

# **Standard for Official New Zealand Sea Level Information**

*TH Standard 54*

*National Topographic Hydrographic Authority*

*3 March 2003*

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## Foreword

Land Information New Zealand (LINZ) (Toitu te Whenua) was established in July 1996. It is a government department with roles and responsibilities in the following key areas:

<b>Regulatory Responsibilities</b>	<b>LINZ Regulatory Groups</b>
National survey control system, cadastral survey infrastructure and electoral boundaries	Office of the Surveyor-General
Topographic and Hydrographic Information	National Topographic/Hydrographic Authority
Land Titles	Office of the Registrar-General of Land
Crown Property and setting rules for rating valuations	Property Regulatory Group

The main role of the department is a regulatory one, to set standards and guidelines and manage contracts for carrying out the day to day business associated with each of the key areas.

LINZ also offers a range of services to customers related to land titles, cadastral and geodetic surveys and Crown property. Land Titles and Survey services are carried out by the Operations Group based in LINZ, processing centres throughout New Zealand.

LINZ overarching objective is to be recognised as a world leader in providing land and seabed information services.

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## Introduction

Land Information New Zealand (LINZ) is the Crown agency responsible for the provision of official New Zealand Sea Level information (often referred to as Tidal Information) to fulfil national and international responsibilities (as the National Hydrographic Authority).

LINZ receives Sea Level Information from Standard Port gauge operators to be able to undertake these functions.

This standard is issued to define the minimum standards for official Sea Level Information from Standard Ports.

## Approval

This Standard is certified as National Topographic/Hydrographic Authority Standard 54, Version 1, with a short title of TH Standard 54



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## Record of Changes

<b>Version</b>	<b>Date</b>	<b>Amendment</b>
1	3 March	New Standard

# **STANDARD FOR OFFICIAL NEW ZEALAND SEA LEVEL INFORMATION**

## **1 Scope**

This standard states:

- the minimum criteria to be used for the delivery of Official New Zealand Sea Level information.

In addition, the following Guidelines are provided at Annex A:

- justification for a Sea Level Standard;
- intended users of the Standard;
- a description of Official Sea Level Information;
- an outline of the management of official Sea Level Information
- definitions of Standard and Secondary Ports

## **2 Related Standards**

1. Regulatory Group Policy 2000/1 dated 1 November 2000, LINZ Requirements for Sea Level Data.
2. International Marine Organisation (IMO) SOLAS Convention of 1974, Regulation 20.
3. IHO Technical Resolution M3, Chapter A, Section 6 (updated to CL22/02)
4. New Zealand Maritime Rules Part 25
5. HYSPEC Version 3.0
6. LINZ OSG Specification for Tide Gauge Reference Marks (June 2002)

### 3 Term(s) and Definition(s)

◆ Table 1: National Topographic Hydrographic Authority Abbreviations and Definitions

Abbreviations	Definitions
Tidal Information (Sea Level Information)	<p>includes all data relating to observation, determination and description of;</p> <p>the vertical rise and fall of the sea,</p> <p>the horizontal motion of tidal streams and currents,</p> <p>the long period movement of sea level and</p> <p>any records documentation or evidence to support information relating to;</p> <p>Standard Ports</p> <p>Secondary Ports</p> <p>Chart datum</p> <p>Benchmarks, including the position of</p> <p>tidal streams</p> <p>currents</p> <p>tidal heights</p> <p>constituents</p> <p>predictions</p>
Official Tidal Information	is information that has been issued by or on the authority of a Government, authorised Hydrographic office or other relevant government institution., (SOLAS Chapter V Regulation 2)
Non-Official Tidal Information	All other Tidal information that does not meet the criteria for Official Tidal Information.

Standard Port	A place where tide or tide constants (constituents) have been determined from observations which are used as a standard for the comparison of simultaneous observations at a subordinate station. It is also a place for which independent daily predictions are given in tide tables. Standard Ports are normally locations where a permanent tide recorder, which is monitored regularly, exists.
Secondary Port	A tide or tidal current station at which a short series of observations was made and reduced by comparison with simultaneous observations at a Standard Port. Tide or tidal current predictions for Secondary Ports are determined by applying a correction to the predictions of a Standard Port.
Tide Station	A location at which measurements are made of the rise and fall of the sea, consisting of a tide staff (pole) connected by level observations to a minimum of three benchmarks and a device for the recording of water level (gauge).
Official Tide Tables	A nautical publication containing daily tidal predictions for Standard Ports and subsequent tidal time differences for Secondary Ports, as issued by the National Hydrographic Authority.
CTH	Chief Topographer Hydrographer
IHO	International Hydrographic Organization
LINZ	Land Information New Zealand
MSA	Maritime Safety Authority of New Zealand
NTHA	National Topographic Hydrographic Authority
NZNA	New Zealand Nautical Almanac
SOLAS	Safety of Life at Sea
TR	Technical Resolution (generally in relation to the IHO)
Matrix Condition	A statistical value between 0.00-1.00 describing the theoretical fit of derived constituents to observed data they were derived from. Values approaching 0.0 = bad, 1.0 = perfect agreement.
RMS	Theoretical Root Mean Square residual.
STD	Standard Deviation.



