

HYDROGRAPHIC DIVISION
MARITIME AND PORT AUTHORITY OF SINGAPORE (MPA)
(Version: Mar 2023)

GENERAL SPECIFICATIONS FOR THE CONDUCT OF HYDROGRAPHIC SURVEYS

1 Engagement of Commercial Hydrographic Surveyor

- 1.1 For navigational purposes, the Contractor shall engage a hydrographic surveyor (Surveyor) approved by MPA. The Surveyor shall be certified by an institution that offers Category 'A/B' programme recognised by International Federation of Surveyors-International Hydrographic Organisation-International Cartographic Association (FIG-IHO-ICA) or as approved by the MPA Chief Hydrographer. The Surveyor shall produce documented proof of such certification to be registered with MPA.
- 1.2 The conduct of hydrographic surveys shall be carried out by a Category 'A/B' certified Surveyor and the survey plans and data shall be endorsed by Category 'A' certified Surveyor. The Surveyor shall be responsible for all survey works carried out including the submission of plans and reports to MPA Chief Hydrographer or his representative.
- 1.3 The Surveyor shall ensure that all survey works are carried out in accordance with the IHO Standards for Hydrographic Surveys S-44.

2 Permission to Conduct Survey

- 2.1 The Surveyor shall apply in writing at least three (3) working days before the conduct of any hydrographic or hydrologic survey or other study of the waters and sea-bed within the territorial limits of Singapore (eg. bathymetric, side-scan imaging, grab sampling and current measurement) to the MPA Chief Hydrographer or his representative for permission to conduct each survey using the application form found in **Annex 1**.
- 2.2 The Surveyor shall obtain the approval of Operations Planning Department (MPA) and/or Marine Environment & Safety Department (MPA) for the vessel movements and conduct of survey works within the territorial limits of Singapore. The contact information is available on MPA corporate website.

3 Access to Inspect Survey Works

- 3.1 The MPA Chief Hydrographer or his representative shall at all reasonable times have access to the survey sites, platforms, vessels and facilities if necessary.
- 3.2 The Surveyor shall arrange for survey inspection carried out by the MPA Chief Hydrographer or his representative if necessary.
- 3.3 All costs incurred for the above inspection carried out by the MPA Chief Hydrographer or his representative shall be borne by the Surveyor.

4 Survey Limits

- 4.1 The survey limits shall extend to at least 100 metres beyond the limits of the approved working area or up to the adjacent sea-wall, wharf, coastline, etc. The Surveyor should seek prior approval from the Operations Planning Department (MPA) for the limits of the working area. The survey limits shall be approved by the MPA Chief Hydrographer or his representative and shown in the survey plan.
- 4.2 All structures, floating or fixed, within the survey limits shall be surveyed and shown on the plan. Any obstructions detected shall be shown clearly on the survey plan. The composition or the nature of the obstructions shall be described in detail in the survey report.
- 4.3 The hydrographic survey shall cover up to High Water Line or Coastline where applicable. Drying lines shall be shown in detail symbolised in accordance with the CHART 1 published by the MPA Hydrographic Division. This is available on MPA corporate website.

5 Method of Hydrographic Survey

The Surveyor shall obtain the approval of the MPA Chief Hydrographer or his representative on the method of hydrographic surveying and equipment to be used before the execution of the survey works.

6 Survey Equipment and Accuracy

The Surveyor shall maintain the records of the following works and submit them to the MPA Chief Hydrographer or his representative for inspection upon request.

6.1 Calibration

The Surveyor shall ensure the survey equipment to be used are appropriate for the scale of survey based on IHO orders of safety of navigation surveys and properly calibrated before usage for any surveys. Refer to **Annex 3** for more information.

6.2 Echo Sounder

Single-beam or Multi-beam echosounder shall be used for hydrographic surveys and properly calibrated according to **Annex 3**. When necessary, the scope for the conduct of reference layer will be determined by the MPA Chief Hydrographer or his representative.

6.3 Sound Velocity Profiler

Sound velocity profiler (SVP) shall be used to complement the conduct of hydrographic surveys. The sound velocity data shall be recorded before the start of each hydrographic survey within the locality of survey limit at the deepest possible depth. If necessary, the Surveyor shall assess the on-site survey data quality and determine the need to conduct SVP before and after the survey.

