



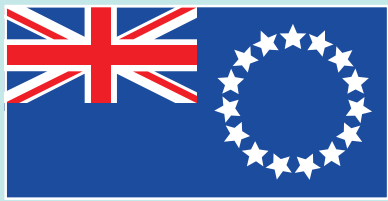
Cook Islands - Penrhyn

2025 Tide Predictions Calendar

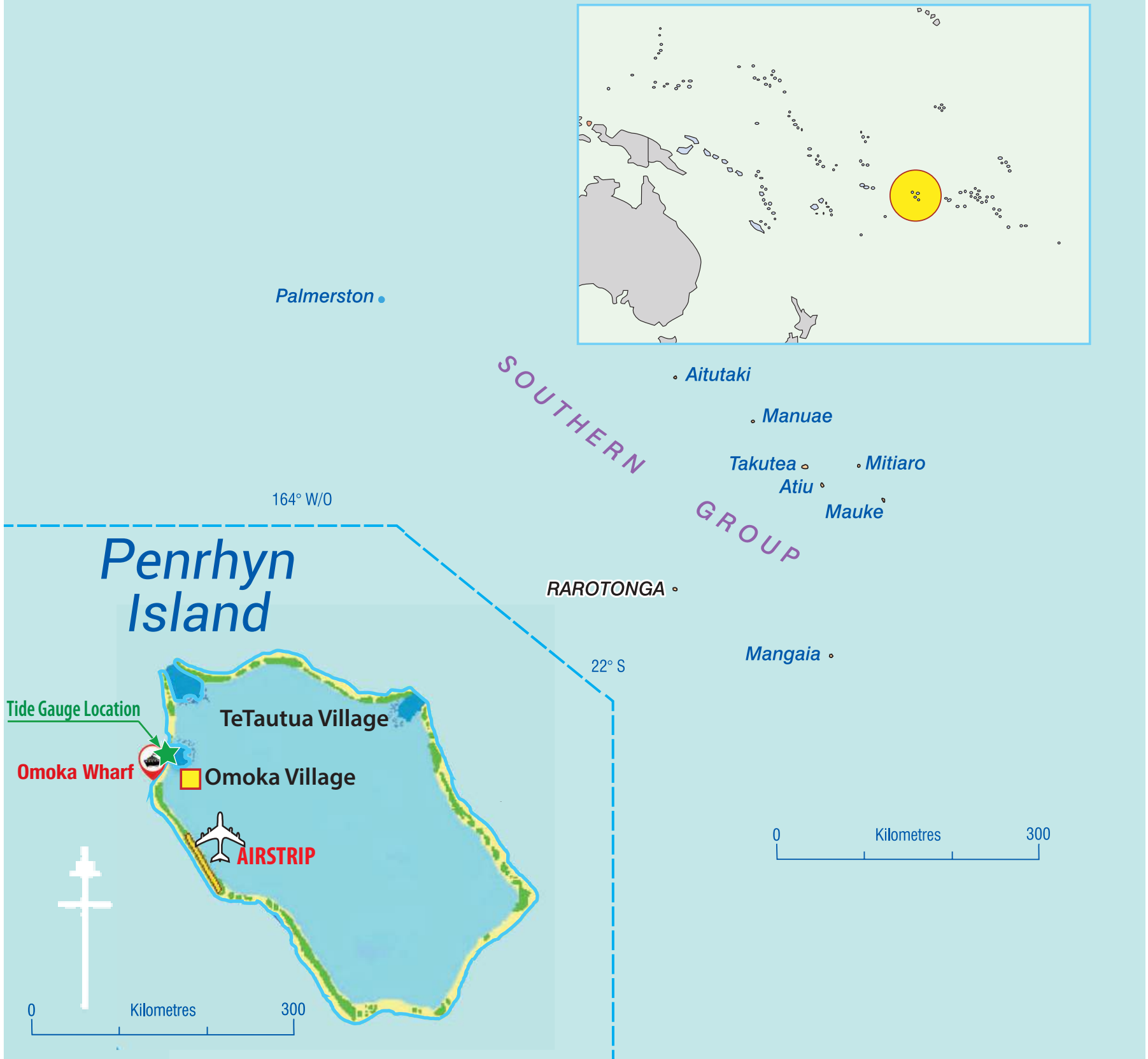
Climate and Oceans Support Program in the Pacific

A Pacific Islands Program supported by the Australian and New Zealand Governments





Cook Islands - Penrhyn



Meteorological and seasonal effects

Tide predictions are based on the effects of the gravitational forces exerted by the moon, the sun, and the rotation of the earth, as well as average seasonal changes.

The actual tide height will be a combination of these effects and the weather conditions at the time. The effects of the weather are not included in tide predictions.

Map courtesy of the Pacific Community.
Some rights reserved.

In the Cook Islands the Maritime Police Division Patrol Boat is used to combat illegal, unreported and unregulated fishing and to protect borders.

Front cover photo courtesy of Alisi Vucago -Waibuta, SPC

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| 10 highest tides for 2025 | | | 10 lowest tides for 2025 | | |
|---------------------------|-------|------------|--------------------------|------|------------|
| Date | Time | Height (m) | Date | Time | Height (m) |
| 27-Feb | 6:17 | 1.48 | 25-Jun | 1:53 | 1.03 |
| 28-Feb | 7:04 | 1.48 | 26-Jun | 2:42 | 1.03 |
| 30-Jan | 7:24 | 1.47 | 24-Jun | 1:02 | 1.03 |
| 26-Feb | 5:30 | 1.47 | 28-May | 3:03 | 1.04 |
| 31-Jan | 8:08 | 1.47 | 29-May | 3:58 | 1.04 |
| 01-Mar | 7:52 | 1.46 | 27-Jun | 3:27 | 1.04 |
| 29-Jan | 6:39 | 1.46 | 23-Jul | 0:45 | 1.04 |
| 28-Feb | 19:59 | 1.46 | 12-Jun | 2:17 | 1.04 |
| 28-Mar | 18:43 | 1.46 | 11-Jun | 1:35 | 1.04 |
| 28-Mar | 5:56 | 1.46 | 30-May | 4:50 | 1.04 |

Tidal analysis for Penrhyn was possible through the use of data from the tide gauge operated by the University of Hawaii. Caldwell, P. C., M. A. Merrifield, P. R. Thompson [2015], Sea level measured by tide gauges from global oceans — the Joint Archive for Sea Level holdings [NCEI Accession 0019568], Version 5.5, NOAA National Centers for Environmental Information, Dataset, doi:10.7289/V5V40S7W.

FIVE MINUTES THAT CAN SAVE YOUR LIFE

Before going out to sea:

**Check the weather
forecast**



**Tell someone who cares
where you are going and when
you plan to return**

**Make sure
all safety equipment
is on board**



**Make sure your engine
is working well**



Pacific
Community
Communauté
du Pacifique

In case of distress call
VHF radio channel **16**

Think
SAFETY
At Sea

Understanding Tides and Sea Level

Many factors contribute to sea level at the coast

Sea level is the height of the sea at any one time. It is controlled by: mean sea level changes, tides, storm surge and waves/swell.

The factor that changes sea level the most on daily timescales is usually tides.



Figure 1. Low and high tide at Betio, Kiribati.
Photo by Zulfikar Begg.

Tide gauges are the main way we monitor sea level

The tide gauge records the parts of the total sea level that vary on timescales of minutes to hours. This includes mean sea level, tides and storm surges.

Tide gauges aren't usually designed to measure components of the sea level that vary more quickly, such as swell and waves. To capture these components, we need to use other instruments such as wave buoys.

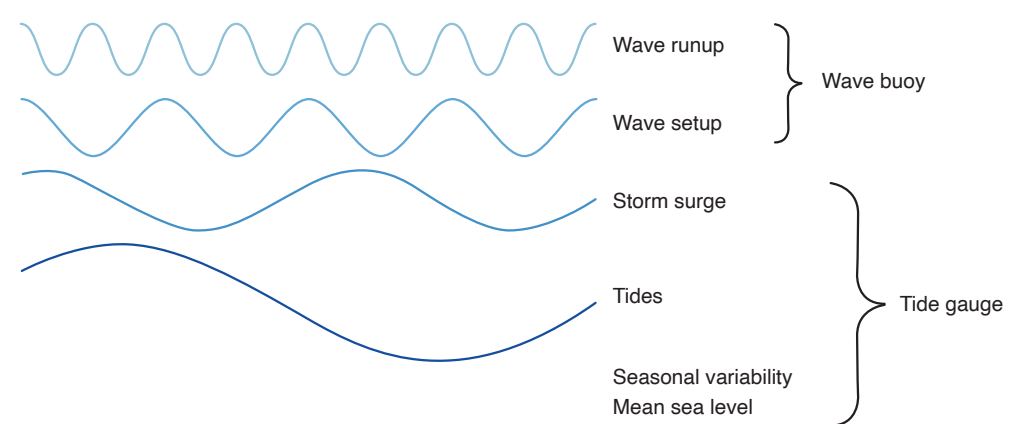


Figure 2. Tide gauges do not record all the factors that control sea level.

What causes tides?

Tides are the daily rise and fall of sea levels. Tides are mainly caused by the gravitational pull of the moon and sun on the Earth. Most locations tend to have two high and two low tides per day.

The timing of high tides is also dependent on the shapes of bays and geographies, varying in highly complex ways.

Spring and neap tides are part of the normal tidal cycle.

They usually occur twice per month.

Spring tides are very high tides that occur during full and new moon phases, when the gravitational forces of the sun and moon combine to exert a stronger pull on the oceans.

Neap tides are lower high tides and higher low tides that occur during the moon's quarter phases, when the gravitational forces between the sun and moon are not aligned.

