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Pacific Safety of Navigation Project

Risk assessment for Port of London, Kiritimati, Kiribati

PACIFIC SAFETY OF NAVIGATION PROJECT

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Pacific Safety of Navigation Project: Risk assessment for Port of London, Kiritimati, Kiribati

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Executive summary

Kiribati is a signatory to the International Convention for the Safety of Life at Sea (SOLAS), of which Chapter V Regulation 13.1 requires the contracting governments to provide "such Aids to Navigation (AtoN) as the volume of traffic justifies and the degree of risk requires."

Kiribati is one of the 13 targeted Pacific Islands Countries and Territories (PICTs) of the Pacific Safety of Navigation Project implemented by the Pacific Community (SPC) and funded by the International Foundation for Aids to Navigation (IFAN), whose aim is to improve safety of navigation in the Pacific region through enhanced AtoN capacity and systems.

During Phase 1, in 2017, the International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) and SPC developed the simplified IALA risk assessment tool (SIRA), a simple qualitative tool to enable smaller states to meet their international obligation of providing AtoN by conducting waterways risk assessments.

During Phase 2 of the project in October 2019, the Kiribati Marine Division of the Ministry of Information, Communication, Transport and Tourism Development (hereinafter "Marine Division") identified Port of London on Kiritimati Island to be the second highest priority area for SPC to assist in conducting a risk assessment using the SIRA tool. Differently than for the SIRA AtoN risk assessment for Betio, two officials from the Marine Division led the maritime stakeholders meeting. The purpose of this new set-up was to further assist the country in building their capacity to develop and maintain safety of navigation services, after one of the Marine Division staff had been trained by SPC in August 2019 for the IALA level 1 Manager Course.

This report details the risks identified, the estimated costs in the event of an incident, the risk control options suggested, and their costs associated with the Port of London.

Within Kiribati the regulatory aspect of AtoN falls within the Ministry of Information, Communication, Transport and Tourism Development (MICTTD) and the operational implementation and maintenance of AtoN comes under the jurisdiction of its Marine Division.

Kiritimati consists of one international and one domestic port. The international port is located on the western ocean side of the atoll, while the port of London is located on the eastern side of London town in the lagoon. There are currently no AtoNs in and around the Port of London.

Kiritimati's maritime stakeholders identified five scenarios for the Port of London. Two groundings on rock at the entrance of the Port of London, one grounding on the reef along the coast of Kiritimati, one grounding on soft bottom along the London Passage and one collision between two local boats in the Port of London.

For each scenario, the cost of the incident was estimated and a risk score was given, taking into account the probability of the incident happening and its potential impact on the country. Risk control options were then identified. The risk scores for the scenarios under the current situation were then compared with the new risk scores if the risk control options were put in place.

Scenario	Risk score	Risk control option	New risk score
Grounding of a landing craft or another similar vessel at entrance to the London Passage due to lack of AtoN marking the entrance	9	Purchase and install 1 port hand beacon at south of Bridges Point and 1 starboard hand beacon near north point of Cochrane Reef at the entrance to London Passage.	3
Grounding of small boats at Peak Point during sunrise and sunset due to low sun issues and lack of AtoN marking the London Passage	6	Conduct community awareness workshops on the use of London Passage. Purchase and install 5 starboard hand and 5 port hand AtoNs along the entire length of the London Passage.	2
Grounding of landing craft or other similar vessels on soft bottom due to siltation along the London Passage	4	Conduct an Environmental Impact Assessment (EIA) for dredging the passage to allow ships to enter the Port of London.	3
Collision of small fishing boats with each other near the bend called Tabonteke, both during the day and at night due to lack of awareness and of navigation lights on the boats	9	Conduct community awareness workshops on basic collision regulation and encourage people to carry visible lights on the boats during night-time.	3
Grounding of vessels along the coast of Kiritimati Island due to lack of landfall lights	9	Fit the two telecommunication towers on the island with visible lights and install two new towers with landfall lights at North West and South West Points.	3

The main outcome of the risk assessment process in the Port of London was 5 recommendations, which aim to reduce the risks to safety of navigation to an acceptable level for stakeholders. The recommendations and costs of their implementation are outlined below.

Recommendation 1

To reduce the risk of grounding of landing crafts and other similar vessels at the entrance to the London Passage, it is recommended that 1 port hand beacon be purchased and installed south of Bridges Point and 1 starboard hand beacon near north point of Cochrane Reef at the entrance to London Passage.

Cost	**Amount (AUD)**
Purchase and installation of a starboard and port beacon with lights and day boards	40,000
Maintenance cost[1]	2,000

[1] The cost of maintenance for AtoN is estimated at 5% annual of the initial cost of purchase

Recommendation 2
To reduce the risk of grounding of small boats during the sunset and sunrise hours around the Peak Point, it is recommended that community awareness workshops on the rules for the use of the London Passage be conducted and 5 starboard hand and 5 port hand AtoNs be purchased and installed along the entire length of the London Passage.

