



KINGDOM OF BAHRAIN

NATIONAL REPORT- JANUARY 2015

(6th RSAHC at Abu Dhabi – 9 to 11 February 2015)

Introduction

1. The Kingdom of Bahrain is an independent Arab kingdom situated centrally on the southern shores of the Arabian Gulf, with the mainland of Saudi Arabia on the west and the peninsula of Qatar on the east.

Kingdom Of Bahrain Statistics

2. Bahrain is an archipelago of over 33 islands and island groups which cover a total area of 762 km². It has territorial waters of 10,000 km², much of which are generally shallow and contain many coral reefs. Bahrain has two main ports, Mina Salman which is located south of the capital city of Al Manama and the new Khalifa Bin Salman Port (KBSP) on the eastern side of Al Muharraq. A natural channel leads from the central Gulf to this main port.

3. In 1992 Bahrain became a member of the International Hydrographic Organization (IHO). The Kingdom of Bahrain Hydrographic Survey Directorate (HSD) has to date surveyed about 65% of the Exclusive Economic Zone (EEZ).

The Hydrographic Survey Directorate (HSD)

4. The Hydrographic Authority for Bahrain was established in 1978 as a Section within the Survey Directorate of Ministry of Housing. The Hydrographic Section became a Directorate within the Survey and Land Registration Bureau since 2008.

5. The Hydrographic Survey Directorate's (HSD) main duties include traditional bathymetry, tidal analysis and tidal stream measurement within the territorial waters of Bahrain and producing appropriate navigational charts for the EEZ.

HSD Activities

6. Since the mid-nineties all hydrographic data have been transformed into digital format. The Directorate has approximately 95% of all data needed for chart production in digital form and uses a comprehensive pool of networked PCs during its data processing and quality assurance/control. As a member of IHO and the United Nations, Bahrain is committed to provide safe water passage for all ships approaching our ports according to UN resolution regarding International Law of the Sea especially Safety of Life at Sea (SOLAS).

HSD Core Business

7. HSD's core business include activities such as to secure International Maritime Safety through its obligations to IMO, publish and update Navigational Charts, publish Annual Tide Tables, publish and update Tidal Stream Atlas and carry out regular bathymetric surveys of the navigationally important areas in the Exclusive Economic Zone (EEZ) of Bahrain including the Bahrain Approach Channel.

8. HSD plays a vital role in improving Bahrain's Infrastructure & Economy by ensuring safe navigation, monitoring of sand search projects and reclamation. HSD also renders highly accurate surveys for the private sector in projects like developing new berths/jetties, reclamation projects, construction of marinas etc. at very nominal price in comparison to private survey companies.

9. HSD also renders assistance to National and International stakeholders by providing customised charts and tidal data, and by quality assurance of private surveys. Approximately 80% of non oil goods is imported to and exported from Bahrain by sea. Bahrain, and Khalifa Bin Salman Port (KBSP) in particular, is well-positioned geographically to serve as a centralised regional hub for large and small container shipping. The larger Panamax container ships will require a draft of 13-14m, and the approach channel is currently being dredged and upgraded to accommodate these. HSD has a critical role in this infrastructure expansion by overseeing international marine obligations to ensure safe navigation within its waters, including the approach channel, ports and holding areas. HSD is currently the only Bahrain Authority with the mandate, certification and capability to carry out these tasks.

10. HSD has international cooperation with the following agencies:-

- (a) International Hydrographic Organisation (IHO) – membership
- (b) United Kingdom Hydrographic Office (UKHO) – 5 year agreements

