26.702	26.700	7.485	
171.50	27.455	0.000	27.455	27.454	7.582	
171.60	28.218	0.000	28.218	28.217	7.681	
171.70	28.991	0.000	28.991	28.990	7.784	
171.80	29.775	0.000	29.775	29.773	7.887	
171.90	30.569	0.000	30.569	30.567	7.992	
172.00	31.373	0.000	31.373	31.372	8.097	
172.10	32.188	0.000	32.188	32.187	8.208	
172.20	33.015	0.000	33.015	33.014	8.329	
172.30	33.854	0.000	33.854	33.853	8.454	

Level (m)	Dead Storage Capacity (M Cu. M)	Live Storage Capacity (M Cu. M)	Gross Storage Capacity using TIN (M Cu. M)	Gross Storage Capacity using Prismoidal formula (M Cu. M)	Spread Area (Sq. Km)	Remarks
172.40	34.706	0.000	34.706	34.705	8.585	
172.50	35.572	0.000	35.572	35.570	8.722	
172.60	36.451	0.000	36.451	36.449	8.853	
172.70	37.343	0.000	37.343	37.341	8.986	
172.80	38.248	0.000	38.248	38.246	9.120	
172.90	39.166	0.000	39.166	39.165	9.248	
173.00	40.098	0.000	40.098	40.097	9.386	
173.10	41.044	0.000	41.044	41.042	9.528	
173.20	42.004	0.000	42.004	42.002	9.671	
173.30	42.978	0.000	42.978	42.976	9.813	
173.40	43.966	0.000	43.966	43.965	9.954	
173.50	44.969	0.000	44.969	44.967	10.098	
173.60	45.986	0.000	45.986	45.984	10.245	
173.70	47.018	0.000	47.018	47.016	10.394	
173.80	48.065	0.000	48.065	48.063	10.547	
173.90	49.127	0.000	49.127	49.126	10.705	
174.00	50.206	0.000	50.206	50.205	10.867	
174.10	51.301	0.000	51.301	51.300	11.042	
174.20	52.414	0.000	52.414	52.413	11.221	
174.30	53.546	0.000	53.546	53.544	11.404	
174.40	54.695	0.000	54.695	54.694	11.588	
174.50	55.866	0.000	55.866	55.864	11.807	
174.60	57.056	0.000	57.056	57.054	11.997	
174.70	58.265	0.000	58.265	58.263	12.189	
174.80	59.494	0.000	59.494	59.492	12.388	
174.90	60.743	0.000	60.743	60.740	12.578	
175.00	62.010	0.000	62.010	62.008	12.764	
175.10	63.296	0.000	63.296	63.293	12.952	
175.20	64.600	0.000	64.600	64.598	13.140	
175.30	65.924	0.000	65.924	65.922	13.343	
175.40	67.269	0.000	67.269	67.267	13.557	
175.50	68.635	0.000	68.635	68.633	13.766	
175.60	70.023	0.000	70.023	70.020	13.977	
175.70	71.431	0.000	71.431	71.429	14.186	
175.80	72.860	0.000	72.860	72.858	14.404	
175.88	74.020	0.000	74.020	74.018	14.595	MDDL
175.90	74.020	0.292	74.312	74.310	14.647	

Level (m)	Dead Storage Capacity (M Cu. M)	Live Storage Capacity (M Cu. M)	Gross Storage Capacity using TIN (M Cu. M)	Gross Storage Capacity using Prismoidal formula (M Cu. M)	Spread Area (Sq. Km)	Remarks
176.00	74.020	1.770	75.790	75.789	14.917	
176.10	74.020	3.276	77.296	77.294	15.191	
176.20	74.020	4.809	78.829	78.827	15.468	
176.30	74.020	6.370	80.390	80.388	15.760	
176.40	74.020	7.961	81.981	81.979	16.053	
176.50	74.020	9.581	83.601	83.600	16.362	
176.60	74.020	11.233	85.253	85.252	16.681	
176.70	74.020	12.917	86.937	86.935	16.980	
176.80	74.020	14.629	88.649	88.648	17.277	
176.90	74.020	16.372	90.392	90.390	17.576	
177.00	74.020	18.145	92.165	92.164	17.890	
177.10	74.020	19.950	93.970	93.968	18.206	
177.20	74.020	21.787	95.807	95.805	18.539	
177.30	74.020	23.657	97.677	97.676	18.867	
177.40	74.020	25.561	99.581	99.580	19.227	
177.50	74.020	27.504	101.524	101.522	19.610	
177.60	74.020	29.483	103.503	103.502	19.982	
177.70	74.020	31.500	105.520	105.519	20.364	
177.80	74.020	33.557	107.577	107.577	20.788	
177.90	74.020	35.658	109.678	109.677	21.219	
178.00	74.020	37.801	111.821	111.821	21.664	
178.10	74.020	39.990	114.010	114.009	22.102	
178.20	74.020	42.222	116.242	116.241	22.542	
178.30	74.020	44.499	118.519	118.519	23.006	
178.40	74.020	46.823	120.843	120.843	23.476	
178.50	74.020	49.195	123.215	123.214	23.957	
178.60	74.020	51.616	125.636	125.636	24.463	
178.70	74.020	54.086	128.106	128.106	24.939	
178.80	74.020	56.604	130.624	130.624	25.435	
178.90	74.020	59.173	133.193	133.193	25.939	
179.00	74.020	61.792	135.812	135.812	26.432	
179.10	74.020	64.460	138.480	138.480	26.934	
179.20	74.020	67.178	141.198	141.198	27.433	
179.30	74.020	69.948	143.968	143.968	27.954	
179.40	74.020	72.769	146.789	146.790	28.488	
179.50	74.020	75.645	149.665	149.665	29.012	
179.60	74.020	78.571	152.591	152.591	29.512	

Level (m)	Dead Storage Capacity (M Cu. M)	Live Storage Capacity (M Cu. M)	Gross Storage Capacity using TIN (M Cu. M)	Gross Storage Capacity using Prismoidal formula (M Cu. M)	Spread Area (Sq. Km)	Remarks
179.70	74.020	81.547	155.567	155.567	30.012	
179.80	74.020	84.573	158.593	158.593	30.516	
179.90	74.020	87.652	161.672	161.672	31.058	
180.00	74.020	90.785	164.805	164.806	31.623	
180.10	74.020	93.975	167.995	167.996	32.176	
180.20	74.020	97.219	171.239	171.240	32.702	
180.30	74.020	100.516	174.536	174.536	33.229	
180.40	74.020	103.866	177.886	177.886	33.776	
180.50	74.020	107.270	181.290	181.290	34.300	
180.60	74.020	110.726	184.746	184.747	34.841	
180.70	74.020	114.239	188.259	188.260	35.410	
180.80	74.020	117.809	191.829	191.830	36.002	
180.90	74.020	121.439	195.459	195.461	36.608	
181.00	74.020	125.130	199.150	199.151	37.202	
181.10	74.020	128.880	202.900	202.901	37.797	
181.20	74.020	132.690	206.710	206.711	38.399	
181.30	74.020	136.560	210.580	210.581	39.010	
181.40	74.020	140.492	214.512	214.514	39.644	
181.50	74.020	144.489	218.509	218.510	40.286	
181.60	74.020	148.550	222.570	222.571	40.933	
181.70	74.020	152.675	226.695	226.696	41.568	
181.80	74.020	156.864	230.884	230.886	42.217	
181.90	74.020	161.120	235.140	235.142	42.906	
182.00	74.020	165.445	239.465	239.467	43.602	
182.10	74.020	169.841	243.861	243.862	44.306	
182.20	74.020	174.307	248.327	248.329	45.018	
182.30	74.020	178.846	252.866	252.868	45.769	
182.40	74.020	183.460	257.480	257.481	46.493	
182.50	74.020	188.146	262.166	262.167	47.229	
182.60	74.020	192.909	266.929	266.931	48.044	
182.70	74.020	197.755	271.775	271.776	48.872	
182.80	74.020	202.683	276.703	276.704	49.689	
182.90	74.020	207.693	281.713	281.714	50.522	
183.00	74.020	212.792	286.812	286.814	51.469	
183.10	74.020	217.983	292.003	292.005	52.345	
183.20	74.020	223.262	297.282	297.284	53.251	
183.30	74.020	228.633	302.653	302.655	54.159	

Level (m)	Dead Storage Capacity (M Cu. M)	Live Storage Capacity (M Cu. M)	Gross Storage Capacity using TIN (M Cu. M)	Gross Storage Capacity using Prismoidal formula (M Cu. M)	Spread Area (Sq. Km)	Remarks
183.40	74.020	234.096	308.116	308.118	55.102	
183.50	74.020	239.656	313.676	313.678	56.102	
183.60	74.020	245.316	319.336	319.339	57.123	
183.70	74.020	251.082	325.102	325.105	58.198	
183.80	74.020	256.957	330.977	330.980	59.309	
183.90	74.020	262.943	336.963	336.966	60.427	
184.00	74.020	269.044	343.064	343.066	61.569	
184.10	74.020	275.255	349.275	349.277	62.663	
184.20	74.020	281.576	355.596	355.598	63.750	
184.30	74.020	288.007	362.027	362.030	64.886	
184.40	74.020	294.553	368.573	368.575	66.034	
184.50	74.020	301.212	375.232	375.234	67.137	
184.60	74.020	307.982	382.002	382.004	68.261	
184.70	74.020	314.864	388.884	388.885	69.361	
184.80	74.020	321.853	395.873	395.875	70.438	
184.90	74.020	328.956	402.976	402.977	71.597	
185.00	74.020	336.168	410.188	410.189	72.645	
185.10	74.020	343.482	417.502	417.503	73.629	
185.20	74.020	350.891	424.911	424.911	74.528	
185.30	74.020	358.386	432.406	432.404	75.342	
185.40	74.020	365.958	439.978	439.976	76.102	
185.50	74.020	373.604	447.624	447.622	76.820	
185.60	74.020	381.320	455.340	455.338	77.494	
185.70	74.020	389.103	463.123	463.121	78.158	
185.80	74.020	396.954	470.974	470.974	78.903	
185.90	74.020	404.879	478.899	478.899	79.595	
186.00	74.020	412.871	486.891	486.890	80.227	
186.10	74.020	420.924	494.944	494.943	80.840	
186.20	74.020	429.039	503.059	503.058	81.451	
186.30	74.020	437.215	511.235	511.234	82.066	
186.40	74.020	445.452	519.472	519.471	82.682	
186.50	74.020	453.751	527.771	527.770	83.304	
186.60	74.020	462.113	536.133	536.133	83.946	
186.70	74.020	470.542	544.562	544.561	84.629	
186.80	74.020	479.045	553.065	553.064	85.423	
186.90	74.020	487.621	561.641	561.640	86.099	
187.00	74.020	496.264	570.284	570.282	86.745	

Level (m)	Dead Storage Capacity (M Cu. M)	Live Storage Capacity (M Cu. M)	Gross Storage Capacity using TIN (M Cu. M)	Gross Storage Capacity using Prismoidal formula (M Cu. M)	Spread Area (Sq. Km)	Remarks
187.10	74.020	504.970	578.990	578.989	87.385	
187.20	74.020	513.741	587.761	587.760	88.041	
187.30	74.020	522.583	596.603	596.604	88.844	
187.40	74.020	531.514	605.534	605.534	89.749	
187.50	74.020	540.524	614.544	614.545	90.463	
187.60	74.020	549.606	623.626	623.627	91.185	
187.70	74.020	558.764	632.784	632.786	92.003	
187.80	74.020	568.004	642.024	642.026	92.790	
187.90	74.020	577.320	651.340	651.342	93.529	
188.00	74.020	586.709	660.729	660.731	94.248	
188.10	74.020	596.170	670.190	670.191	94.954	
188.20	74.020	605.700	679.720	679.721	95.655	
188.30	74.020	615.300	689.320	689.322	96.352	
188.40	74.020	624.971	698.991	698.992	97.057	
188.50	74.020	634.713	708.733	708.734	97.782	
188.60	74.020	644.528	718.548	718.550	98.538	
188.70	74.020	654.424	728.444	728.445	99.366	
188.80	74.020	664.397	738.417	738.418	100.089	
188.90	74.020	674.441	748.461	748.461	100.778	
189.00	74.020	684.552	758.572	758.573	101.454	
189.10	74.020	694.731	768.751	768.751	102.108	
189.20	74.020	704.973	778.993	778.993	102.733	
189.30	74.020	715.276	789.296	789.296	103.335	
189.40	74.020	725.640	799.660	799.659	103.929	
189.50	74.020	736.062	810.082	810.082	104.519	
189.59	74.020	745.493	819.513	819.513	105.071	FRL
189.60	74.020	746.544	820.564	820.564	105.142	
189.70	74.020	757.090	831.110	831.110	105.775	
189.80	74.020	767.700	841.720	841.721	106.441	
189.90	74.020	778.380	852.400	852.401	107.169	
190.00	74.020	789.134	863.154	863.156	107.917	
190.10	74.020	799.965	873.985	873.986	108.701	
190.20	74.020	810.875	884.895	884.897	109.503	
190.30	74.020	821.866	895.886	895.887	110.304	
190.40	74.020	832.936	906.956	906.957	111.108	
190.50	74.020	844.088	918.108	918.110	111.936	
190.60	74.020	855.328	929.348	929.350	112.855	

Level (m)	Dead Storage Capacity (M Cu. M)	Live Storage Capacity (M Cu. M)	Gross Storage Capacity using TIN (M Cu. M)	Gross Storage Capacity using Prismoidal formula (M Cu. M)	Spread Area (Sq. Km)	Remarks
190.70	74.020	866.653	940.673	940.674	113.631	
190.80	74.020	878.054	952.074	952.074	114.378	
190.90	74.020	889.528	963.548	963.549	115.110	
191.00	74.020	901.075	975.095	975.096	115.830	
191.10	74.020	912.694	986.714	986.714	116.546	
191.20	74.020	924.384	998.404	998.404	117.245	
191.30	74.020	936.143	1010.163	1010.163	117.939	
191.40	74.020	947.971	1021.991	1021.992	118.634	
191.50	74.020	959.872	1033.892	1033.894	119.409	
191.60	74.020	971.849	1045.869	1045.870	120.104	
191.70	74.020	983.890	1057.910	1057.911	120.727	
191.80	74.020	995.993	1070.013	1070.014	121.324	
191.90	74.020	1008.155	1082.175	1082.175	121.905	
192.00	74.020	1020.374	1094.394	1094.394	122.473	
192.10	74.020	1032.649	1106.669	1106.669	123.032	
192.20	74.020	1044.980	1119.000	1119.000	123.587	
192.24	74.020	1049.928	1123.948	1123.948	123.811	HFL

Table 6.2-1 Capacity and Area

6.3 Comparative Statement of Dharoi Reservoir

Elevation	Original Capacity	Original Area	Capacity Year 2006	Area Year 2006	Capacity Year 2021	Area Year 2021	Remark
158.5	0.000	0.000	0.000	0.000	0.000	0.000	
161.54	1.603	1.110	0.000	0.000	0.000	0.000	
162.79	3.577	2.150	0.000	0.000	0.000	0.000	
163.79			0.000	0.000	0.002	0.000	
164.59	8.511	3.640	0.003	0.002	0.118	0.024	
165.59			0.230	0.487	1.475	0.747	
166.11	15.418	5.580	0.606	0.963	1.992	1.652	
166.59			1.243	1.687	2.445	2.719	
167.59			3.501	2.830	3.469	5.651	
167.64	25.903	7.520	3.644	2.882	3.522	5.826	
168.59			6.880	4.001	4.520	9.648	
169.59			11.488	5.145	5.703	14.747	
170.59			17.141	6.159	6.699	20.963	
170.69	54.272	11.030	17.762	6.257	6.792	21.638	
171.59			23.825	7.205	7.671	28.142	
172.59			31.541	8.238	8.841	36.362	
173.59			40.414	9.614	10.230	45.884	
173.74	93.744	15.170	41.876	9.884	10.454	47.435	
174.59			50.944	11.492	11.979	56.936	
175.59			63.546	13.808	13.956	69.883	
175.88	131.990		67.655	14.542	14.595	74.020	MDDL
176.59			78.794	16.854	16.650	85.087	
176.78	148.016	21.850	82.059	17.513	17.218	88.304	
177.59			97.471	20.698	19.944	103.303	
178.59			120.704	25.913	24.415	125.391	
179.59			149.100	30.854	29.461	152.296	
179.83	235.593	35.400	156.645	32.027	30.678	159.511	
180.59			182.522	36.064	34.785	184.398	
181.59			221.362	41.803	40.868	222.161	
182.59			266.733	49.140	47.962	266.449	
182.88	368.807	53.620	281.303	51.362	50.346	280.704	
183.59			319.918	57.271	57.018	318.766	
184.59			381.379	66.063	68.147	381.320	
185.59			451.662	74.085	77.428	454.566	
185.93	569.862	75.870	477.342	76.777	79.789	481.290	
186.59			530.252	84.692	83.880	535.294	
187.59			616.232	90.289	91.111	622.715	
188.59			710.451	97.472	98.460	717.563	
188.98	843.832	101.170	749.276	100.564	101.320	756.545	
189.59	907.880	107.450	813.137	107.713	105.071	819.513	FRL

Table 6.3-1 COMPARATIVE STATEMENT OF DHAROI RESERVOIR

6.4 Gross Storage Capacity in M Cu. m of the Reservoir - Year 2021:

RL in m	0	0.1	0.2	0.3	0.4	0.5	0.59	0.6	0.7	0.8	0.88	0.9
162	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
163	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001
164	0.001	0.001	0.002	0.005	0.008	0.015	0.024	0.025	0.039	0.061	0.085	0.092
165	0.136	0.198	0.278	0.376	0.490	0.619	0.747	0.761	0.915	1.080	1.218	1.254
166	1.439	1.632	1.835	2.048	2.271	2.503	2.719	2.744	2.993	3.252	3.466	3.520
167	3.798	4.086	4.384	4.693	5.012	5.343	5.651	5.686	6.039	6.403	6.702	6.778
168	7.163	7.559	7.964	8.381	8.808	9.246	9.648	9.694	10.152	10.621	11.005	11.102
169	11.594	12.099	12.615	13.144	13.685	14.239	14.747	14.804	15.381	15.969	16.446	16.567
170	17.175	17.793	18.422	19.060	19.707	20.364	20.963	21.030	21.706	22.390	22.945	23.084
171	23.788	24.501	25.225	25.958	26.702	27.455	28.142	28.218	28.991	29.775	30.409	30.569
172	31.373	32.188	33.015	33.854	34.706	35.572	36.362	36.451	37.343	38.248	38.982	39.166
173	40.098	41.044	42.004	42.978	43.966	44.969	45.884	45.986	47.018	48.065	48.914	49.127
174	50.206	51.301	52.414	53.546	54.695	55.866	56.936	57.056	58.265	59.494	60.492	60.743
175	62.010	63.296	64.600	65.924	67.269	68.635	69.883	70.023	71.431	72.860	74.020	74.312
176	75.790	77.296	78.829	80.390	81.981	83.601	85.087	85.253	86.937	88.649	90.041	90.392
177	92.165	93.970	95.807	97.677	99.581	101.524	103.303	103.503	105.520	107.577	109.254	109.678
178	111.821	114.010	116.242	118.519	120.843	123.215	125.391	125.636	128.106	130.624	132.675	133.193
179	135.812	138.480	141.198	143.968	146.789	149.665	152.296	152.591	155.567	158.593	161.052	161.672
180	164.805	167.995	171.239	174.536	177.886	181.290	184.398	184.746	188.259	191.829	194.729	195.459
181	199.150	202.900	206.710	210.580	214.512	218.509	222.161	222.570	226.695	230.884	234.283	235.140
182	239.465	243.861	248.327	252.866	257.480	262.166	266.449	266.929	271.775	276.703	280.704	281.713
183	286.812	292.003	297.282	302.653	308.116	313.676	318.766	319.336	325.102	330.977	335.757	336.963

RL in m	0	0.1	0.2	0.3	0.4	0.5	0.59	0.6	0.7	0.8	0.88	0.9
184	343.064	349.275	355.596	362.027	368.573	375.232	381.320	382.002	388.884	395.873	401.546	402.976
185	410.188	417.502	424.911	432.406	439.978	447.624	454.566	455.340	463.123	470.974	477.309	478.899
186	486.891	494.944	503.059	511.235	519.472	527.771	535.294	536.133	544.562	553.065	559.921	561.641
187	570.284	578.990	587.761	596.603	605.534	614.544	622.715	623.626	632.784	642.024	649.471	651.340
188	660.729	670.190	679.720	689.320	698.991	708.733	717.563	718.548	728.444	738.417	746.446	748.461
189	758.572	768.751	778.993	789.296	799.660	810.082	819.513	820.564	831.110	841.720	850.258	852.400
190	863.154	873.985	884.895	895.886	906.956	918.108	928.220	929.348	940.673	952.074	961.247	963.548
191	975.095	986.714	998.404	1010.163	1021.991	1033.892	1044.668	1045.869	1057.910	1070.013	1079.738	1082.175
192	1094.394	1106.669	1119.000									
192.24	1123.948											

Table 6.4-1 GROSS STORAGE CAPACITY IN M cu. m YEAR -2021

Note: Gross storage capacity for FRL at 189.59 m is 819.513 M Cu. m, dead storage at 175.88 00 m is 74.02 M Cu. m and HFL at 192.24 m is 1123.948 M Cu. m.

