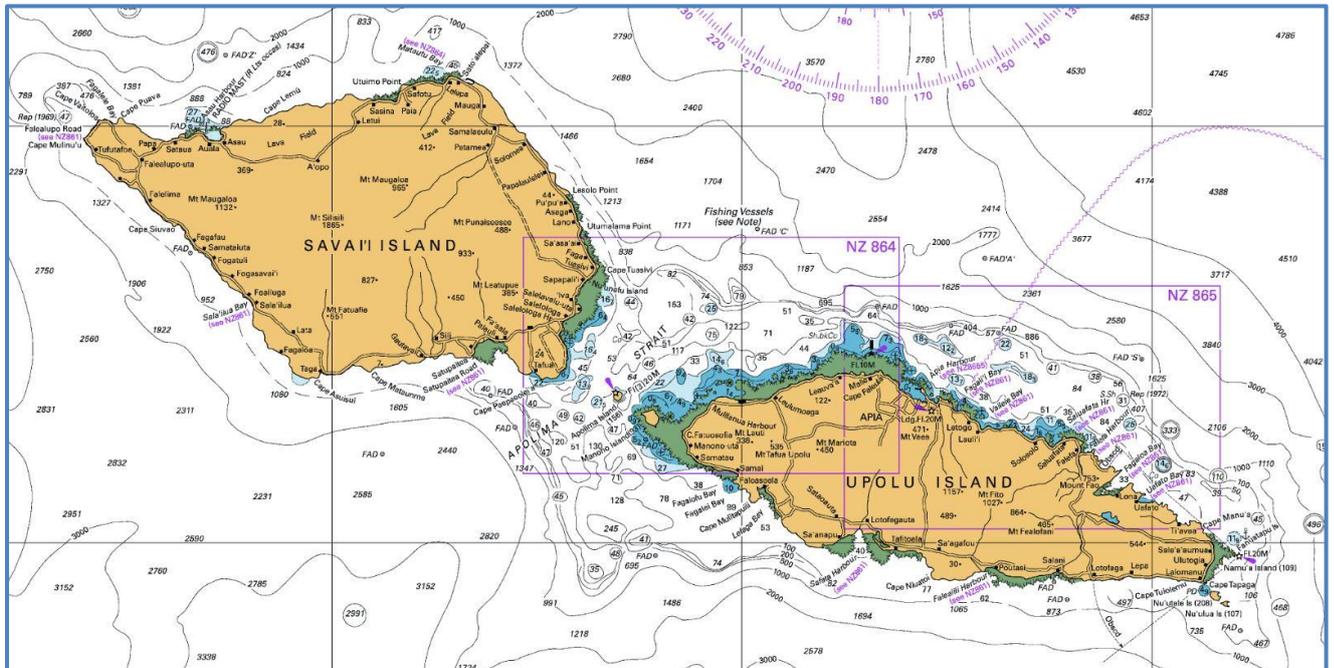


# PACIFIC REGIONAL NAVIGATION INITIATIVE

## SAMOA Hydrographic Risk Assessment Executive Summary



Report Number: RNALZ17001\_A

Version: 1.1

Date: 17 September 2017

Supported by the New Zealand Aid Programme

# **PACIFIC REGIONAL NAVIGATION INITIATIVE**

## **SAMOA Hydrographic Risk Assessment**

### **Executive Summary**

A joint production by: Land Information New Zealand  
Level 7 Radio New Zealand House  
155 The Terrace  
Wellington  
NEW ZEALAND

and

Rod Nairn & Associates Pty Ltd  
Hydrographic and Maritime Consultants  
ABN 50 163 730 58  
42 Tamarind Drive  
Cordeaux Heights NSW  
AUSTRALIA

Authors: Rod Nairn, Michael Beard, Stuart Caie, Ian Harrison, James O'Brien

Disclaimer: The views expressed in this publication do not necessarily reflect those of the New Zealand Government.