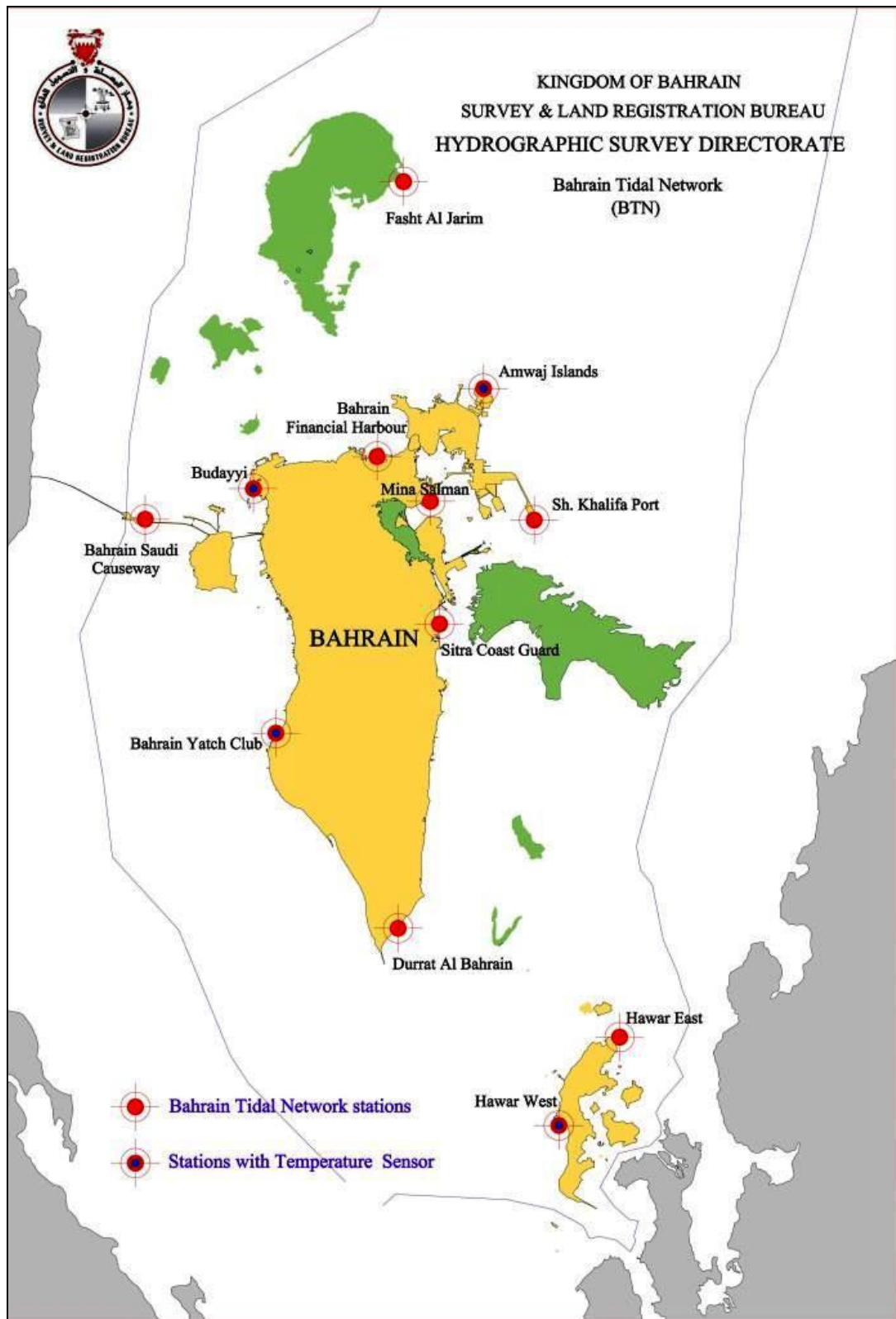
- (c) International Centre for Electronic Navigational Charts (IC-ENC) – membership through UKHO
- (d) United States Naval Office (NAVO)/National Geospatial Intelligence Agency (NGA) - 5 year agreement on sharing resources

HSD's Major achievements for 2014

11. Bahrain Tidal Network (BTN):-

(a) The tide levels in Bahrain is very complicated due to the geographical peculiarities of this island. The tide ranges vary from over 2 meters at places to less than 0.2 meters at certain places. Application of correct tide levels was always a great challenge for the hydrographers. To ensure the authenticity of prevailing depths post bathymetric survey, has prompted, this office to encompass the tidal data for the entire area of Bahrain territorial waters. This network will give a leverage that could be empowering for the production of co-tidal charts after acquiring substantial data from the BTN project.