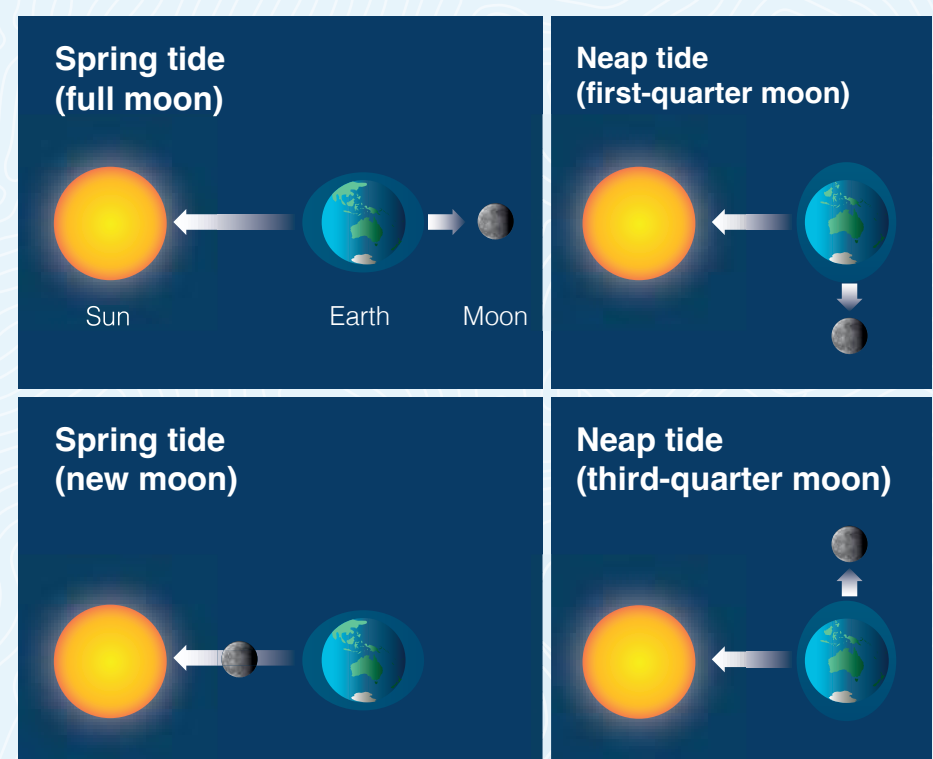
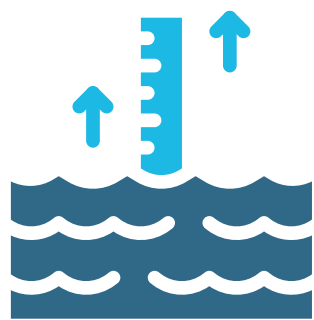


Figure 3. Spring and neap tides occur every month and correspond with the phases of the moon.



King tides are very high spring tides

King tides occur a few times every year, when the gravitational pull of the sun and moon upon the earth is strongest. This happens when the sun and moon are closest to the earth in their orbits.

In the Pacific, king tides are likely to occur during the months of November to March.

King tides can cause coastal flooding, even on a clear, sunny day.

When king tides coincide with cyclones, floods or storms, sea levels can rise even higher, potentially flooding low-lying coastal areas and causing damage to property and the coastline. The actual height reached by a king tide will depend on the local weather and ocean conditions on the day.

Sea level rise means that king tides now reach higher levels than they used to. Sea level rise also means that other moderate or high tides can now reach levels that king tides used to.



Figure 4. King tide event in Funafuti, Tuvalu.
Photo by Moritz Wandres.

The time and heights of tides are very predictable

Tides follow the laws of physics and can be calculated with mathematical formulas.

By recording sea level over many years, we can understand how tides and sea level change over time. The Pacific Sea Level and Geodetic Monitoring Project has recorded sea level and weather statistics in 13 Pacific countries as far back as 1993.

These observations tell stories. How high was the highest tide in Apia? How does El Niño impact sea levels in Kiribati? All of this information is also used to verify and improve tide predictions.

Why are some tides higher or lower than predicted?

Tides are only one of many factors that control sea levels. Sea levels may differ from predicted tide levels due to:

- 1. Storm surge:** Higher water levels due to weather conditions or storms. This can result from wind speed and direction, air temperature, barometric pressure and other weather conditions that can greatly affect water levels.
- 2. Sea level rise:** Sea level rise can contribute to higher tides.
- 3. Climate drivers:** El Niño or La Niña conditions in the Pacific can raise or lower sea level by as much as 50 cm.
- 4. Waves:** Both nearby and faraway events, such as storms, landslides and earthquakes can create large waves that lead to coastal flooding.
- 5. Geography:** The shape of bays and coastal geography can influence water levels.

For more information

To access tide calendars, wave and weather maps, and climate data for your location visit: www.bom.gov.au/pacific/index.shtml and <https://oceanportal.spc.int/portal/ocean.html>

For Real-Time Display of tide gauge data, visit: <http://www.bom.gov.au/cosppac/rtdd/q1c7o0hj48yu/>

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Tides and Sea Level for Coastal Development and Safe Navigation

What is a Tide Datum?

A Tide Datum is a fixed level against which sea level can be measured in a given location. A tide station datum was established when the sea level monitoring station featured in this calendar was first installed. The tide predictions in this calendar are all relative to Tide Prediction Datum.

Why do we need a Tide Datum?

Tide records must be referenced to a common datum to ensure consistency. This is important if the tide gauges are moved or in the event they are damaged or destroyed. In this case, tide readings from replacement gauges can be referenced to the same datum as before and continue to contribute to our understanding of tides.

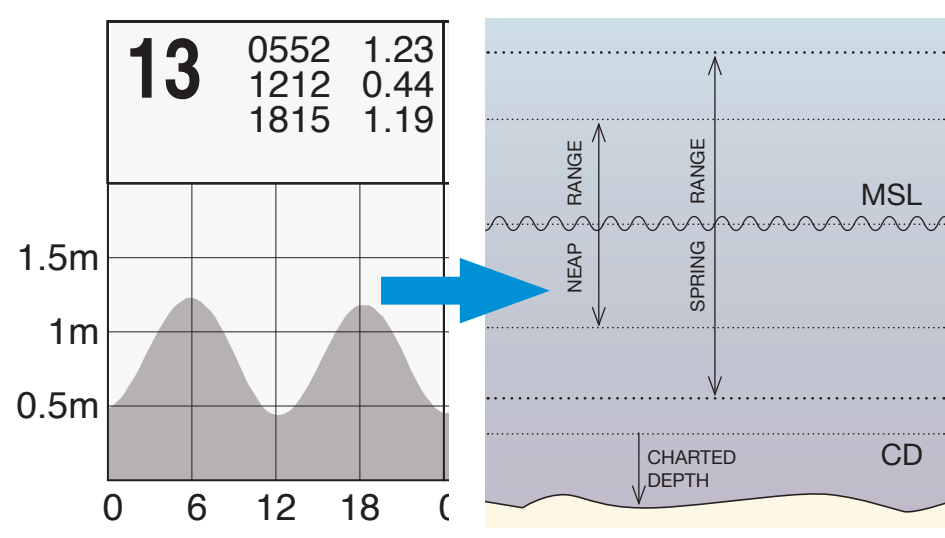


Figure 1. How does THIS..... relate to THIS?



Figure 2. An elevation sign from Tarawa, Kiribati. © SPC

What is the relationship between tides and sea level?

When the range of highest and lowest tides are averaged over a long period (usually at least 19 years), we can establish Mean Sea Level as an important reference level, as all heights on land are measured in metres or feet above mean sea level as in Figure 2.

All sea level monitoring stations are tide gauges, but not all tide gauges can accurately measure changes in sea level. The Pacific Sea Level and Geodetic Monitoring stations include specialised weather, ocean, and land monitoring sensors that have been operating since 1991, allowing us to measure the extent to which sea level is affected by natural variability and man-made climate change at those locations.

Who uses this information?

Makers of maps and nautical charts, land surveyors, engineers and geospatial specialists need this information to ensure the accuracy of their maps and charts. Coastal developers need it as well, to ensure roads, bridges, wharfs, sea walls, buildings and other infrastructure are built at an appropriate height above sea level.

It is especially important for the safety of navigation in ports and coastal areas, so ships can sail safely. The depths marked on a nautical chart are in relation to a Chart Datum. Every chart indicates the datum to which it refers, as in Figure 3.

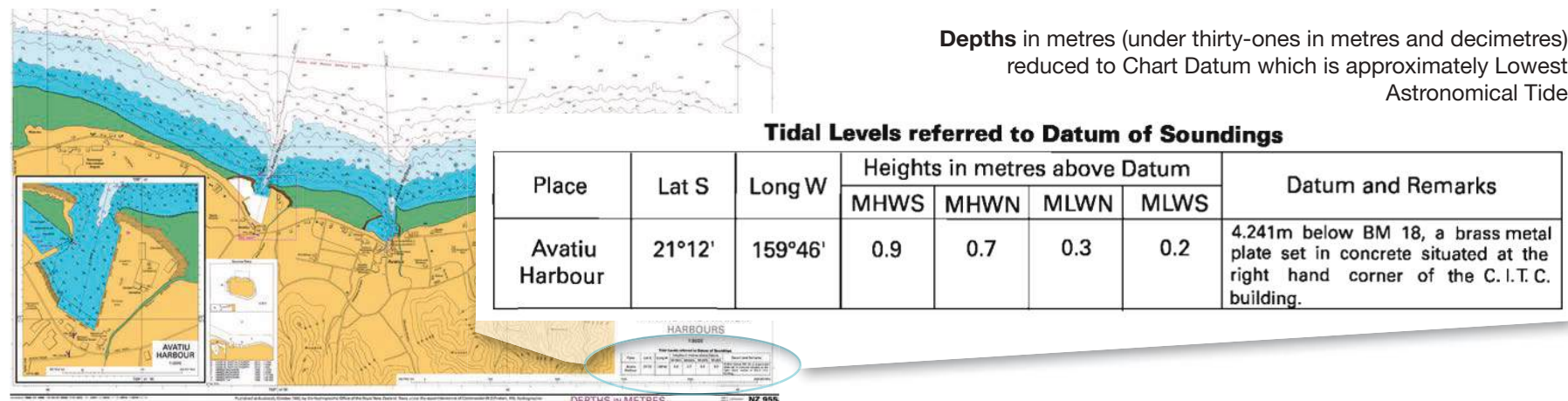


Figure 3. A nautical chart of Avatiu Harbor in Rarotonga, Cook Islands. Zooming into the key, we can see Chart Datum for this chart is about the same as Lowest Astronomical Tide.