Cost	**Amount (AUD)**
Conduct community awareness workshops on the rules for the use of the London Passage	18,000
Purchase and installation of 5 starboard and 5 port hand beacons with appropriate lights and day boards	200,000
Maintenance cost	10,000

Recommendation 3
To reduce the risk of grounding of landing craft and other similar vessels along the London Passage, it is recommended that an Environmental Impact Assessment (EIA) be conducted for dredging the passage to a safe minimum depth to allow ships to enter the Port of London.

Cost	**Amount (AUD)**
Conduct an Environmental Impact Assessment (EIA) for dredging the London Passage	50,000

Recommendation 4
To reduce the risk of collision of small fishing boats with each other near the bend called Tabonteke, both during the day and at night, it is recommended that the Marine Division conduct community awareness workshops on basic collision regulation and encourage people to carry visible lights during night-time.

Cost	**Amount (AUD)**
Conduct community awareness programme on basic collision regulation	18,000

Recommendation 5
To reduce the risk of vessels grounding when navigating along the coastline of Kiritimati Island, it is recommended that the two telecommunication towers on the island be fitted with visible lights, and two new towers be installed with landfall lights at North West Point and South West Point.

Cost	**Amount (AUD)**
Install new lights on the present two telecommunication towers and purchase and install two new towers with landfall lights	100,000
Maintenance cost	5,000

1 Background

In early 2016, with support from the International Foundation for Aids to Navigation (IFAN), the Pacific Community (SPC) started the Pacific Safety of Navigation Project in 13 Pacific Island countries and territories (PICTs)[2]. The project aims to improve safety of navigation in the Pacific region through enhanced aids to navigation (AtoN) capacity and systems, and hence support economic development, shipping and trade in the Pacific region through safer maritime routes managed in accordance with international instruments and best practices.

During Phase 1, which ended in July 2018, SPC worked in close collaboration with the International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) to conduct technical, legal and economic assessments in the 13 PICTs, to identify needs and gaps in these areas. Another significant output of Phase 1 was the development of a new tool for risk assessment in small island developing states, the simplified IALA risk assessment tool (SIRA). In June 2018, IALA trained personnel in 12 of the 13 PICTs on the use of SIRA to conduct AtoN risk assessments in their countries.

Phase 2 of the project builds on the Phase 1 assessments and tools developed, to further assist in building capacity to develop and maintain AtoN in PICTs. Activities include conducting risk assessments (as required by Regulation 13 of the International Convention for the Safety of Life at Sea – SOLAS); developing safety of navigation policy and a legal framework; improving budgetary management; and supporting regional coordination related to safety of navigation in the Pacific.

In October 2019, the Ministry of Information, Communication, Transport and Tourism Development (MICTTD) of Kiribati invited SPC to assist in conducting a risk assessment of Port of London, which is the country's second international port, on Kiritimati Island. When on Kiritimati, the Marine Division organised a field visit to look at the London Passage and different hazards present in the London harbour.

This report details the risks identified, the estimated costs in the event of an incident, the risk control options suggested and the costs associated using the SIRA methodology for the Port of London.

Kiribati is a maritime nation, with a large percentage of citizens working in or around the maritime industry. Shipping is critical to the economic and social welfare of the people of Kiritimati, and safe navigation is vital to secure this welfare and to protect the environment. Kiribati is a signatory to the International Maritime Organization (IMO) Safety of Life at Sea (SOLAS) Convention. Regulation 13 of Chapter V of the 1974 SOLAS Convention (as amended) states that "each Contracting Government undertakes to provide, as it deems practical and necessary either individually or in co-operation with other Contracting Governments, such aids to navigation as the volume of traffic justifies and the degree of risk requires."

The SIRA risk control process comprises five steps that follow a standardised management or systems analysis approach:

1. Identify hazards
2. Assess risks
3. Specify risk control options
4. Make a decision

[1] Cook Islands, Kiribati, Federated States of Micronesia, Marshall Islands, Nauru, Niue, Palau, Samoa, Solomon Islands, Tonga, Tokelau, Tuvalu and Vanuatu.

5. Take action.

SIRA is intended as a basic tool to identify risk control options for potential undesirable incidents that Kiribati should address as part of its obligation under SOLAS Chapter V Regulations 12 and 13. The assessment and management of risk is fundamental to the provision of effective AtoN services.

The assessment involved a stakeholder meeting as a first step, to gather the views on hazards and risks in the Port of London from those directly involved with or affected by AtoN service provision. Information provided by this step was then used by the two officials from the Marine Division, namely the AtoN Manager, Mr Eritaia Tauro, and the AtoN Supervisor, Mr Tioti Bateriki, to complete together with SPC the full risk assessment matrix based on five identified possible scenarios for Port of London.