(b) The installation and commissioning of BTN was successfully completed by June 2014. BTN consist of a network of 12 Radar type tide gauges installed around the coastal areas of Bahrain. This network ensures that the tide levels of any part of Bahrain are available at any point of time during a bathymetric survey. Four stations out of these twelve stations have been equipped with temperature sensor to obtain water temperature at strategic locations to enhance studies on water temperature variations in view of geographical peculiarities and weather pattern around Bahrain. The advantage of the Radar tide gauge is that since there are no sensors submerged in water the problem of excessive marine growth experienced in Bahrain is overcome and hence it requires only less maintenance activities.



(c) The tide gauges records and transmit the water level data every 10 minutes to SLRB server through GPRS network. The IT department of Survey & Land Registration Bureau (SLRB) in coordination with HSD has developed a very user friendly and useful web interface and database for

the tide data. The indigenously developed web hosting has ensured a great amount of cost reduction & flexibility as the professional web hosting services impose heavy prices for hosting such data.



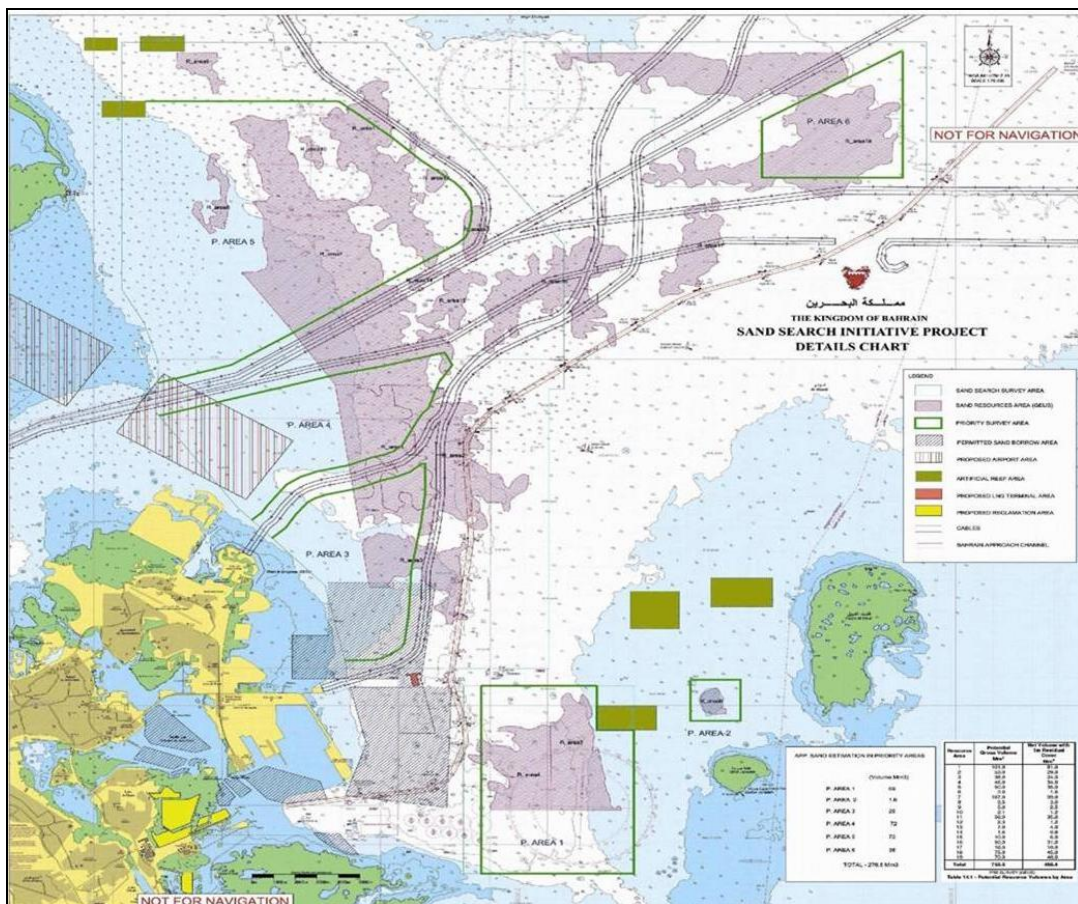
BTN TIDE GAUGE

(d) HSD office has 24 hours availability to the data from the 12 stations through internet and the data can be downloaded in any desired format for the post processing of bathymetric data. The future plan for this network includes online access of the data to the shipping community and port

authorities for online monitoring of tide levels. Also the tide predictions for the annual tide tables will become more accurate with the availability of more data at more locations. Overall this data will serve as a great asset to any future studies or researches in the region.