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Tides and Extreme Tide Events

How are tides predicted?

The time and approximate heights of tides are very predictable. They follow the laws of physics and can be calculated with mathematical formulas.

By observing and recording tides at a single location over many years, we can gain a better understanding of tides and sea level changes over time.

The Pacific Sea Level and Geodetic Monitoring Project has been recording sea level and weather statistics at 13 Pacific countries for more than 25 years.

These observations tell a story about the sea levels at these locations, such as: How high was the highest tide in Apia? What effect does El Niño have on sea levels in Kiribati? All of this information is also used to verify and improve tide predictions.



Figure 4. Technicians working on the Cook Islands tide gauge, which has been monitoring sea level and weather conditions in Rarotonga for over 25 years.
Photo: Stamy Criticos (2012).

Why are some tides higher or lower than predicted?

Tide levels can vary from predicted levels for a number of reasons, including:

1. **Geography:** The shape of bays and other coastal geography can magnify or otherwise influence water levels.
2. **Weather:** Wind speed and direction, air temperature, barometric pressure and other weather conditions can greatly affect water levels.
3. **Waves:** Both nearby and faraway events such as storms, landslides and earthquakes can create large waves that lead to coastal flooding.
4. **Climate drivers:** El Niño or La Niña conditions in the Pacific can raise or lower sea level by as much as 50 cm.
5. **Sea-level rise:** Through assessing observations and research, the Intergovernmental Panel on Climate Change (IPCC) concluded that global average sea levels have been rising at a rate of about 3 mm per year since 1993. Levels were 225 mm higher in 2012 compared to 1880. Sea-level rise can contribute to higher tides, but the rates are not the same at all locations.

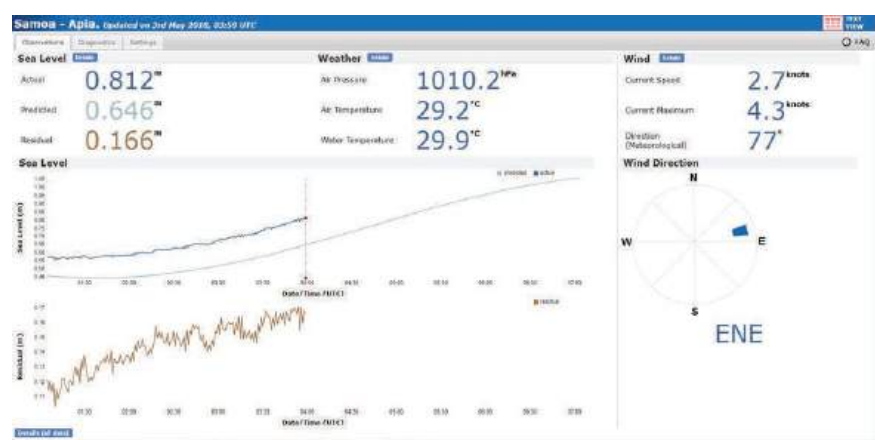


Figure 5. Predicted vs actual sea level at the Apia tide gauge Samoa, 3 May 2018.

The **Pacific Sea Level and Geodetic Monitoring Project** provides sea level and meteorological information for 13 countries and tide predictions for 25 locations in the Pacific region. It is an important resource for those involved in disaster mitigation and adaptation planning, coastal development, and the shipping, fishing and tourism industries.

To access tide calendars, wave and weather maps, and climate data for your location visit:
www.bom.gov.au/pacific/index.shtml

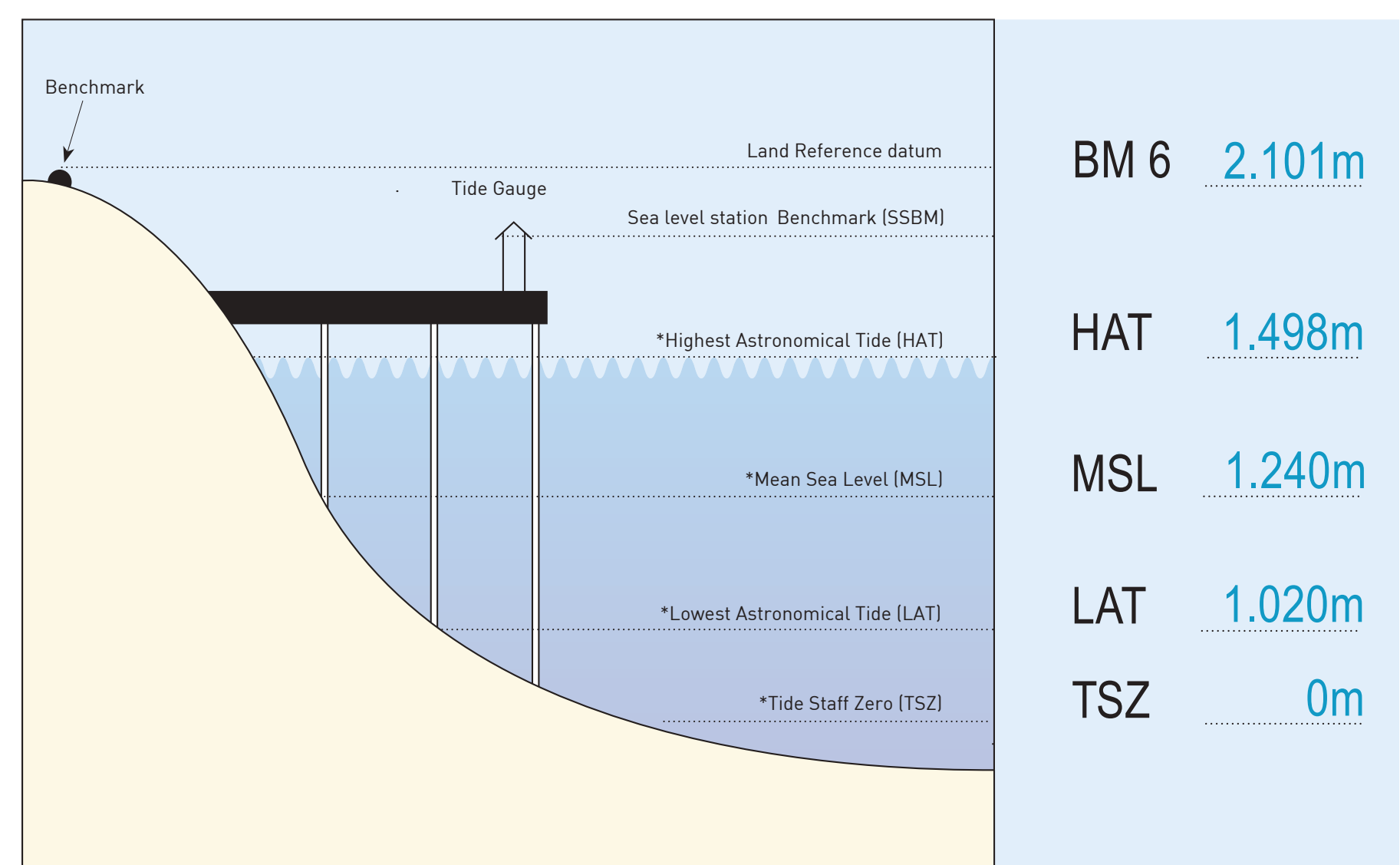
For Real-Time Display of tide gauge data, visit: <http://www.bom.gov.au/cosppac/rtd/q1c7o0hj48yu/>

How do the predicted water levels on this calendar relate to chart depths in my country?

The tide predictions in this calendar are not intended to be used directly with hydrographic charts, as the prediction datum and hydrographic chart datum may not coincide. However, the tidal levels listed below are provided to help put the tide predictions into context for use with other information.

Penrhyn

The diagram below includes the predicted heights of key tide components based on analysis of the data available.



Useful Tide Definitions

The water levels to the left are calculated using actual observations/data over many years.

Highest Astronomical Tide

The highest tide level predicted over 19 years under normal weather conditions

Mean Sea Level

The average level of the sea surface expected for the year*

Lowest Astronomical Tide

The lowest tide level predicted over 19 years under normal weather conditions

Tide Staff Zero

The datum from which sea level observations are measured .

Prediction Datum

The datum of tide predictions and tidal levels listed in this tide calendar.