2 Description of the waterway

The Port of London is the major port in Kiritimati and the second international port of Kiribati, and was thus identified by the Marine Division as a priority for the second risk assessment in the country. Within Kiribati, the regulatory aspect of AtoNs falls within the Ministry of Information, Communication, Transport and Tourism development (MICTTD) and the operational implementation and maintenance of AtoNs comes under the jurisdiction of its Marine Division.

Kiritimati atoll consists of one international and one domestic port. The international port is located on the western ocean side of the atoll, while the Port of London is located on the eastern side of London town in the lagoon. There are currently no AtoNs in and around the Port of London.

There are three entrances that can be used as access into the Port of London. The London Passage between the Bridges Point and the Cochrane Reef is approximately 470 metres wide, with an average navigable depth of around 5 metres in the central part of the passage. The Cook Island Passage, between the Cochrane Reef and the Sample Reef, is approximately 700 metres wide, with an average navigable depth of around 6 metres in the central part of the passage. Finally, the South Passage between Cook Island and Benson Point is approximately 800 metres wide, with an average navigable depth of 5 metres. Out of the three passages, the London Passage is the main passage used by vessels.

A maximum tidal flow of 3 knots can be expected at the entrance to the London Passage, usually during low water. The average predicted visibility is around 5 nautical miles, but this can be reduced to 0.05 nautical mile in bad weather conditions. A maximum predicted swell of 10 metres can be expected at the entrance to the port during bad weather conditions. There are a few hazards present in the London harbour, such as shallow areas, strong winds, currents, waves and lack of AtoNs, which can pose problems for maritime traffic.

