

**4<sup>th</sup> IHO-HSSC Meeting  
UKHO, Taunton 26-28 September 2012**

**Report of the Tidal and Water Level Working Group**

<b>Submitted by:</b>	Chairman, TWLWG
<b>Related Documents:</b>	Report of TWLWG4 meeting (available from IHO web site).
<b>Related Projects:</b>	None

<b>Chair:</b>	Stephen Gill, USA
<b>Vice-Chair:</b>	Zarina Jayaswal, Australia
<b>Secretary:</b>	David Wyatt, IHB
<b>Member States:</b>	Australia, Brazil, Canada, Chile, China, Cuba, Denmark, Ecuador, Finland, France, Germany, India, Indonesia, Italy, Japan, Korea Rep of, New Zealand, Norway, Portugal, South Africa, Spain, UK, Uruguay, USA, Venezuela.
<b>Expert Contributor Organisations:</b>	Bohdan Pillich (Tidal Expert) IOC-GLOSS
<i>see Annex A for full details</i>	

**Meetings Held During Reporting Period**

TWLWG4      8 - 10 May 2012, Cape Town, South Africa

**Next Meeting**

TWLWG5      April/May 2013, venue tbc

**Work Program**

The 4<sup>th</sup> meeting of the TWLWG took place at the Calders Hotel & Conference Centre, Fish Hoek, South Africa from 8 – 10 May 2012 and was hosted by the South African Hydrographic Office (SAHO). The meeting was attended by 14 representatives from 12 IHO Member States and the IHB; representatives from Namibia and Mozambique attended as observers.

During discussion on the Standard Constituent List (Task A) it was considered to be of merit to carry out a study of Tidal Predictions generated as a result of analysis of a “common data set” by different analysis software. A new task A.2 has been added to the draft work plan at Annex B

TWLWG has produced a draft document, which contains the feature attributes to be included in the “Standard for Digital Tide Tables”. These have been passed to TSMAD for further work to progress.

During discussion on the Dynamic Application of Tides in ECDIS the work already completed in the USA was highlighted and it was agreed a descriptive document should be produced in which the challenges and problems which needed to be overcome should be articulated. It was agreed these issues and boundaries need to be identified and passed to HSSC for further comment and direction.

Liaison, led by Australia, with TSMAD and DIPWG on a “Tidal Heights – Objects and Attributes Catalogue” has continued.

Discussion on the Standard for the Transmission of Real Time Tidal Data highlighted the work undertaken by NOAA and the need for all TWLWG members to continue their work towards creating a definitive document. Contact with companies manufacturing transmitting tide gauges and those members of TWLWG who also attend IALA meetings have continued liaison on the use of AIS binary messages.

During discussions regarding the exchange of harmonic constants/predictions the IT challenge of using XML data format was highlighted and the need to develop the capability to use this data format for future ease of data exchange. It was suggested there was a need to review the Technical Resolution on Times Zones due to the differences between the ISO standard (ISO 8601) format and that used by mariners in respect of S-100 and nautical publications.

TWLWG discussions regarding its review of IHO resolution 3/1919 as amended, (Datums and Benchmarks) and the definitions of Low Water, Mean Water and High Water concluded this work required the input of other WGs reporting to HSSC, in particular CSPCWG. Although the WP requirement was to focus on non-tidal areas such as the Baltic Sea rather than inland waters, Finland questioned exactly which non-tidal areas should be included. US highlighted the work conducted between US and Canada in the Great Lakes. It was concluded the text should separate tidal and non-tidal waters and appropriate wording should be submitted to HSSC for approval. A draft revision of this resolution is attached at Annex C for HSSC endorsement and subsequent submission to Member States for adoption.

UK highlighted correspondence with NOC and activities undertaken by UKHO in determining the ellipsoidal height of MSL at the coast. It was agreed this should be progressed and expanded to cover the entire globe. The metadata, which should accompany GPS data obtained at a tide gauge site, was highlighted and discussed. The connection with the GLOSS programme was emphasised and the Chairman encouraged TWLWG Members to consider involvement in and support of this programme. It was agreed this should be considered for inclusion in the TWLWG WP by HSSC.

During discussion on the inventory of tide gauges used by IHO Member States, the Chairman encouraged all to check their data listings and to approach cooperating and non-IHO member states to provide information to increase the geographical spread of the information held. In addition TWLWG were encouraged to provide tide gauge sampling rates and web links for inclusion in the Inventory on the IHO website. The draft document 'Actual Tides On-line Link, ATOL,' was highlighted and all agreed it would be a useful resource to be added to the TWLWG website. It was noted there would be an on-going requirement to maintain the listing once published.