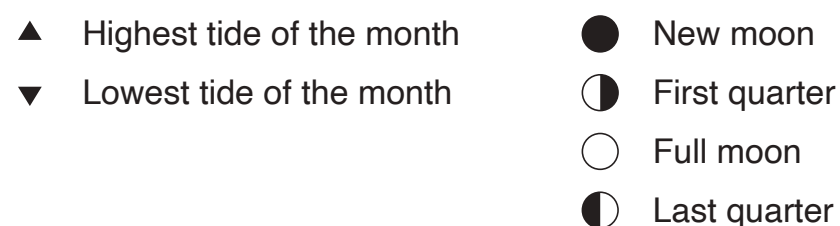
**Updated every year as part of the tide prediction and tidal level calculations. Distinct from any historic MSL, LAT or HAT values established as fixed height datum.*

For more information about Tide Datum and Sea Level Monitoring,
you can email: cosppac@spc.int or tides@bom.gov.au



Local Standard Time

SATURDAY



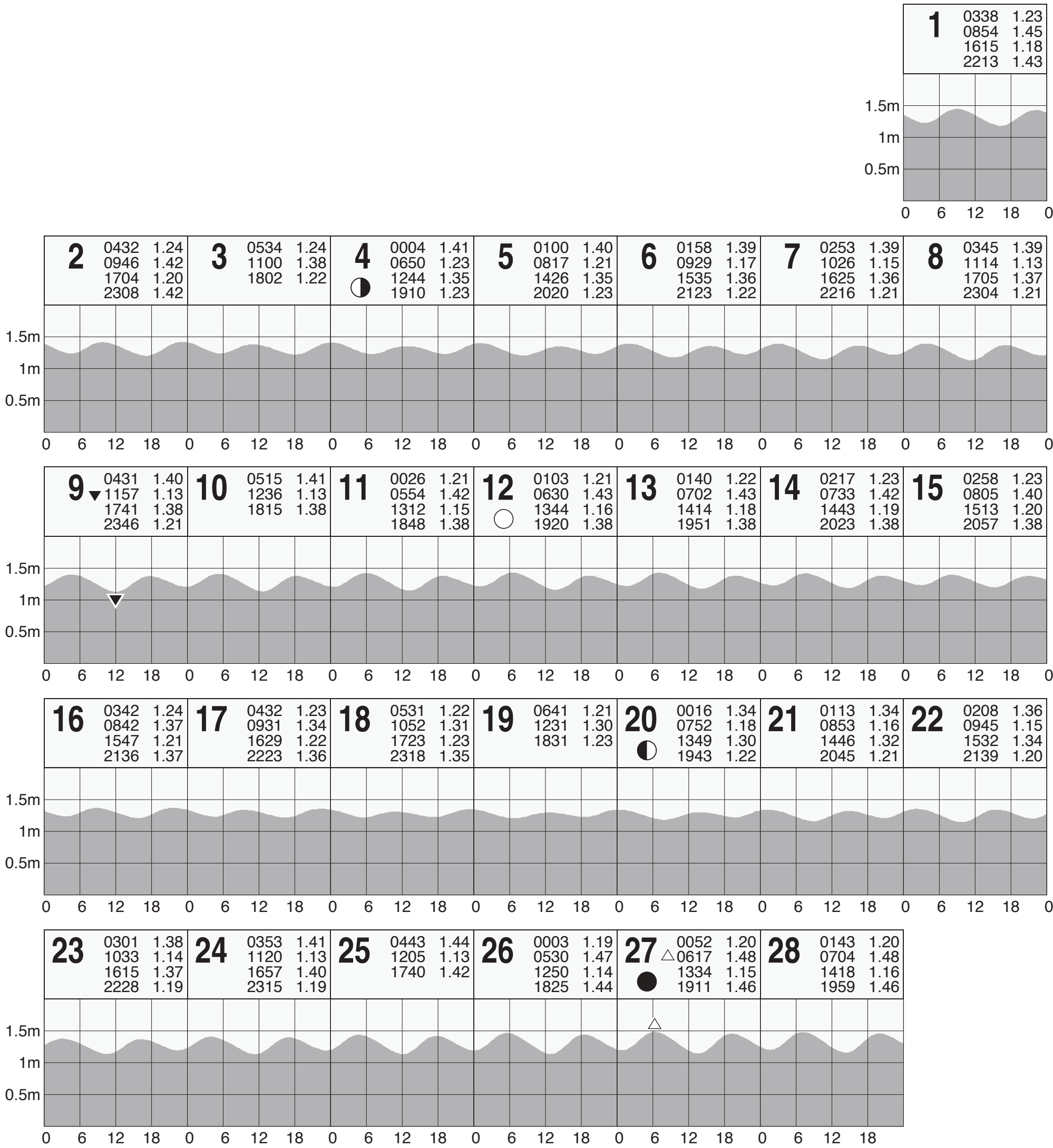
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Tide gauge zero is 2.101 metres below BM6

TIDAL PREDICTIONS FOR COOK ISLANDS - PENRHYN

FEBRUARY 2025 Local Standard Time

SUNDAY MONDAY TUESDAY WEDNESDAY THURSDAY FRIDAY SATURDAY



- ▲

Highest tide of the month
- ▼

Lowest tide of the month
- △

Highest tide of the year
- New moon
- ◐

First quarter
- Full moon
- ◑

Last quarter

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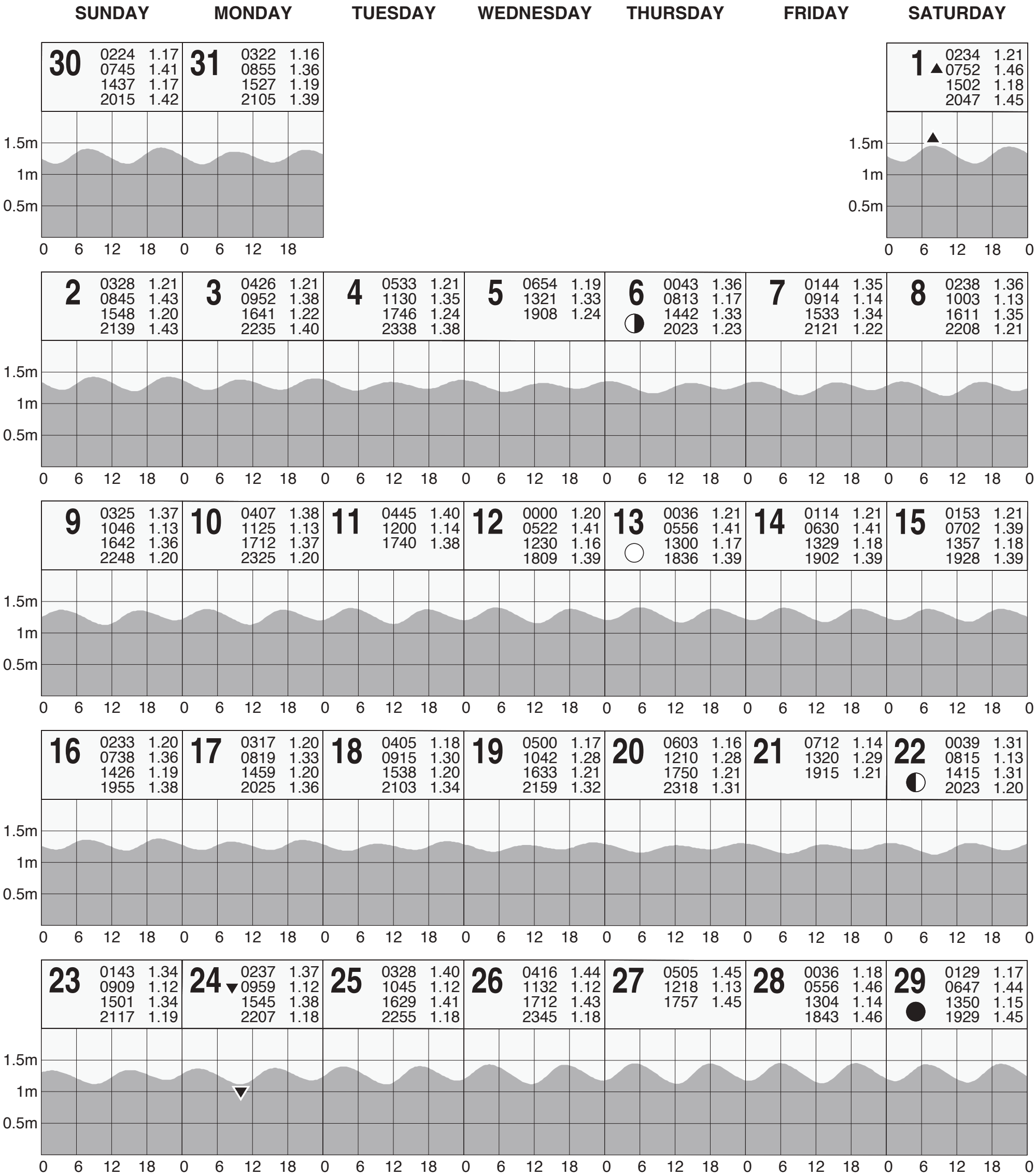
Disclaimer: These tide predictions are supplied in good faith and are believed to be correct. They are not necessarily related to a local hydrographic chart datum.

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Tide gauge zero is 2.101 metres below BM6