6.5 Live Storage Capacity in M Cu. m of the Reservoir - Year 2021:

RL (m)	0	0.1	0.2	0.3	0.4	0.5	0.59	0.6	0.7	0.8	0.88	0.9
175										0.000	0.000	0.292
176	1.770	3.276	4.809	6.370	7.961	9.581	11.067	11.233	12.917	14.629	16.021	16.372
177	18.145	19.950	21.787	23.657	25.561	27.504	29.283	29.483	31.500	33.557	35.234	35.658
178	37.801	39.990	42.222	44.499	46.823	49.195	51.371	51.616	54.086	56.604	58.655	59.173
179	61.792	64.460	67.178	69.948	72.769	75.645	78.276	78.571	81.547	84.573	87.032	87.652
180	90.785	93.975	97.219	100.516	103.866	107.270	110.378	110.726	114.239	117.809	120.709	121.439
181	125.130	128.880	132.690	136.560	140.492	144.489	148.141	148.550	152.675	156.864	160.263	161.120
182	165.445	169.841	174.307	178.846	183.460	188.146	192.429	192.909	197.755	202.683	206.684	207.693
183	212.792	217.983	223.262	228.633	234.096	239.656	244.746	245.316	251.082	256.957	261.737	262.943
184	269.044	275.255	281.576	288.007	294.553	301.212	307.300	307.982	314.864	321.853	327.526	328.956
185	336.168	343.482	350.891	358.386	365.958	373.604	380.546	381.320	389.103	396.954	403.289	404.879
186	412.871	420.924	429.039	437.215	445.452	453.751	461.274	462.113	470.542	479.045	485.901	487.621
187	496.264	504.970	513.741	522.583	531.514	540.524	548.695	549.606	558.764	568.004	575.451	577.320
188	586.709	596.170	605.700	615.300	624.971	634.713	643.543	644.528	654.424	664.397	672.426	674.441
189	684.552	694.731	704.973	715.276	725.640	736.062	745.493	746.544	757.090	767.700	776.238	778.380
190	789.134	799.965	810.875	821.866	832.936	844.088	854.200	855.328	866.653	878.054	887.227	889.528
191	901.075	912.694	924.384	936.143	947.971	959.872	970.648	971.849	983.890	995.993	1005.718	1008.155
192	1020.374	1032.649	1044.980									
192.24	1049.928											

Table 6.5-1 LIVE STORAGE CAPACITY IN M cu. m YEAR -2021

Note: Live storage capacity for FRL at 189.59 m 776.238 M Cu. m and HFL at 192.24 m is 1049.928 M Cu. m.

6.6 Spread Area in Sq.Km of the Reservoir - Year 2021:

RL in m	0	0.1	0.2	0.3	0.4	0.5	0.59	0.6	0.7	0.8	0.88	0.9
162	0	0	0	0	0	0	0	0	0	0	0	0
163	0	0	0	0	0	0	0.001	0.001	0.001	0.002	0.002	0.003
164	0.004	0.007	0.015	0.029	0.049	0.079	0.118	0.123	0.174	0.255	0.344	0.372
165	0.526	0.708	0.897	1.062	1.214	1.357	1.475	1.486	1.590	1.696	1.776	1.797
166	1.892	1.983	2.076	2.179	2.273	2.364	2.445	2.454	2.543	2.634	2.710	2.730
167	2.826	2.928	3.035	3.141	3.252	3.368	3.469	3.480	3.584	3.693	3.780	3.801
168	3.905	4.007	4.111	4.220	4.325	4.426	4.520	4.531	4.636	4.747	4.840	4.864
169	4.985	5.106	5.227	5.351	5.472	5.593	5.703	5.715	5.824	5.929	6.010	6.030
170	6.133	6.235	6.330	6.428	6.522	6.615	6.699	6.709	6.801	6.893	6.970	6.989
171	7.085	7.181	7.284	7.386	7.485	7.582	7.671	7.681	7.784	7.887	7.971	7.992
172	8.097	8.208	8.329	8.454	8.585	8.722	8.841	8.853	8.986	9.120	9.222	9.248
173	9.386	9.528	9.671	9.813	9.954	10.098	10.230	10.245	10.394	10.547	10.674	10.705
174	10.867	11.042	11.221	11.404	11.588	11.807	11.979	11.997	12.189	12.388	12.542	12.578
175	12.764	12.952	13.140	13.343	13.557	13.766	13.956	13.977	14.186	14.404	14.595	14.647
176	14.917	15.191	15.468	15.760	16.053	16.362	16.650	16.681	16.980	17.277	17.515	17.576
177	17.890	18.206	18.539	18.867	19.227	19.610	19.944	19.982	20.364	20.788	21.132	21.219
178	21.664	22.102	22.542	23.006	23.476	23.957	24.415	24.463	24.939	25.435	25.842	25.939
179	26.432	26.934	27.433	27.954	28.488	29.012	29.461	29.512	30.012	30.516	30.948	31.058
180	31.623	32.176	32.702	33.229	33.776	34.300	34.785	34.841	35.410	36.002	36.488	36.608
181	37.202	37.797	38.399	39.010	39.644	40.286	40.868	40.933	41.568	42.217	42.769	42.906
182	43.602	44.306	45.018	45.769	46.493	47.229	47.962	48.044	48.872	49.689	50.346	50.522
183	51.469	52.345	53.251	54.159	55.102	56.102	57.018	57.123	58.198	59.309	60.189	60.427

RL in m	0	0.1	0.2	0.3	0.4	0.5	0.59	0.6	0.7	0.8	0.88	0.9
184	61.569	62.663	63.750	64.886	66.034	67.137	68.147	68.261	69.361	70.438	71.377	71.597
185	72.645	73.629	74.528	75.342	76.102	76.820	77.428	77.494	78.158	78.903	79.464	79.595
186	80.227	80.840	81.451	82.066	82.682	83.304	83.880	83.946	84.629	85.423	85.966	86.099
187	86.745	87.385	88.041	88.844	89.749	90.463	91.111	91.185	92.003	92.790	93.383	93.529
188	94.248	94.954	95.655	96.352	97.057	97.782	98.460	98.538	99.366	100.089	100.641	100.778
189	101.454	102.108	102.733	103.335	103.929	104.519	105.071	105.142	105.775	106.441	107.022	107.169
190	107.917	108.701	109.503	110.304	111.108	111.936	112.773	112.855	113.631	114.378	114.965	115.110
191	115.830	116.546	117.245	117.939	118.634	119.409	120.039	120.104	120.727	121.324	121.790	121.905
192	122.473	123.032	123.587									
192.24	123.811											

Table 6.6-1 SPREAD AREA IN SQ. KM YEAR -2021

Note: Spread Area for FRL at 189.59 m is 105.071 Sq. Km and HFL at 192.24 m is 123.811 Sq. Km.

6.7 Sediment Analysis:

6.7.1 Observed Rate of Sedimentation

The reservoir was impounded during the year 1976. As per survey of the year 1976, total area of reservoir at FRL 189.59m was 107.45 Sq. Km, corresponding storage capacity was 907.88 M Cu. m, and Dead storage at 175.88m was 131.99 M Cu. m.

The reservoir was surveyed by Remote Sensing Technique in the year 2006. As per survey of the year 2006, total area of reservoir at FRL 189.59m was 107.713 Sq. Km, corresponding storage capacity was 813.137 M Cu. m, and Dead storage at 175.88m was 67.655 M Cu. m.

The reservoir was recently surveyed by means of integrated bathymetric and topographic survey in year 2021. As per survey recent survey, total area of reservoir at FRL 189.59 m is 105.07 Sq. Km, corresponding storage capacity is 189.59 M Cu. m and Dead storage at 175.88 m is 74.02 M Cu. m.

The rate of siltation in the reservoir (up to FRL 189.59m) during the last 45 years (1976-2021), was found to be 1.964 M Cu. m / year.

Original Reservoir data:

Year of Impounding : 1976
 Catchment Area : 5540 Sq. Km
 Surface area at 189.59 m : 107.45 Sq. Km
 Live storage at 189.59 m : 775.89 M Cu. m
 Dead storage at 175.88 m : 131.989 M Cu. m
 Gross storage at 189.59 : 907.88 M Cu. m

Rate of Sedimentation (at FRL 189.59) with respect to impounding year 1976													
Sr. No	Year of Survey	Capacity in M Cu. m			Period in years	Silt Deposited in M Cu. m	Silt Rate in M Cu. m/year	Loss in Capacity in M Cu. m and percentage			Silt Index ham/100 Sq. Km/Yr.	Annual % loss	Remarks
		Dead	Live	Gross				Dead	Live	Gross			
1	1976	131.99	775.89	907.88	-	-	-	-	-	-	3.57	-	
2	2006 By Remote Sensing	67.655	745.482	813.137	30	94.743	3.1581	64.335 48.74%	30.408 3.92%	94.743 10.44%	5.517	0.34%	Significant Category
3	2020 by integrated Bathymetric and Topographic survey	74.02	745.493	819.513	45	88.367	1.964	57.97 43.92%	30.397 3.92%	88.367 9.73%	3.545	0.22%	Significant Category

Table 6.7-1 RATE OF SEDIMENTATION

According to IS -12182 (1987)

Annual % loss - Class of Reservoir
 Up to 0.1 - Insignificant
 0.1 to 0.5 - Significant
 Above 0.5 - Serious

Rate of Silt = Loss in Gross Capacity in M Cu. m/No of Years
 Silt Index = (Silt Rate/Catchment area) x 10000
 Annual % Loss = Loss in % of Gross Capacity/No of years

6.8 Conclusion

- By above table we can conclude that the capacity of reservoir is decreased significantly due to deposition of sediments in the reservoir. The annual percentage loss from survey of the year 2006 and 2021 is observed to be 0.34% and 0.216% respectively.
- The decrease in annual percentage loss from 0.34%(2006 survey) to 0.216%(2021 survey) is because at initial stage after dam construction sedimentation takes place at higher rate compare to later on.
- The increase in storage capacity (6.376 M Cu. m increased in gross storage capacity) in 2021 survey data compared to 2006 survey data is due to difference in method used to acquire survey data of the reservoir during 2006 and 2021.
- Remote Sensing method used in previous survey works on estimations of water spread area. In remote sensing method, the difference between water spread area between year of survey and earlier survey year is a real extent of silting at these levels. This change in water spread area at that water level is used to calculate storage capacity. This is the disadvantage of this method as it can only estimate area. In addition, this method is time consuming, as we will have to wait for water level to change from MDDL (lowest water level reservoir has recorded) to FRL. Also data acquired by this method is less reliable as compared to recent survey method.

6.9 Methods for controlling the sedimentation

According to IS-6518:2017 there are several factors involved in controlling sedimentation in reservoirs and they relate to aspects on,

- a) Design of reservoir.
- b) Control of sediment inflow.
- c) Control of sediment deposition.
- d) Removal of sediments.

All these aspects are to be simultaneously taken note of and appropriate measures be adopted.

6.9.1 Design of Reservoirs

The capacity of reservoirs is governed by a number of factors which are covered in IS 5477 (Parts 1 to 4). From the point of view of sediment deposition, the following points may be given due consideration:

- a) The sediment yield which depends on the topographical, geological and geomorphological set up, meteorological factors, land use/land cover, intercepting tanks, etc.;
- b) Sediment delivery characteristics of the channel system;
- c) The efficiency of the reservoir as sediment trap;
- d) The ratio of capacity of reservoir to the inflow;
- e) Configuration of reservoir;
- f) Method of operation of reservoir; and

g) Provisions for silt exclusion.

- The rate of sediment delivery increases with the quantum of discharge.
- The percentage of sediment trapped by a reservoir with a given drainage area increases with the increased capacity. In some cases an increased capacity will however, result in greater loss of water due to evaporation. However, with the progress of sedimentation, there is decrease of storage capacity which in turn lowers the trap efficiency of the reservoir.
- The capacity of the reservoir and the size and characteristics of the reservoir and its drainage area are the most important factors governing the annual rate of accumulation of sediment. Periodical reservoir sedimentation surveys provide guidance on the rate of sedimentation. In the absence of observed data for the reservoir concerned, data from other reservoirs of similar capacity and catchment characteristics may be adopted.
- Sedimentation takes place not only in the dead storage but also in the live storage space in the reservoir. The practice for design of reservoir is to use the observed suspended sediment data available from key hydrological networks and also the data available from hydrographic surveys of other reservoirs in the same region.

This data may be used to simulate sedimentation status over a period of reservoir life as mentioned in IS 12182.

- Raising the Dam at Periodic Intervals:

Engineering economic analysis of some reservoir projects probably would show that it is cheaper to build a substantially lower dam initially, and to raise it at intervals until its ultimate height for the given original capacity so that long useful life may result. Stage-wise construction also provides lower trapping efficiency and less evaporation in the initial stages.

However, this method may not be feasible in all the existing dams. Wherever this method is contemplated, proper consideration should be given on the strength.

6.9.2 Control of Sediment Inflow

There are many methods for controlling sediment inflows and they can be divided as follows:

1. Watershed management/soil conservation measures to check production and transport of sediment in the catchment area

1.1. The engineering methods

1.1.1. Check Dams

- a) They help to arrest degradation of stream bed thereby arresting the slope failure; and
- b) They reduce the velocity of stream flow, thereby causing the deposition of the sediment load.

Check dams become necessary, where the channel gradients are steep and there is a heavy inflow of sediment from the watershed. They are constructed of local material like earth, rock, timber, etc. These are suitable for small catchment varying in size from 40 to 400 hectares. It is necessary to provide small check dams on the subsidiary streams flowing into the main streams

besides the check dams in the main stream. Proper consideration should be given to the number and location of check dams required. It is preferable to minimize the height of the check dams. If the stream has, a very-steep slope, it is desirable to start with a smaller height for the check dams than may ultimately be necessary.

Check dams may generally cost more per unit of storage than the reservoirs they protect. Therefore, it may not always be possible to adopt them as a primary method of sediment control in new reservoirs. However, feasibility of providing check dams at later date should not be overlooked while planning the construction of a new reservoir

1.1.2. Contour Bunding and Trenching

These are important methods of controlling soil erosion on the hills and sloping lands, where gradients of cultivated fields or terraces are flatter, say up to 10 percent. By these methods the hill side is split up into small compartments on which the rain is retained and surface run-off is modified with prevention of soil erosion. In addition to contour bunding, side trenching is also provided as per requirement.

1.1.3. Gully Plugging

This is done by small rock fill dams. These dams will be effective in filling up the gullies with sediment coming from the upstream of the catchment and also prevent further widening of the gully.

1.1.4. Bank Protection

This is achieved by terracing, revetment, retaining walls, gabions and spurs.

1.2. Agronomy

The agronomic measures include establishment of vegetative screen, contour farming, strip cropping and crop rotation.

1.3. Forestry

Forestry measures include forest conservancy, control on grazing, lumbering, operations and forest fires along with management and protection of forest plantations.

2. Preventive measures to check inflow of sediment into the reservoir

2.1. Restricting the waste/sediment entering into the reservoirs due to agricultural and infrastructural activities surrounding the submergence.

2.2. Construction of by-pass channels or conduits.

The various methods in this category require the construction of some type of diversion dam or weir at the head of the reservoir basin, and a canal, tunnel or conduit leading around the reservoir to a point below the dam where the flow may re-enter the main channels. In such cases the flood flows of sediment laden water are by-passed to the downstream of the dam. In some cases where topography permits construction of new off channel reservoirs can be considered. These reservoirs will invariably have a forebay and check dam on the upstream for trapping the sediment. The stored water in the fore bay is led to the reservoir and the sediment

trapped is flushed through by by-pass channel/ conduit/tunnel to the main channel downstream of the dam.

6.9.3 Control of Sediment Deposition

The deposition of sediment in a reservoir may be controlled to a certain extent by designing and operating gates or other outlets in the dam in such a manner as to permit selective withdrawals of water having a higher than average sediment content. The suspended sediment content of the water in reservoirs is higher during and just after flood flow. Thus, more the water wasted at such times, the smaller will be the percentage of the total sediment load to settle into permanent deposits. There are generally three methods:

- **Density current**

Water at various levels of a reservoir often contains radically different concentrations of suspended sediment particularly during and after flood flows. If all wastewater could be withdrawn at those levels where the concentration is highest, a significant amount of sediment might be removed from the reservoir. Because a submerged outlet draws water towards it from all directions, the vertical dimension of the opening should be small with respect to the thickness of the layer and the rate of withdrawal also should be low.

- **Waste-water release**

Controlling the sedimentation by controlling waste- water release is obviously possible only when water can be or should be wasted. This method is applicable only when a reservoir is of such size that a small part of large flood flows will fill it.