Satellite AIS data under licence from ORBCOM (augmented by IHS Global Pte Ltd)

## FOREWORD

This executive summary provides an overview of the full report, RNALZ17001 - 17 August 2017, on the hydrographic risk assessment of Samoan waters. The hydrographic risk assessment was based on the Land Information New Zealand (LINZ) Hydrographic Risk Assessment Methodology, as published in Report Number 15NZ322 Issue 03<sup>1</sup>. This risk assessment is part of the continuing programme of Pacific regional hydrographic risk assessments being conducted by LINZ, supported by the Ministry of Foreign Affairs and Trade (MFAT), which is intended to cover the extent of New Zealand's area of charting responsibility. This assessment follows other published risk assessments of Vanuatu, the Cook Islands, Tonga and Niue, which are available from the [International Hydrographic Organization website at this link](#).<sup>2</sup>

The intent is that these assessments, conducted using similar methodology, provide participating governments with consistent and comparable information that will assist them and other supporting aid agencies, to make informed decisions in relation to investment in hydrographic work, to improve safety of navigation, to deliver economic benefit and reduce the risk of loss of life.

## ACKNOWLEDGEMENTS

Our thanks to the Samoan Government officials and citizens who provided invaluable advice and information to support this risk assessment, details of all personnel interviewed are contained in Annex H to this report. Additionally, the support of Measina Meredith, Development Programme Coordinator from the New Zealand High Commission, was invaluable in arranging the in-country visit.

---

<sup>1</sup> This report also builds upon the updated procedures developed during the Niue risk assessment (Land Information New Zealand and Rod Nairn & Associates Pty Ltd, 2016).

<sup>2</sup> [https://www.iho.int/srv1/index.php?option=com\\_content&view=article&id=623&Itemid=407&lang=en](https://www.iho.int/srv1/index.php?option=com_content&view=article&id=623&Itemid=407&lang=en)

This page intentionally blank

## EXECUTIVE SUMMARY

### Maritime Overview

0.1 **Samoa** is a volcanic island group consisting of two main islands and seven smaller islands. It has a land area of 2,844km<sup>2</sup> and a small maritime Exclusive Economic Zone (EEZ) of approximately 120,000km<sup>2</sup> limited by neighbouring island states of Tokelau in the north, American Samoa in the north east and east, Tonga in the south and Wallis and Futuna in the west.

0.2 Most of the **maritime traffic** that traverses the Samoan EEZ calls at the Port of Apia, which is the only official first port of arrival, the centre of Samoa's international trade and a relatively busy port. These vessels include tankers (fuel and LPG), cruise ships, passenger ferries, general cargo, fishing, research and recreational/superyachts. There is a relatively small amount of other commercial traffic which bypasses Samoa and transits the EEZ, mainly in a generally NE/SW direction from SW Pacific to Hawaii/North America or in a NW/SE direction to connect between North Asia and American Samoa.

0.3 On a weekly cycle, Samoan Shipping Corporation (SSC) operates **international ferry/cargo services** from Apia to Pago Pago (American Samoa) in MV *Lady Naomi* and to Tokelau MV *SSC Fasefulu*. Charter services to Swains Island (American Samoa) and the Cook Islands are also available. A small passenger ferry *Mataliki* is also operated by the Tokelau Government.

0.4 A **domestic inter-island ferry service** of two vessels is operated by SSC between Mulifanua (Upolu) and Salelologa (Savai'i) normally providing six return trips per day across the Apolima Strait. A regular barge service operated by SSC also carries dangerous goods (petrol, diesel and LPG) from Apia to Salelologa.

0.5 Other domestic vessels are limited to *alia* fishing catamarans, a few ocean capable game fishing vessels up to 12m, and small dive runabouts in tourist areas, as well as numerous traditional fishing outrigger canoes.

0.6 Most of the traffic visiting Apia traverses Apolima Strait, this crosses the high frequency domestic inter-island ferry service making Apolima Strait the highest density traffic region in Samoa.