TIDAL PREDICTIONS FOR COOK ISLANDS - PENRHYN

MARCH 2025Local Standard Time



- ▲ Highest tide of the month

▼ Lowest tide of the month
- New moon

◐ First quarter

○ Full moon

◑ Last quarter

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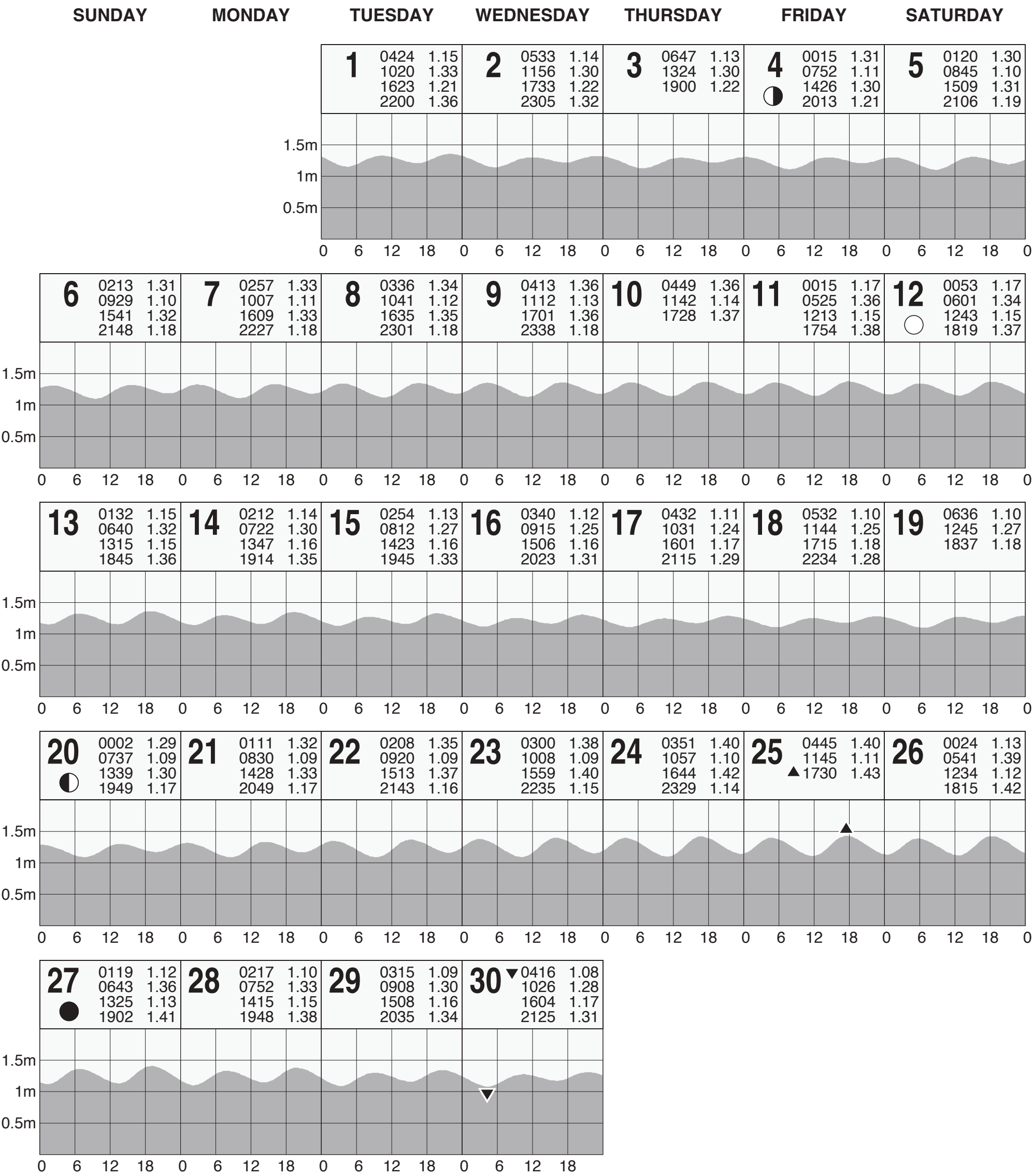
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Tide gauge zero is 2.101 metres below BM6

TIDAL PREDICTIONS FOR COOK ISLANDS - PENRRHYN

APRIL 2025Local Standard Time



- ▲

Highest tide of the month
- ▼

Lowest tide of the month
- New moon
- ◐

First quarter
- ◯

Full moon
- ◑

Last quarter

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Disclaimer: These tide predictions are supplied in good faith and are believed to be correct. They are not necessarily related to a local hydrographic chart datum.

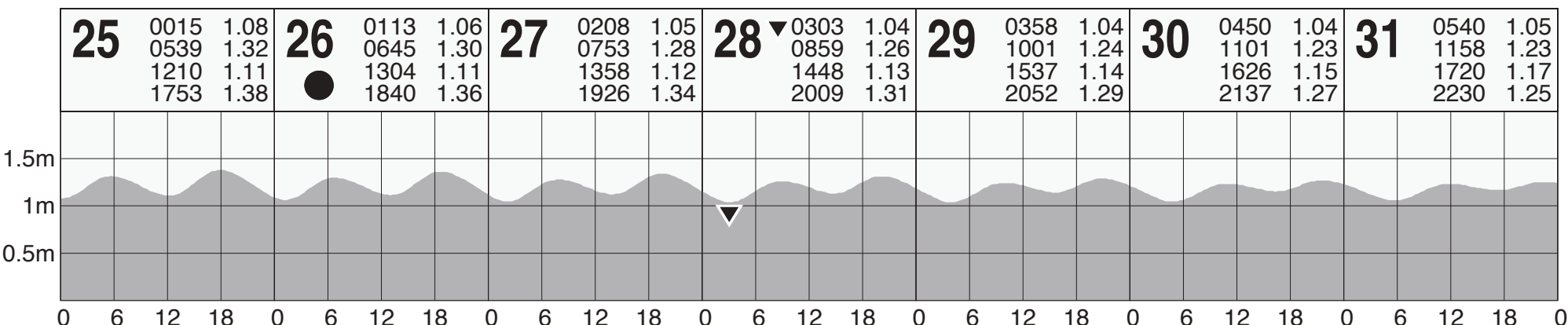
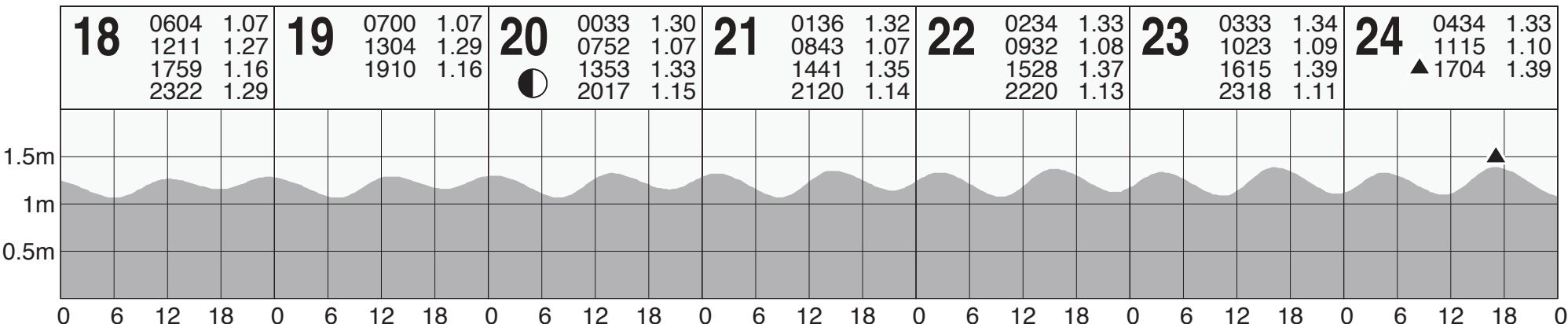
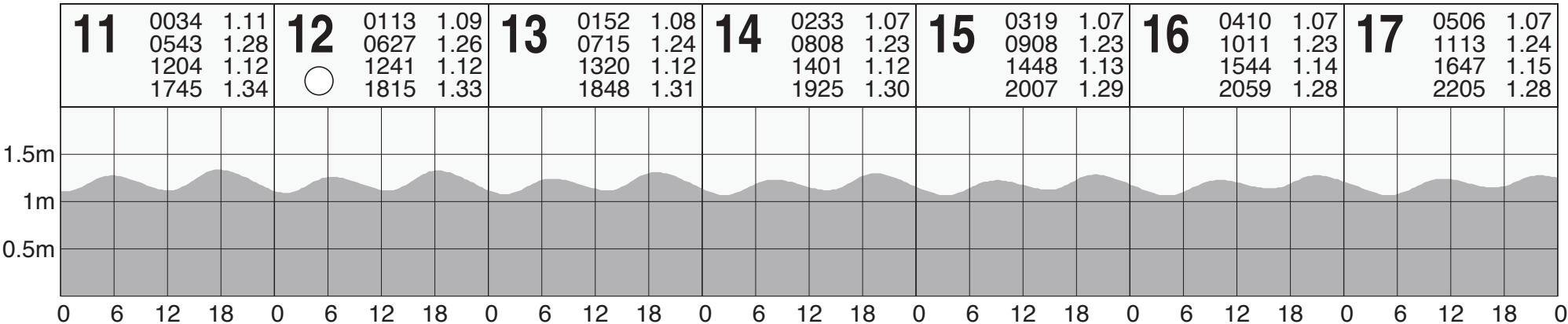
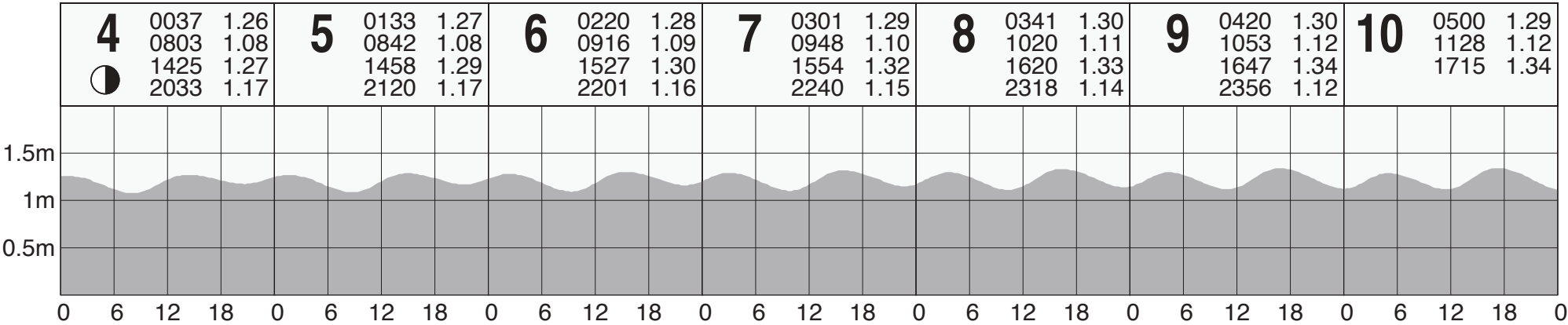
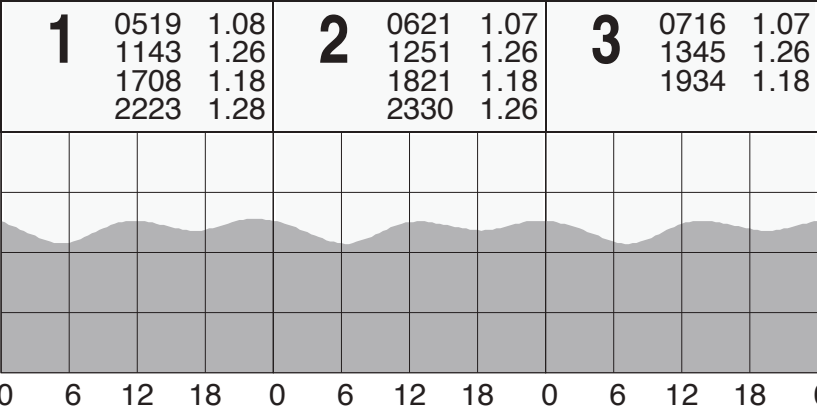
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Tide gauge zero is 2.101 metres below BM6