TWLWG considered activities in relation to WP task H and the UK briefed on activities involved with the Permanent Service for Mean Sea Level and information available on the website ([www.psmsl.org/products/anomalies](http://www.psmsl.org/products/anomalies)). US explained how Climate Change research on sea level used the data and the importance of a common datum to this research. It was highlighted the records of long term tidal observations and sea level data, including older analogue traces, were of particular value in Tsunami research and for flooding studies. Norway reported on studies into the impact of sea level rise on amphidromic points. It was agreed Member States should take long term records of their best quality data to conduct a series of one year analysis of constituents (M2, S2, N2, K1, O1 and P1) and to exchange the results to generate a data set for further research.

In the draft Work Plan, attached at Annex B, the completion dates for some items have been amended to reflect progress made to date.

#### **Progress on HSSC Action Items**

N/A

#### **Problems Encountered**

N/A

**Any Other Items of Note**

N/A

**Conclusions and Recommended Actions**

N/A

**Justification and Impacts**

N/A

**Action Required of HSSC**

The HSSC is invited to:

- a. note this report
- b. re-appoint the TWLWG to continue its work under its current Terms of Reference
- c. endorse the draft Work Plan at Annex B
- d. approve the draft IHO resolution 3/1919 as amended, (Datums and Benchmarks) and the definitions of Low Water, Mean Water and High Water for submission to IHO Member States.

## TWLWG Membership

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**Annex A to TWLWG Report to HSSC4**

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**Annex A to TWLWG Report to HSSC4**

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**Annex A to TWLWG Report to HSSC4**

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**Annex A to TWLWG Report to HSSC4**

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## 1 TWLWG Work Plan

### 1.1 TWLWG Tasks

- A Maintain Standard Tidal Constituent List (IHO Work Programme 3.2.4 refers)
- B Prepare a Standard for Digital Tide Tables (IHOTC Report to the XVII<sup>th</sup> IHC as adopted)
- C Liaise with TSMAD on tidal matters relevant to the Dynamic Application of Tides in ECDIS and develop a Standard of the transmission of real-time tidal data (Action HSSC1/18)
- E Review the various definitions of MSL and their relevance to Hydrographic Offices and review the IHO tidal resolutions to ensure that they are compatible with the requirements of non-tidal areas such as the Baltic Sea.
- F Prepare and maintain an inventory of tide gauges used by Member States and to publish it on the IHO/TWLWG web site.
- H Compare the tidal predictions generated as a result of analysis of a common data set using different analysis software.
- I Review and provide feedback of On-line real time water level observation document

Task	Work item	Priority H-high M-medium L-low	Milestones	Start Date	End Date	Status P-planned O-ongoing C-completed	Contact Person(s) * indicates leader	Related Pubs/Standard
A.1	Maintain Standard Tidal Constituent List	H	No updates required in 2012	Continuous		O	Chris Jones*	
A.2	Compare the tidal predictions generated as a result of analysis of a common data set using different analysis software.	H	Select Common data set Analyse using different software Predict common set of tides Compare results	Continuous		O	Stephen Gill*	

Task	Work item	Priority H-high M-medium L-low	Milestones	Start Date	End Date	Status P-planned O-ongoing C-completed	Contact Person(s) * indicates leader	Related Pubs/Standard
B.2	Prepare a Standard for Digital Tide Tables	H	Prepare draft Standard	2009	2013	O	Stephen Gill* Chris Jones Zarina Jayaswal	
C.1	Liaise with TSMAD and DIPWG on tidal matters relevant to the Dynamic Application of Tides in ECDIS	H	Prepare draft pages for Objects and Attributes.  Prepare draft Product Specifications (S1**) for tidal data in S-100.	2010  2012	2012  2013	O  O	ZarinaJayaswa* Stephen Gill Chris Jones Juan Fierro Ruth Farre Dan Pillich	
C.2	Develop a Standard for the transmission of real-time tidal data	H		2009	2013	O	Stephen Gill* Chris Jones Zarina Jayaswal Juan Fierro	
E.1	Review the various definitions of MSL and their relevance to Hydrographic Offices and review the IHO tidal resolutions to ensure that they are compatible with the requirements of non-tidal areas such as the Baltic Sea.	H	Reviewed at TWLWG2- Further work undertaken at TWLWG3 and TWLWG4. Definition of MSL approved for submission to HDWG. Work on the IHO resolutions ongoing.	2009	2013	O	Jukka Varonen* Tor Tørresen Phil MacAulay Stephen Shipman Chris Jones Stephen Gill	
F.1	Prepare and maintain an inventory of tide gauges used by Member States and to publish it on the IHO/TWLWG web site.	H	Initial inventory from TWLWG members available on IHO web site. CL36/2010 sent to Member States seeking wider input.	Continuous		O	David Wyatt* Stephen Gill	