### Current State of Nautical Charting

0.7 **Nautical charting** of Samoan EEZ is provided by New Zealand. The overall suitability of a nautical chart is defined by: the scale of the chart in relation to its intended use, whether the position and depth datums are compatible with modern

navigation methods, and the quality of its underlying hydrographic survey information, known as CATZOC<sup>3</sup>. The Samoan chart coverage consists of a modern metric large scale chart of Apia Harbour, NZ 8655 at a scale of 1:7,500, and Salelologa and Mulifanua Harbours, NZ 8645 at a scale of 1:10,000, which are of a good standard. Medium scale 1:50,000 charts of Apolima Strait, NZ 864, and Approaches to Apia, NZ 865, provide good coastal navigation scale coverage of the north coast of Upolu but have areas of old and sparsely surveyed waters (CATZOC D), particularly near the coast, which should be updated with available data. Notably, there is no coastal scale coverage of the east and south coasts of Upolu Island nor of Savai'i Island outside Apolima Strait.

0.8 A small scale 1:500,000 chart, NZ 86 covers the Samoan Islands (including American Samoa) and is considered a good landfall chart but it is not considered suitable for coastal navigation and approaching coastal harbours.

0.9 Of critical concern is that there is no appropriate scale approach or harbour chart for the port at Aleipata (Satitooa) at the eastern end of Upolu, which contains a wharf and the only slipway in Samoa, and is capable of slipping vessels up to 1,000 tonnes and 50m in length. This port does not feature as high risk in the numerical assessment due to the lack of traffic data to the port but provision of adequate charting is a prerequisite for future development.

0.10 **Old charts and plans.** The port of Asau on the north-western coast of Savai'i is no longer used commercially. An older chart NZ 1414, scale 1:10,000 uses a non-GPS horizontal datum and parts of the chart are CATZOC U. It provides adequate coverage for recreational, game fishing vessels and occasional visits from patrol vessel *Nafanua*. This chart would require significant updating and positional shift to WG84 datum to produce an ENC which would be required should the port be required to support future commercial shipping. Re-establishment of leads and channel markers would also be required. Notably the replacement patrol vessel due in 2020 will also require ENC for navigation.

0.11 A sheet of 'fathoms' plans, NZ 861 at various scales, provides basic information for 11 small bays and harbours based on old, sparse sketch surveys. While the information is useful for recreational yachts and patrol vessel *Nafanua*, recompilation into metric units needs to be justified by potential future benefit.

0.12 The full extent of Samoa's EEZ is covered by small scale international charts NZ 14629 (INT 629) at a scale of 1:1,500,000 and partial coverage is also on NZ 14630 (INT

---

<sup>3</sup> CATZOC is a measure of hydrographic charting quality. It represents the Zone of Confidence determined by the hydrographic authority for a specified area of a chart. Areas are encoded against five categories (ZOC A1, A2, B, C, D), with a sixth category (U) for data which has not been assessed. The categorisation of hydrographic data is based on three factors (position accuracy, depth accuracy, and sea floor coverage).

630) and NZ 14631 (INT 631) at the same scale. Chart NZ 14605 (INT 605) at a scale of 1:3,500,000 provides an overview of the ocean region. These small-scale charts are considered suitable for their intended purpose of ocean navigation.

### Navigation Safety Considerations

0.13 **Hazards to navigation.** The Samoan EEZ is relatively free from offshore dangers with Pasco Bank on the western boundary, the only hazard charted at less than 20m deep. Most of the coastline is surrounded by fringing reef of varying width, these being wider on the northern coast. Outside the reef and within the 50m contour there are some isolated shoals with depths charted between 9m and 25m, other uncharted shoals may exist in the areas of old and sparse surveys. Some areas of the more exposed south coast are steep-to, with deep water right up to the coastal cliffs.