12. National Sand Search Project

(a) The National sand search project is aimed towards identifying the potential sand resources all around Bahrain to continue with the economic growth of Bahrain. Since Bahrain is surrounded by sea on all sides it has a good deposit of natural sand resources. The problem faced in extracting these natural resources is the lack of reliable data regarding the sand deposits.



SAND SEARCH PROJECT CHART

(b) In 2013, it was estimated that Bahrain needed 377 million m³ for the government projects, however, there was no data for the available sand resources for undertaking these projects. Therefore the government authorities decided that a national sand search project may be undertaken in

order to have a National Marine Chart consisting of all available data which will act as an effective tool for the decision makers.

(c) HSD acted as the coordinator for the Sand Search Governance committee and various sub committees. HSD has collected and compiled all available data from different stake holders and an initial database has been set up.

(d) The survey boat equipped with sub bottom profiler was deployed to carry out the initial sand search survey for the existing borrow area off East Hidd. The existing sand volume calculation and the amount of sand extracted for the past 20 years were estimated. HSD also conducted a sand search survey for determining potential borrow area for the East Sitra Project. The quantity of sand available to the most suitable area of the project site has been determined by HSD and the project is presently under progress.



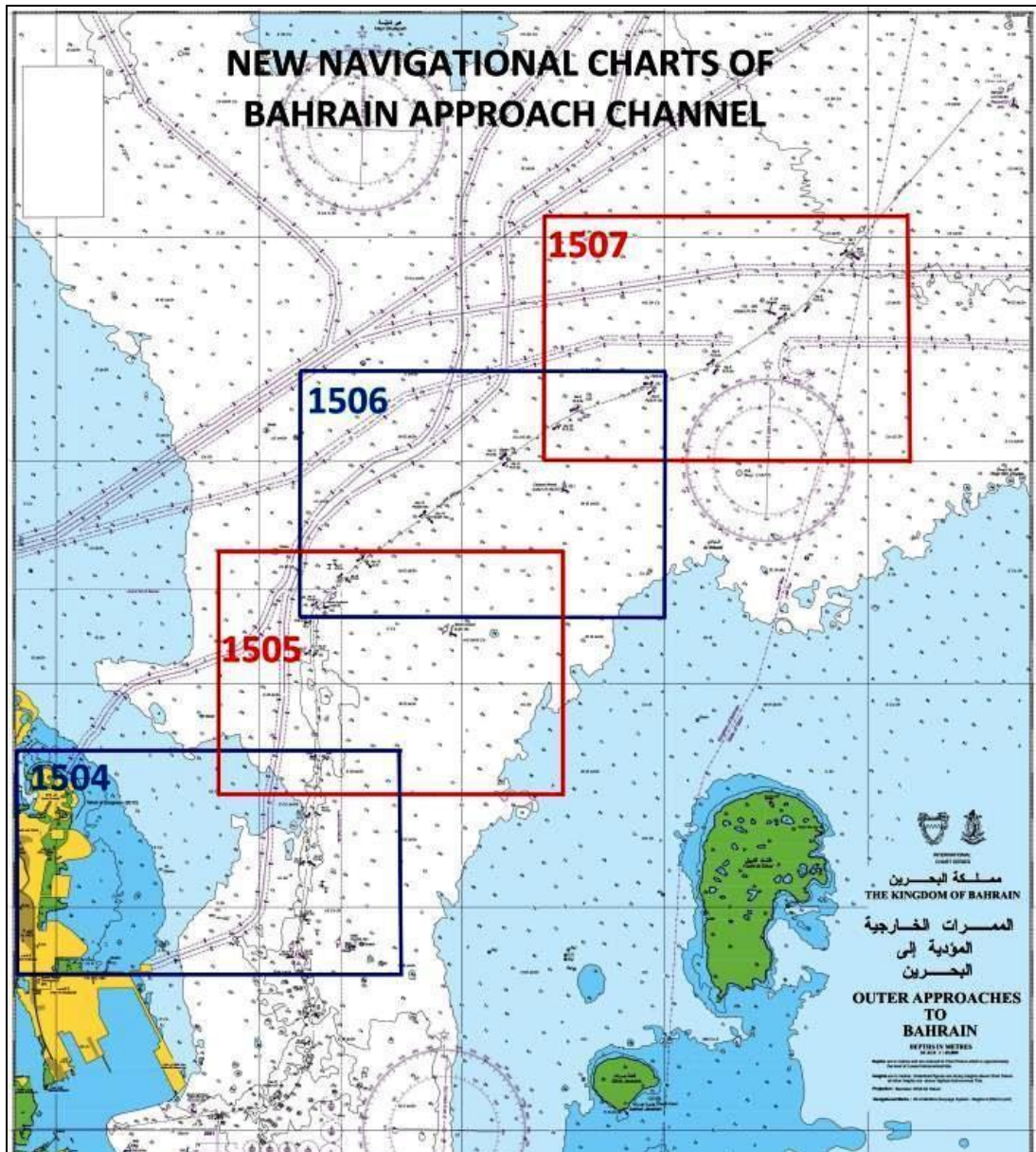
Dredging in progress for East Sitra project at the location identified by HSD