6.4 Horizontal Positioning System

The horizontal positioning shall be controlled by Differential Global Positioning System (DGPS)/ Real Time Kinematic (RTK) DGPS or electronic positioning system providing an accuracy of +/- 1m or better. The rover's primary correction shall be prioritised according to the following order: 1) RTK, 2) DGPS, 3) Any other positioning systems. The frequency for RTK correction is 440.637500 MHz and the frequencies for DGPS corrections are tuned to 298 KHz and 308 KHz for Raffles and Horsburgh stations respectively which are being transmitted simultaneously.

7 Survey Scale

The survey scale shall be determined by the survey requirements.

8 Sounding Datum

The Chart Datum to be used for the reduction of soundings shall be determined by the MPA Chief Hydrographer. The Chart Datum used shall be stated clearly in all survey plans and records.

9 Survey Coordinate Reference System

The survey results shall be plotted on a coordinate system based on the SVY21 datum with projection origin (unmarked) located at:

- Latitude 1° 22' 00" N
- Longitude 103° 50' 00" E
- Northing 38744.572 m
- Easting 28001.642 m

Source: Boundaries and Survey Maps Act (Chapter 25), Published 29 Mar 2005

10 Tidal Corrections

10.1 Tidal heights for the reduction of soundings shall be taken from the MPA tide gauge nearest to the survey area. Tidal heights data shall be obtained from MPA Hydrographic Division.

10.2 For the installation and usage of privately owned tide gauge for tidal corrections, the Surveyor shall seek permission from MPA Chief Hydrographer or his representative in writing.

11 Survey Field Records

The survey field records shall be maintained by the Surveyor for inspection by the MPA Chief Hydrographer or his representative if necessary. These following records must be duly certified and submitted to MPA Hydrographic Division:

- a) Name of Surveyor;
- b) Daily record of range checks;
- c) Daily record of tidal height measurements;
- d) Record of sound velocity profiler data and cast locations;
- e) Plots of the actual tracks travelled by the survey vessel;
- f) Survey and sounding plans; and,
- g) Any other relevant records

12 Survey Plans

12.1 Soundings shall be processed for shoal bias, plotted accurately and clearly in the survey plans.

12.2 The high spots of the survey area shall be circled clearly on the survey plans (eg. based on least depths of berth boxes and controlling depths of navigation channels).

- 12.3 The outlines of isolated seabed features such as rocks, wrecks and obstructions shall be plotted and shown in the survey plans according to Chart 1 published by the MPA Hydrographic Division.
- 12.4 Multi-beam echosounder soundings shall be plotted at intervals of not more than 3 mm on survey plan along the entire sounding line.
- 12.5 Single-beam echosounder soundings shall be surveyed at closer intervals where seabed is irregular to ensure the soundings are plotted at intervals of not more than 5 mm on survey plan of 1:1000 scale.
- 12.6 The soundings shall be plotted to 1 decimal place (truncated) on the survey plan and shown in both survey and geographical grids - SVY21 & WGS84.
- 12.7 All symbols, abbreviations and terms depicted on the plan shall be in accordance with the CHART 1 published by the MPA Hydrographic Division. Depths shown on plans shall be clear, legible and free from overplotting. Any heights of isolated features shall be shown.
- 12.8 Results of all pre & post-works surveys shall be plotted on separate plans at the same survey scale and reference photos shall be included.
- 12.9 Any aids to navigation observed within the survey limit shall be plotted clearly in the survey plans.
- 12.10 Drying lines and depth contours of 2m, 5m, 10m, 15m, 20m and 30m shall be drawn on all relevant survey plans. The contours depicting the approved dredging/dumping depth shall also be drawn on the relevant survey plans.

13 Submission of Survey Plans & Records

13.1 Certification

The Surveyor shall certify all survey plans, field records, reports, data sheet, equipment calibration records, plots, etc before submitting them to the MPA Chief Hydrographer or his representative.