0.14 There are currently 23 **unlit FADs** charted in the coastal waters of Samoa. However, the Ministry of Fisheries advises that only one currently exists. This indicates that there is a failure of the communication channels to report changes to Maritime Safety Information (MSI) to the regional MSI and charting authority, LINZ. Fisheries Division intends to deploy new FADs from late June 2017 and game fishing interests are also known to deploy FADs. It is important that charts are kept up to date for the correct positions of FADs as they are unlit and constitute a navigational hazard near the coast. If a vessel becomes fouled on these devices and disables its propulsion or steering, then it could contribute to the risk of grounding on the nearby reef.

0.15 There is a **modern LiDAR bathymetric survey** of the coastal area of Samoa which was carried out by Fugro LADS<sup>4</sup> which provides good quality bathymetry at 5m spot spacing of the coastal waters down to depths of about 40m. This data was initially collected under the “Ridge to Reef” sea-level rise monitoring project. However, under the Pacific Regional Navigation Initiative, New Zealand funded additional processing of the data to extract further hydrographic information and identify seabed features significant to navigation. The relevant charts are currently being updated to include this new information. This risk assessment has been conducted using the standard of published charting in May 2017. However, the significant reduction in hydrographic risk that will be achieved once the LiDAR data has been included in published charts is also highlighted in sections 7 and 8.

---

<sup>4</sup> Fugro LADS is a commercial hydrographic survey company based in Australia who was selected to collect data for the “Ridge to Reef” project.

## Hydrographic Risk Assessment Results

0.16 The “in-country”<sup>5</sup> risk assessment found insignificant risk in the offshore areas of the EEZ. The *significant* hydrographic risk exists in the approaches to, and within the port of Apia. *Heightened* risk exists in the wider approaches to Apia and in the high traffic areas of Apolima Strait between Salelologa Harbour, Mulifanua Harbour and Apolima Island. This risk is associated with the greatest vessel traffic density but the risk is lower than in the approaches to Apia because of the higher quality of hydrographic survey in Apolima Strait.