13. New Navigational Charts:-

(a) The existing navigational chart covering the Bahrain Approach channel was on a scale of 1:65 000 and the feedback from mariners indicated that a larger scale chart for this navigationally critical area would be very helpful. The channel was dredged to 13.6 meter in 2010 and larger

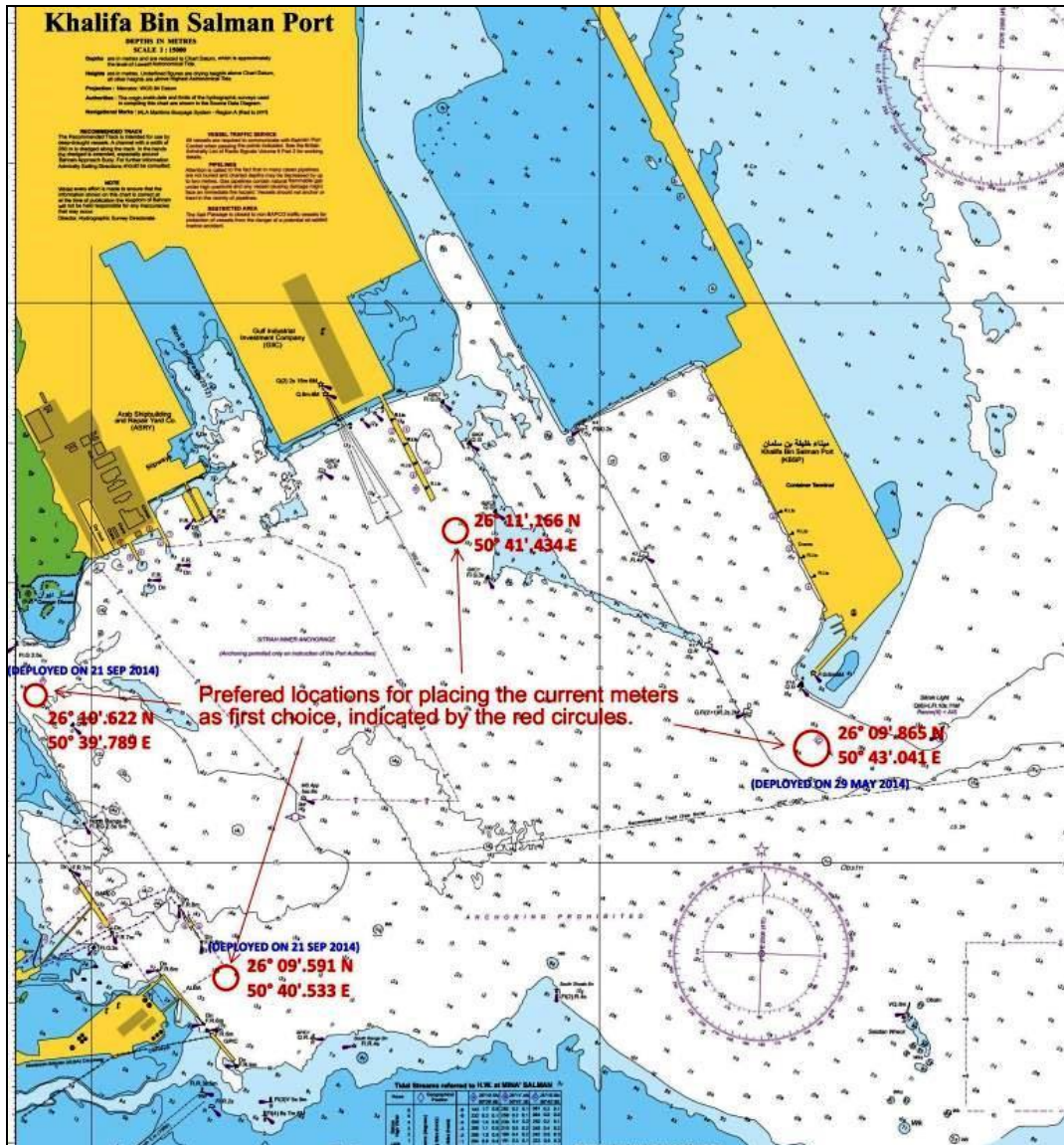
ships with lesser keel clearance required more comprehensive data for safe navigation.