Task	Work item	Priority H-high M-medium L-low	Milestones	Start Date	End Date	Status P-planned O-ongoing C-completed	Contact Person(s) * indicates leader	Related Pubs/Standard
H1	The study of long term data sets for the determination of global sea level rise.	H		2011	2014	O	Chris Jones Salvador Moreno Stephen Gill Tor Tørresen Gwenaële Jan Do-Seong Byun	
I1	On-line real time water level observation document	H	Review and feedback by 1 August 2012	2012	2013	O	David Wyatt	

## 1.2 TWLWG Meetings (IHO Task 3.1.11 refers)

Date	Location	Activity
8 – 10 May 2012	Fish Hoek, South Africa	4 <sup>th</sup> Meeting
April/May 2013	To be decided	5 <sup>th</sup> Meeting

Chair: Stephen Gill                      Email: Stephen.Gill@noaa.gov  
Vice-Chair: Zarina Jayaswal            Email: Zarina.Jayaswal@defence.gov.au  
Secretary: David Wyatt                  Email: David.Wyatt@iho.int

TITLE	Reference	Last amendment (CL or IHC)	1 <sup>st</sup> Edition Reference
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DATUMS AND BENCH MARKS	3/1919 as amended	19/2008	A2.5
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1 It is resolved that chart datums (datums for sounding reduction), the datums of tide prediction and other tidal datums shall always be connected with the general land survey datum, and, in addition, with a prominent and permanent fixed mark in the neighbourhood of the tide gauge, station, observatory etc.

2 It is resolved that ellipsoidal height determinations of the vertical reference marks used for tidal observations should be made, in order to support the production of seamless data sets; i.e. to allow the translation between data sets with differing vertical datums. It is further resolved that such observations should relate to a geocentric reference system, preferably the International Terrestrial Reference System (ITRS) or one of its realizations e.g. the World Geodetic System 1984 (WGS84).

Where the tidal range is appreciable (>30cm)

3 It is resolved that heights on shore, including elevations of lights, should be referred to a HW datum. The datum used should be clearly stated on charts.

4 It is resolved that the datum for tide predictions shall be the same as chart datum (datum for sounding reduction). It is further resolved that the Lowest Astronomical Tide (LAT), or as closely equivalent to this level as is practically acceptable to Hydrographic Offices, be adopted as chart datum. Alternatively the differences between LAT and national chart datums may be specified in nautical documents. If low water levels in a specific area frequently deviate from LAT, chart datum may be adapted accordingly.

5 It is resolved that Highest Astronomical Tide (HAT) be adopted as the datum for vertical clearances. Alternatively the differences between HAT and national datums for vertical clearances may be specified in nautical documents. If high water levels in a specific area frequently deviate from HAT, the datum for vertical clearances may be adapted accordingly.

*Note: LAT (HAT) is defined as the lowest (highest) tide level which can be predicted to occur under average meteorological conditions and under any combination of astronomical conditions. It is recommended that LAT and HAT be calculated either over a minimum period of 19 years using harmonic constants derived from a minimum of one year's observations or by other proven methods known to give reliable results. Tide levels should, if possible, reflect the estimated error values obtained during the determination of these levels.*

Where the tidal range is negligible (<30cm)

6 It is resolved that heights on shore, including elevations of lights, should be referred to Mean Sea Level (MSL) or other level as closely equivalent to this as is practically acceptable to Hydrographic Offices. The datum used should be clearly stated on charts.

*Note: The adopted level may be a well-defined geodetic datum as used for heights in land survey applications or an observed local Mean Water Level (MWL) based on long series of water level observations.*

7 It is further resolved that a HW datum be used for vertical clearances. In order to allow the development of regional solutions, it is recommended that an appropriate long term range of low/high water definitions of the lower/upper 94-100 percentile be adopted.

### Inland Waters

8 It is resolved that data shown on charts and publications should be referred to an appropriate low water datum. The selection of the datum to be used is a difficult issue which can only be determined locally and which will be largely dependent on seasonal hydrological conditions.