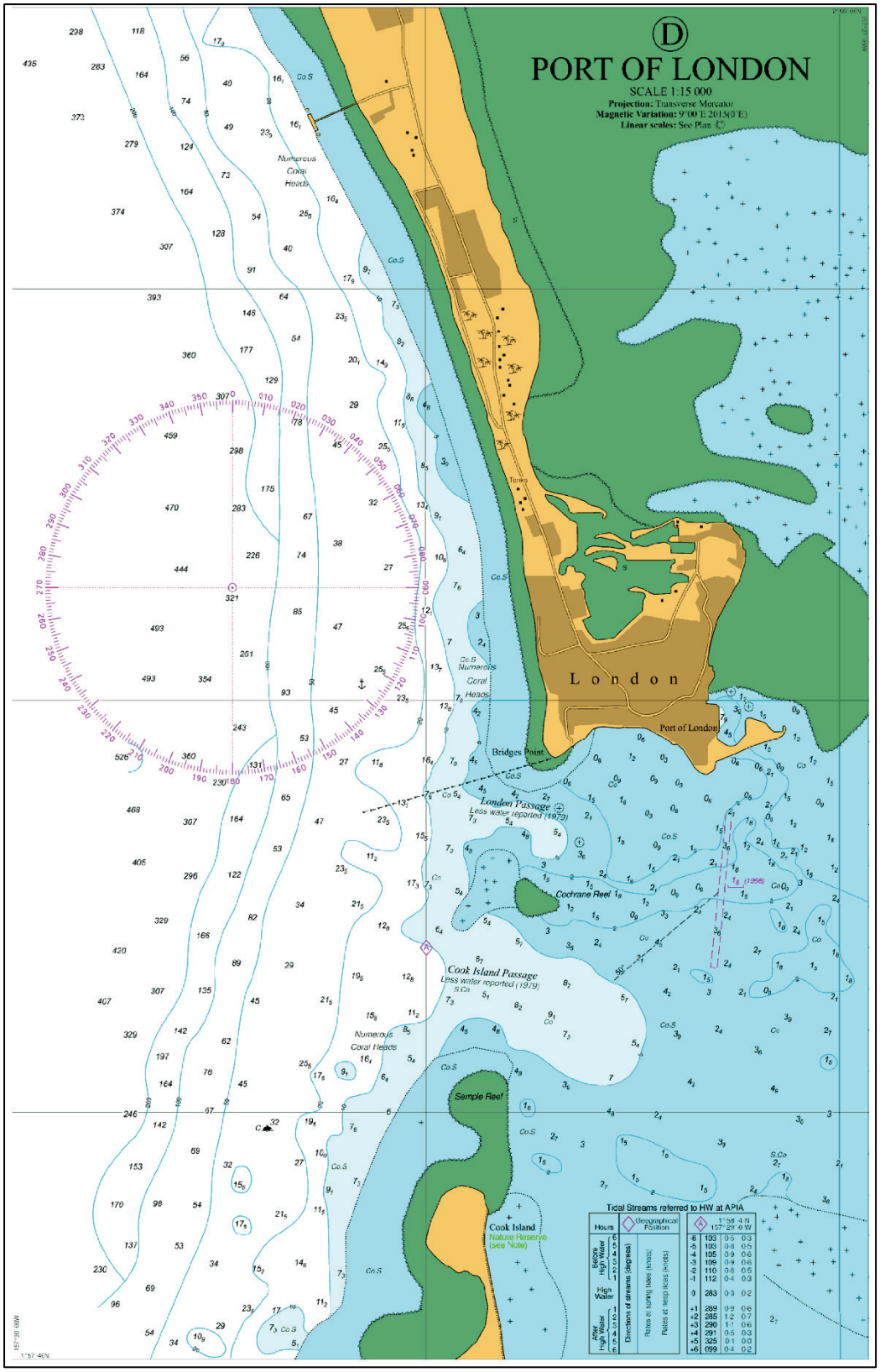

Figure 1. Chart BA 714_4 covers Port of London at a scale of 1:50,000.

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3 Stakeholder meeting

As the first step of the SIRA process, a stakeholder meeting was organised by Mr Kaititi Tengata, Senior Marine Radio Officer of the Kiritimati Marine Division in Kiritimati on 28 November 2019, at the Village Hotel conference room.

The aim of the meeting was to gather the points of view of individuals, groups and organisations involved with or affected by AtoN service provision in Port of London. The stakeholders (Figure 2) in Kiritimati included staff from the Kiribati Ports Authority, Kiribati Customs Administration and Enforcement, Kiritimati Marine Division, Environment and Conservation Division, Tourism Authority of Kiribati, Central Pacific Producers Ltd, Fishing Association and Fishing Communities (Annex A). During the meeting, the participants were divided into two groups according to their experience and background. They then helped to identify potential hazards and possible scenarios in the Port of London using the latest chart of the area and their experience.

Figure 2. Maritime stakeholders meeting participants in Kiritimati.

4 Hazards and risks

A hazard is something that may cause an undesirable incident. Risk is the chance of injury or loss as defined as a measure of “probability or likelihood” and “severity or impact”. Examples of injury or loss include an adverse effect on health, property, the environment or other areas of value.

The purpose of the stakeholder meeting was to generate a prioritised list of hazards specific to the Port of London. For the risk assessment, SPC and AtoN Manager, Marine Division, Kiribati Ministry of Information, Communication, Transport and Tourism Development, Mr Eritaia Tauro and AtoN Supervisor Mr Tioti Bateriki worked together to discuss the risks associated with the identified hazards and identify the risk control options and recommendations.

The list of hazards identified for the Port of London is given in Annex B.

4.1 Types of hazard

Twenty-one hazards were identified for Port of London that were grouped into the following six categories:

- natural hazards, such as storms, earthquakes, safe minimum depth, proximity to danger, minimum visibility, low sun issues and other natural phenomena;
- economic hazard such as insufficient AtoN funding;
- technical hazards such as system or equipment failure, quality and validity of charted information, sub-standard ships, and failure of communications systems;
- human factors such as crew competency, safety culture, influence of alcohol and/or drugs, and, linguistic challenges;
- operational hazards such as seasonal activities, poor promulgation of Maritime Safety Information (MSI), poor response to marking new dangers and ramp launching area; and
- maritime space hazards, such as crowded waterways and wrecks and missing light issues.

The above six types of hazard have the capability to generate seven different types of losses:

- health losses including death and injury;
- property losses including real and intellectual property;
- economic losses leading to increased costs or reduction of revenues;
- liability loss resulting when an organisation is sued for an alleged breach of legal duty; such cases must be defended even if no blame is assigned. Liability losses are capable of destroying or crippling an organisation;
- personnel loss when services of a key employee are lost;
- environmental losses (negative impact on land, air, water, flora or fauna); and
- loss of reputation or status.

4.2 Risk factors

Any risk analysis needs to consider the range of factors that contribute to the overall risk exposure. Table 1 lists some of the factors that could be taken into consideration when identifying hazards for waterways and ports.

Table 1. Risk factors relating to marine navigation.

Ship traffic	Traffic volume	Navigational conditions	Waterway configuration	Short-term consequence	Long-term consequence
Quality of boats	Deep draught	Night/day operations	Depth/draft/under-keel clearance	Injuries to people	Health and safety impacts
Crew competency	Shallow draught	Sea state	Passage width	Oil spill	Lifestyle disruptions
Traffic mix	Commercial fishing boats	Wind conditions	Visibility obstructions	Hazardous material release	Fisheries impacts
Traffic density	Recreational boats	Currents (river, tidal, ocean)	Waterway complexity	Property damage	Impacts on endangered species
Nature of cargo	High speed craft	Visibility restrictions	Bottom type	Denial of use of waterway	Shoreline damage
Participation rate in routing systems, such as VTS	Passenger ships	Ice conditions	Stability (siltation)		Reef damage
		Background lighting	AtoN mix and configuration		Economic impacts
		Debris	Quality of hydrographical data		

Risk is evaluated to allow attention to be focused on high-risk areas, and to identify and evaluate factors which influence the level of risk. Once all the risks have been assessed, they are then evaluated in terms of the documented needs, issues and concerns of the stakeholders, and the benefits and costs of the activity, to determine the acceptability of the risk.