(b) HSD has done multibeam surveys of the channel in 2010 and 2012 and hence had sufficient data to produce the new charts. Therefore 4 new charts in 1:15 000 scale covering the entire stretch of the channel was produced by HSD in consultation with Bahrain Port Management authorities, UKHO and NGA. The paper charts have been finalised and it is ready for publishing. The work on the ENC cells of these charts are progressing and is expected to be released soon.



14. Current Meter Observations:-

(a) The existing data of the tidal stream around the island of Bahrain is old and hence HSD has decided to update Bahrain's tidal Stream Atlas. Towards this goal current meter observations for duration of 30 days have been initiated. HSD has already collected 30 days current meter data from four locations which are very much crucial for the shipping traffic entering and leaving Bahrain.

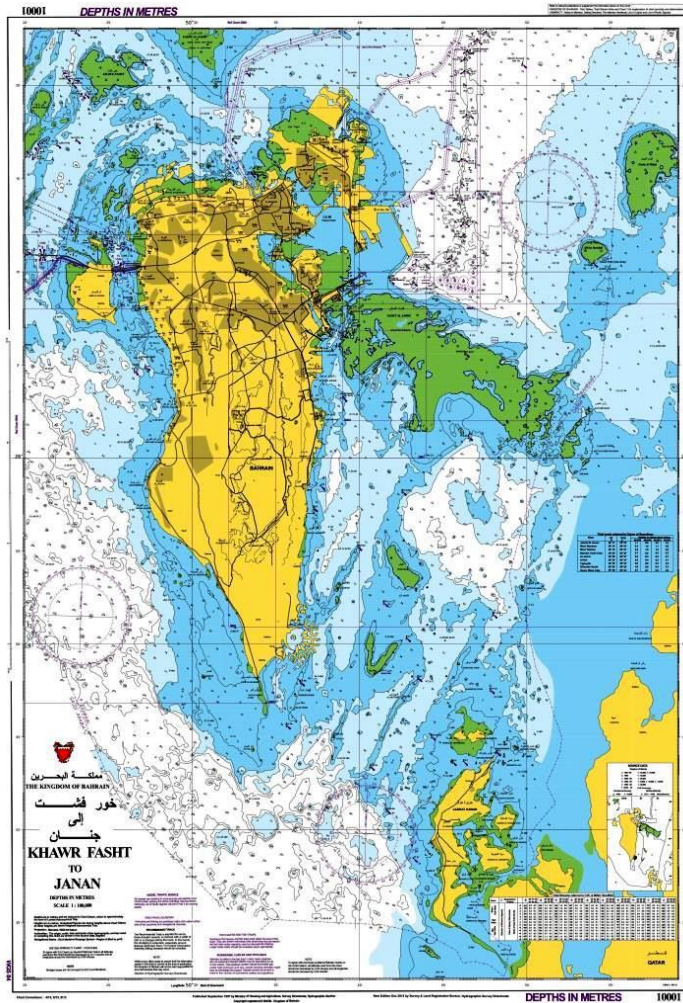


(b) Efforts are on to cover all navigationally critical areas and areas where the currents are different due to the geographical locations and other factors with a 30 days current meter observations. Once sufficient data is obtained a current flow model can be created which can stimulate the current at any locations around Bahrain.