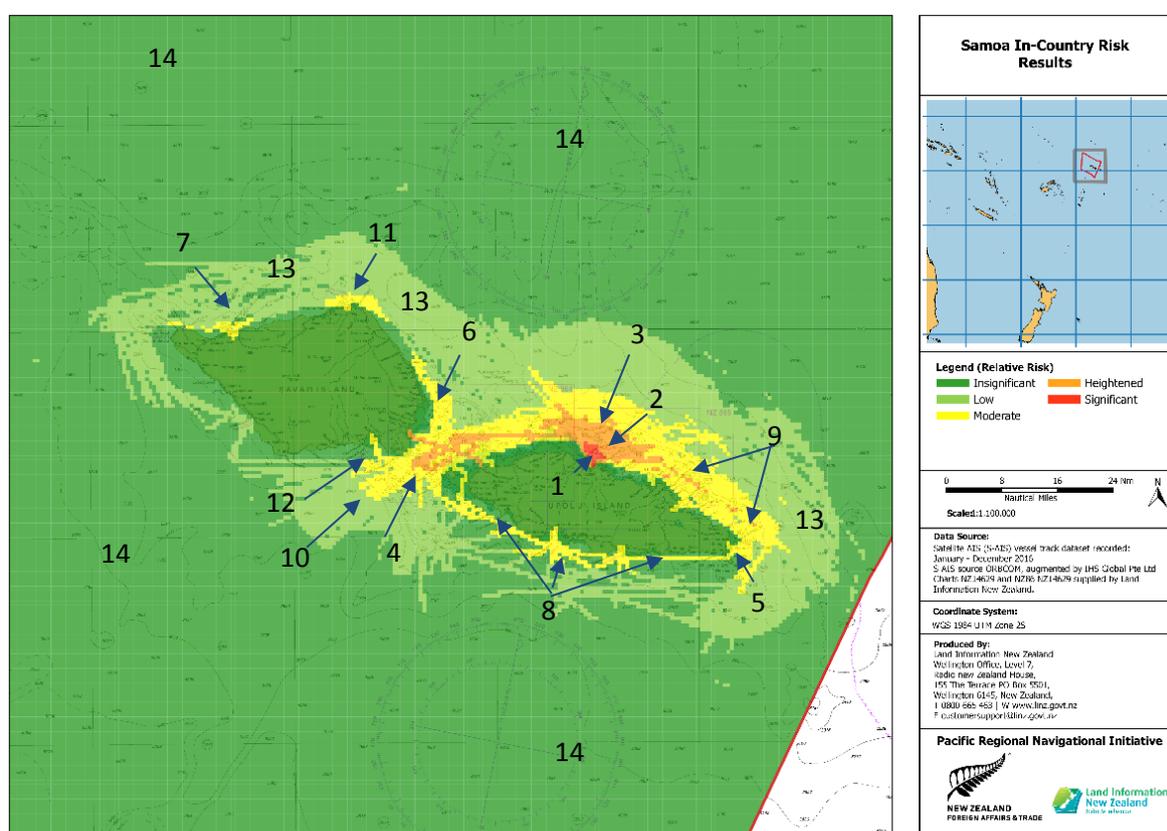


Figure 1: “In-country” Risk Results (see paragraph 0.17 for numbers)

<sup>5</sup> The “in-country” risk assessment refers to results displayed using colour band classification break values calculated only from the local EEZ study area data, thus ensuring that the full colour range is utilised in the heat map. These are relative results across the Samoan EEZ.

0.17 The risk results for Samoa are summarised in the following table (numbers refer to locations in Figure 1):

<b>SAMOA</b> <b>Summary of Hydrographic Risk Assessment Results</b> (Based on "In-Country" Risk)		
Location	Explanation	Comparative Risk Level
1. North coast Upolu, Apia Harbour	Sole international port, high GT traffic, close to sensitive reefs and reserves, charted at CATZOC B	Significant
2. North coast Upolu, near approaches to Apia Harbour	High GT traffic, close to important reserves charted at CATZOC B, C or D,	Significant
3. North coast Upolu, offshore approaches to Apia Harbour	High GT Traffic, close to important reefs, charted at CATZOC D	Heightened
4. Apolima Strait and Mulifanua Port to Salelologa Port	Very high GT traffic, close to coastal reefs, mostly charted at CATZOC A with some B and D areas	Heightened
5. East coast Upolu, Aleipata Port	Low GT traffic but no sufficient scale chart, close to reefs and reserves CATZOC D	Moderate
6. East coast Savai'i between Cape Tuasivi to Lesolo Point	Low GT traffic, close to coastal reef and reserves CATZOC U	Moderate
7. North-west Savai'i, approaches to Asau Harbour	Low GT traffic, close to coastal reefs, areas of CATZOC D and U	Moderate
8. South coast Upolu, route between Aleipata Port Falealili Harbour, Safata Harbour and Cape Fatuosofia	Low GT traffic, close to sensitive coastal reef and reserves charted at CATZOC D or CATZOC U	Moderate
9. North and east coasts of Upolu, out to 12 nm	Low GT traffic, close to sensitive reefs and reserves, mainly CATZOC U	Moderate
10. Approaches to Apolima Strait	High GT traffic, distant from sensitive reefs, CATZOC D or U	Moderate
11. North coast Savai'i: vicinity of Matautu Bay	Low GT traffic but occasional cruise ship, close to coastal reef, CATZOC D	Moderate
12. South coast Savai'i: vicinity of Palauli and Satupa'itea Road	Low GT traffic, close to coastal reef and reserves, CATZOC D	Moderate
13. Generally, out to 20 nm from the coast	Moderate GT traffic, distant from coastal reef, CATZOC D	Low
14. Offshore areas of EEZ further than 20 nm from the coast	Generally low GT traffic areas, distant from reefs and sensitive areas, CATZOC D or U	Insignificant