In the design of the dam, sediment may be passed through or over it as an effective method of silt control by placing a series of outlets at various elevations. The percentage of total sediment load that might be ejected from the reservoir through proper gate control will differ greatly with different locations. It is probable that as much as 20 percent of the sediment inflow could be passed through many reservoirs by venting through outlets designed and controlled.

- **Scouring Sluicing**

This method is somewhat similar to both the control of waste-water release and the draining and flushing methods

The distinctions amongst them are the following:

- a) The waste-water release method ejects sediment laden flood flows through deep spillway gates or large under-sluices at the rate of discharge that prevents sedimentation.
- b) Drainage and flushing method involves the slow release of stored water from the reservoir through small gates or valves making use of normal or low flow to entrain and carry the sediment, and

- c) Scouring sluicing depends for its efficiency on either the scouring action exerted by the sudden rush of impounded water under a high head through under-sluices or on the scouring action of high flood discharge coming into the reservoir

Scouring sluicing method can be used in the following:

- i. Small power dams that depend to a great extent on pondage but not on storage;
- ii. Small irrigation reservoirs, where only a small fraction of the total annual flow can be stored;
- iii. Any reservoir in narrow channels, gorges, etc, where water wastage can be afforded; and
- iv. When the particular reservoir under treatment is a unit in an interconnected system so that the other reservoirs can supply the water needed.

6.9.4 Removal of Sediment Deposit

The most practical means of maintaining the storage capacity are those designed to prevent accumulation of permanent deposits as the removal operations are extremely expensive, unless the material removed is usable. Therefore, the redemption of lost storage by removal should be adopted as a last resort. The removal of sediment deposit implies in general, that the deposits are sufficiently compacted or consolidated to act as a solid and, therefore, are unable to flow along with the water. The removal of sediment deposits may be accomplished by a variety of mechanical and hydraulic or methods, such as excavation, dredging, siphoning, draining, flushing, flood sluicing, and sluicing aided by such measures as hydraulic or mechanical agitation or blasting of the sediment. The excavated sediments may be suitably disposed off so that, these do not find the way again in the reservoir.

1. Excavation

The method involves draining most of or all the water in the basin and removing the sediment by hand or power operated shovel, dragline scraper or other mechanical means.

The excavation of silt and clay, which constitute most of the material in larger reservoirs, is more difficult than the excavation of sand and gravel. Fine-textured sediment cannot be excavated easily from larger reservoirs unless it is relatively fluid or relatively compact.

2. Dredging

This involves the removal of deposits from the bottom of a reservoir and their conveyance to some other point by mechanical or hydraulic means, while water storage is being maintained.

Dredging practices are grouped as:

- a) Mechanical dredging by bucket, ladder, etc;
- b) Suction dredging with floating pipeline and a pump usually mounted on a barge; and
- c) Siphon dredging with a floating pipe extending over the dam or connected to an opening in the dam and usually with a pump on a barge.

NOTES

- 1) Practicality of the two methods, namely, excavation and dredging, requires to be carefully considered in any particular case.

- 2) Suitable measures to prevent deposition of the dredged silt in the natural channel where it is discharged need to be adopted.

3. Draining and Flushing

The method involves relatively slow release of all stored water in a reservoir through gates or valves located near bottom of the dam and the maintenance thereafter of open outlets for a shorter or longer period during which normal stream flow cuts into or directed against the sediment deposits. Therefore, this method may be adopted in flood control reservoirs.

4. Sluicing with Controlled Water

This method differs from the flood sluicing in that the controlled water supply permits choosing the time of sluicing more advantageously and that the water may be directed more effectively against the sediment deposits. While the flood sluicing depends either on the occurrence of flood or on being able to release rapidly all of a full or nearly full supply of water in the main reservoir is empty. The advantage of this method is that generally more sediment can be removed per unit of water used than in flood scouring or draining and flushing.

5. Sluicing with Hydraulic and Mechanical Agitation

Methods that stir up break up or move deposits of sediment into a stream current flowing through a drained reservoir basin or into a lake current moving through and out of a full reservoir will tend to make the removal of sediment from the reservoir more complete. Wherever draining, flushing or sluicing appear to be warranted, the additional use of hydraulic means for stirring up the sediment deposits, or sloughing them off, into a stream flowing through the reservoir basin should be considered. It has, however, limited application.

6.10 Area – Capacity – Curve of Dharoi Reservoir:

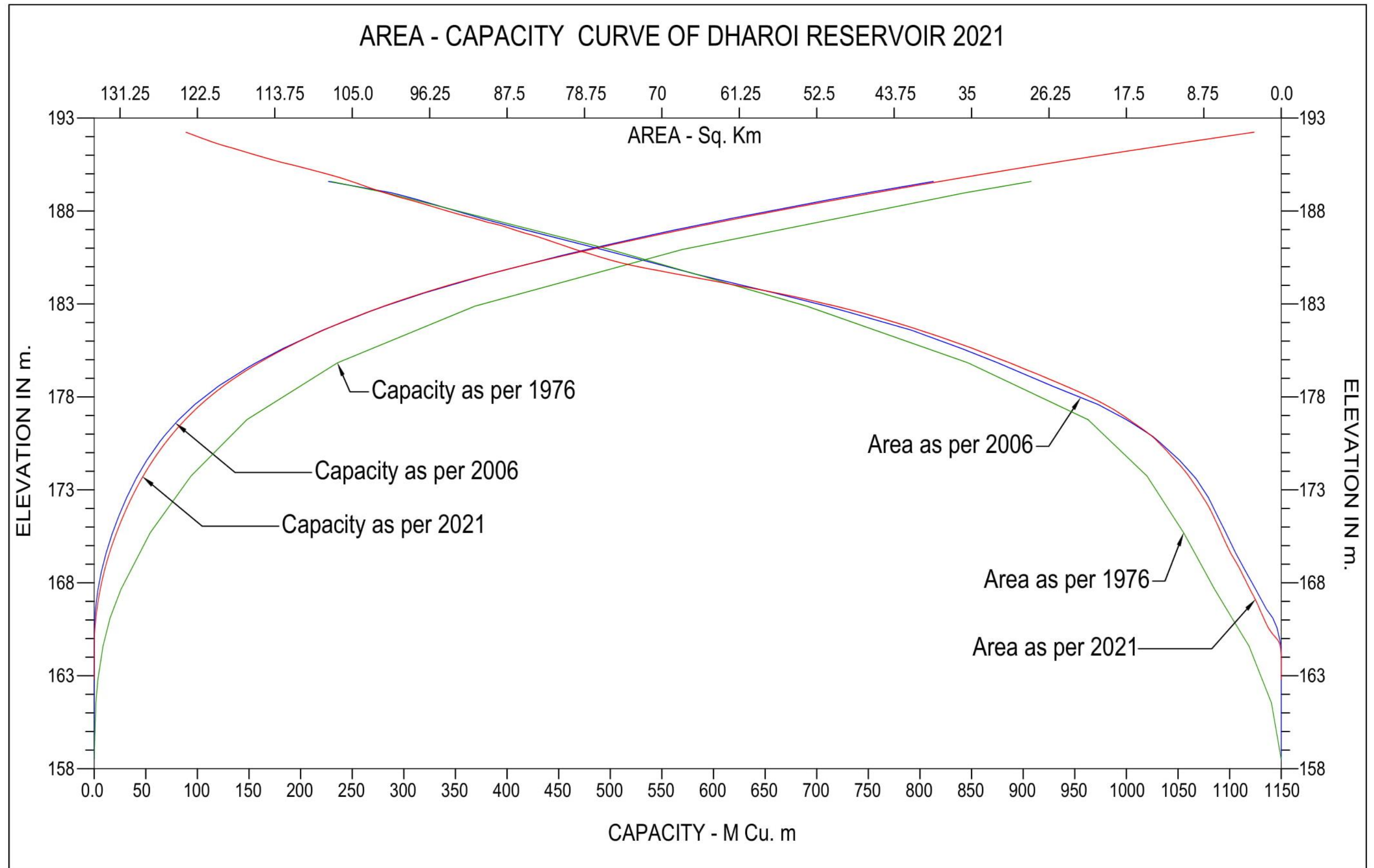


Figure 6.10-1 AREA – CAPACITY - CURVE

6.11 Segment map, Contour map, 3D Image and L-section:

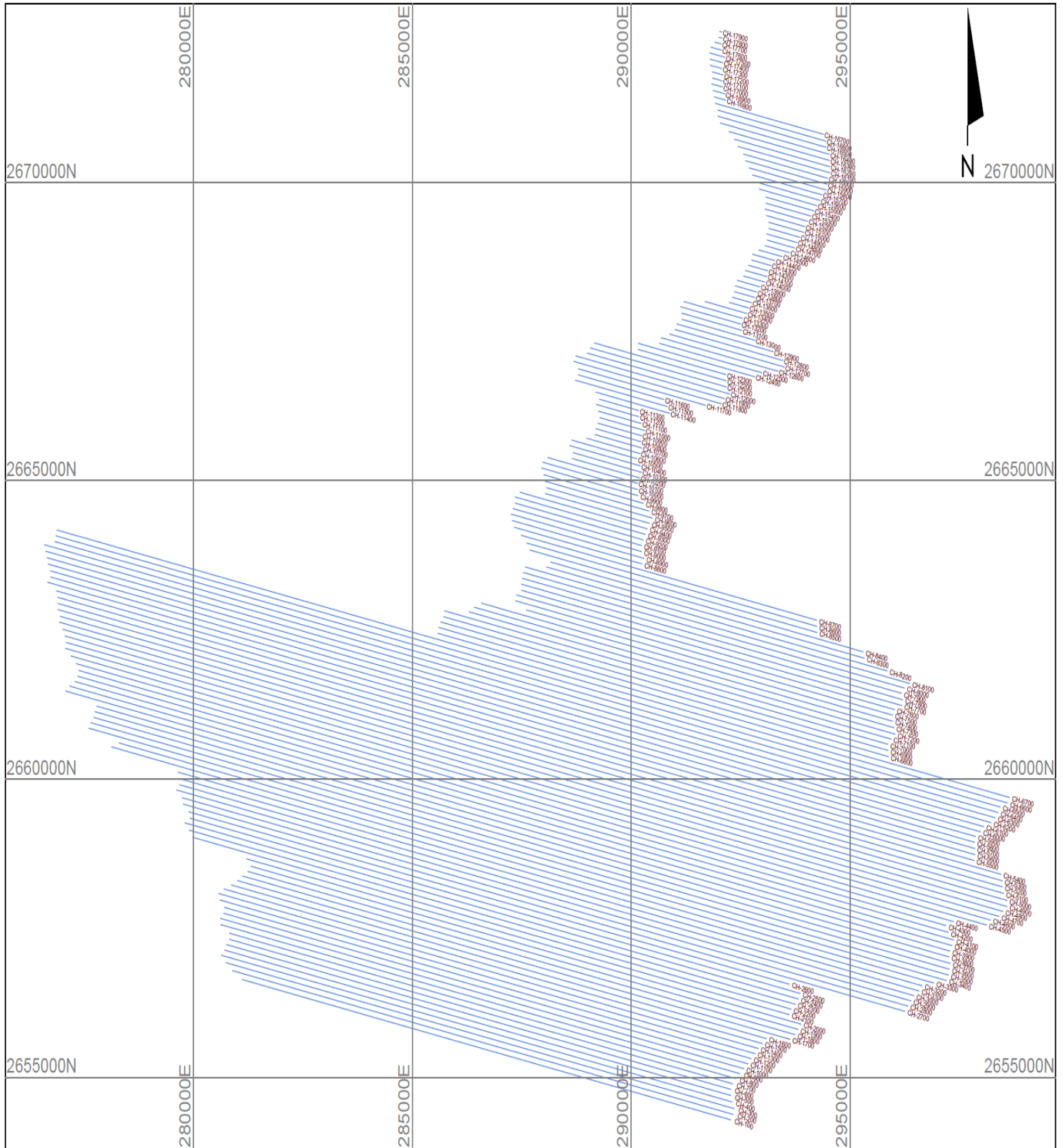


Figure 6.11-1 SEGMENT MAP FOR CROSS SECTION

Cross sections showing bed profile at 100m interval were prepared and are provided as soft copy in CD/Hard Disc. Total 179 cross section profiles were prepared.