## 4 Sea Level Data Standards for Standard Ports

The minimum standards for levels the two levels of Sea Level Information, Source and Derived data, are specified in this Section.

Only the accuracy requirements for Standard Ports are detailed in this standard. Sea level information received from Secondary Ports should conform as closely as practical to that of Standard Ports; however, it is acknowledged that in the vast majority of cases, this will not be possible.

### 4.1 Source Data

The following table sets out the minimum standards for Standard Port source sea level information for LINZ:

◆ Table 2: Minimum Standards for Source Sea Level Information

Information Type	Minimum Standard ( $2\sigma$ )	Notes
Sea Level Readings	<ul style="list-style-type: none"> <li>• +/- 0.01m</li> <li>• To within +/- 10 seconds</li> <li>• Maximum period between logging intervals 5 minutes</li> </ul>	<ol style="list-style-type: none"> <li>1. Relative to auditable and recoverable datum (eg published CD in NZNA)</li> <li>2. Recorded value to be an average of height samples taken over a minimum of 30 seconds centred on time of reading</li> <li>3. Ground truthing from minimum of 25hour pole/gauge calibration every 12 months and regular checks against tide staff.</li> <li>4. If possible, Barometric Pressure at the station is to be recorded.</li> </ol>

<b>Tidal Current Measurements for Chart Tidal Diamonds</b>	<ul style="list-style-type: none"> <li>• +/- 0.1 knot</li> <li>• +/- 5°</li> <li>• Minimum period of observations NLT 25 hours over Springs period</li> <li>• Maximum period between logging intervals 10 minutes</li> </ul>	<ol style="list-style-type: none"> <li>1. At depth specified</li> <li>2. In date manufacturers calibration certificate required for automatic recording equipment.</li> </ol>
<b>Tidal Station Bench Mark connections</b>	<ul style="list-style-type: none"> <li>• As detailed in HYSPEC (Ver 3.0) article 3.5</li> <li>• Refer also to OSG Specification for Tide Gauge Reference Marks</li> </ul>	

## 4.2 Derived Data

The following table sets out the minimum standards for LINZ products derived from Standard Port source sea level information:

◆ Table 3: Minimum Standards for Products derived from Source Sea Level Information

Information Type	Minimum Standard ( $2\sigma$ )	Notes
<b>Tidal Constituents for Standard Port Predictions</b>	<ul style="list-style-type: none"> <li>• Matrix Condition 0.7 – 1.0</li> <li>• RMS Error NMT 0.13m (0.145m)</li> <li>• STD NMT 0.11m (0.14m)</li> <li>• Derived from Minimum continuous Observation Period of 13 months</li> </ul>	<ol style="list-style-type: none"> <li>1. Variation to stated values may be accepted where theoretical RMS is low.</li> <li>2. Bluff Standard Port values in brackets - affected by Inverted Barometer Effect</li> <li>3. Continuous period means broken by periods NMT 8% of total hourly datapoints</li> <li>4. Constituents are to be computed annually, incorporating new observations. “Master” constituent sets are to be reviewed at periods NMT every 3 years</li> </ol>
<b>Tidal Predictions for Standard Ports</b>	<ul style="list-style-type: none"> <li>• +/- 5 minutes</li> <li>• +/- 0.05m</li> </ul>	<ol style="list-style-type: none"> <li>1. Values are for normal meteorological effects / river flow (if applicable)</li> <li>2. Accuracy determined by direct comparison of predictions against station staff observations over minimum 25 hour period, at intervals not exceeding 18 months.</li> <li>3. Official, annual predictions to be available for release between 12 – 18 months in advance to IHO member states.</li> </ol>