0.18 The “regional” risk assessment of Samoa is seen in the plot below. This plot calibrates the risk colour bands to the same scale as those used for the other south-west pacific risk assessments. The fact that the resulting Samoa risk shows risk areas across the full range of insignificant (green) to significant (red) indicates that Samoa’s hydrographic risk is of a similar order of magnitude to previous assessments of Tonga and the Cook Islands (Niue results showed generally insignificant risk). However, this “regional” result does show generally less risk than the “in-country” result. Clearly, there is a significant reduction in the areas of moderate and heightened risk compared to the “in-country” analysis at Figure 1 above. The lower “regional” risk is a good result for Samoa. Note that the result is influenced by a combination of all the input risk factors described in Annex B and there is no simplistic explanation. However, there is some influence of the “regional” risk weightings being lower than the “in-country” risk weightings for some categories (see Annex E) and the risk classifications being quite sensitive to minor changes in the risk colour bands particularly in the mid ranges of *low* (light green), *moderate* (yellow) and *orange* (heightened risk).

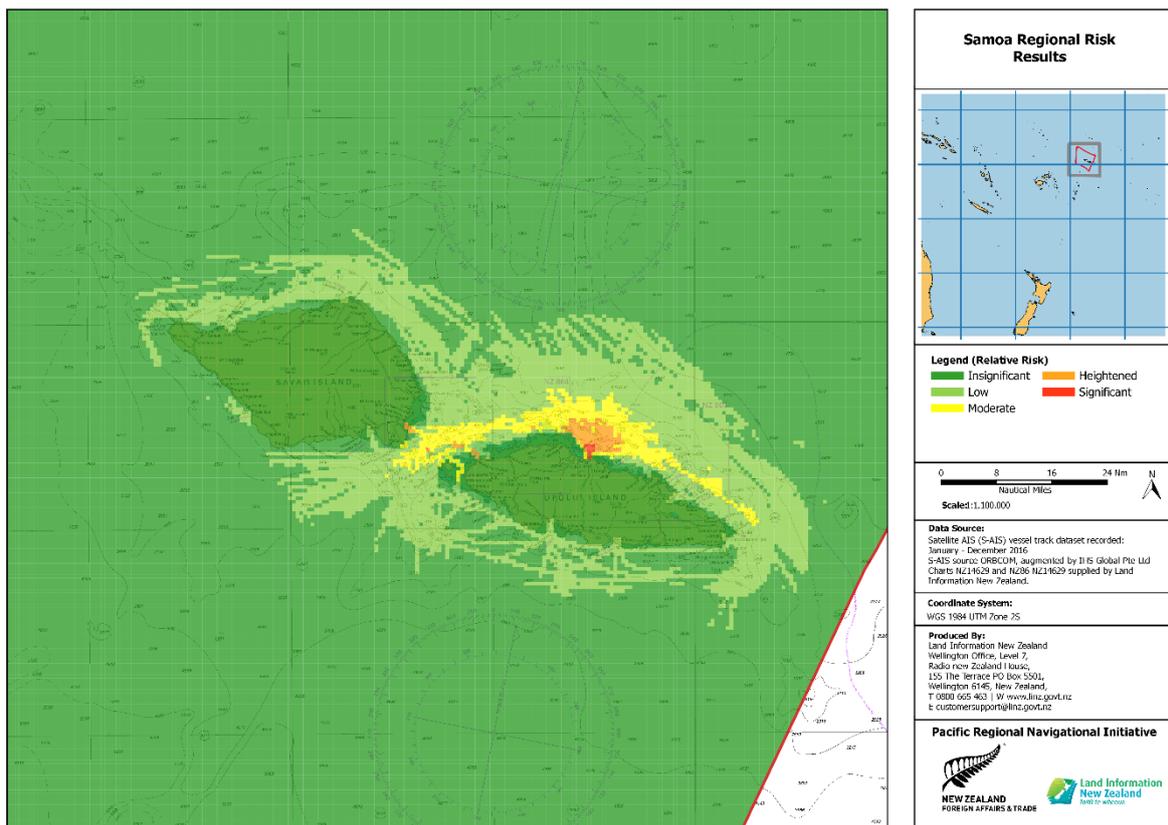


Figure 2: Risk results calibrated to “regional” colour bands

## Recommendations

0.19 **Considering** the current hydrographic risk, the benefits and costs of hydrographic improvements, the likelihood of increased coastal traffic from future development initiatives and the cost of mitigation of maritime accidents, the following **charting improvements are recommended**:

- a. The LiDAR bathymetry data should be incorporated into the published charts to extend the navigable area and reduce those areas currently indicated as “inadequately surveyed”. This will reduce the hydrographic risk in near coastal waters, and particularly improve the safety of recreational, local fishing and patrol vessels that visit remote coastal areas. It will also support the potential expansion of cruise vessel destinations.
- b. Produce an appropriate scale approach and harbour chart for Aleipata Port, (Satitua) to support potential future use of the port.
- c. The continuation of the 1:50,000 scale coastal chart series to provide a suitable approach chart for the port of Aleipata and to support future expanded cruise ship, recreational and commercial operations. The priority for this series is the eastern coast of Upolu and the northern coast of Savai'i covering the moderate risk areas near Asau Harbour and Matautu Bay. Consideration should also be given to charting the southern coast of Upolu where *moderate* hydrographic risk exists. The south coast of Savai'i is not considered necessary due to the lack of traffic or hydrographic risk. This chart series will be of a suitable scale as the source for ENC (compulsory for all SOLAS class vessels), and other electronic chart systems commonly used in recreational vessels.