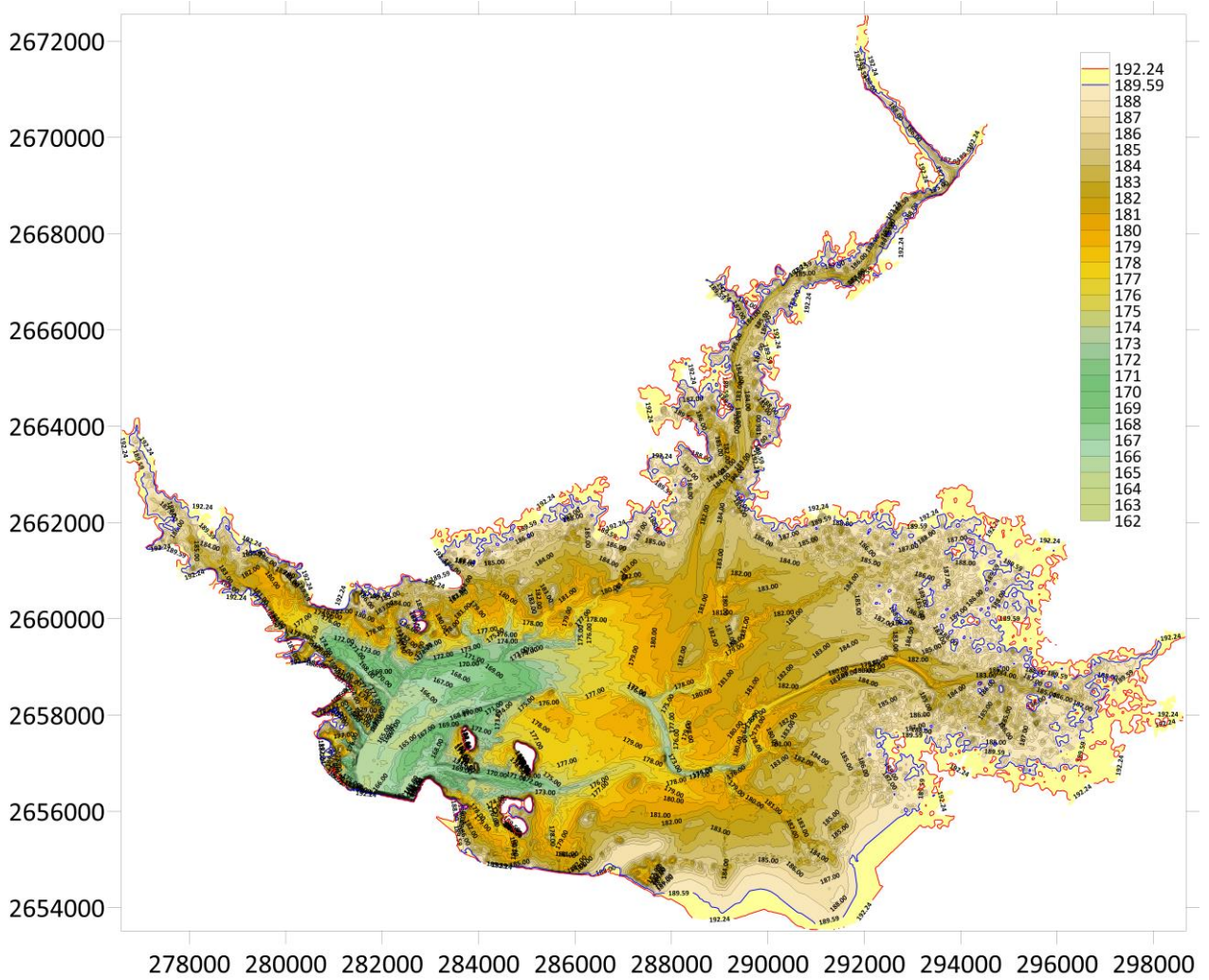


Figure 6.11-2 CONTOUR MAP

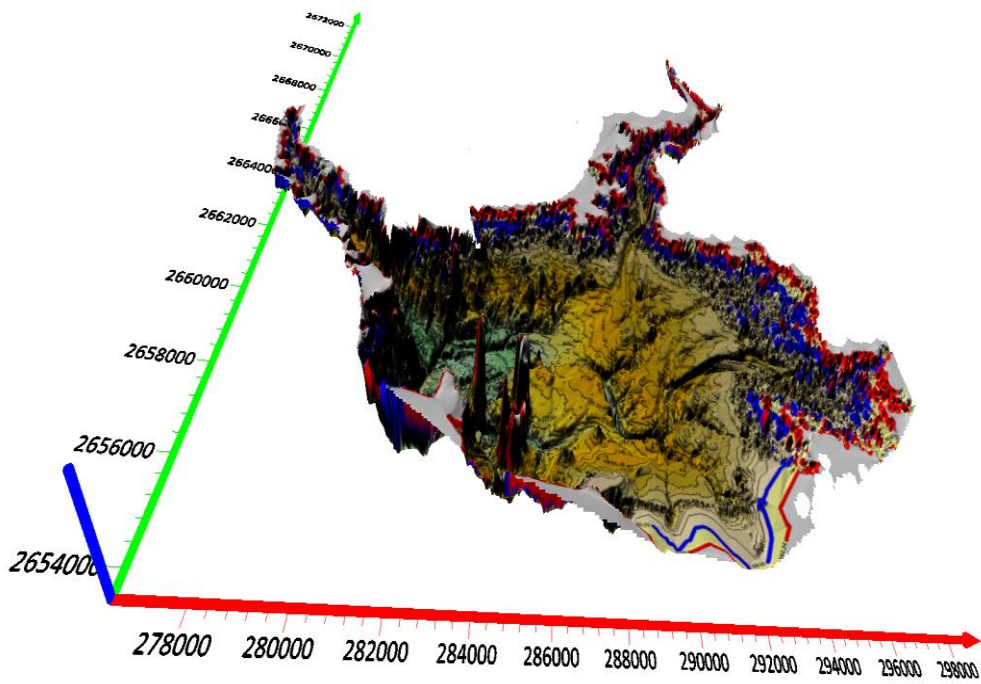


Figure 6.11-3 3D IMAGE

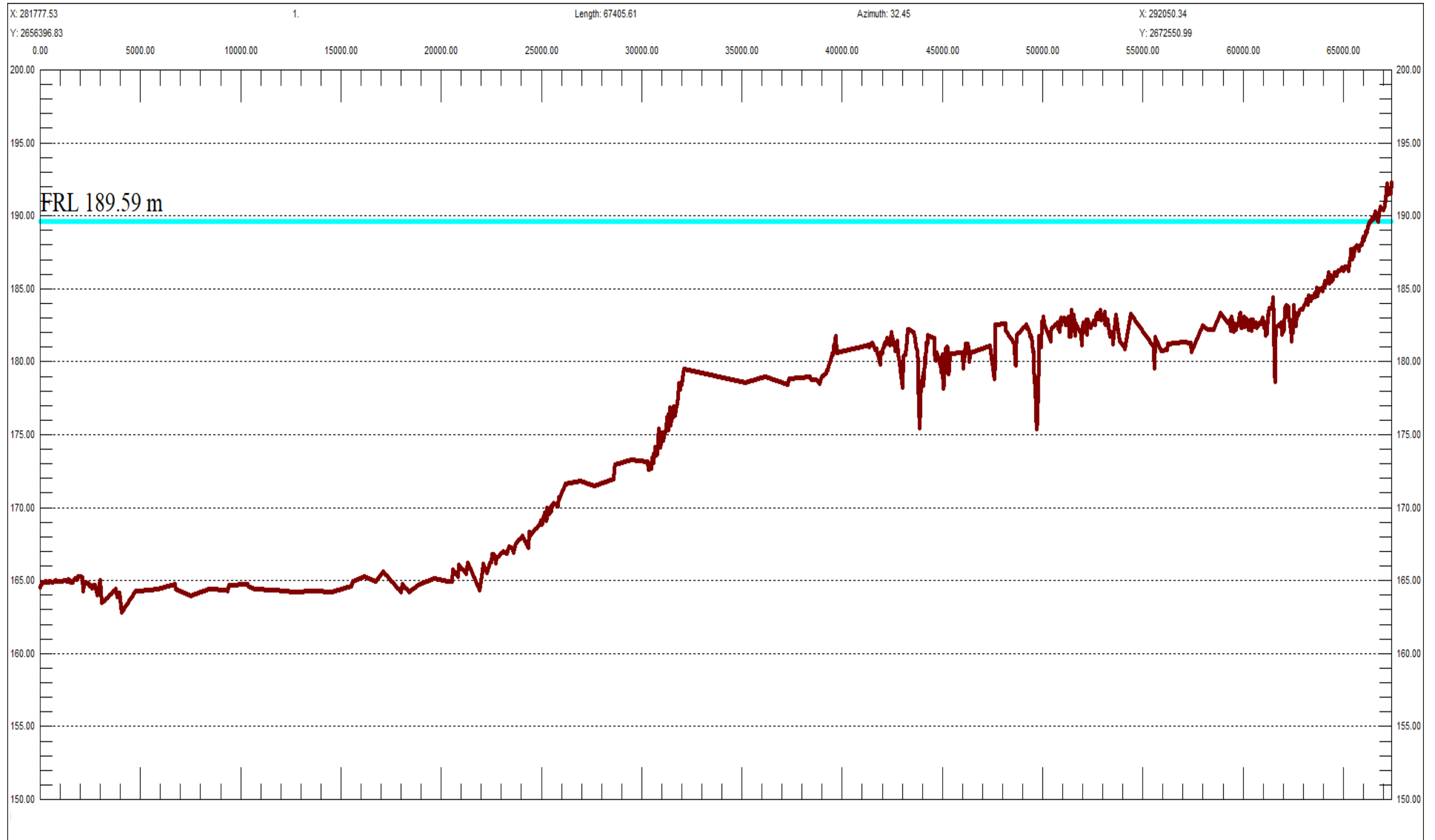


Figure 6.11-4 L-Section

7 DGPS OBSERVATION REPORT



AUSPOS GPS Processing Report

January 5, 2021

This document is a report of the GPS data processing undertaken by the AUSPOS Online GPS Processing Service (version: AUSPOS 2.4) . The AUSPOS Online GPS Processing Service uses International GNSS Service (IGS) products (final, rapid, ultra-rapid depending on availability) to compute precise coordinates in International Terrestrial Reference Frame (ITRF) anywhere on Earth and Geocentric Datum of Australia (GDA) within Australia. The Service is designed to process only dual frequency GPS phase data.

An overview of the GPS processing strategy is included in this report.

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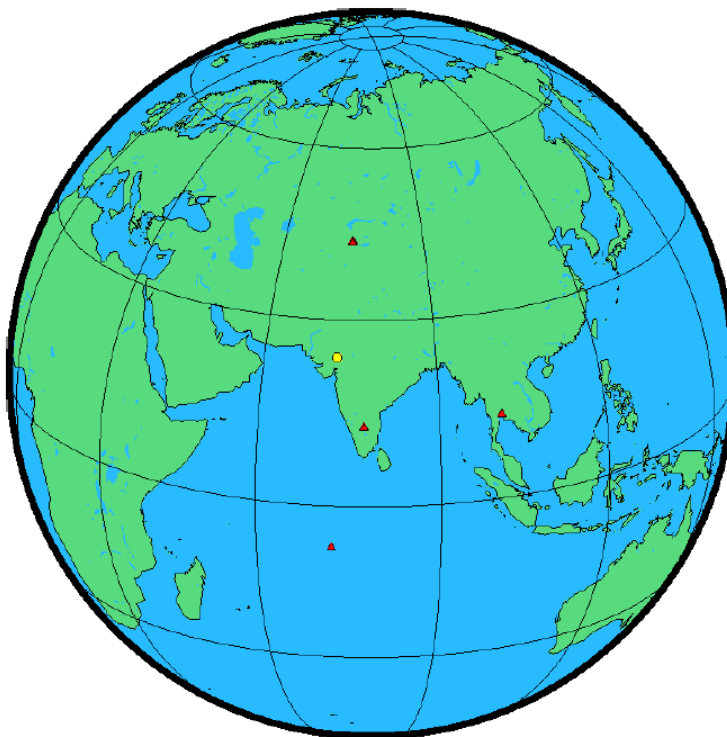


1 User Data

All antenna heights refer to the vertical distance from the Ground Mark to the Antenna Reference Point (ARP).

Station (s)	Submitted File	Antenna Type	Antenna Height (m)	Start Time	End Time
DLOG	DLOG_04012021_182729.210	TIAPENG6 NONE	1.870	2021/01/04 10:28:00	2021/01/04 13:32:00

2 Processing Summary



Date	User Stations	Reference Stations	Orbit Type
2021/01/04 10:28:00	DLOG	CHUM CUSV DGAR IISC POL2	IGS ultra rapid



3 Computed Coordinates, ITRF2014

All coordinates are based on the IGS realisation of the ITRF2014 reference frame. All the given ITRF2014 coordinates refer to a mean epoch of the site observation data. All coordinates refer to the Ground Mark.

3.1 Cartesian, ITRF2014

Station	X (m)	Y (m)	Z (m)	ITRF2014 @
DLOG	1718884.190	5570710.500	2578815.624	04/01/2021
CHUM	1228950.357	4508080.003	4327868.537	04/01/2021
CUSV	-1132915.004	6092528.522	1504633.164	04/01/2021
DGAR	1916268.721	6029977.739	-801719.381	04/01/2021
IISC	1337935.759	6070317.124	1427877.333	04/01/2021
POL2	1239970.928	4530790.164	4302578.877	04/01/2021

3.2 Geodetic, GRS80 Ellipsoid, ITRF2014

Geoid-ellipsoidal separations, in this section, are computed using a spherical harmonic synthesis of the global EGM2008 geoid. More information on the EGM2008 geoid can be found at <http://earth-info.nga.mil/GandG/wgs84/gravitymod/egm2008/>.



Station	Latitude (DMS)	Longitude (DMS)	Ellipsoidal Height(m)	Derived Above Geoid Height(m)
DLOG	24 00 16.83048	72 51 07.20157	145.445	196.822
CHUM	42 59 54.60554	74 45 03.97433	716.337	759.327
CUSV	13 44 09.28935	100 32 02.12529	74.243	105.592
DGAR	-7 16 10.84994	72 22 12.88450	-64.941	8.940
IISC	13 01 16.21555	77 34 13.37590	843.690	929.611
POL2	42 40 47.17463	74 41 39.37363	1714.213	1754.279

3.3 UTM Grid, GRS80 Ellipsoid, ITRF2014

Station	East (m)	North (m)	Zone	Ellipsoidal Height (m)	Derived Above Geoid Height(m)
DLOG	281498.070	2656410.878	43	145.445	196.822
CHUM	479712.398	4760678.446	43	716.337	759.327
CUSV	665854.724	1519047.246	47	74.243	105.592
DGAR	209611.516	9195594.992	43	-64.941	8.940
IISC	778796.699	1440886.653	43	843.690	929.611
POL2	474951.460	4725300.183	43	1714.213	1754.279

8 SINGLE BEAM ECHOSOUNDER BAR CHECK RESULTS

BOAT 1

GEOSERVICES MARITIME PVT. LTD.					
QUALITY MANUAL AND PROCEDURE					
Singlebeam Echosounder Barcheck Correction Table					
Project No.	Project Title: Bathymetric Survey		Vessel: BOAT 1	Place: Dharoi dam	
Date: 5-Jan-21	Time: 10:15				
Observed By: JOMON		Echosounder Model SONARMITE		Area Depth 15.5	
Echosounder Settings					
Draft HI	Index "k" HI	Draft LO	Index "k" LO	Sound Velocity	
0.4				Average	Upto Depth
				1512/1527	
Barcheck Frequency selected		Survey Frequency:		Manufacturer's Accuracy	
210		210/33		0.20 % of Depth	0.03 m
Observations while lowering			Observations while hoisting		
Bar Depth (m)	ES Reading (m)	Difference (m)	Bar Depth (m)	ES Reading (m)	Difference (m)
3	3.01	-0.01	10	10.02	-0.02
4	3.99	0.01	9	9.02	-0.02
5	5.01	-0.01	8	8.02	-0.02
6	5.99	0.01	7	7	0
7	7.01	-0.01	6	6	0
8	8.02	-0.02	5	5.01	-0.01
9	8.99	0.01	4	4	0
10	10.02	-0.02	3	3.01	-0.01
		Average	Average		-0.0083
		-0.0050	Std. Deviation		0.0098
		Std. Dev	Cumulative Average		-0.01
		0.0131	Cumulative Std. Deviation		0.0023
The Echosounder Barcheck Values are Negligible for Application					
					
GMPL Party Chief					

GEO-SERVICES MARITIME PVT. LTD.



QUALITY MANUAL AND PROCEDURE

Singlebeam Echosounder Barcheck Correction Table

Project No.	Project Title: Bathymetric Survey	Vessel: BOAT 1	Place: Dharoi dam
Date: 6-Jan-21	Time: 10:20		
Observed By: JOMON	Echosounder Model SONARMITE	Area Depth 15.5	



Echosounder Settings



Draft HI	Index "k" HI	Draft LO	Index "k" LO	Sound Velocity	
0.4				Average 1512/1527	Upto Depth
Barcheck Frequency selected 210		Survey Frequency: 210/33		Manufacturer's Accuracy 0.20 % of Depth	0.03 m

Observations while lowering			Observations while hoisting		
Bar Depth (m)	ES Reading (m)	Difference (m)	Bar Depth (m)	ES Reading (m)	Difference (m)
3	3	0	10	10.01	-0.01
4	4.01	-0.01	9	8.99	0.01
5	5.02	-0.02	8	8.01	-0.01
6	6.01	-0.01	7	7.02	-0.02
7	7.01	-0.01	6	6.01	-0.01
8	8.01	-0.01	5	4.99	0.01
9	9.01	-0.01	4	4	0
10	9.99	0.01	3	3.01	-0.01
	Average	-0.0075		Average	-0.0033
	Std. Dev	0.0089		Std. Deviation	0.0121
				Cumulative Average	-0.01
				Cumulative Std. Deviation	0.0023

The Echosounder Barcheck Values are Negligible for Application

GMPL Party Chief

GEOservices MARITIME PVT. LTD.					
QUALITY MANUAL AND PROCEDURE					
Singlebeam Echosounder Barcheck Correction Table					
Project No.	Project Title:		Vessel:	Place:	
	Bathymetric Survey		BOAT 1	Dharoi dam	
Date:	Time:				
7-Jan-21	11:30				
Observed By:			Echosounder Model	Area Depth	
JOMON			SONARMITE	15.5	
Echosounder Settings					
Draft HI	Index "k" HI	Draft LO	Index "k" LO	Sound Velocity	
0.4				Average	Upto Depth
				1512/1527	
Barcheck Frequency selected		Survey Frequency:		Manufacturer's Accuracy	
210		210/33		0.20 % of Depth	0.03 m
Observations while lowering			Observations while hoisting		
Bar Depth (m)	ES Reading (m)	Difference (m)	Bar Depth (m)	ES Reading (m)	Difference (m)
3	3.01	-0.01	10	10.01	-0.01
4	4	0	9	8.99	0.01
5	5	0	8	7.98	0.02
6	6.01	-0.01	7	7.02	-0.02
7	7	0	6	6.01	-0.01
8	7.99	0.01	5	5	0
9	8.99	0.01	4	4.01	-0.01
10	10.02	-0.02	3	3.01	-0.01
Average		-0.0025	Average		-0.0017
Std. Dev		0.0104	Std. Deviation		0.0147
Cumulative Average				0.00	
Cumulative Std. Deviation				0.0031	
The Echosounder Barcheck Values are Negligible for Application					
 GMPL Party Chief					

GEOservices MARITIME PVT. LTD.					
QUALITY MANUAL AND PROCEDURE					
Singlebeam Echosounder Barcheck Correction Table					
Project No.	Project Title: Bathymetric Survey		Vessel: BOAT 1	Place: Dharoi dam	
Date: 8-Jan-21	Time: 10:15				
Observed By: JOMON			Echosounder Model SONAR MITE	Area Depth 15.5	
Echosounder Settings					
Draft HI	Index "k" HI	Draft LO	Index "k" LO	Sound Velocity	
0.4				Average 1512/1527	Upto Depth
Barcheck Frequency selected 210		Survey Frequency: 210/33		Manufacturer's Accuracy 0.20 % of Depth 0.03 m	
Observations while lowering			Observations while hoisting		
Bar Depth (m)	ES Reading (m)	Difference (m)	Bar Depth (m)	ES Reading (m)	Difference (m)
3	3	0	10	10.01	-0.01
4	3.98	0.02	9	9.01	-0.01
5	5	0	8	8.02	-0.02
6	6.02	-0.02	7	6.99	0.01
7	6.99	0.01	6	5.99	0.01
8	8	0	5	4.98	0.02
9	8.99	0.01	4	3.99	0.01
10	10.01	-0.01	3	3	0
Average		0.0013	Average		0.0033
Std. Dev		0.0125	Std. Deviation		0.0151
			Cumulative Average		0.00
			Cumulative Std. Deviation		0.0018
The Echosounder Barcheck Values are Negligible for Application					
 GMPL Party Chief					

GEOservices MARITIME PVT. LTD.



QUALITY MANUAL AND PROCEDURE

Singlebeam Echosounder Barcheck Correction Table

Project No.	Project Title: Bathymetric Survey	Vessel: BOAT 1	Place: Dharoi dam
Date: 9-Jan-21	Time: 10:15		
Observed By: JOMON	Echosounder Model SONARMITE	Area Depth 15.5	


Echosounder Settings


Draft HI	Index "k" HI	Draft LO	Index "k" LO	Sound Velocity	
0.4				Average 1512/1527	Upto Depth
Barcheck Frequency selected 210		Survey Frequency: 210/33		Manufacturer's Accuracy 0.20 % of Depth	0.03 m


Observations while lowering			Observations while hoisting		
Bar Depth (m)	ES Reading (m)	Difference (m)	Bar Depth (m)	ES Reading (m)	Difference (m)
3	2.99	0.01	10	10.01	-0.01
4	3.98	0.02	9	9.01	-0.01
5	5.01	-0.01	8	8.02	-0.02
6	6	0	7	6.99	0.01
7	6.99	0.01	6	6.01	-0.01
8	8	0	5	4.98	0.02
9	8.99	0.01	4	4.01	-0.01
10	10.02	-0.02	3	3.01	-0.01
	Average	0.0025		Average	-0.0033
	Std. Dev	0.0128		Std. Deviation	0.0151
				Cumulative Average	0.00
				Cumulative Std. Deviation	0.0016

The Echosounder Barcheck Values are Negligible for Application

GMPL Party Chief

GEOSERVICES MARITIME PVT. LTD.					
QUALITY MANUAL AND PROCEDURE					
Singlebeam Echosounder Barcheck Correction Table					
Project No.	Project Title:	Vessel:	Place:		
	Bathymetric Survey	BOAT 1	Dharoi dam		
Date:	Time:				
10-Jan-21	10:15				
Observed By:	Echosounder Model	Area Depth			
JOMON	SONARMITE	15.5			
Echosounder Settings					
Draft HI	Index "k" HI	Draft LO	Index "k" LO	Sound Velocity	
0.4				Average	Upto Depth
				1512/1527	
Barcheck Frequency selected		Survey Frequency:		Manufacturer's Accuracy	
210		210/33		0.20 % of Depth	0.03 m
Observations while lowering			Observations while hoisting		
Bar Depth (m)	ES Reading (m)	Difference (m)	Bar Depth (m)	ES Reading (m)	Difference (m)
3	3.02	-0.02	10	10.01	-0.01
4	4.01	-0.01	9	9.02	-0.02
5	5	0	8	7.98	0.02
6	6.01	-0.01	7	6.99	0.01
7	7.01	-0.01	6	6.03	-0.03
8	8.01	-0.01	5	5.03	-0.03
9	9.01	-0.01	4	3.98	0.02
10	9.98	0.02	3	3.01	-0.01
Average		-0.0062	Average		-0.0050
Std. Dev		0.0119	Std. Deviation		0.0243
Cumulative Average				-0.01	
Cumulative Std. Deviation				0.0088	
The Echosounder Barcheck Values are Negligible for Application					
<div style="background-color: yellow; width: 200px; height: 15px; margin: 0 auto;"></div> GMPL Party Chief					

GEOSERVICES MARITIME PVT. LTD.					
QUALITY MANUAL AND PROCEDURE					
Singlebeam Echosounder Barcheck Correction Table					
Project No.	Project Title:	Vessel:	Place:		
	Bathymetric Survey	BOAT 1	Dharoi dam		
Date:	Time:				
11-Jan-21	10:15				
Observed By:	Echosounder Model	Area Depth			
JOMON	SONARMITE	15.5			
Echosounder Settings					
Draft HI	Index "k" HI	Draft LO	Index "k" LO	Sound Velocity	
0.4				Average	Upto Depth
				1512/1527	
Barcheck Frequency selected		Survey Frequency:		Manufacturer's Accuracy	
210		210/33		0.20 % of Depth	0.03 m
Observations while lowering			Observations while hoisting		
Bar Depth (m)	ES Reading (m)	Difference (m)	Bar Depth (m)	ES Reading (m)	Difference (m)
3	3	0	10	9.99	0.01
4	4.02	-0.02	9	9.01	-0.01
5	5.01	-0.01	8	8	0
6	5.99	0.01	7	6.98	0.02
7	7.03	-0.03	6	6.01	-0.01
8	7.99	0.01	5	5	0
9	9	0	4	3.98	0.02
10	10.01	-0.01	3	3.02	-0.02
Average		-0.0062	Average		0.0033
Std. Dev		0.0141	Std. Deviation		0.0137
				Cumulative Average	0.00
				Cumulative Std. Deviation	0.0003
The Echosounder Barcheck Values are Negligible for Application					
GMPL Party Chief					

GEO-SERVICES MARITIME PVT. LTD.						
QUALITY MANUAL AND PROCEDURE						
Singlebeam Echosounder Barcheck Correction Table						
Project No.	Project Title:		Vessel:	Place:		
	Bathymetric Survey		BOAT 1	Dharoi dam		
Date:	Time:					
13-Jan-21	10:15					
Observed By:			Echosounder Model	Area Depth		
JOMON			SONARMITE	15.5		
Echosounder Settings						
Draft HI	Index "k" HI	Draft LO	Index "k" LO	Sound Velocity		
0.4				Average	Upto Depth	
				1512/1527		
Barcheck Frequency selected		Survey Frequency:		Manufacturer's Accuracy		
210		210/33		0.20 % of Depth	0.03 m	
Observations while lowering			Observations while hoisting			
Bar Depth (m)	ES Reading (m)	Difference (m)	Bar Depth (m)	ES Reading (m)	Difference (m)	
3	3.01	-0.01	10	10.02	-0.02	
4	4.01	-0.01	9	8.99	0.01	
5	4.99	0.01	8	8.01	-0.01	
6	6.02	-0.02	7	6.99	0.01	
7	7	0	6	5.99	0.01	
8	8.01	-0.01	5	5.01	-0.01	
9	9.01	-0.01	4	4	0	
10	9.99	0.01	3	3.01	-0.01	
	Average	-0.0050		Average	0.0017	
	Std. Dev	0.0107		Std. Deviation	0.0098	
				Cumulative Average	0.00	
				Cumulative Std. Deviation	0.0006	
The Echosounder Barcheck Values are Negligible for Application						
GMPL Party Chief						

GEOSERVICES MARITIME PVT. LTD.