Zero risk is not often realised, unless the activity generating the risk is abandoned. Rather than striving to reduce the risk to zero, authorities should reduce the risk to "as low as reasonably practicable" (ALARP; Figure 4).

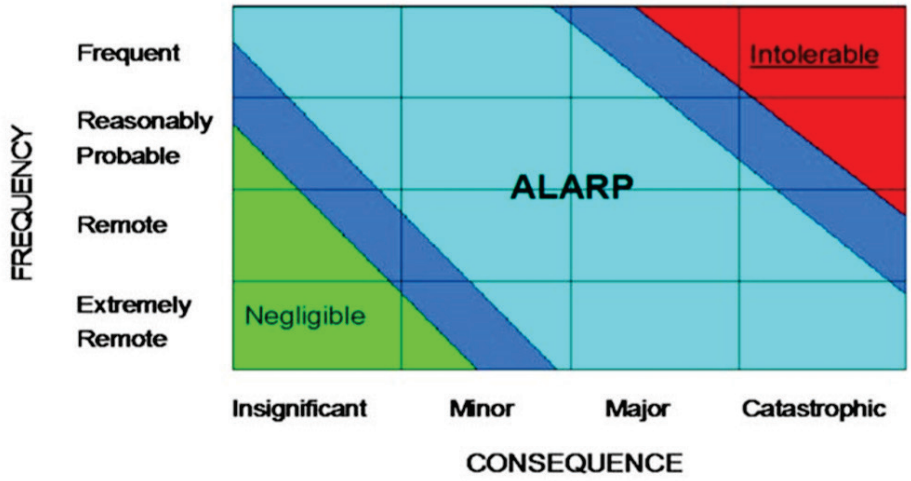

Figure 4. Graphical representation of the levels of risk. The risk level boundaries (negligible/ALARP/intolerable) are purely illustrative.

It is important to remember that, when communicating with stakeholders about risk, perception is usually different to reality. People make judgements of the acceptability of a risk based on their perceptions, rather than on scientific factors such as probability. The public's perception of a risk may be influenced by many things, including age, gender, level of education and previous exposure to information on the hazard. Public perceptions of risk may therefore differ from those of technical experts.

5 Scenarios

During the stakeholder meeting and discussions with Kiribati's Marine Division AtoN Manager and the Marine Supervisor (who are also SIRA and IALA level 1 AtoN certified managers) various hazards were identified for Port of London, which could lead to a number of different incidents or scenarios. Each hazard was considered carefully and the scenarios it could cause were identified and recorded.

The scenarios for Port of London were classified into two categories: grounding and collision.

Annex C lists the identified scenarios for Port of London.

5.1 Grounding

Grounding is defined as a boat being aground or hitting/touching shore or sea bottom or underwater objects (wrecks, etc.). There were two grounding scenarios identified for the Port of London. Grounding on reef and grounding on soft bottom. Most of the groundings on the reef at the entrance to the port are due to the lack of proper AtoNs marking the passage. Grounding on soft bottom was due to siltation along the passage into the port.

5.2 Collision

Collision is defined as striking or being struck by another ship, regardless of whether under way, anchored or moored. The probability of collision depends on navigational conditions, waterway configuration, and type and volume of traffic. The basic types of collisions are head-on, overtaking, bend, merging and crossing collisions. An analysis of the routes and their geometry, combined with the volume and mix of traffic for Port of London, resulted in one probable collision scenario: a head-on collision, where small fishing vessels can collide with each other near the bend called Taboteke in the passage during day and night. This is attributed to the lack of navigational aids on small boats, crew competency and lack of knowledge about the rules of the road (COLREG).

5.3 Other scenarios

There was one other scenario discussed during the stakeholder meeting: the possibility of vessels grounding along the Kiritimati coast on approach to the main ports due to the lack of any landfall lights along the coast.

6 Probability and impact

SIRA specifies five levels of probability (Table 2) and five levels of impact that each type of scenario would create (Table 3). Each scenario is allocated a score for both probability and impact, and the risk value is calculated from the product of these scores. In this step of the process, the probability and consequences associated with each scenario were estimated and discussed with the Kiribati Marine Division AtoN Manager and the Supervisor.

Table 2. Levels of probability specified for the simplified IALA risk assessment tool (SIRA).