13.2 Survey Plans

The Surveyor shall submit digital copy of the survey plans to the MPA Chief Hydrographer or his representative. The accepted formats are .pdf and .dxf.

13.3 Survey Reports

The Surveyor shall submit a digital comprehensive survey report to the MPA Chief Hydrographer or his representative comprising details of Outline of Operation, Field Operation, Data Processing, Data Analysis, Findings of survey, List of Accompanying Documents, and any other relevant information or photos of each completed survey.

13.4 Processed Bathymetric Data File

The Surveyor shall submit a set of processed bathymetric survey data in appropriate formats together with an index chartlet showing the surveyed areas covered by each data file and the co-ordinates for those points defining the surveyed areas. The data shall be processed at a resolution of 0.5m. The accepted formats are .ascii, .txt and .csv. Refer to **Annex 2** for more information.

The metadata shall include the uncertainty achieved for both horizontal and vertical uncertainty components, i.e. Total Vertical Uncertainty (TVU) and Total Horizontal Uncertainty (THU).

13.5 Raw Bathymetric Data File

The Surveyor shall retain all raw bathymetric survey data of all projects for a period of one (1) year. The data shall be submitted to MPA Chief Hydrographer or his representative upon request.

14 Side Scan Sonar Survey

14.1 Upon completion of the entire works, a side scan sonar survey covering the limits of the hydrographic survey shall be carried out by the Surveyor in the presence of the MPA Chief Hydrographer or his representative if necessary. The cost for the side scan sonar survey shall be borne by the Surveyor.

14.2 The survey lines shall be conducted at an effective interval range to ensure 100% feature detection and search of the scanned corridor. Refer to IHO S-44 glossary available on the following website:

<https://iho.int/en/standards-and-specifications>

14.3 The positions of all these features shall be plotted on 1:1000 scale survey plan.

14.4 The Surveyor shall retrieve and compare the preliminary side scan sonar survey report with the post side scan sonar survey report (if applicable) to identify any potential new debris/obstructions arising from the sonar contacts and indicate clearly in the latest report.

14.5 The post side scan sonar survey plan shall include the sonar contacts identified from the preliminary side scan sonar survey. The Surveyor shall provide assessment based on the evaluation of sonar contacts and state clearly in the submitted report.

14.6 The Surveyor shall submit a set of comprehensive side scan sonar survey digital report, survey plans including sonar contacts imagery and other relevant records in formats of .pdf and .dxf to the MPA Chief Hydrographer or his representative.

15 Topographic Survey

15.1 The Contractor shall submit the digital copy of topographic survey plan to the MPA Chief Hydrographer or his representative. The submitted digital copy of topographic survey plan shall be certified digitally by a Registered Land Surveyor at a scale of not smaller than 1:1000. The topographic survey plan and data shall be submitted in both raster (.pdf) and vector (.dxf/.shp) formats.

15.2 The data shall be geo-referenced and based on SVY21. The topographic survey plan shall include High and Low Water Mark (HWM & LWM) and Coastline referenced to Chart Datum.

15.3 A set of digital photographs of all newly constructed structures and natural features shall also be included in the submission.

16 Current Measurement

16.1 Current measurements shall be conducted using a Current Profiler (CP).

16.1.1 A seabed mounted CP shall be upward looking and capable of measuring vertical profiles of horizontal water currents. It shall be self-contained. and mounted to a sinker on the seabed. Approval for the installation of a seabed mounted CP is granted by the Hydrographic Division (MPA) and Operations Planning Department (MPA).

16.1.2 Should the CP be buoy mounted, the Surveyor should seek prior approval from the Operations Planning Department (MPA) for the buoy's location. Upon approval, the buoy's markings and light shall be specified by the Aids to Navigation Department (MPA).