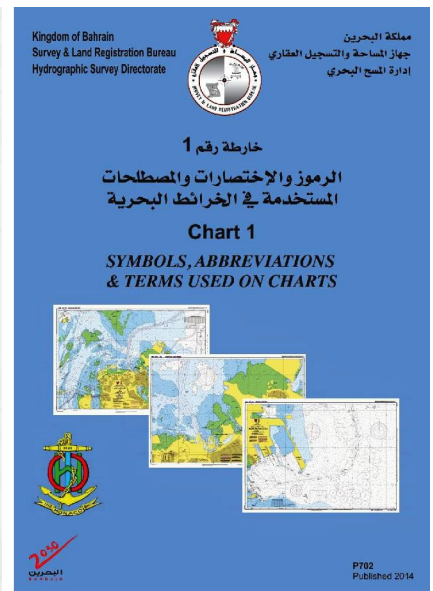
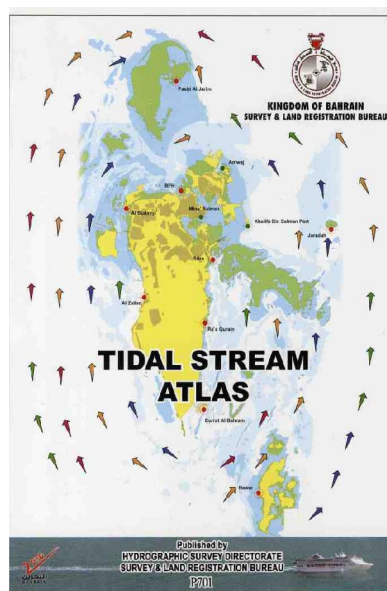
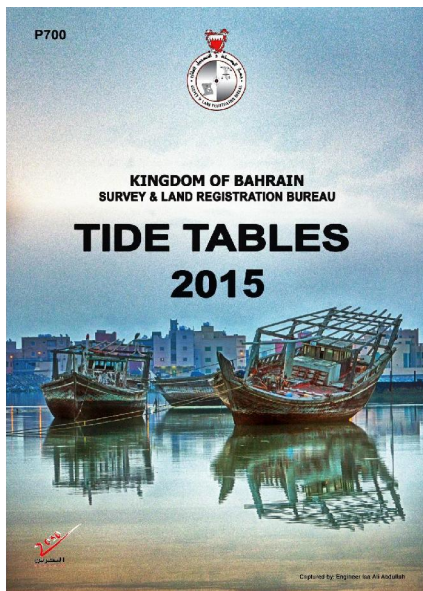
Products

15. The major products of HSD are as follows:-

Chart No.	Title	Edition	Scale	Datum
1501 INT7258	Mina' Salman and Approaches	Feb 2012	1:15000	WGS 84
1502 INT7259	Mina Manama and Approaches	Feb 2012	1:15000	WGS 84
1503 INT7261	Khalifa Bin Salman Port	Feb 2012	1:15000	WGS 84
2001	Sitra to Umm Jalid	Feb 2012	1:20000	WGS 84
2502	Hawar	Mar 2004	1:25000	WGS 84
5001	Sitrah to Tighalib	Feb 2012	1:50000	WGS 84
5002	Hidd Al Jamal to Hidd Al Theeb	Nov 2008	1:50000	WGS 84
5003	Al Baynah al Saghirah to Ra's Al Barr	Feb 2012	1:50000	WGS 84
1509 INT7255	Approaches to Bahrain	Feb 2012	1:50000	WGS 84
5006	Hayr Shutayah to Khawr Fasht	May 2011	1:50000	WGS 84
6501 INT7254	Outer Approaches to Bahrain	Feb 2012	1:65000	WGS 84
10001	Khawr Fasht to Janan	Feb 2012	1:10000	WGS 84
P700	Tide Tables	Annual Editions		
P701	Tidal Streams Atlas	Sep 1997		
P702	Symbols, Abbreviations & Terms Used on charts - Chart 1	Apr 2006		
Electronic Navigation Charts (ENC) 1501, 1503, 5006, 6501 to IHO S57 Standards				
Customized Charts, soundings, tidal and water temperature data as per customer requirement				