Classification	Score	Probability
Very rare	1	Very rare or unlikely, will occur only in exceptional circumstances and not more than once in 20 years
Rare	2	Rare, may occur every 2-20 years
Occasional	3	Occasional, may occur every 2 months to 2 years
Frequent	4	Frequent, may occur once every weekly to every 2months
Very frequent	5	Very frequent, may occur at least once every week

Table 3. Levels of impact specified for the simplified IALA risk assessment tool (SIRA).

Description	Score	Service disruption criteria	Human impact criteria	Financial criteria	Environment criteria
Insignificant	1	No service disruption apart from some delays or nuisance	No injury to humans; possible significant nuisance	Loss, including third-party losses, of less than USD 1000	No damage
Minor	2	Some non-permanent loss of services such as closure of a port or waterway for up to 4 hours	Minor injury to one or more individuals, may require hospitalisation	Loss, including third-party losses, of USD 1000–50,000	Limited short-term damage to the environment

Severe	3	Sustained disruption to services such as closure of a port or waterway for 4–24 hours	Injuries to several individuals requiring hospitalisation	Loss, including third-party losses, of USD 50,000–5,000,000	Short-term damage to the environment over a small area
Major	4	Sustained disruption to services such as closure of a major port or waterway for 1–30 days or permanent or irreversible loss of services	Severe injuries to many individuals or loss of life	Loss, including third-party losses, of USD 5,000,000–50,000,000	Long-term to irreversible damage to the environment over a limited area
Catastrophic	5	Sustained disruption to services such as closure of a major port or waterway for months or years	Severe injuries to numerous individuals and/or loss of several lives	Loss, including third-party losses, of over USD 50,000,000	Irreversible damage to the environment over a large area

7 The acceptability of risk

Having determined probability and impact scores by consensus, the risk values are calculated by multiplying these scores, as shown in the matrix in Table 4. To determine whether the risks are acceptable or not, SIRA specifies four colour-banded levels of risk (Table 5). These colours are superimposed on the matrix in Table 4.

Table 4. Risk value matrix.

		PROBABILITY / (LIKELIHOOD)				
		Very Rare (1)	Rare (2)	Occasional (3)	Frequent (4)	Very frequent (5)
CONSEQUENCE (IMPACT)	Catastrophic (5)	5	10	15	20	25
	Major (4)	4	8	12	16	20
	Severe (3)	3	6	9	12	15
	Minor (2)	2	4	6	8	10
	Insignificant (1)	1	2	3	4	5

Table 5. Categories of risk, and action required.

Risk Value	Risk Category	Action Required
1 – 4	Green	Low risk not requiring additional risk control options unless they can be implemented at low cost in terms of time, money and effort.
5 – 8	Yellow	Moderate risk which must be reduced to the *"as low as reasonably practicable"* (ALARP) level by the implementation of additional control options which are likely to require additional funding.
9-12	Amber	High risk for which substantial and urgent efforts must be made to reduce it to "ALARP" levels within a defined time period. Significant funding is likely to be required and services may need to be suspended or restricted until risk control options have been actioned.
15-25	Red	Very high and unacceptable risk for which substantial and immediate improvements are necessary. Major funding may be required and ports and waterways are likely to be forced to close until the risk has been reduced to an acceptable level.

8 Risk control options

The objective of the risk assessment was to identify risk mitigation options for each undesirable incident that would, if implemented, reduce the risk to a level as low as reasonably practicable (ALARP) and which would be acceptable to stakeholders. Before any risk control decisions were made, they were communicated through the stakeholder consultation process. The risks were evaluated in terms of the overall needs, issues and concerns of the stakeholders. The mitigation options include:

- new or enforcement of existing rules and procedures;
- improved and charted hydrographical, meteorological and general navigation information;
- enhanced AtoN service provision;
- improved radio communications; and
- improved decision support systems.

Table 6 shows the risk scores for the scenarios under the current situation at Port of London with new risk scores when the risks are mitigated. The detailed risk control options for Port of London is shown in the risk control matrix in Annex D.

Table 6. Risk control options for Port of London and changes in risk score.