- 16.1.3 The location of the seabed or buoy mounted CP shall be verified by the Surveyor and submitted to Hydrographic Division (MPA) and Operations Planning Department (MPA).
- 16.1.4 The current measurement using vessel-mounted CP (downward looking) shall be conducted by the Surveyor or appointed competent personnel.
- 16.2 The CP shall automatically record the average value over 10-minute intervals. Each data recording shall be the average of all valid data over the 10-minute intervals. The CP shall be able self-check the data and reject erroneous data before recording.
- 16.3 The output of the recorded data for speed shall be in centimetre/second (cm/s) and direction in degrees relative to True North.
- 16.4 The Surveyor shall propose the CP mooring design and the proposed deployed location to the MPA Chief Hydrographer or his representative and Operations Planning Department (MPA). Should the CPs be deployed in shipping channels, the moorings must be dimensionally low profiled to reduce the likelihood of collision with passing vessels. The proposed sinkers for mounting the CPs must be resistant to corrosion.
- 16.5 The Surveyor shall ensure that the deployed CP's tilt angle does not exceed 5 degrees from the upright direction.
- 16.6 Data Formats and Reports
- 16.6.1 The application shall be able to output the results of current data in graphs and tabular ASCII format in dd/mm/yy hh:mm speed (cm/s) direction (degrees) for current measurement.
- 16.6.2 The Surveyor is to submit the following records digitally to MPA Hydrographic Division every month:
- a) All recorded data and graphs of the measured current records shall be stored in ASCII format; and,
 - b) A copy of monthly report in digital copy

*[*MPA reserves the right to use the submitted survey data for the purpose of updating nautical charts.]*

Hydrographic Division
Maritime and Port Authority of Singapore
7B Keppel Road,
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Singapore 089055



APPLICATION FOR APPROVAL TO CARRY OUT HYDROGRAPHIC SURVEY, HYDROLOGIC SURVEY OR OTHER STUDY OF THE WATERS AND SEABED WITHIN SINGAPORE TERRITORIAL WATERS

Please complete the Application Form and submit it, with a chartlet showing the geographic coordinates of the survey limits and the MPA-approved working limits to MPA Chief Hydrographer, Hydrographic Division, at least five (5) working days before the commencement of survey.

Please note that you are required to read and comply with the instructions found in the MPA General Specifications for the Conduct of Hydrographic Surveys, which is available on the MPA corporate website.

[A] PARTICULARS OF SURVEY:

- 1) MPA COMET and PMN No. _____
- 2) Project Title & Type of Survey _____
- 3) Location of Survey _____
- 4) Dates of Survey _____
- 5) Survey Launch Registration No. _____
- 6) Equipment to be used:
 - Echo Sounder (Brand & Model) _____
 - Positioning System (INS Brand & Model) _____ DGPS/ RTK / OTHERS _____
 - Any other survey equipment used _____

[B] PARTICULARS OF APPLICANTS:

Name of Client	<input type="text"/>	Tel. No.	<input type="text"/>
Contact Person's Name	<input type="text"/>	Email	<input type="text"/>
Contact Person's Designation	<input type="text"/>		

Name of Survey Company	<input type="text"/>	Tel. No.	<input type="text"/>
Contact Person's Name	<input type="text"/>	Email	<input type="text"/>
Contact Person's Designation	<input type="text"/>		

Signature _____ Date _____

Official Company Stamp _____

Surveyor(s) Conducting Survey (FIG/IHO/ICA Cat 'A/B' accredited)	<input type="text"/>
	<input type="text"/>
	<input type="text"/>
	<input type="text"/>

[C] FOR OFFICIAL USE: Survey Permission No. (SPN):
(Please quote this number in your report)

The above Survey Application is APPROVED / NOT APPROVED.

MPA General Specifications for the Conduct of Hydrographic Surveys are APPLICABLE/ NOT APPLICABLE.

MPA Tide Gauge to be used:

Please contact to arrange for an MPA representative to be present.