QUALITY MANUAL AND PROCEDURE

Singlebeam Echosounder Barcheck Correction Table

Project No.	Project Title: Bathymetric Survey	Vessel: BOAT 1	Place: Dharoi dam
Date: 14-Jan-21	Time: 10:00		
Observed By: JOMON	Echosounder Model SONARMITE	Area Depth 15.5	

Echosounder Settings

Draft HI	Index "k" HI	Draft LO	Index "k" LO	Sound Velocity	
0.4				Average	Upto Depth
				1512/1527	
Barcheck Frequency selected 210		Survey Frequency: 210/33		Manufacturer's Accuracy 0.20 % of Depth 0.03 m	

Observations while lowering			Observations while hoisting		
Bar Depth (m)	ES Reading (m)	Difference (m)	Bar Depth (m)	ES Reading (m)	Difference (m)
3	3	0	10	10.02	-0.02
4	4	0	9	8.98	0.02
5	5.02	-0.02	8	7.99	0.01
6	6.01	-0.01	7	7.01	-0.01
7	6.99	0.01	6	5.98	0.02
8	8.01	-0.01	5	4.99	0.01
9	9.02	-0.02	4	3.99	0.01
10	10.03	-0.03	3	3.01	-0.01
Average		-0.0100	Average		0.0100
Std. Dev		0.0131	Std. Deviation		0.0110
			Cumulative Average		0.00
			Cumulative Std. Deviation		0.0015

The Echosounder Barcheck Values are Negligible for Application

GMPL Party Chief

GEOSERVICES MARITIME PVT. LTD.



QUALITY MANUAL AND PROCEDURE

Singlebeam Echosounder Barcheck Correction Table

Project No.	Project Title: Bathymetric Survey	Vessel: BOAT 1	Place: Dharoi dam
Date: 15-Jan-21	Time: 11:30		
Observed By: JOMON	Echosounder Model SONARMITE	Area Depth 15.5	



Echosounder Settings


Draft HI	Index "k" HI	Draft LO	Index "k" LO	Sound Velocity	
0.4				Average	Upto Depth
				1512/1527	
Barcheck Frequency selected		Survey Frequency:		Manufacturer's Accuracy	
210		210/33		0.20 % of Depth	0.03 m



Observations while lowering			Observations while hoisting		
Bar Depth (m)	ES Reading (m)	Difference (m)	Bar Depth (m)	ES Reading (m)	Difference (m)
3	3	0	10	10.01	-0.01
4	4	0	9	8.99	0.01
5	4.99	0.01	8	8.02	-0.02
6	6.01	-0.01	7	7.02	-0.02
7	6.99	0.01	6	6.01	-0.01
8	8.01	-0.01	5	5.02	-0.02
9	9.01	-0.01	4	4	0
10	10.02	-0.02	3	3.01	-0.01
	Average	-0.0037		Average	-0.0100
	Std. Dev	0.0106		Std. Deviation	0.0126
				Cumulative Average	-0.01
				Cumulative Std. Deviation	0.0014



The Echosounder Barcheck Values are Negligible for Application



GMPL Party Chief

GEOSERVICES MARITIME PVT. LTD.					
QUALITY MANUAL AND PROCEDURE					
Singlebeam Echosounder Barcheck Correction Table					
Project No.	Project Title:		Vessel:	Place:	
	Bathymetric Survey		BOAT 1	Dharoi dam	
Date:	Time:				
16-Jan-21	10:00				
Observed By:			Echosounder Model	Area Depth	
JOMON			SONAR MITE	15.5	
Echosounder Settings					
Draft HI	Index "k" HI	Draft LO	Index "k" LO	Sound Velocity	
0.4				Average	Upto Depth
				1512/1527	
Barcheck Frequency selected		Survey Frequency:		Manufacturer's Accuracy	
210		210/33		0.20 % of Depth	0.03 m
Observations while lowering			Observations while hoisting		
Bar Depth (m)	ES Reading (m)	Difference (m)	Bar Depth (m)	ES Reading (m)	Difference (m)
3	3.01	-0.01	10	10.01	-0.01
4	4	0	9	8.98	0.02
5	5.02	-0.02	8	8.02	-0.02
6	6.01	-0.01	7	6.98	0.02
7	7.02	-0.02	6	5.99	0.01
8	8.01	-0.01	5	5.01	-0.01
9	9.02	-0.02	4	3.98	0.02
10	10.01	-0.01	3	3	0
Average		-0.0125	Average		0.0067
Std. Dev		0.0071	Std. Deviation		0.0175
Cumulative Average				0.00	
Cumulative Std. Deviation				0.0074	
The Echosounder Barcheck Values are Negligible for Application					
 GMPL Party Chief					

GEOSERVICES MARITIME PVT. LTD.						
QUALITY MANUAL AND PROCEDURE						
Singlebeam Echosounder Barcheck Correction Table						
Project No.		Project Title:		Vessel:		Place:
		Bathymetric Survey		BOAT 1		Dharoi dam
Date:		Time:				
17-Jan-21		10:20				
Observed By:			Echosounder Model		Area Depth	
JOMON			SONARMITE		15.5	
Echosounder Settings						
Draft HI		Index "k" HI		Draft LO		Index "k" LO
0.4						
				Sound Velocity		
				Average		Upto Depth
				1512/1527		
Barcheck Frequency selected			Survey Frequency:		Manufacturer's Accuracy	
210			210/33		0.20 % of Depth 0.03 m	
Observations while lowering			Observations while hoisting			
Bar Depth (m)	ES Reading (m)	Difference (m)	Bar Depth (m)	ES Reading (m)	Difference (m)	
3	3.01	-0.01	10	10.02	-0.02	
4	4.01	-0.01	9	8.99	0.01	
5	5	0	8	7.98	0.02	
6	5.99	0.01	7	7.01	-0.01	
7	7.01	-0.01	6	6.01	-0.01	
8	8.01	-0.01	5	4.99	0.01	
9	9.02	-0.02	4	4.02	-0.02	
10	9.99	0.01	3	3	0	
Average		-0.0050	Average		0.0000	
Std. Dev		0.0107	Std. Deviation		0.0155	
				Cumulative Average		0.00
				Cumulative Std. Deviation		0.0034
The Echosounder Barcheck Values are Negligible for Application						
<div style="background-color: yellow; width: 200px; height: 20px; margin: 0 auto;"></div>						
GMPL Party Chief						

GEOservices MARITIME PVT. LTD.						
QUALITY MANUAL AND PROCEDURE						
Singlebeam Echosounder Barcheck Correction Table						
Project No.	Project Title:		Vessel:	Place:		
	Bathymetric Survey		BOAT 1	Dharoi dam		
Date:	Time:					
18-Jan-21	10:15					
Observed By:			Echosounder Model	Area Depth		
JOMON			SONARMITE	15.5		
Echosounder Settings						
Draft HI	Index "k" HI	Draft LO	Index "k" LO	Sound Velocity		
0.4				Average	Upto Depth	
				1512/1527		
Barcheck Frequency selected		Survey Frequency:		Manufacturer's Accuracy		
210		210/33		0.20 % of Depth	0.03 m	
Observations while lowering			Observations while hoisting			
Bar Depth (m)	ES Reading (m)	Difference (m)	Bar Depth (m)	ES Reading (m)	Difference (m)	
3	2.99	0.01	10	9.98	0.02	
4	4.02	-0.02	9	8.99	0.01	
5	4.99	0.01	8	8.03	-0.03	
6	6.01	-0.01	7	6.97	0.03	
7	7.02	-0.02	6	5.99	0.01	
8	8.01	-0.01	5	4.99	0.01	
9	9.03	-0.03	4	4	0	
10	9.97	0.03	3	3	0	
Average		-0.0050	Average		0.0050	
Std. Dev		0.0200	Std. Deviation		0.0197	
Cumulative Average				0.00		
Cumulative Std. Deviation				0.0002		
The Echosounder Barcheck Values are Negligible for Application						
 GMPL Party Chief						

GEOSERVICES MARITIME PVT. LTD.					
QUALITY MANUAL AND PROCEDURE					
Singlebeam Echosounder Barcheck Correction Table					
Project No.	Project Title:	Vessel:	Place:		
	Bathymetric Survey	BOAT 1	Dharoi dam		
Date:	Time:				
19-Jan-21	10:15				
Observed By:	Echosounder Model	Area Depth			
JOMON	SONARMITE	15.5			
Echosounder Settings					
Draft HI	Index "k" HI	Draft LO	Index "k" LO	Sound Velocity	
0.4				Average	Upto Depth
				1512/1527	
Barcheck Frequency selected		Survey Frequency:		Manufacturer's Accuracy	
210		210/33		0.20 % of Depth	0.03 m
Observations while lowering			Observations while hoisting		
Bar Depth (m)	ES Reading (m)	Difference (m)	Bar Depth (m)	ES Reading (m)	Difference (m)
3	3	0	10	9.99	0.01
4	3.99	0.01	9	9.01	-0.01
5	5.01	-0.01	8	8.03	-0.03
6	5.99	0.01	7	6.99	0.01
7	7.01	-0.01	6	6.01	-0.01
8	8.03	-0.03	5	5.01	-0.01
9	9.01	-0.01	4	3.99	0.01
10	10.01	-0.01	3	3.01	-0.01
Average		-0.0062	Average		-0.0067
Std. Dev		0.0130	Std. Deviation		0.0151
			Cumulative Average		-0.01
			Cumulative Std. Deviation		0.0014
The Echosounder Barcheck Values are Negligible for Application					
 GMPL Party Chief					

GEOSERVICES MARITIME PVT. LTD.						
QUALITY MANUAL AND PROCEDURE						
Singlebeam Echosounder Barcheck Correction Table						
Project No.	Project Title:		Vessel:	Place:		
	Bathymetric Survey		BOAT 1	Dharoi dam		
Date:	Time:					
20-Jan-21	10:15					
Observed By:			Echosounder Model	Area Depth		
JOMON			SONARMITE	15.5		
Echosounder Settings						
Draft HI	Index "k" HI	Draft LO	Index "k" LO	Sound Velocity		
0.4				Average	Upto Depth	
				1512/1527		
Barcheck Frequency selected		Survey Frequency:		Manufacturer's Accuracy		
210		210/33		0.20 % of Depth	0.03 m	
Observations while lowering			Observations while hoisting			
Bar Depth (m)	ES Reading (m)	Difference (m)	Bar Depth (m)	ES Reading (m)	Difference (m)	
3	2.99	0.01	10	10.03	-0.03	
4	4	0	9	9.01	-0.01	
5	5	0	8	8.03	-0.03	
6	5.98	0.02	7	6.98	0.02	
7	7.01	-0.01	6	6.01	-0.01	
8	8.03	-0.03	5	5.01	-0.01	
9	9.02	-0.02	4	3.99	0.01	
10	10.01	-0.01	3	3	0	
Average		-0.0050	Average		-0.0050	
Std. Dev		0.0160	Std. Deviation		0.0176	
Cumulative Average				0.00		
Cumulative Std. Deviation				0.0011		
The Echosounder Barcheck Values are Negligible for Application						
						
GMPL Party Chief						

GEO-SERVICES MARITIME PVT. LTD.



QUALITY MANUAL AND PROCEDURE

Singlebeam Echosounder Barcheck Correction Table

Project No.	Project Title: Bathymetric Survey	Vessel: BOAT 1	Place: Dharoi dam
Date: 21-Jan-21	Time: 11:30		
Observed By: JOMON	Echosounder Model SONARMITE	Area Depth 15.5	


Echosounder Settings


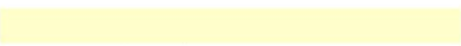
Draft HI	Index "k" HI	Draft LO	Index "k" LO	Sound Velocity	
0.4				Average 1512/1527	Upto Depth
Barcheck Frequency selected 210		Survey Frequency: 210/33		Manufacturer's Accuracy 0.20 % of Depth	0.03 m


Observations while lowering			Observations while hoisting		
Bar Depth (m)	ES Reading (m)	Difference (m)	Bar Depth (m)	ES Reading (m)	Difference (m)
3	3	0	10	9.99	0.01
4	3.99	0.01	9	9.02	-0.02
5	5	0	8	8.02	-0.02
6	6.01	-0.01	7	7.01	-0.01
7	7.01	-0.01	6	6.02	-0.02
8	8.03	-0.03	5	5	0
9	8.98	0.02	4	4.02	-0.02
10	10.02	-0.02	3	2.99	0.01
	Average	-0.0050		Average	-0.0150
	Std. Dev	0.0160		Std. Deviation	0.0084
				Cumulative Average	-0.01
				Cumulative Std. Deviation	0.0054



The Echosounder Barcheck Values are Negligible for Application


GMPL Party Chief

GEOSERVICES MARITIME PVT. LTD.					
QUALITY MANUAL AND PROCEDURE					
Singlebeam Echosounder Barcheck Correction Table					
Project No.	Project Title:		Vessel:	Place:	
	Bathymetric Survey		BOAT 1	Dharoi dam	
Date:	Time:				
22-Jan-21	10:15				
Observed By:			Echosounder Model	Area Depth	
JOMON			SONARMITE	15.5	
Echosounder Settings					
Draft HI	Index "k" HI	Draft LO	Index "k" LO	Sound Velocity	
0.4				Average	Upto Depth
				1512/1527	
Barcheck Frequency selected		Survey Frequency:		Manufacturer's Accuracy	
210		210/33		0.20 % of Depth	0.03 m
Observations while lowering			Observations while hoisting		
Bar Depth (m)	ES Reading (m)	Difference (m)	Bar Depth (m)	ES Reading (m)	Difference (m)
3	3	0	10	10.02	-0.02
4	4.01	-0.01	9	8.97	0.03
5	5.02	-0.02	8	8.02	-0.02
6	6.03	-0.03	7	7.03	-0.03
7	6.98	0.02	6	6.01	-0.01
8	8.01	-0.01	5	5.02	-0.02
9	8.99	0.01	4	4	0
10	9.98	0.02	3	2.99	0.01
Average		-0.0025	Average		-0.0083
Std. Dev		0.0183	Std. Deviation		0.0214
Cumulative Average				-0.01	
Cumulative Std. Deviation				0.0022	
The Echosounder Barcheck Values are Negligible for Application					
<div style="background-color: yellow; width: 200px; height: 20px; margin: 0 auto;"></div> <p>GMPL Party Chief</p>					

GEO-SERVICES MARITIME PVT. LTD.					
QUALITY MANUAL AND PROCEDURE					
Singlebeam Echosounder Barcheck Correction Table					
Project No.	Project Title:		Vessel:	Place:	
	Bathymetric Survey		BOAT 1	Dharoi dam	
Date:	Time:				
23-Jan-21	11:30				
Observed By:			Echosounder Model	Area Depth	
JOMON			SONARMITE	15.5	
Echosounder Settings					
Draft HI	Index "k" HI	Draft LO	Index "k" LO	Sound Velocity	
0.4				Average	Upto Depth
				1512/1527	
Barcheck Frequency selected		Survey Frequency:		Manufacturer's Accuracy	
210		210/33		0.20 % of Depth	0.03 m
Observations while lowering			Observations while hoisting		
Bar Depth (m)	ES Reading (m)	Difference (m)	Bar Depth (m)	ES Reading (m)	Difference (m)
3	3.02	-0.02	10	9.99	0.01
4	4.01	-0.01	9	8.97	0.03
5	5.1	-0.1	8	8.01	-0.01
6	6	0	7	7.03	-0.03
7	7.03	-0.03	6	6.01	-0.01
8	8.01	-0.01	5	4.99	0.01
9	9.03	-0.03	4	4.01	-0.01
10	10.01	-0.01	3	3	0
Average		-0.0262	Average		-0.0033
Std. Dev		0.0316	Std. Deviation		0.0207
Cumulative Average				-0.01	
Cumulative Std. Deviation				0.0077	
The Echosounder Barcheck Values are Negligible for Application					
 GMPL Party Chief					

GEOSERVICES MARITIME PVT. LTD.					
QUALITY MANUAL AND PROCEDURE					
Singlebeam Echosounder Barcheck Correction Table					
Project No.	Project Title:		Vessel:	Place:	
	Bathymetric Survey		BOAT 1	Dharoi dam	
Date:	Time:				
24-Jan-21	11:30				
Observed By:			Echosounder Model	Area Depth	
JOMON			SONARMITE	15.5	
Echosounder Settings					
Draft HI	Index "k" HI	Draft LO	Index "k" LO	Sound Velocity	
0.4				Average	Upto Depth
				1512/1527	
Barcheck Frequency selected		Survey Frequency:		Manufacturer's Accuracy	
210		210/33		0.20 % of Depth	0.03 m
Observations while lowering			Observations while hoisting		
Bar Depth (m)	ES Reading (m)	Difference (m)	Bar Depth (m)	ES Reading (m)	Difference (m)
3	3	0	10	9.98	0.02
4	4.03	-0.03	9	9.04	-0.04
5	4.98	0.02	8	8.01	-0.01
6	5.97	0.03	7	6.98	0.02
7	7.02	-0.02	6	5.99	0.01
8	8.01	-0.01	5	4.99	0.01
9	9.03	-0.03	4	4.01	-0.01
10	9.98	0.02	3	3.01	-0.01
Average		-0.0025	Average		-0.0033
Std. Dev		0.0238	Std. Deviation		0.0216
Cumulative Average				0.00	
Cumulative Std. Deviation				0.0015	
The Echosounder Barcheck Values are Negligible for Application					
<div style="background-color: yellow; height: 20px; width: 250px; margin-bottom: 5px;"></div> GMPL Party Chief					