Scenario	Risk score	Risk control option	New risk score
Grounding of a landing craft or another similar vessel at entrance to the London Passage due to lack of AtoNs marking the entrance	9	Purchase and install 1 port hand beacon at south of Bridges Point and 1 starboard hand beacon near north point of Cochrane Reef at the entrance to London Passage.	3
Grounding of small boats at Peak Point during sunrise and sunset due to low sun issues and lack of AtoNs marking the London Passage	6	Conduct community awareness workshops on the use of London Passage. Purchase and install 5 starboard hand and 5 port hand AtoNs along the entire length of the London Passage.	2
Grounding of landing craft or other similar vessels on soft bottom due to siltation along the London Passage	4	Conduct an Environmental Impact Assessment (EIA) for dredging the passage to allow ships to enter the Port of London.	3

Collision of small fishing boats with each other near the bend called Tabonteke, both during the day and at night due to lack of awareness and of navigation lights on the boats	9	Conduct community awareness workshops on basic collision regulation and encourage people to carry visible lights on the boats during night-time.	3
Grounding of vessels along the coast of Kiritimati Island due to lack of landfall lights	9	Fit the two telecommunication towers on the island with visible lights and install two new towers with landfall lights at northwest and southwest points.	3

9 Costing the risk control options

The outcomes of the risk assessment are essentially qualitative and subjective, based on the expert opinions of the stakeholders. The next step is to reach consensus on which risk control options to action. The risk control options are prioritised to facilitate the decision-making process.

Costing of the options is part of the decision-making process. Most of the control options identified require funding. Costs must cover capital, labour and other resources needed for planning and implementation, as well as costs of operation and maintenance throughout the life cycle under consideration. Maintenance is important to ensure that AtoN equipment and systems continue to perform at the levels required for mariners to safely navigate the waterways.

The control measures need to be both effective in reducing risk, but also cost-effective. The cost of the measures should not normally exceed the reduction in the expected value of the loss.

The cost of the options should be evaluated over a time frame equivalent to the economic or useful life of the facilities and assets associated with the option.

10 Recommendations

A key outcome of the risk assessment undertaken at the Port of London is five recommendations to reduce the risks to safety of navigation to an acceptable level for stakeholders.

Recommendation 1 (addressing grounding scenario)

This recommendation addresses potential grounding of landing craft and other similar vessels at the entrance to the London Passage due to lack of AtoNs marking the entrance of the passage.

It is recommended that a starboard and a port beacon with lights and day boards to be installed on either side of the entrance into the London Passage at the following locations shown below (Figure 5).

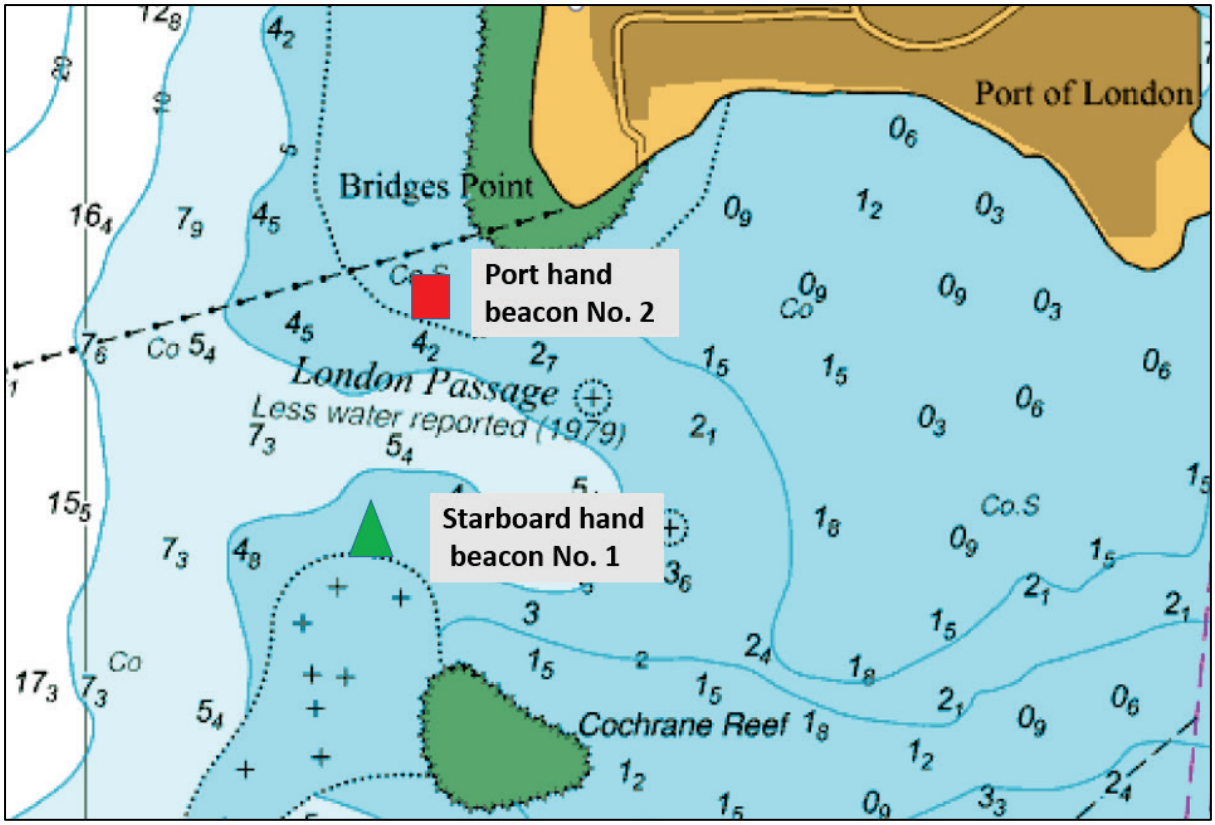

Figure 5. Locations of AtoNs to be installed at the entrance of the London Passage

The above recommendations should potentially help to reduce the risk to as low as reasonably practicable.