MPA Chief Hydrographer

Date

DIGITAL BATHYMETRIC SURVEY DATA FILE STRUCTURE

I. FILE STRUCTURE

FILE 1 - SURVEY INFORMATION FILE

Name of Company	: (max 30 characters)
Project Title	: (max 120 characters)
Client's name	: (max 30 characters)
Name of Surveyor	: (max 25 characters)
Vessel's name or Reg. No.	: (max 25 characters)
Positioning System used	: (max 20 characters)
Tide Station used	: (max 20 characters)
Survey Area Limits	: Min Easting, Min Northing (SVY21 grid) : Max Easting, Max Northing (SVY21 grid)
Scale of Survey	: (1:500, 1:1000, 1:2500 or 1:5000)
Date of survey	: (DD/MM/YY)
Type of survey	: (Select from the listed below) <i>Pre-dredging survey</i> <i>Post-dredging survey</i> <i>Pre-construction survey</i> <i>Post-construction survey</i> <i>Pre-reclamation survey</i> <i>Post-reclamation survey</i> <i>Pre-removal survey</i> <i>Post-removal survey</i> <i>Pre-installation survey</i> <i>Post-installation survey</i> <i>Pre-soil investigation survey</i> <i>Post-soil investigation survey</i> <i>Pre-cable installation survey</i> <i>Post-cable installation survey</i> <i>Pre-dumping survey</i> <i>Post-dumping survey</i> <i>Investigation survey</i> <i>Monitoring survey</i> <i>Interim survey</i> <i>Other survey</i>
Metadata (TVU & THU)	: (max 120 characters)
Name of Survey Data file	: (max 12 characters)
Data Processing Software	: (max 30 characters)

FILE 2 - BATHYMETRIC SURVEY DATA FILE

Easting,Northing,Reduced Depth,Tidal Correction Value,Time,Date
Easting,Northing,Reduced Depth,Tidal Correction Value,Time,Date
.....
Easting,Northing,Reduced Depth,Tidal Correction Value,Time,Date

II. DATA FORMAT

Eastings and Northings shall be in SVY21 Grid Metres to two decimal places.

Reduced Depths shall be soundings that have tidal corrections applied and reduced to Chart Datum. It shall be in metres and at least to two decimal places.

Tidal Correction Values shall be in metres and at least two decimal places.

Time and Date shall be in HH:MM:SS (24 Hours Clock) and DDMMYYYY formats respectively.

A new line shall be used for every sounding. The Bathymetric Survey Data File shall be continuous with no blank lines or page breaks.

Sounding resolution shall be 0.5m.

LIST OF EQUIPMENT CALIBRATION AND GROUND TRUTH

The Surveyor shall adopt the following calibration guidelines:

1. System Ground Truth (X,Y,Z) – During initialisation / whenever system is reinstalled.
 - a. Horizontal (X,Y) – Run at least 4 lines over a prominent object (eg. sinker block) in shallow waters, in 4 different directions. The object must appear in the same location with positioning error of <0.1m with active RTK signal.
 - b. Vertical (Z) – Bar check as stated below.
2. Reference layer – This check is carried out with MPA to ascertain the survey results produced for external client(s) are accurate and in accordance with IHO standards for hydrographic surveys S-44 when necessary.

The details and frequencies of calibration tests shall include but not limited to the following equipment:

Single-beam Echo Sounder (SBES)

Calibration test	Details	Frequency
Bar check	Depth Range: ≤ 5m - increment of 1m Tolerance: 0.03m Note: Ensure roll value is zero at all times (eg. area of calm water and weight distribution)	Monthly/Per project basis

Multi-beam Echo Sounder (MBES)

Calibration test	Details	Frequency
Patch test	Roll, Pitch, Yaw, Latency	Monthly/Per project basis
Bar check	Depth Range: ≤ 5m - increment of 1m Tolerance: 0.03m Note: Ensure roll value is zero at all times (eg. area of calm water and equal weight distribution)	Monthly/Per project basis
Reference layer	Location: To liaise with MPA Chief Hydrographer or his representatives Tolerance: 0.02m	As requested by MPA Chief Hydrographer or his representatives

Sound Velocity Sensor & Sound Velocity Profiler (SVP)

Calibration test	Details	Frequency
Laboratory certification	Sound velocity: 1375m/s - 1600m/s Pressure: 1dBar to 500dBar Temperature: 0° to 30°C	Once every 2 years

Hydrographic Vessel

Calibration test	Details	Frequency
Dimension Control	Sensors offsets	Once every 2 years or whenever system is reinstalled
Squat test	Vessel draft	Once every 2 years or whenever system is reinstalled
GNSS & IMU	GAMS - Figure of 8	Once every 2 years or whenever system is reinstalled