GEOSERVICES MARITIME PVT. LTD.						
QUALITY MANUAL AND PROCEDURE						
Singlebeam Echosounder Barcheck Correction Table						
Project No.	Project Title:		Vessel:	Place:		
	Bathymetric Survey		BOAT 1	Dharoi dam		
Date:	Time:					
25-Jan-21	11:30					
Observed By:			Echosounder Model	Area Depth		
JOMON			SONARMITE	15.5		
Echosounder Settings						
Draft HI	Index "k" HI	Draft LO	Index "k" LO	Sound Velocity		
0.4				Average	Upto Depth	
				1512/1527		
Barcheck Frequency selected		Survey Frequency:		Manufacturer's Accuracy		
210		210/33		0.20 % of Depth	0.03 m	
Observations while lowering			Observations while hoisting			
Bar Depth (m)	ES Reading (m)	Difference (m)	Bar Depth (m)	ES Reading (m)	Difference (m)	
3	3	0	10	10.01	-0.01	
4	4	0	9	9.02	-0.02	
5	5.01	-0.01	8	8.01	-0.01	
6	5.99	0.01	7	6.98	0.02	
7	7	0	6	5.98	0.02	
8	7.99	0.01	5	5	0	
9	9.02	-0.02	4	4.01	-0.01	
10	9.99	0.01	3	3	0	
	Average	0.0000		Average	0.0000	
	Std. Dev	0.0107		Std. Deviation	0.0167	
			Cumulative Average		0.00	
			Cumulative Std. Deviation		0.0043	
The Echosounder Barcheck Values are Negligible for Application						
 GMPL Party Chief						

GEOservices MARITIME PVT. LTD.						
QUALITY MANUAL AND PROCEDURE						
Singlebeam Echosounder Barcheck Correction Table						
Project No.	Project Title:		Vessel:	Place:		
	Bathymetric Survey		BOAT 1	Dharoi dam		
Date:	Time:					
26-Jan-21	11:30					
Observed By:			Echosounder Model	Area Depth		
JOMON			SONARMITE	15.5		
Echosounder Settings						
Draft HI	Index "k" HI	Draft LO	Index "k" LO	Sound Velocity		
0.4				Average	Upto Depth	
				1512/1527		
Barcheck Frequency selected		Survey Frequency:		Manufacturer's Accuracy		
210		210/33		0.20 % of Depth	0.03 m	
Observations while lowering			Observations while hoisting			
Bar Depth (m)	ES Reading (m)	Difference (m)	Bar Depth (m)	ES Reading (m)	Difference (m)	
3	3.01	-0.01	10	10.03	-0.03	
4	4.01	-0.01	9	9.01	-0.01	
5	4.99	0.01	8	8.01	-0.01	
6	5.99	0.01	7	7.02	-0.02	
7	7.01	-0.01	6	6.01	-0.01	
8	8.02	-0.02	5	4.97	0.03	
9	8.99	0.01	4	4.01	-0.01	
10	9.98	0.02	3	3.02	-0.02	
Average		0.0000	Average		-0.0050	
Std. Dev		0.0141	Std. Deviation		0.0176	
			Cumulative Average		0.00	
			Cumulative Std. Deviation		0.0024	
The Echosounder Barcheck Values are Negligible for Application						
<div style="background-color: yellow; height: 20px; width: 200px; margin-bottom: 5px;"></div> <p>GMPL Party Chief</p>						

GEOSERVICES MARITIME PVT. LTD.



QUALITY MANUAL AND PROCEDURE

Singlebeam Echosounder Barcheck Correction Table

Project No.	Project Title: Bathymetric Survey	Vessel: BOAT 1	Place: Dharoi dam
Date: 27-Jan-21	Time: 11:30		
Observed By: JOMON	Echosounder Model SONARMITE	Area Depth 15.5	

Echosounder Settings

Draft HI	Index "k" HI	Draft LO	Index "k" LO	Sound Velocity	
0.4				Average 1512/1527	Upto Depth
Barcheck Frequency selected 210		Survey Frequency: 210/33		Manufacturer's Accuracy 0.20 % of Depth 0.03 m	

Observations while lowering

Observations while hoisting

Bar Depth (m)	ES Reading (m)	Difference (m)	Bar Depth (m)	ES Reading (m)	Difference (m)
3	3.01	-0.01	10	10.01	-0.01
4	4	0	9	9.01	-0.01
5	5	0	8	8.03	-0.03
6	6.01	-0.01	7	7.02	-0.02
7	6.99	0.01	6	6.01	-0.01
8	8	0	5	5	0
9	8.99	0.01	4	4.01	-0.01
10	10.02	-0.02	3	3.01	-0.01
	Average	-0.0025		Average	-0.0133
	Std. Dev	0.0104		Std. Deviation	0.0103
				Cumulative Average	-0.01
				Cumulative Std. Deviation	0.0000

The Echosounder Barcheck Values are Negligible for Application

GMPL Party Chief

GEO-SERVICES MARITIME PVT. LTD.



QUALITY MANUAL AND PROCEDURE

Singlebeam Echosounder Barcheck Correction Table

Project No.	Project Title: Bathymetric Survey	Vessel: BOAT 1	Place: Dharoi dam
Date: 28-Jan-21	Time: 10:20		
Observed By: JOMON	Echosounder Model SONAR-MITE	Area Depth 15.5	

Echosounder Settings

Draft HI	Index "k" HI	Draft LO	Index "k" LO	Sound Velocity	
0.4				Average 1512/1527	Upto Depth
Barcheck Frequency selected 210		Survey Frequency: 210/33		Manufacturer's Accuracy 0.20 % of Depth 0.03 m	



Observations while lowering

Observations while hoisting

Bar Depth (m)	ES Reading (m)	Difference (m)	Bar Depth (m)	ES Reading (m)	Difference (m)
3	2.99	0.01	10	10.02	-0.02
4	3.99	0.01	9	8.99	0.01
5	5.02	-0.02	8	8.03	-0.03
6	5.99	0.01	7	7.01	-0.01
7	7.01	-0.01	6	6	0
8	8.01	-0.01	5	4.99	0.01
9	8.99	0.01	4	4	0
10	9.99	0.01	3	3	0
Average		0.0012	Average		-0.0033
Std. Dev		0.0125	Std. Deviation		0.0151
Cumulative Average				0.00	
Cumulative Std. Deviation				0.0018	

The Echosounder Barcheck Values are Negligible for Application

GMPL Party Chief

GEOservices MARITIME PVT. LTD.						
QUALITY MANUAL AND PROCEDURE						
Singlebeam Echosounder Barcheck Correction Table						
Project No.	Project Title: Bathymetric Survey		Vessel: BOAT 1	Place: Dharoi dam		
Date: 29-Jan-21	Time: 10:20					
Observed By: JOMON			Echosounder Model SONARMITE	Area Depth 15.5		
Echosounder Settings						
Draft HI	Index "k" HI	Draft LO	Index "k" LO	Sound Velocity		
0.4				Average 1512/1527	Upto Depth	
Barcheck Frequency selected 210		Survey Frequency: 210/33		Manufacturer's Accuracy 0.20 % of Depth 0.03 m		
Observations while lowering			Observations while hoisting			
Bar Depth (m)	ES Reading (m)	Difference (m)	Bar Depth (m)	ES Reading (m)	Difference (m)	
3	3	0	10	10.01	-0.01	
4	4.02	-0.02	9	8.99	0.01	
5	5	0	8	8.01	-0.01	
6	6.01	-0.01	7	7.01	-0.01	
7	6.99	0.01	6	5.99	0.01	
8	8.01	-0.01	5	4.99	0.01	
9	9.01	-0.01	4	3.99	0.01	
10	10.01	-0.01	3	2.98	0.02	
Average		-0.0062	Average		0.0033	
Std. Dev		0.0092	Std. Deviation		0.0103	
				Cumulative Average	0.00	
				Cumulative Std. Deviation	0.0008	
The Echosounder Barcheck Values are Negligible for Application						
 GMPL Party Chief						

GEOSERVICES MARITIME PVT. LTD.



QUALITY MANUAL AND PROCEDURE

Singlebeam Echosounder Barcheck Correction Table

Project No.	Project Title: Bathymetric Survey	Vessel: BOAT 1	Place: Dharoi dam
Date: 30-Jan-21	Time: 10:30		
Observed By: JOMON	Echosounder Model SONARMITE	Area Depth 15.5	

Echosounder Settings

Draft HI	Index "k" HI	Draft LO	Index "k" LO	Sound Velocity	
0.4				Average 1512/1527	Upto Depth
Barcheck Frequency selected 210		Survey Frequency: 210/33		Manufacturer's Accuracy 0.20 % of Depth 0.03 m	

Observations while lowering

Observations while hoisting

Bar Depth (m)	ES Reading (m)	Difference (m)	Bar Depth (m)	ES Reading (m)	Difference (m)
3	3	0	10	9.98	0.02
4	4.02	-0.02	9	9.02	-0.02
5	5.01	-0.01	8	7.98	0.02
6	6.01	-0.01	7	7.03	-0.03
7	7.01	-0.01	6	6	0
8	7.99	0.01	5	5.01	-0.01
9	8.98	0.02	4	4	0
10	10.03	-0.03	3	3.02	-0.02
	Average	-0.0062		Average	-0.0067
	Std. Dev	0.0160		Std. Deviation	0.0175
				Cumulative Average	-0.01
				Cumulative Std. Deviation	0.0011

The Echosounder Barcheck Values are Negligible for Application

GMPL Party Chief

GEOSERVICES MARITIME PVT. LTD.



QUALITY MANUAL AND PROCEDURE

Singlebeam Echosounder Barcheck Correction Table

Project No.	Project Title: Bathymetric Survey	Vessel: BOAT 1	Place: Dharoi dam
Date: 31-Jan-21	Time: 11:30		
Observed By: JOMON	Echosounder Model SONARMITE	Area Depth 15.5	

Echosounder Settings

Draft HI	Index "k" HI	Draft LO	Index "k" LO	Sound Velocity	
0.4				Average 1512/1527	Upto Depth
Barcheck Frequency selected 210		Survey Frequency: 210/33		Manufacturer's Accuracy 0.20 % of Depth 0.03 m	

Observations while lowering

Observations while hoisting

Bar Depth (m)	ES Reading (m)	Difference (m)	Bar Depth (m)	ES Reading (m)	Difference (m)
3	2.99	0.01	10	9.99	0.01
4	3.99	0.01	9	8.99	0.01
5	5.03	-0.03	8	8.02	-0.02
6	6.01	-0.01	7	6.98	0.02
7	6.99	0.01	6	6.01	-0.01
8	8.02	-0.02	5	5	0
9	9.01	-0.01	4	4	0
10	9.99	0.01	3	3	0



Average -0.0038
Std. Dev 0.0160

Average 0.0000
Std. Deviation 0.0141

Cumulative Average 0.00
Cumulative Std. Deviation 0.0013

The Echosounder Barcheck Values are Negligible for Application

GMPL Party Chief

GEOSERVICES MARITIME PVT. LTD.					
QUALITY MANUAL AND PROCEDURE					
Singlebeam Echosounder Barcheck Correction Table					
Project No.	Project Title:	Vessel:	Place:		
	Bathymetric Survey	BOAT 1	Dharoi dam		
Date:	Time:				
1-Feb-21	10:15				
Observed By:	Echosounder Model	Area Depth			
JOMON	SONARMITE	15.5			
Echosounder Settings					
Draft HI	Index "k" HI	Draft LO	Index "k" LO	Sound Velocity	
0.4				Average	Upto Depth
				1512/1527	
Barcheck Frequency selected		Survey Frequency:		Manufacturer's Accuracy	
210		210/33		0.20 % of Depth	0.03 m
Observations while lowering			Observations while hoisting		
Bar Depth (m)	ES Reading (m)	Difference (m)	Bar Depth (m)	ES Reading (m)	Difference (m)
3	3	0	10	10.01	-0.01
4	4	0	9	9.01	-0.01
5	5.01	-0.01	8	8.02	-0.02
6	6	0	7	7.02	-0.02
7	7	0	6	6.01	-0.01
8	7.99	0.01	5	5	0
9	9.01	-0.01	4	4.01	-0.01
10	10.01	-0.01	3	3	0
Average		-0.0025	Average		-0.0117
Std. Dev		0.0071	Std. Deviation		0.0075
			Cumulative Average		-0.01
			Cumulative Std. Deviation		0.0003
The Echosounder Barcheck Values are Negligible for Application					
 GMPL Party Chief					

GEOSERVICES MARITIME PVT. LTD.



QUALITY MANUAL AND PROCEDURE

Singlebeam Echosounder Barcheck Correction Table

Project No.	Project Title: Bathymetric Survey	Vessel: BOAT 1	Place: Dharoi dam
Date: 2-Feb-21	Time: 10:15		
Observed By: JOMON	Echosounder Model SONAR MITE	Area Depth 15.5	

Echosounder Settings

Draft HI	Index "k" HI	Draft LO	Index "k" LO	Sound Velocity	
0.4				Average 1512/1527	Upto Depth
Barcheck Frequency selected 210		Survey Frequency: 210/33		Manufacturer's Accuracy 0.20 % of Depth	0.03 m

Observations while lowering

Observations while hoisting

Bar Depth (m)	ES Reading (m)	Difference (m)	Bar Depth (m)	ES Reading (m)	Difference (m)
3	3.01	-0.01	10	10.02	-0.02
4	3.99	0.01	9	9.03	-0.03
5	5.01	-0.01	8	8.02	-0.02
6	6	0	7	7.02	-0.02
7	7.02	-0.02	6	6.01	-0.01
8	7.99	0.01	5	5.01	-0.01
9	9.01	-0.01	4	4.01	-0.01
10	10.01	-0.01	3	3.01	-0.01
	Average	-0.0050		Average	-0.0167
	Std. Dev	0.0107		Std. Deviation	0.0082
				Cumulative Average	-0.01
				Cumulative Std. Deviation	0.0018

The Echosounder Barcheck Values are Negligible for Application

GMPL Party Chief

GEOSERVICES MARITIME PVT. LTD.



QUALITY MANUAL AND PROCEDURE

Singlebeam Echosounder Barcheck Correction Table

Project No.	Project Title: Bathymetric Survey	Vessel: BOAT 1	Place: Dharoi dam
Date: 2-Feb-21	Time: 10:15		
Observed By: JOMON	Echosounder Model SONARMITE	Area Depth 15.5	

Echosounder Settings

Draft HI	Index "k" HI	Draft LO	Index "k" LO	Sound Velocity	
0.4				Average 1512/1527	Upto Depth
Barcheck Frequency selected 210		Survey Frequency: 210/33		Manufacturer's Accuracy 0.20 % of Depth	0.03 m

Observations while lowering

Observations while hoisting

Bar Depth (m)	ES Reading (m)	Difference (m)	Bar Depth (m)	ES Reading (m)	Difference (m)
3	3.01	-0.01	10	10.02	-0.02
4	3.99	0.01	9	9.03	-0.03
5	5.01	-0.01	8	8.02	-0.02
6	6	0	7	7.02	-0.02
7	7.02	-0.02	6	6.01	-0.01
8	7.99	0.01	5	5.01	-0.01
9	9.01	-0.01	4	4.01	-0.01
10	10.01	-0.01	3	3.01	-0.01

Average -0.0050

Average -0.0167

Std. Dev 0.0107

Std. Deviation 0.0082

Cumulative Average -0.01
Cumulative Std. Deviation 0.0018

The Echosounder Barcheck Values are Negligible for Application

GMPL Party Chief

GEOSERVICES MARITIME PVT. LTD.



QUALITY MANUAL AND PROCEDURE

Singlebeam Echosounder Barcheck Correction Table

Project No.	Project Title: Bathymetric Survey	Vessel: BOAT 1	Place: Dharoi dam
Date: 4-Feb-21	Time: 10:15		
Observed By: JOMON	Echosounder Model SONARMITE	Area Depth 15.5	

Echosounder Settings

Draft HI	Index "k" HI	Draft LO	Index "k" LO	Sound Velocity	
0.4				Average 1512/1527	Upto Depth
Barcheck Frequency selected 210		Survey Frequency: 210/33		Manufacturer's Accuracy 0.20 % of Depth	0.03 m

Observations while lowering			Observations while hoisting		
Bar Depth (m)	ES Reading (m)	Difference (m)	Bar Depth (m)	ES Reading (m)	Difference (m)
3	3	0	10	10.01	-0.01
4	4	0	9	9.01	-0.01
5	5.01	-0.01	8	8.02	-0.02
6	6	0	7	6.99	0.01
7	7.02	-0.02	6	6.01	-0.01
8	7.99	0.01	5	5	0
9	9.02	-0.02	4	4.01	-0.01
10	10.01	-0.01	3	3	0
	Average	-0.0062		Average	-0.0067
	Std. Dev	0.0106		Std. Deviation	0.0103
				Cumulative Average	-0.01
				Cumulative Std. Deviation	0.0002

The Echosounder Barcheck Values are Negligible for Application

GMPL Party Chief

GEOSERVICES MARITIME PVT. LTD.