- d. Modernise chart NZ 1414 Asau by shifting it to WGS84 horizontal datum to be compatible with GPS positioning systems, and produce an equivalent ENC to support future patrol boat and future potential commercial port operations.
- e. Modernisation (including metrication and incorporation of LiDAR data) of plans of those non-commercial ports that are most utilised for recreational/superyacht, cruise ship and patrol vessel visits to include:
  - a. Vaialele Bay – Modernisation of fathoms plan
  - b. Saluafata Harbour - Modernisation of fathoms plan
  - c. Fagaloa Bay - Modernisation of fathoms plan
  - d. Safata Harbour - Modernisation of fathoms plan
  - e. Siumu Bay - Production of a new plan
  - f. Matautu Bay – Production of a larger scale (1:25,000) plan

- f. Ensure effective communications of MSI from Samoan information sources to the regional MSI coordinator and charting authority so that changes that impact navigational safety, such as the charted status of navigational aids and FADS are kept up to date.

### Other Hydrographic and Navigation Safety Observations

0.20 The following factors relating to safe navigation were noted during the risk assessment:

- a. The port of Mulifanua has a very shallow dredged channel charted at 2.5m deep. The ferry *Lady Samoa III* has a designed draft of 2.35m and operates on a routine schedule at all states of the tide. It is considered that at some states of the tide and in some weather conditions interaction between the vessel and the seabed could occur, this may cause the ship to shear off course resulting in an incident. It is recommended consideration be given to dredging the channel to provide greater under keel clearance.
  - b. The line of the outer leads at Mulifanua does not provide sufficient clearance from the reef on the southern side and ships must approach the channel from the north side of the lead line with the leads open. Consideration should be given to dredging to clear the channel (preferred) or repositioning the outer leads and adjusting the leading line.
  - c. The line of the outer leads at Salelologa does not provide sufficient clearance from the reef on the northern side and ships must approach the channel from south of the lead line with the leads open. Consideration should be given to dredging to clear the channel (preferred) or repositioning the outer leads and adjusting the leading line.
-