TIDAL PREDICTIONS FOR COOK ISLANDS - PENRHYN

MAY 2025Local Standard Time

SUNDAYMONDAYTUESDAYWEDNESDAYTHURSDAYFRIDAYSATURDAY



- ▲

Highest tide of the month
- ▼

Lowest tide of the month
- New moon
- ◐

First quarter
- Full moon
- ◑

Last quarter

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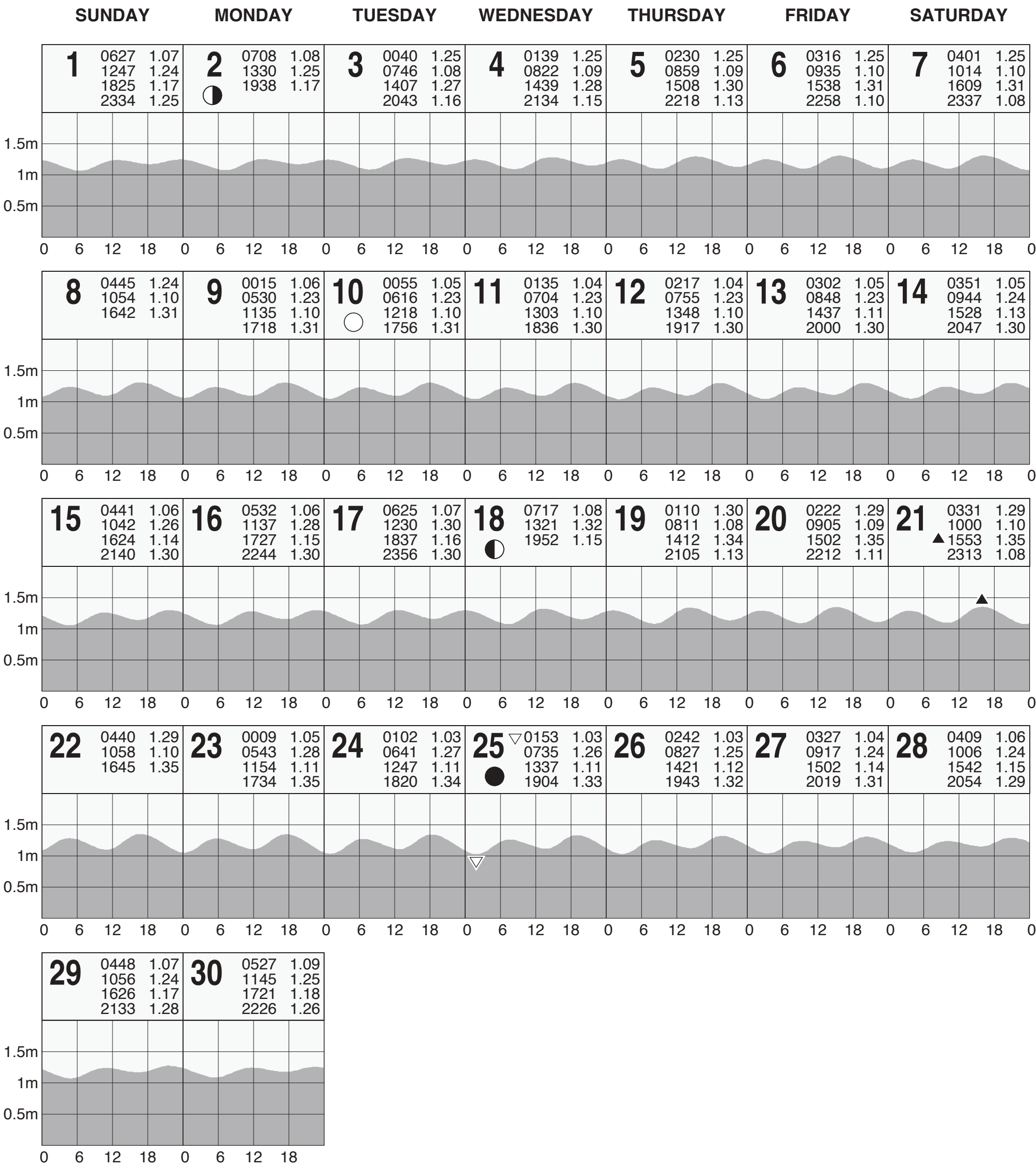
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Tide gauge zero is 2.101 metres below BM6

TIDAL PREDICTIONS FOR COOK ISLANDS - PENRHYN

JUNE 2025

Local Standard Time



- ▲

Highest tide of the month
- ▼

Lowest tide of the month
- ▽

Lowest tide of the year
- New moon
- ◐

First quarter
- Full moon
- ◑

Last quarter

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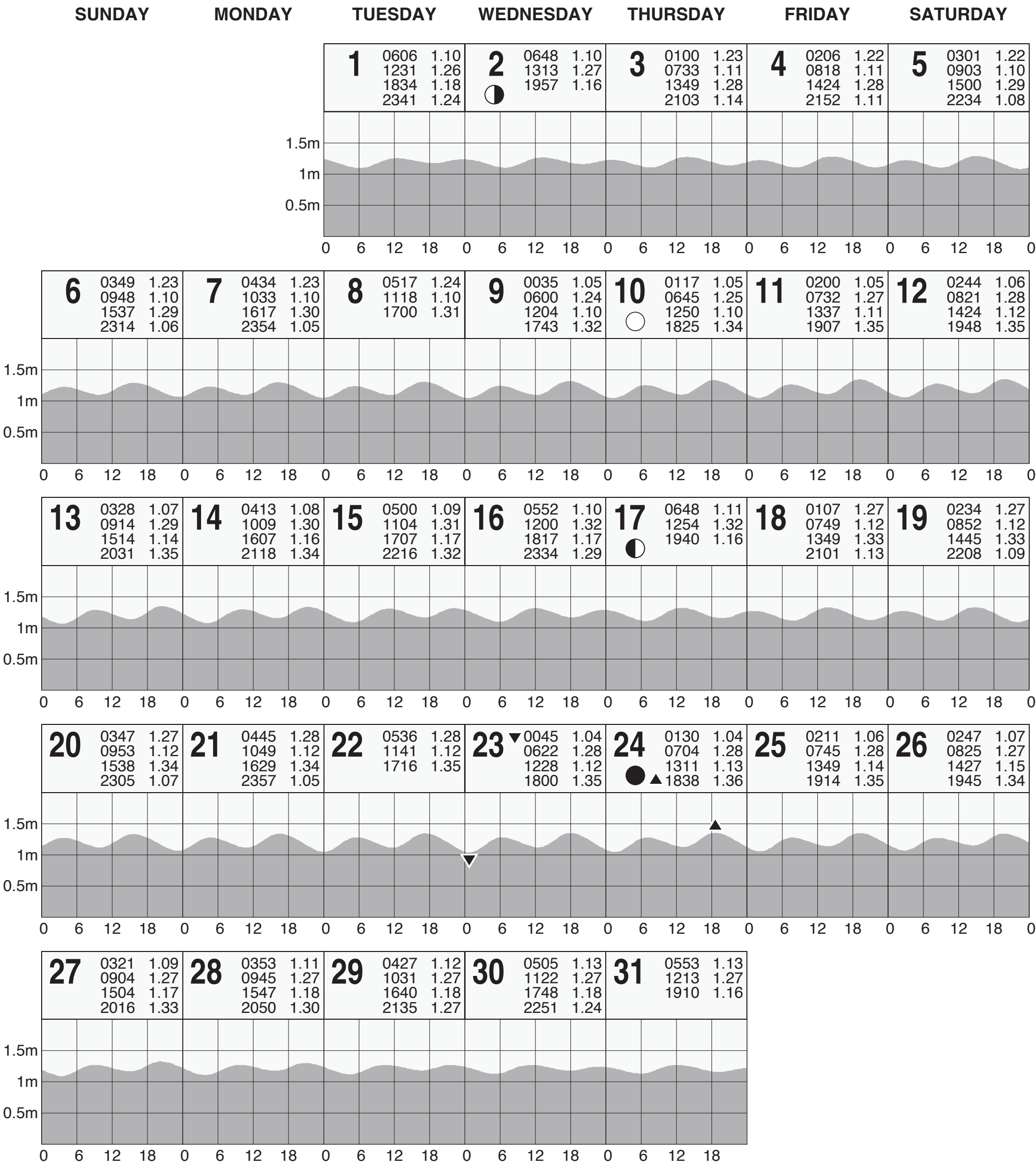
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TIDAL PREDICTIONS FOR COOK ISLANDS - PENRHYN