QUALITY MANUAL AND PROCEDURE

Singlebeam Echosounder Barcheck Correction Table

Project No.	Project Title: Bathymetric Survey	Vessel: BOAT 1	Place: Dharoi dam
Date: 5-Feb-21	Time: 10:15		
Observed By: JOMON	Echosounder Model SONARMITE	Area Depth 15.5	

Echosounder Settings

Draft HI	Index "k" HI	Draft LO	Index "k" LO	Sound Velocity	
0.4				Average 1512/1527	Upto Depth
Barcheck Frequency selected 210		Survey Frequency: 210/33		Manufacturer's Accuracy 0.20 % of Depth 0.03 m	


Observations while lowering



Observations while hoisting

Bar Depth (m)	ES Reading (m)	Difference (m)	Bar Depth (m)	ES Reading (m)	Difference (m)
3	3.01	-0.01	10	10.01	-0.01
4	3.99	0.01	9	9.01	-0.01
5	5	0	8	8.02	-0.02
6	6	0	7	7.02	-0.02
7	7.01	-0.01	6	6	0
8	8.02	-0.02	5	5	0
9	9.01	-0.01	4	4.01	-0.01
10	9.99	0.01	3	3.01	-0.01
Average		-0.0037	Average		-0.0100
Std. Dev		0.0106	Std. Deviation		0.0089
			Cumulative Average		-0.01
			Cumulative Std. Deviation		0.0012


The Echosounder Barcheck Values are Negligible for Application


GMPL Party Chief


GEO-SERVICES MARITIME PVT. LTD.						
QUALITY MANUAL AND PROCEDURE						
Singlebeam Echosounder Barcheck Correction Table						
Project No.	Project Title:			Vessel:	Place:	
	Bathymetric Survey			BOAT 1	Dharoi dam	
Date:	Time:					
6-Feb-21	11:00					
Observed By:			Echosounder Model	Area Depth		
JOMON			SONARMITE	15.5		
Echosounder Settings						
Draft HI	Index "k" HI	Draft LO	Index "k" LO	Sound Velocity		
0.4				Average	Upto Depth	
				1512/1527		
Barcheck Frequency selected		Survey Frequency:		Manufacturer's Accuracy		
210		210/33		0.20 % of Depth	0.03 m	
Observations while lowering			Observations while hoisting			
Bar Depth (m)	ES Reading (m)	Difference (m)	Bar Depth (m)	ES Reading (m)	Difference (m)	
3	3.01	-0.01	10	9.97	0.03	
4	3.99	0.01	9	8.99	0.01	
5	5.01	-0.01	8	7.98	0.02	
6	5.99	0.01	7	7.01	-0.01	
7	6.98	0.02	6	5.99	0.01	
8	8.02	-0.02	5	5.03	-0.03	
9	9.01	-0.01	4	4.02	-0.02	
10	10.03	-0.03	3	3.01	-0.01	
	Average	-0.0050		Average	-0.0033	
	Std. Dev	0.0169		Std. Deviation	0.0197	
				Cumulative Average	0.00	
				Cumulative Std. Deviation	0.0020	
The Echosounder Barcheck Values are Negligible for Application						
<div style="background-color: yellow; height: 15px; width: 25%; margin-bottom: 5px;"></div> GMPL Party Chief						



GEOSERVICES MARITIME PVT. LTD.					
QUALITY MANUAL AND PROCEDURE					
Singlebeam Echosounder Barcheck Correction Table					
Project No.	Project Title:	Vessel:	Place:		
	Bathymetric Survey	BOAT 1	Dharoi dam		
Date:	Time:				
7-Feb-21	10:30				
Observed By:	Echosounder Model		Area Depth		
JOMON	SONARMITE		15.5		
Echosounder Settings					
Draft HI	Index "k" HI	Draft LO	Index "k" LO	Sound Velocity	
0.4				Average	Upto Depth
				1512/1527	
Barcheck Frequency selected		Survey Frequency:		Manufacturer's Accuracy	
210		210/33		0.20 % of Depth	0.03 m
Observations while lowering			Observations while hoisting		
Bar Depth (m)	ES Reading (m)	Difference (m)	Bar Depth (m)	ES Reading (m)	Difference (m)
3	3.01	-0.01	10	9.99	0.01
4	4.01	-0.01	9	8.98	0.02
5	4.99	0.01	8	7.98	0.02
6	5.99	0.01	7	6.97	0.03
7	7	0	6	5.99	0.01
8	8.01	-0.01	5	4.99	0.01
9	9.01	-0.01	4	4.01	-0.01
10	10.02	-0.02	3	3	0
Average		-0.0050	Average		0.0133
Std. Dev		0.0107	Std. Deviation		0.0137
Cumulative Average				0.00	
Cumulative Std. Deviation				0.0021	
The Echosounder Barcheck Values are Negligible for Application					
 GMPL Party Chief					


BOAT 2


GEOSERVICES MARITIME PVT. LTD.					
QUALITY MANUAL AND PROCEDURE					
Singlebeam Echosounder Barcheck Correction Table					
Project No.	Project Title: Bathymetric Survey	Vessel: BOAT 2	Place: Dharoi dam		
Date: 20-Jan-21	Time: 11:30				
Observed By: PRUTHVIRAAJ MOHILE		Echosounder Model ODOM HYDROTRACK	Area Depth 15.5		
Echosounder Settings					
Draft HI	Index "k" HI	Draft LO	Index "k" LO	Sound Velocity	
0.4				Average 1512/1527	Upto Depth
Barcheck Frequency selected 210		Survey Frequency: 210/33		Manufacturer's Accuracy 0.20 % of Depth 0.03 m	
Observations while lowering			Observations while hoisting		
Bar Depth (m)	ES Reading (m)	Difference (m)	Bar Depth (m)	ES Reading (m)	Difference (m)
3	3	0	10	10.04	-0.04
4	4	0	9	9.01	-0.01
5	5.01	-0.01	8	8	0
6	6.02	-0.02	7	7	0
7	6.98	0.02	6	6.02	-0.02
8	7.99	0.01	5	5.01	-0.01
9	9.03	-0.03	4	4.01	-0.01
10	10.02	-0.02	3	3	0
Average		-0.0062	Average		-0.0083
Std. Dev		0.0169	Std. Deviation		0.0075
				Cumulative Average	-0.01
				Cumulative Std. Deviation	0.0066
The Echosounder Barcheck Values are Negligible for Application					
GMPL Party Chief					


GEOSERVICES MARITIME PVT. LTD.						
QUALITY MANUAL AND PROCEDURE						
Singlebeam Echosounder Barcheck Correction Table						
Project No.	Project Title: Bathymetric Survey		Vessel: BOAT 2		Place: Dharoi dam	
Date: 21-Jan-21	Time: 10:00					
Observed By: PRUTHVIRAAJ MOHILE			Echosounder Model ODOM HYDROTRACK		Area Depth 15.5	
Echosounder Settings						
Draft HI	Index "k" HI	Draft LO	Index "k" LO	Sound Velocity		
0.4				Average	Upto Depth	
				1512/1527		
Barcheck Frequency selected		Survey Frequency:		Manufacturer's Accuracy		
210		210/33		0.20 % of Depth	0.03 m	
Observations while lowering			Observations while hoisting			
Bar Depth (m)	ES Reading (m)	Difference (m)	Bar Depth (m)	ES Reading (m)	Difference (m)	
3	2.99	0.01	10	10.02	-0.02	
4	3.98	0.02	9	8.99	0.01	
5	5	0	8	8.02	-0.02	
6	6.02	-0.02	7	7	0	
7	7.01	-0.01	6	6	0	
8	8.01	-0.01	5	5.01	-0.01	
9	9.03	-0.03	4	4	0	
10	10.01	-0.01	3	3.01	-0.01	
Average		-0.0062	Average		-0.0033	
Std. Dev		0.0160	Std. Deviation		0.0103	
				Cumulative Average		0.00
				Cumulative Std. Deviation		0.0040
The Echosounder Barcheck Values are Negligible for Application						
GMPL Party Chief						


GEOSERVICES MARITIME PVT. LTD.					
QUALITY MANUAL AND PROCEDURE					
Singlebeam Echosounder Barcheck Correction Table					
Project No.	Project Title: Bathymetric Survey		Vessel: BOAT 2	Place: Dharoi dam	
Date: 22-Jan-21	Time: 10:00				
Observed By: PRUTHVIRAAJ MOHILE		Echosounder Model ODOM HYDROTRACK		Area Depth 15.5	
Echosounder Settings					
Draft HI	Index "k" HI	Draft LO	Index "k" LO	Sound Velocity	
0.4				Average 1512/1527	Upto Depth
Barcheck Frequency selected 210		Survey Frequency: 210/33		Manufacturer's Accuracy 0.20 % of Depth 0.03 m	
Observations while lowering			Observations while hoisting		
Bar Depth (m)	ES Reading (m)	Difference (m)	Bar Depth (m)	ES Reading (m)	Difference (m)
3	3	0	10	10.01	-0.01
4	4	0	9	9.01	-0.01
5	5.01	-0.01	8	8.02	-0.02
6	6.01	-0.01	7	6.99	0.01
7	7.01	-0.01	6	6.01	-0.01
8	7.99	0.01	5	5	0
9	9.03	-0.03	4	4.01	-0.01
10	9.99	0.01	3	3	0
Average		-0.0050	Average		-0.0067
Std. Dev		0.0131	Std. Deviation		0.0103
			Cumulative Average		-0.01
			Cumulative Std. Deviation		0.0020
The Echosounder Barcheck Values are Negligible for Application					
<div style="background-color: yellow; height: 20px; width: 25%; margin-bottom: 5px;"></div> GMPL Party Chief					


GEOSERVICES MARITIME PVT. LTD.						
QUALITY MANUAL AND PROCEDURE						
Singlebeam Echosounder Barcheck Correction Table						
Project No.	Project Title: Bathymetric Survey		Vessel: BOAT 2	Place: Dharoi dam		
Date: 23-Jan-21	Time: 10:20					
Observed By: PRUTHVIRAAJ MOHILE			Echosounder Model ODOM HYDROTRACK	Area Depth 15.5		
Echosounder Settings						
Draft HI	Index "k" HI	Draft LO	Index "k" LO	Sound Velocity		
0.4				Average 1512/1527	Upto Depth	
Barcheck Frequency selected 210		Survey Frequency: 210/33		Manufacturer's Accuracy 0.20 % of Depth 0.03 m		
Observations while lowering			Observations while hoisting			
Bar Depth (m)	ES Reading (m)	Difference (m)	Bar Depth (m)	ES Reading (m)	Difference (m)	
3	2.99	0.01	10	10.03	-0.03	
4	4.01	-0.01	9	9.01	-0.01	
5	5	0	8	8.02	-0.02	
6	6.02	-0.02	7	6.99	0.01	
7	7.01	-0.01	6	6.01	-0.01	
8	8	0	5	5.03	-0.03	
9	9.03	-0.03	4	4.01	-0.01	
10	10.02	-0.02	3	3.02	-0.02	
Average		-0.0100	Average		-0.0117	
Std. Dev		0.0131	Std. Deviation		0.0133	
			Cumulative Average		-0.01	
			Cumulative Std. Deviation		0.0001	
The Echosounder Barcheck Values are Negligible for Application						
 GMPL Party Chief						


GEOSERVICES MARITIME PVT. LTD.						
QUALITY MANUAL AND PROCEDURE						
Singlebeam Echosounder Barcheck Correction Table						
Project No.	Project Title:		Vessel:	Place:		
	Bathymetric Survey		BOAT 2	Dharoi dam		
Date:	Time:					
24-Jan-21	10:30					
Observed By:		Echosounder Model		Area Depth		
PRUTHVIRAAJ MOHILE		ODOM HYDROTRACK		15.5		
Echosounder Settings						
Draft HI	Index "k" HI	Draft LO	Index "k" LO	Sound Velocity		
0.4				Average	Upto Depth	
				1512/1527		
Barcheck Frequency selected		Survey Frequency:		Manufacturer's Accuracy		
210		210/33		0.20 % of Depth	0.03 m	
Observations while lowering			Observations while hoisting			
Bar Depth (m)	ES Reading (m)	Difference (m)	Bar Depth (m)	ES Reading (m)	Difference (m)	
3	3	0	10	10.01	-0.01	
4	4	0	9	9.02	-0.02	
5	5.01	-0.01	8	7.99	0.01	
6	6.01	-0.01	7	6.98	0.02	
7	6.99	0.01	6	6.01	-0.01	
8	7.99	0.01	5	5.03	-0.03	
9	8.98	0.02	4	4	0	
10	10.01	-0.01	3	3.02	-0.02	
Average		0.0012	Average		-0.0050	
Std. Dev		0.0113	Std. Deviation		0.0187	
Cumulative Average				0.00		
Cumulative Std. Deviation				0.0053		
The Echosounder Barcheck Values are Negligible for Application						
<div style="border: 1px solid black; height: 20px; width: 100%;"></div>						
GMPL Party Chief						



GEOSERVICES MARITIME PVT. LTD.						
QUALITY MANUAL AND PROCEDURE						
Singlebeam Echosounder Barcheck Correction Table						
Project No.	Project Title:		Vessel:	Place:		
	Bathymetric Survey		BOAT 2	Dharoi dam		
Date:	Time:					
25-Jan-21	10:30					
Observed By:			Echosounder Model	Area Depth		
PRUTHVIRAAJ MOHILE			ODOM HYDROTRACK	15.5		
Echosounder Settings						
Draft HI	Index "k" HI	Draft LO	Index "k" LO	Sound Velocity		
0.4				Average	Upto Depth	
				1512/1527		
Barcheck Frequency selected		Survey Frequency:		Manufacturer's Accuracy		
210		210/33		0.20 % of Depth	0.03 m	
Observations while lowering			Observations while hoisting			
Bar Depth (m)	ES Reading (m)	Difference (m)	Bar Depth (m)	ES Reading (m)	Difference (m)	
3	3	0	10	10.02	-0.02	
4	4.01	-0.01	9	8.99	0.01	
5	4.99	0.01	8	7.99	0.01	
6	5.98	0.02	7	6.98	0.02	
7	7	0	6	5.99	0.01	
8	7.99	0.01	5	5	0	
9	8.98	0.02	4	4	0	
10	10.02	-0.02	3	3	0	
Average		0.0037	Average		0.0083	
Std. Dev		0.0141	Std. Deviation		0.0075	
Cumulative Average				0.01		
Cumulative Std. Deviation				0.0046		
The Echosounder Barcheck Values are Negligible for Application						
GMPL Party Chief						



GEOSERVICES MARITIME PVT. LTD.						
QUALITY MANUAL AND PROCEDURE						
Singlebeam Echosounder Barcheck Correction Table						
Project No.	Project Title: Bathymetric Survey		Vessel: BOAT 2	Place: Dharoi dam		
Date: 26-Jan-21	Time: 10:00					
Observed By: PRUTHVIRAAJ MOHILE			Echosounder Model ODOM HYDROTRACK	Area Depth 15.5		
Echosounder Settings						
Draft HI	Index "k" HI	Draft LO	Index "k" LO	Sound Velocity		
0.4				Average 1512/1527	Upto Depth	
Barcheck Frequency selected 210		Survey Frequency: 210/33		Manufacturer's Accuracy 0.20 % of Depth 0.03 m		
Observations while lowering			Observations while hoisting			
Bar Depth (m)	ES Reading (m)	Difference (m)	Bar Depth (m)	ES Reading (m)	Difference (m)	
3	3	0	10	9.99	0.01	
4	4	0	9	8.99	0.01	
5	5.01	-0.01	8	8.01	-0.01	
6	5.98	0.02	7	6.98	0.02	
7	7.02	-0.02	6	5.99	0.01	
8	8.01	-0.01	5	5.01	-0.01	
9	8.98	0.02	4	4	0	
10	9.99	0.01	3	2.99	0.01	
Average		0.0012	Average		0.0033	
Std. Dev		0.0146	Std. Deviation		0.0121	
				Cumulative Average		0.00
				Cumulative Std. Deviation		0.0017
The Echosounder Barcheck Values are Negligible for Application						
GMPL Party Chief						


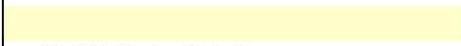
GEOSERVICES MARITIME PVT. LTD.						
QUALITY MANUAL AND PROCEDURE						
Singlebeam Echosounder Barcheck Correction Table						
Project No.	Project Title: Bathymetric Survey		Vessel: BOAT 2	Place: Dharoi dam		
Date: 27-Jan-21	Time: 10:30					
Observed By: PRUTHVIRAAJ MOHILE		Echosounder Model ODOM HYDROTRACK		Area Depth 15.5		
Echosounder Settings						
Draft HI	Index "k" HI	Draft LO	Index "k" LO	Sound Velocity		
0.4				Average 1512/1527	Upto Depth	
Barcheck Frequency selected 210		Survey Frequency: 210/33		Manufacturer's Accuracy 0.20 % of Depth 0.03 m		
Observations while lowering			Observations while hoisting			
Bar Depth (m)	ES Reading (m)	Difference (m)	Bar Depth (m)	ES Reading (m)	Difference (m)	
3	3.01	-0.01	10	10.01	-0.01	
4	4.02	-0.02	9	9.01	-0.01	
5	4.99	0.01	8	8.01	-0.01	
6	5.99	0.01	7	6.98	0.02	
7	7	0	6	6	0	
8	8.01	-0.01	5	5.01	-0.01	
9	9.01	-0.01	4	4	0	
10	10.01	-0.01	3	3	0	
Average		-0.0050	Average		-0.0017	
Std. Dev		0.0107	Std. Deviation		0.0117	
Cumulative Average				0.00		
Cumulative Std. Deviation				0.0007		
The Echosounder Barcheck Values are Negligible for Application						
GMPL Party Chief						


GEOSERVICES MARITIME PVT. LTD.						
QUALITY MANUAL AND PROCEDURE						
Singlebeam Echosounder Barcheck Correction Table						
Project No.	Project Title: Bathymetric Survey		Vessel: BOAT 2		Place: Dharoi dam	
Date: 28-Jan-21	Time: 11:00					
Observed By: PRUTHVIRAAJ MOHILE			Echosounder Model ODOM HYDROTRACK		Area Depth 15.5	
Echosounder Settings						
Draft HI	Index "k" HI	Draft LO	Index "k" LO	Sound Velocity		
0.4				Average	Upto Depth	
				1512/1527		
Barcheck Frequency selected		Survey Frequency:		Manufacturer's Accuracy		
210		210/33		0.20 % of Depth	0.03 m	
Observations while lowering			Observations while hoisting			
Bar Depth (m)	ES Reading (m)	Difference (m)	Bar Depth (m)	ES Reading (m)	Difference (m)	
3	3.01	-0.01	10	9.99	0.01	
4	4.01	-0.01	9	9.01	-0.01	
5	5.01	-0.01	8	8.01	-0.01	
6	6.02	-0.02	7	6.98	0.02	
7	7.02	-0.02	6	5.98	0.02	
8	7.99	0.01	5	4.99	0.01	
9	9.01	-0.01	4	3.99	0.01	
10	10.01	-0.01	3	2.99	0.01	
Average		-0.0100	Average		0.0067	
Std. Dev		0.0093	Std. Deviation		0.0137	
				Cumulative Average		0.00
				Cumulative Std. Deviation		0.0031
The Echosounder Barcheck Values are Negligible for Application						
GMPL Party Chief						



GEOSERVICES MARITIME PVT. LTD.						
QUALITY MANUAL AND PROCEDURE						
Singlebeam Echosounder Barcheck Correction Table						
Project No.	Project Title: Bathymetric Survey		Vessel: BOAT 2	Place: Dharoi dam		
Date: 29-Jan-21	Time: 11:00					
Observed By: PRUTHVIRAAJ MOHILE		Echosounder Model ODOM HYDROTRACK		Area Depth 15.5		
Echosounder Settings						
Draft HI	Index "k" HI	Draft LO	Index "k" LO	Sound Velocity		
0.4				Average 1512/1527	Upto Depth	
Barcheck Frequency selected 210		Survey Frequency: 210/33		Manufacturer's Accuracy 0.20 % of Depth 0.03 m		
Observations while lowering			Observations while hoisting			
Bar Depth (m)	ES Reading (m)	Difference (m)	Bar Depth (m)	ES Reading (m)	Difference (m)	
3	3	0	10	9.98	0.02	
4	3.99	0.01	9	9.01	-0.01	
5	5	0	8	7.99	0.01	
6	6	0	7	6.98	0.02	
7	7.01	-0.01	6	5.98	0.02	
8	7.99	0.01	5	5.02	-0.02	
9	9.01	-0.01	4	3.99	0.01	
10	9.99	0.01	3	2.99	0.01	
Average		0.0012	Average		0.0050	
Std. Dev		0.0083	Std. Deviation		0.0164	
Cumulative Average				0.00		
Cumulative Std. Deviation				0.0057		
The Echosounder Barcheck Values are Negligible for Application						
GMPL Party Chief						