<b>Tidal Stream Determinations for Chart Tidal Diamonds</b>	<ul style="list-style-type: none"> <li>• +/- 0.15 knot</li> <li>• +/- 10°</li> </ul>	<ol style="list-style-type: none"> <li>1. Values are for normal meteorological effects / river flow (if applicable)</li> <li>2. Estimate of reliability of results by interpretation of tidal stream analysis.</li> </ol>
<b>Tidal Stream Predictions for NZNA</b>	<ul style="list-style-type: none"> <li>• +/- 15 minutes</li> </ul>	<ol style="list-style-type: none"> <li>1. Time of change of direction only.</li> </ol>
<b>Chart Datum (CD)</b>	<ul style="list-style-type: none"> <li>• To be set at +/- 0.05m of the lowest predicted value during period of 19 years.</li> </ul>	<ol style="list-style-type: none"> <li>1. LAT is to be computed annually, using the best constituent set available, incorporating the most recent tidal data obtained. Where it differs by more than 0.1m from the current value of CD published in NZNA for a period of more than 2 years, an assessment is to be made concerning the appropriateness of the CD in use.</li> <li>2. For most Standard Ports in NZ, a complete 19 years set of observations has not been collected. In such cases, CD should be derived on the longest period of acceptable continuous data held.</li> <li>3. Where possible, necessary changes to published CD will coincide with chart New Editions or New Charts of the largest scale harbour charts of the Standard Port concerned.</li> </ol>

<p><b>Tidal Levels (MHWS, MLWS, MLWN, MHWN)</b></p>	<ul style="list-style-type: none"> <li>• To be set at +/- 0.05m of the tidal level values derived from a minimum of 13 months of tidal observations.</li> </ul>	<ol style="list-style-type: none"> <li>1. Methods employed to derive tidal levels must account for the N2 constituent.</li> <li>2. Tidal levels are to be computed annually, incorporating the most recent tidal data obtained. Where they differs by more than 0.1m from the current values of published in NZNA for a period of more than 2 years, an assessment is to be made concerning the appropriateness of the levels in use.</li> </ol>
<p><b>Mean Sea Level</b></p>	<ul style="list-style-type: none"> <li>• To be set at the average height of hourly tidal observations over a 19 year period</li> </ul>	<ol style="list-style-type: none"> <li>1. For most Standard Ports in NZ, a complete 19 years set of observations has not been collected. In such cases, MSL should be derived on the longest period of acceptable continuous data held.</li> </ol>

## Annex A

# Guidelines to Standards for Official New Zealand Sea Level Information

## 1 Introduction

Supporting information and background used in the production of the Standards for Official New Zealand Sea Level Information (TH54) is included in this Annex.

### 1.1 *Justification*

The NZ Government is signatory to a number of international agreements concerning the provision of nautical information for the purposes of safe navigation. Regulations issued by the Maritime Safety Authority further define these responsibilities. Land Information New Zealand is the national authority for hydrographic information and has responsibility to provide authoritative sea level information in order to meet these commitments.

Regulatory Group Policy 2000/1 details the specific regulatory requirements for sea level data.

### 1.2 *Intended Users of the Standard*

This Standard is intended for the following users:

- LINZ Regulatory Groups –
  - to support the development of related specifications and policies to support any guidelines and project-related specifications
- LINZ Contracts Group –
  - to outline the over-arching criteria for the purchase and delivery sea level information
  - to provide the framework against which the delivered services will be measured.
- LINZ Providers of Sea Level Information –
  - to provide the framework against which the delivered services are to be collected and subsequently measured against
- Users of Official Sea Level Information –
  - To provide confidence in stated accuracy of Official Sea Level Information

### 1.3 Official Sea Level Information - Description

Official sea level information produced by LINZ is to meet the requirements of the New Zealand Maritime Rule 25. This specifically relates to Official Tide Tables and Nautical Charts. The table below details the Official Sea Level Information required:

◆ Table 4: Official Sea Level Information Produced by LINZ

<b>Information Type</b>	<b>Purpose</b>
<b>Raw Sea Level Records</b>	Archive of records required to support derived sea level products
<b>Formatted Digital raw Data</b>	Source data from which tidal constituents are produced
<b>Analysis Reports</b>	Source of quality assessment for derived sea level products
<b>Tidal Constituents</b>	Source data from which tidal predictions are produced
<b>Tidal Time Differences</b>	Time differences for MHW and MLW between Secondary Ports and the associated Standard Port, where sufficient data is available for Secondary Port to allow this.
<b>Tidal Predictions</b>	Tidal predictions produced from Standard Port tidal constituents for mariners and public. Does not include tidal predictions for Secondary Ports derived from the application of time differences and height ratios from Standard Ports.
<b>Tidal Levels</b>	<p>The following sea levels, derived for Standard Ports based on the criteria set out in Section 10.2:</p> <ul style="list-style-type: none"> <li>• MHWS, MHWN, MLWN, MHWS, MSL, CD, LAT and HAT</li> </ul> <p>The following sea levels, derived for Secondary Ports, where sufficient data is available for Secondary Port to allow this:</p> <ul style="list-style-type: none"> <li>• MHWS, MHWN, MLWN, MHWS, MSL, CD, LAT and HAT</li> </ul>