JULY 2025

Local Standard Time



- ▲

Highest tide of the month
- ▼

Lowest tide of the month
- New moon
- ◐

First quarter
- ◯

Full moon
- ◑

Last quarter

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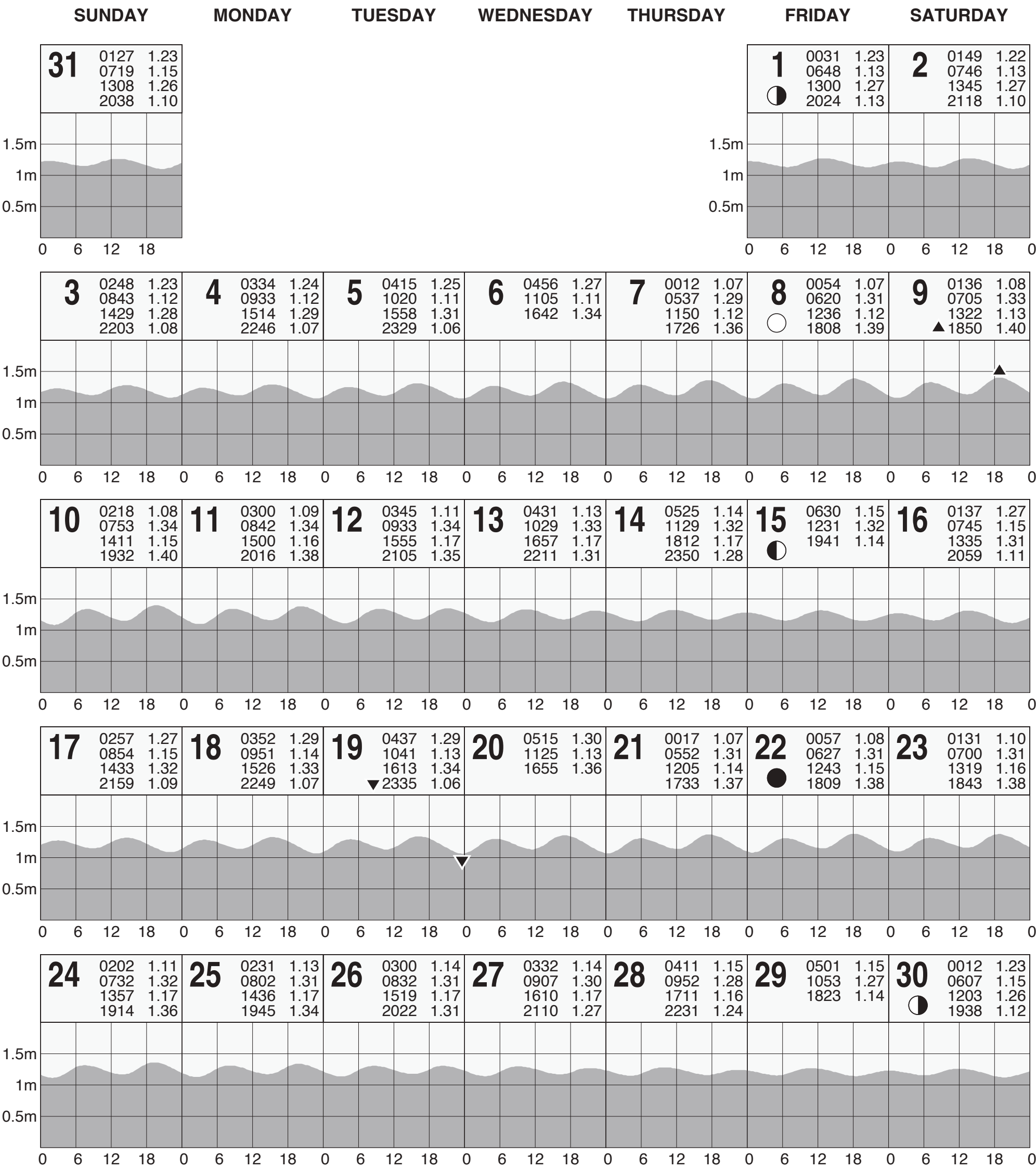
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TIDAL PREDICTIONS FOR COOK ISLANDS - PENRRHYN

AUGUST 2025Local Standard Time



- ▲

Highest tide of the month
- ▼

Lowest tide of the month
- New moon
- ◐

First quarter
- ◯

Full moon
- ◑

Last quarter

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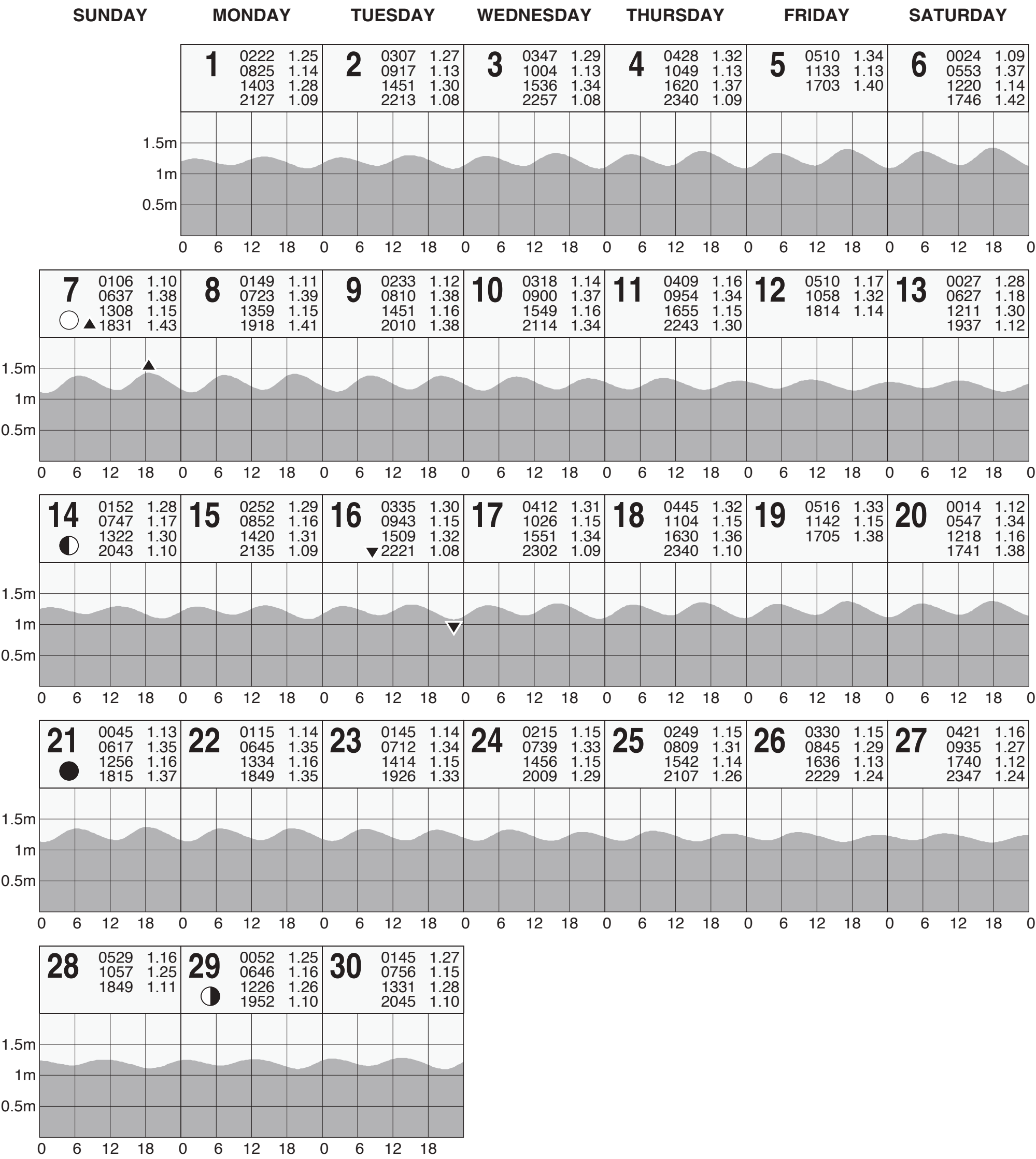
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TIDAL PREDICTIONS FOR COOK ISLANDS - PENRRHYN

SEPTEMBER 2025 Local Standard Time



- ▲ Highest tide of the month

▼ Lowest tide of the month
- New moon

◐ First quarter

○ Full moon

◑ Last quarter

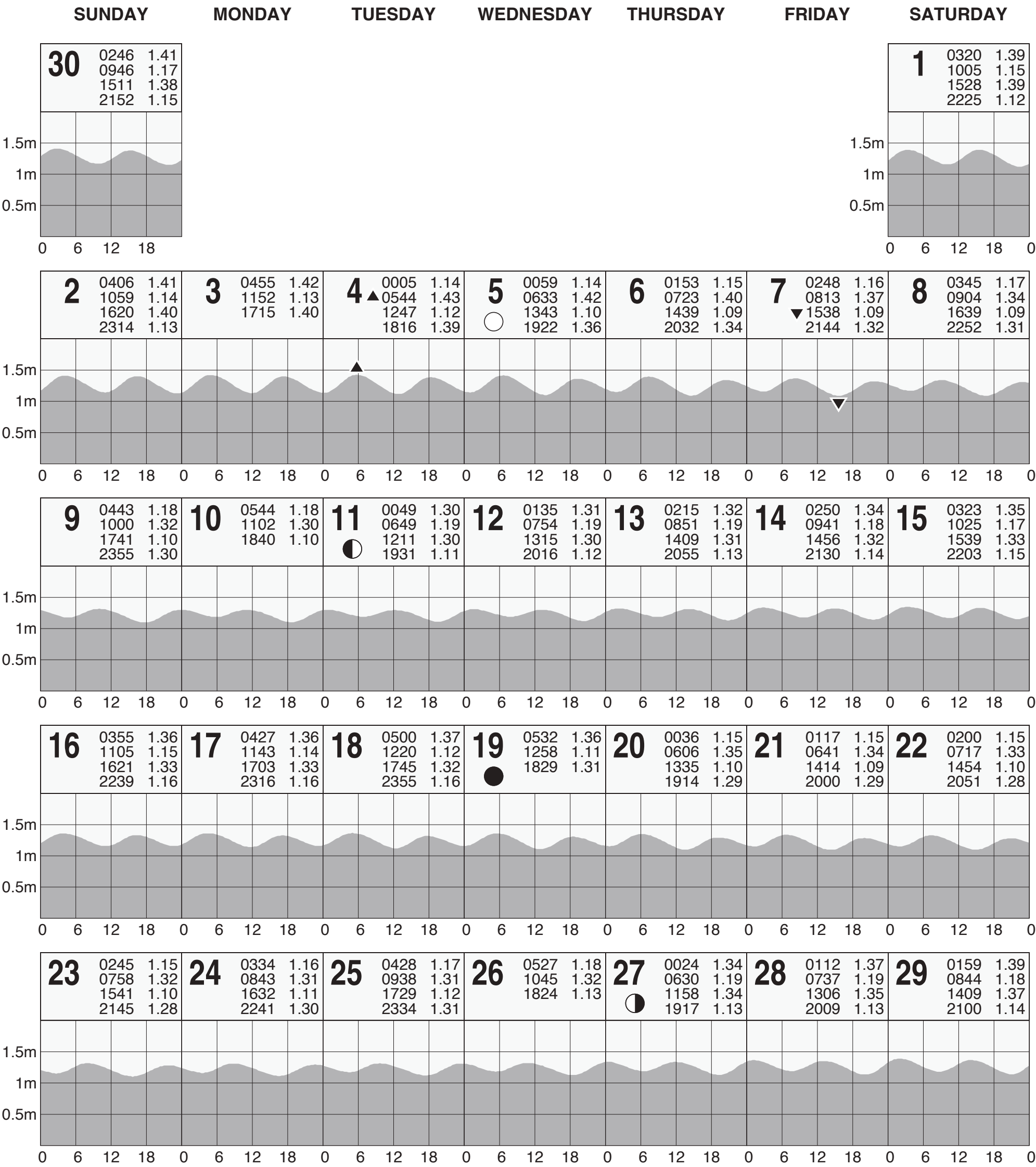
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TIDAL PREDICTIONS FOR COOK ISLANDS - PENRHYN