GEOSERVICES MARITIME PVT. LTD.					
QUALITY MANUAL AND PROCEDURE					
Singlebeam Echosounder Barcheck Correction Table					
Project No.	Project Title: Bathymetric Survey		Vessel: BOAT 2	Place: Dharoi dam	
Date: 30-Jan-21	Time: 11:00				
Observed By: PRUTHVIRAAJ MOHILE			Echosounder Model ODOM HYDROTRACK	Area Depth 15.5	
Echosounder Settings					
Draft HI	Index "k" HI	Draft LO	Index "k" LO	Sound Velocity	
0.4				Average 1512/1527	Upto Depth
Barcheck Frequency selected 210		Survey Frequency: 210/33		Manufacturer's Accuracy 0.20 % of Depth 0.03 m	
Observations while lowering			Observations while hoisting		
Bar Depth (m)	ES Reading (m)	Difference (m)	Bar Depth (m)	ES Reading (m)	Difference (m)
3	3	0	10	10.01	-0.01
4	3.99	0.01	9	8.99	0.01
5	5.01	-0.01	8	8	0
6	5.99	0.01	7	7.01	-0.01
7	6.98	0.02	6	5.98	0.02
8	7.99	0.01	5	5.02	-0.02
9	9.01	-0.01	4	4.01	-0.01
10	10.02	-0.02	3	3	0
Average		0.0012	Average		-0.0017
Std. Dev		0.0136	Std. Deviation		0.0147
			Cumulative Average		0.00
			Cumulative Std. Deviation		0.0008
The Echosounder Barcheck Values are Negligible for Application					
 GMPL Party Chief					



GEOSERVICES MARITIME PVT. LTD.					
QUALITY MANUAL AND PROCEDURE					
Singlebeam Echosounder Barcheck Correction Table					
Project No.	Project Title:	Vessel:	Place:		
	Bathymetric Survey	BOAT 1	Dharoi dam		
Date:	Time:				
31-Jan-21	11:30				
Observed By:	Echosounder Model	Area Depth			
JOMON	SONARMITE	15.5			
Echosounder Settings					
Draft HI	Index "k" HI	Draft LO	Index "k" LO	Sound Velocity	
0.4				Average	Upto Depth
				1512/1527	
Barcheck Frequency selected		Survey Frequency:		Manufacturer's Accuracy	
210		210/33		0.20 % of Depth	0.03 m
Observations while lowering			Observations while hoisting		
Bar Depth (m)	ES Reading (m)	Difference (m)	Bar Depth (m)	ES Reading (m)	Difference (m)
3	2.99	0.01	10	9.99	0.01
4	3.99	0.01	9	8.99	0.01
5	5.03	-0.03	8	8.02	-0.02
6	6.01	-0.01	7	6.98	0.02
7	6.99	0.01	6	6.01	-0.01
8	8.02	-0.02	5	5	0
9	9.01	-0.01	4	4	0
10	9.99	0.01	3	3	0
Average		-0.0038	Average		0.0000
Std. Dev		0.0160	Std. Deviation		0.0141
Cumulative Average				0.00	
Cumulative Std. Deviation				0.0013	
The Echosounder Barcheck Values are Negligible for Application					
 GMPL Party Chief					



GEOSERVICES MARITIME PVT. LTD.					
QUALITY MANUAL AND PROCEDURE					
Singlebeam Echosounder Barcheck Correction Table					
Project No.	Project Title:		Vessel:	Place:	
	Bathymetric Survey		BOAT 2	Dharoi dam	
Date:	Time:				
1-Feb-21	10:15				
Observed By:		Echosounder Model		Area Depth	
SHAJEER SA		ODOM HYDROTRACK		15.5	
Echosounder Settings					
Draft HI	Index "k" HI	Draft LO	Index "k" LO	Sound Velocity	
0.4				Average	Upto Depth
				1512/1527	
Barcheck Frequency selected		Survey Frequency:		Manufacturer's Accuracy	
210		210/33		0.20 % of Depth	0.03 m
Observations while lowering			Observations while hoisting		
Bar Depth (m)	ES Reading (m)	Difference (m)	Bar Depth (m)	ES Reading (m)	Difference (m)
3	3	0	10	9.98	0.02
4	4.01	-0.01	9	8.99	0.01
5	5	0	8	8.02	-0.02
6	6.01	-0.01	7	7.01	-0.01
7	6.99	0.01	6	6	0
8	7.99	0.01	5	5.02	-0.02
9	8.99	0.01	4	4	0
10	9.99	0.01	3	3	0
Average		0.0025	Average		-0.0067
Std. Dev		0.0089	Std. Deviation		0.0121
Cumulative Average				0.00	
Cumulative Std. Deviation				0.0023	
The Echosounder Barcheck Values are Negligible for Application					
 GMPL Party Chief					


GEO SERVICES MARITIME PVT. LTD.						
QUALITY MANUAL AND PROCEDURE						
Singlebeam Echosounder Barcheck Correction Table						
Project No.	Project Title: Bathymetric Survey		Vessel: BOAT 2	Place: Dharoi dam		
Date: 2-Feb-21	Time: 10:20					
Observed By: SHAJEER SA		Echosounder Model ODOM HYDROTRACK		Area Depth 15.5		
Echosounder Settings						
Draft HI	Index "k" HI	Draft LO	Index "k" LO	Sound Velocity		
0.4				Average 1512/1527	Upto Depth	
Barcheck Frequency selected 210		Survey Frequency: 210/33		Manufacturer's Accuracy 0.20 % of Depth 0.03 m		
Observations while lowering			Observations while hoisting			
Bar Depth (m)	ES Reading (m)	Difference (m)	Bar Depth (m)	ES Reading (m)	Difference (m)	
3	3	0	10	10.02	-0.02	
4	4	0	9	9.01	-0.01	
5	4.99	0.01	8	8.01	-0.01	
6	6.01	-0.01	7	7.01	-0.01	
7	7	0	6	5.99	0.01	
8	8.01	-0.01	5	5	0	
9	8.99	0.01	4	3.99	0.01	
10	10.03	-0.03	3	3	0	
Average		-0.0037	Average		-0.0017	
Std. Dev		0.0130	Std. Deviation		0.0098	
				Cumulative Average	0.00	
				Cumulative Std. Deviation	0.0023	
The Echosounder Barcheck Values are Negligible for Application						
GMPL Party Chief						


GEOSERVICES MARITIME PVT. LTD.						
QUALITY MANUAL AND PROCEDURE						
Singlebeam Echosounder Barcheck Correction Table						
Project No.	Project Title:		Vessel:	Place:		
	Bathymetric Survey		BOAT 2	Dharoi dam		
Date:	Time:					
3-Feb-21	10:30					
Observed By:			Echosounder Model	Area Depth		
SHAJEER SA			ODOM HYDROTRACK	15.5		
Echosounder Settings						
Draft HI	Index "k" HI	Draft LO	Index "k" LO	Sound Velocity		
0.4				Average	Upto Depth	
				1512/1527		
Barcheck Frequency selected		Survey Frequency:		Manufacturer's Accuracy		
210		210/33		0.20 % of Depth	0.03 m	
Observations while lowering			Observations while hoisting			
Bar Depth (m)	ES Reading (m)	Difference (m)	Bar Depth (m)	ES Reading (m)	Difference (m)	
3	3.01	-0.01	10	9.99	0.01	
4	4.01	-0.01	9	9.03	-0.03	
5	5	0	8	8.01	-0.01	
6	5.99	0.01	7	7.01	-0.01	
7	6.98	0.02	6	6	0	
8	8.01	-0.01	5	5.02	-0.02	
9	8.99	0.01	4	4	0	
10	10.02	-0.02	3	2.99	0.01	
Average		-0.0012	Average		-0.0117	
Std. Dev		0.0136	Std. Deviation		0.0117	
			Cumulative Average		-0.01	
			Cumulative Std. Deviation		0.0013	
The Echosounder Barcheck Values are Negligible for Application						
 GMPL Party Chief						


GEOSERVICES MARITIME PVT. LTD.					
QUALITY MANUAL AND PROCEDURE					
Singlebeam Echosounder Barcheck Correction Table					
Project No.	Project Title: Bathymetric Survey		Vessel: BOAT 2	Place: Dharoi dam	
Date: 4-Feb-21	Time: 10:10				
Observed By: SHAJEER SA		Echosounder Model ODOM HYDROTRACK		Area Depth 15.5	
Echosounder Settings					
Draft HI	Index "k" HI	Draft LO	Index "k" LO	Sound Velocity	
0.4				Average 1512/1527	Upto Depth
Barcheck Frequency selected 210		Survey Frequency: 210/33		Manufacturer's Accuracy 0.20 % of Depth 0.03 m	
Observations while lowering			Observations while hoisting		
Bar Depth (m)	ES Reading (m)	Difference (m)	Bar Depth (m)	ES Reading (m)	Difference (m)
3	3	0	10	9.99	0.01
4	4.01	-0.01	9	9.02	-0.02
5	4.99	0.01	8	8.02	-0.02
6	6	0	7	7.01	-0.01
7	6.99	0.01	6	5.99	0.01
8	7.99	0.01	5	5.01	-0.01
9	9.02	-0.02	4	4	0
10	10.01	-0.01	3	3	0
Average		-0.0012	Average		-0.0083
Std. Dev		0.0113	Std. Deviation		0.0117
Cumulative Average				0.00	
Cumulative Std. Deviation				0.0003	
The Echosounder Barcheck Values are Negligible for Application					
GMPL Party Chief					

GEOSERVICES MARITIME PVT. LTD.						
QUALITY MANUAL AND PROCEDURE						
Singlebeam Echosounder Barcheck Correction Table						
Project No.	Project Title:		Vessel:	Place:		
	Bathymetric Survey		BOAT 2	Dharoi dam		
Date:	Time:					
5-Feb-21	10:10					
Observed By:		Echosounder Model		Area Depth		
SHAJEER SA		ODOM HYDROTRACK		15.5		
Echosounder Settings						
Draft HI	Index "k" HI	Draft LO	Index "k" LO	Sound Velocity		
0.4				Average	Upto Depth	
				1512/1527		
Barcheck Frequency selected		Survey Frequency:		Manufacturer's Accuracy		
210		210/33		0.20 % of Depth	0.03 m	
Observations while lowering			Observations while hoisting			
Bar Depth (m)	ES Reading (m)	Difference (m)	Bar Depth (m)	ES Reading (m)	Difference (m)	
3	3	0	10	10.03	-0.03	
4	4.02	-0.02	9	9.02	-0.02	
5	4.99	0.01	8	8.02	-0.02	
6	6.01	-0.01	7	6.98	0.02	
7	6.99	0.01	6	5.99	0.01	
8	8.01	-0.01	5	4.99	0.01	
9	9.01	-0.01	4	4.01	-0.01	
10	9.98	0.02	3	3	0	
Average		-0.0012	Average		-0.0017	
Std. Dev		0.0136	Std. Deviation		0.0172	
Cumulative Average				0.00		
Cumulative Std. Deviation				0.0026		
The Echosounder Barcheck Values are Negligible for Application						
 GMPL Party Chief						

GEOSERVICES MARITIME PVT. LTD.					
QUALITY MANUAL AND PROCEDURE					
Singlebeam Echosounder Barcheck Correction Table					
Project No.	Project Title: Bathymetric Survey		Vessel: BOAT 2	Place: Dharoi dam	
Date: 6-Feb-21	Time: 10:00				
Observed By: SHAJEER SA			Echosounder Model ODOM HYDROTRACK	Area Depth 15.5	
Echosounder Settings					
Draft HI	Index "k" HI	Draft LO	Index "k" LO	Sound Velocity	
0.4				Average 1512/1527	Upto Depth
Barcheck Frequency selected 210		Survey Frequency: 210/33		Manufacturer's Accuracy 0.20 % of Depth 0.03 m	
Observations while lowering			Observations while hoisting		
Bar Depth (m)	ES Reading (m)	Difference (m)	Bar Depth (m)	ES Reading (m)	Difference (m)
3	3	0	10	10.02	-0.02
4	4	0	9	9.01	-0.01
5	5	0	8	7.99	0.01
6	5.99	0.01	7	6.99	0.01
7	7.02	-0.02	6	6	0
8	8.02	-0.02	5	4.99	0.01
9	9.01	-0.01	4	4	0
10	10.02	-0.02	3	2.99	0.01
Average		-0.0075	Average		0.0033
Std. Dev		0.0116	Std. Deviation		0.0082
				Cumulative Average	0.00
				Cumulative Std. Deviation	0.0025
The Echosounder Barcheck Values are Negligible for Application					
 GMPL Party Chief					

GEOSERVICES MARITIME PVT. LTD.					
QUALITY MANUAL AND PROCEDURE					
Singlebeam Echosounder Barcheck Correction Table					
Project No.	Project Title:		Vessel:	Place:	
	Bathymetric Survey		BOAT 2	Dharoi dam	
Date:	Time:				
7-Feb-21	10:15				
Observed By:		Echosounder Model		Area Depth	
SHAJEER SA		ODOM HYDROTRACK		15.5	
Echosounder Settings					
Draft HI	Index "k" HI	Draft LO	Index "k" LO	Sound Velocity	
0.4				Average	Upto Depth
				1512/1527	
Barcheck Frequency selected		Survey Frequency:		Manufacturer's Accuracy	
210		210/33		0.20 % of Depth	0.03 m
Observations while lowering			Observations while hoisting		
Bar Depth (m)	ES Reading (m)	Difference (m)	Bar Depth (m)	ES Reading (m)	Difference (m)
3	3	0	10	9.98	0.02
4	4.01	-0.01	9	8.99	0.01
5	5.02	-0.02	8	7.99	0.01
6	6.01	-0.01	7	7.03	-0.03
7	7.01	-0.01	6	6.01	-0.01
8	7.99	0.01	5	5	0
9	9.02	-0.02	4	4	0
10	10.01	-0.01	3	3	0
		Average	Average		-0.0087
		Std. Dev	Std. Deviation		0.0099
			Cumulative Average		-0.01
			Cumulative Std. Deviation		0.0036
The Echosounder Barcheck Values are Negligible for Application					
GMPL Party Chief					

GEOSERVICES MARITIME PVT. LTD.						
QUALITY MANUAL AND PROCEDURE						
Singlebeam Echosounder Barcheck Correction Table						
Project No.	Project Title: Bathymetric Survey		Vessel: BOAT 2	Place: Dharoi dam		
Date: 8-Feb-21	Time: 9:55					
Observed By: SHAJEER SA		Echosounder Model ODOM HYDROTRACK		Area Depth 15.5		
Echosounder Settings						
Draft HI	Index "k" HI	Draft LO	Index "k" LO	Sound Velocity		
0.4				Average	Upto Depth	
				1512/1527		
Barcheck Frequency selected		Survey Frequency:		Manufacturer's Accuracy		
210		210/33		0.20 % of Depth	0.03 m	
Observations while lowering			Observations while hoisting			
Bar Depth (m)	ES Reading (m)	Difference (m)	Bar Depth (m)	ES Reading (m)	Difference (m)	
3	2.99	0.01	10	10.02	-0.02	
4	3.98	0.02	9	9.02	-0.02	
5	4.98	0.02	8	8.02	-0.02	
6	6.01	-0.01	7	7	0	
7	7	0	6	6.01	-0.01	
8	8.01	-0.01	5	5.01	-0.01	
9	9.02	-0.02	4	4.01	-0.01	
10	10.03	-0.03	3	3	0	
Average		-0.0025	Average		-0.0117	
Std. Dev		0.0183	Std. Deviation		0.0075	
			Cumulative Average		-0.01	
			Cumulative Std. Deviation		0.0076	
The Echosounder Barcheck Values are Negligible for Application						
<div style="background-color: yellow; height: 15px; width: 25%; margin-bottom: 5px;"></div> GMPL Party Chief						

GEOSERVICES MARITIME PVT. LTD.						
QUALITY MANUAL AND PROCEDURE						
Singlebeam Echosounder Barcheck Correction Table						
Project No.	Project Title:		Vessel:	Place:		
	Bathymetric Survey		BOAT 2	Dharoi dam		
Date:	Time:					
9-Feb-21	10:15					
Observed By:			Echosounder Model	Area Depth		
SHAJEER SA			ODOM HYDROTRACK	15.5		
Echosounder Settings						
Draft HI	Index "k" HI	Draft LO	Index "k" LO	Sound Velocity		
0.4				Average	Upto Depth	
				1512/1527		
Barcheck Frequency selected		Survey Frequency:		Manufacturer's Accuracy		
210		210/33		0.20 % of Depth	0.03 m	
Observations while lowering			Observations while hoisting			
Bar Depth (m)	ES Reading (m)	Difference (m)	Bar Depth (m)	ES Reading (m)	Difference (m)	
3	3	0	10	10.01	-0.01	
4	4	0	9	9.01	-0.01	
5	5.01	-0.01	8	8.01	-0.01	
6	6	0	7	6.99	0.01	
7	7.01	-0.01	6	5.99	0.01	
8	7.99	0.01	5	5.01	-0.01	
9	8.98	0.02	4	3.99	0.01	
10	10.01	-0.01	3	2.99	0.01	
Average		0.0000	Average		0.0000	
Std. Dev		0.0107	Std. Deviation		0.0110	
Cumulative Average				0.00		
Cumulative Std. Deviation				0.0002		
The Echosounder Barcheck Values are Negligible for Application						
GMPL Party Chief						

9 PHOTOGRAPHS

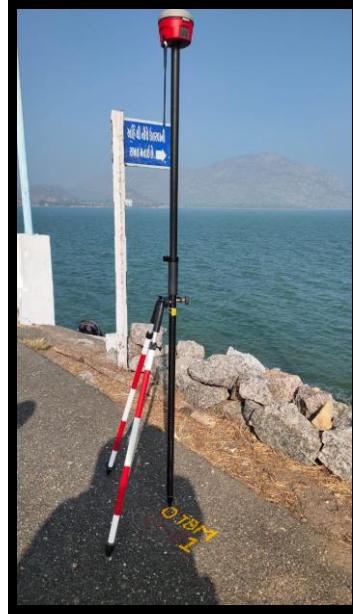
The following Photographs showing the Survey activities and features available at site



Configuration of SBES Equipment



Topographic survey in progress



TBM 1



Head Regulator



**REPORT ON TOPOGRAPHIC & BATHYMETRIC
SURVEY FOR ASSESSMENT OF RESERVOIR
CAPACITY & SEDIMENTATION IN DHAROI
RESERVOIR, GUJARAT, INDIA UNDER NATIONAL
HYDROLOGY PROJECT**



END OF REPORT