Bahrain Chart – 10001



Bahrain Publications

Equipment, Technology & Software

16. The survey boats Al Masaha and Al Masaha II are operational. Access databases have been developed by HSD to accommodate data and integrate with CARIS software. Multi-beam Echo Sounders have been used in partnership with the US Navy to produce comprehensive (100%) bathymetry of port areas and Approach Channel until March 2010 when a R2Sonic 2022 system was purchased and installed in Al Masaha. A joint survey with US Navy was conducted in November 2012 at few navigationally critical areas. CARIS HIPS (Hydrographic Information Processing System) software is used for the processing of multi-beam and single beam data. CARIS Paper chart composer is used for production of paper charts. CARIS S57 Composer is used to convert paper chart information to vector based Electronic Navigation Charts (ENC). Presently HSD is using the Caris Bathy Database system for bathymetric management. In 2012 an Applanix POS MV system was installed in Al Masaha.

17. R2Sonic:- The R2Sonic Multi-beam was commissioned on board Al Masaha in March 2010 which meets the criteria of undertaking the survey operations around Bahrain territorial waters to the highest IHO standards. Specially designed for use in water depths up to 200 meters, R2Sonic multi-beam echo sounder is ideal for bathymetric surveys and for use in support of dredging operations. The Multi-beam can accurately measure a profile area of sea floor across the width that is 3.5 times the measured water depth.

18. Sub Bottom Profile (SBP):- It was commissioned on onboard Al Masaha in 2010 along with the R2Sonic MBES. The system is capable of giving the sediment thickness with a reliable accuracy and it has been used in the sand search survey.

19. Inter-tidal Zones – LIDAR & Satellite Bathymetry:- Bahrain has approximately 1000sq km of inter-tidal zones. International boundaries are defined by the low astronomical tidal line (LAT). The surveying of these zones by conventional single beam echo sounder is slow, limited by tidal access and short (3 hours) tidal windows in a fortnightly cycle. These areas could be more comprehensively surveyed using Light Detection & Ranging (LIDAR) and Satellite Bathymetry combined with tidal data. Bahrain is planning to obtain data for the complete inter tidal zones and near shore areas using these methods.

Manpower & Training

20. Continuous on job training and availability of latest software and equipment ensures that HSD has a highly qualified manpower force capable of carrying out the hydrographic tasks required. Four Bahraini graduate trainees have been inducted into HSD and they have been actively involved in day to day activities of HSD. The following international conferences/seminars were attended by the staff of HSD:-

- (a) Mr. Jasim Butaibeh of HSD attended the RSAHC Shallow Water Workshop at Abu Dhabi from 22 – 26 September 2014.
- (b) Mr. Hussain Kowaitan of HSD attended the RSAHC MSI Training Course at Muscat, Oman from 15 – 17 December 2014.

Work Program for 2015

21. With limited resources HSD had always achieved great result in the field of Hydrography with the help of International organisations and friendly nations. HSD intends to continue with that good momentum and the major tasks envisaged for this year is as follows:-

- (a) Progress with the National sand search survey project and create a database of the sand resources available to aid in the economic growth of Bahrain.
- (b) Produce the four new ENC chart and release it to the market.
- (c) Analyse the tide data obtained from the new BTN project and derive more accurate harmonic constituents for tide predictions.
- (d) Resurvey of the Approach Channel (approx 60km x 260m) following phase 2 dredging and route alteration.
- (e) Update and production of all navigational charts and ENCs.
- (f) Publication of Annual Tide Tables.
- (g) Carry out Current meter observations at navigationally important areas.
- (h) Conduct the survey of the northern part of the Bahrain territorial waters covering an approximate area of 2500 sq km.
- (i) Resurvey of areas where the existing data is very old.