NOVEMBER 2025 Local Standard Time



- ▲

Highest tide of the month
- ▼

Lowest tide of the month
- New moon
- ◐

First quarter
- ◯

Full moon
- ◑

Last quarter

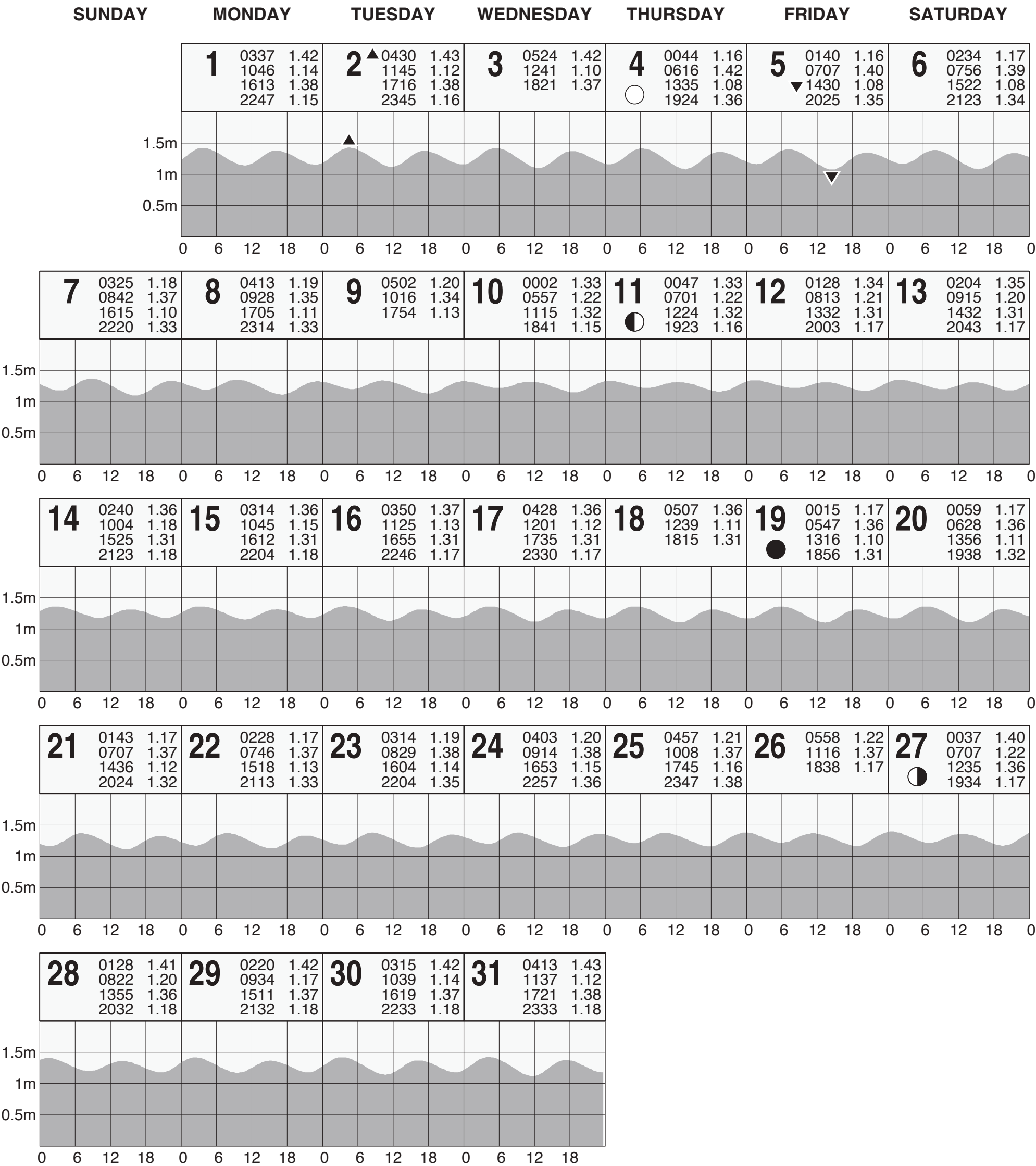
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TIDAL PREDICTIONS FOR COOK ISLANDS - PENRHYN

DECEMBER 2025 Local Standard Time



- ▲ Highest tide of the month

▼ Lowest tide of the month
- New moon

◐ First quarter

◯ Full moon

◑ Last quarter

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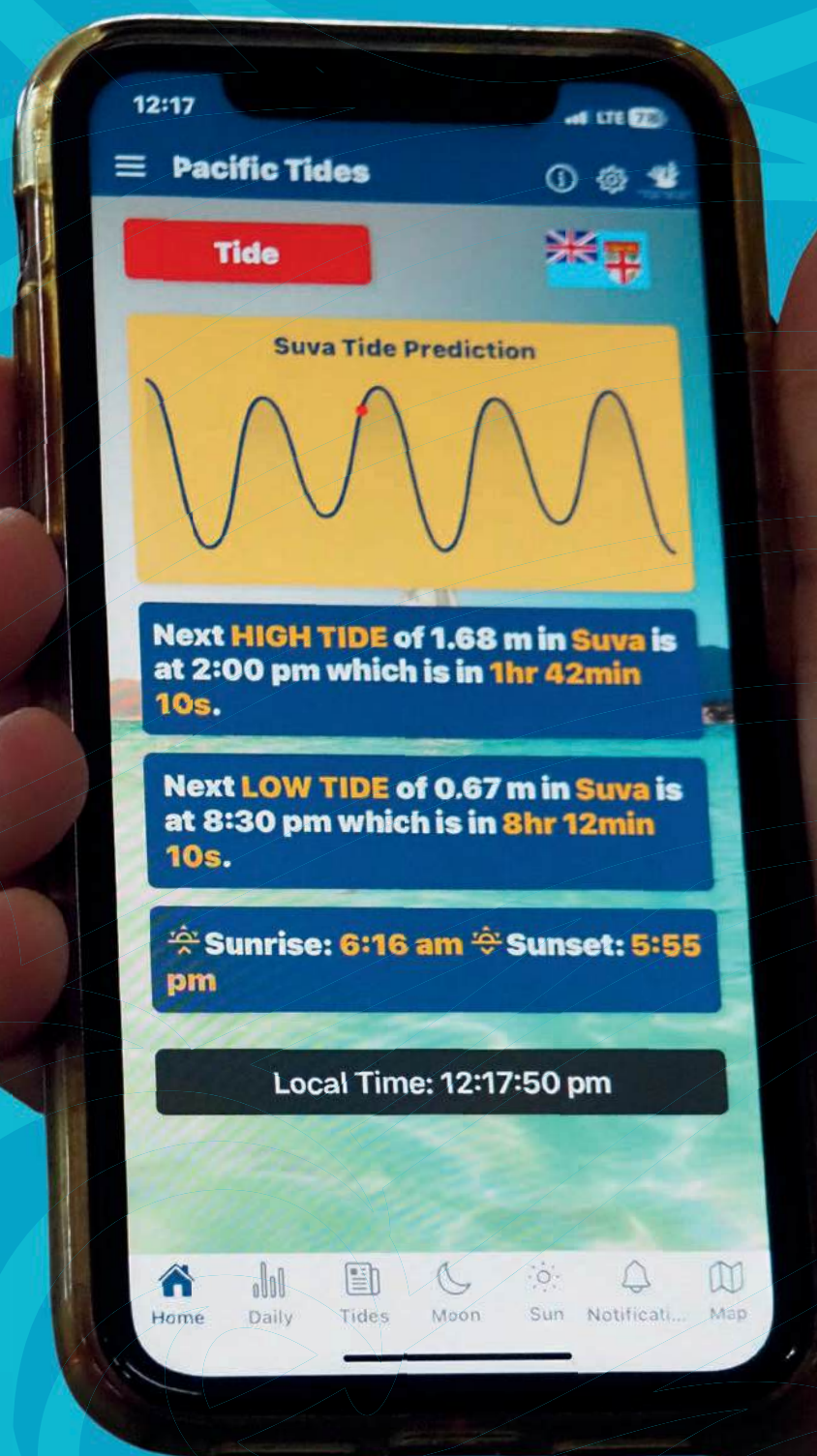
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Pacific Tides App

A simple way to access reliable tide and moon phase forecasts for Pacific Island countries from your mobile phone.

Highest and Lowest tides
Moon and Sun phases
Integrated geo-location services
(quick access to tidal information
based on your location)
Configurable daylight saving and
timezone offsets
Real-time countdown of tide times
Data downloader for offline usage





Further Information:

Climate and Oceans Support Program in the Pacific (COSPPac)

Geoscience, Energy and Maritime Division

Pacific Community Private Mail Bag, Suva, Fiji

Email: cosppac@spc.int

Website: www.spc.int



Pacific Community
Communauté
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