<b>Tidal Stream Determinations</b>	<ul style="list-style-type: none"> <li>• Tidal stream information based on criteria set out in Section 10.2, at locations selected to support safe navigation</li> <li>• Tidal stream predictions detailing change of flow for channels / straits / narrow passages where a knowledge of this information significantly enhances the safe navigation of vessels.</li> </ul>
<b>Bench Mark Connections</b>	Links to land network for MSL and Tidal Levels
<b>Charting Tidal Blocks</b>	<p>Authoritative sea level information for charts, including:</p> <ul style="list-style-type: none"> <li>• Statement describing BM connections to CD at unique location</li> <li>• Tidal Levels at tidal stations relevant to chart</li> </ul>

## 1.4 *Management of Official Sea Level Data*

### 1.4.1 *Ownership of Sea Level Data*

LINZ normally obtains sea level information through gratis supply from Standard Port and other gauge operators. In such cases, intellectual property rights of the supplied data are to be clearly established between LINZ and the information provider.

### 1.4.2 *Access to Sea Level Data*

#### 1.4.2.1 *General Access*

Sea level information received by LINZ for which intellectual property rights have been retained by the data supplier, will only be released to third parties with their written permission.

The intellectual property rights of data purchased by LINZ through hydrographic survey programmes or by other means is retained by LINZ and is to be treated as information under the official information act.

Products derived from any sea level information received by LINZ (eg Tidal Predictions) is to be treated as information under the official information act.



#### **1.4.2.2**    *Restricted Access*

The exception to the access conditions set out in 8.2.1, are tidal constituents, which are not normally released to third parties. This is consistent with the recommendations made in IHO Resolution A6.9, amended to CL 22/2001.

#### **1.4.3**    *Custody of Sea Level Data*

LINZ will maintain a database of all sea level information received, to support the generation of the Official Sea Level Information detailed in Table 2 above.

### **1.5**    *Tidal Stations – Definitions*

#### **1.5.1**    *General*

LINZ has national and international responsibilities to produce tidal predictions in the form of Nautical Tide Tables. These tidal predictions are for two types of tidal stations – Standard Port Tidal Stations (also known as Reference Stations) and Secondary Tidal Stations (also known as Subordinate Stations).

##### **1.5.1.1**    *Standard Port Tidal Stations*

The definition of a Standard Port Tidal Station is detailed at Section 3 of this Standard. A full description can be found in the Hydrographic Dictionary produced by the IHO.

Standard Ports in New Zealand were selected for the purposes of providing a location from which tidal observations could be made, and ultimately tidal predictions derived to support the safe navigation of vessels using the Port in which they were located.

Daily tide tables are required to be produced for Standard Ports by the national hydrographic authority, to meet SOLAS and NZ maritime regulations. The following 16 Standard Ports have been adopted based on the above justification in New Zealand and are to be maintained:

◆ Table 5: NZ Standard Ports

<b>LINZ Station Number</b>	<b>Standard Port</b>
070	Auckland
072	Bluff
028	Dunedin
078	Gisborne
107	Lyttelton
079	Marsden Point
097	Napier
077	Nelson
027	Onehunga
043	Picton
076	Port Taranaki
073	Tauranga
034	Timaru
071	Wellington
074	Westport
108	Whangarei

### 1.5.1.2 Secondary Port Tidal Stations

The definition of a Secondary Port Tidal Station is detailed at Section 3 of this Standard. A full description can be found in the Hydrographic Dictionary produced by the IHO.

Secondary Ports are normally located in areas where tidal predictions to the accuracy defined for Standard Ports are not critical to safe navigation to the typical vessel transiting the area. Tide or tidal current predictions for Secondary Ports can be determined by applying a correction to the predictions of a Standard Port. Such

corrections are provided in the form special tables in the Official Tide Tables. This is consistent with the recommendations made in IHO Resolution G3.1.

There are currently 195 Secondary Ports listed in the 2002 NZNA that detail tidal level information and time differences referenced to Standard Ports. As hydrographic surveys are undertaken and this number will increase.