The costs to implement this recommendation are as follows:

Recommendation	Amount (AUD)
Purchase and installation of starboard and port beacons with lights and day boards at the following locations: 1. Port hand beacon No. 2 Latitude: 01-58.785859N; Longitude: 157-28.772202W 2. Starboard hand beacon No. 1 Latitude: 01-58.638909N; Longitude: 157-28.823947W	40,000
Maintenance cost	2,000

Recommendation 2 (addressing grounding scenario)

This recommendation addresses potential grounding of small boats during the sunset and sunrise hours around the Peak Point due to the sun's glare as well as lack of AtoNs marking the London Passage.

It is recommended that safety awareness workshops be delivered to the communities on the rules of the use of the passage and also that five starboard and five port hand beacons with appropriate lights and day boards be purchased and installed along the entire length of the London Passage at the locations shown in Figure 6.

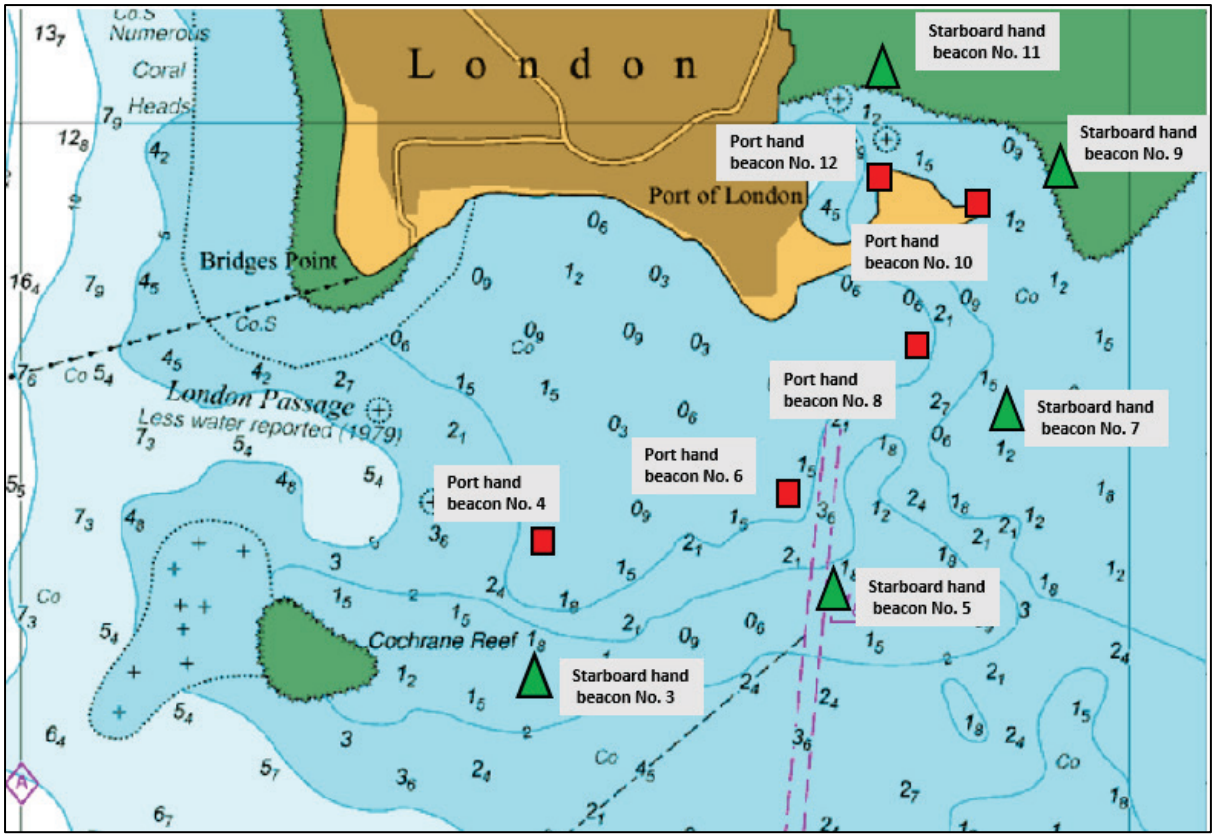

Figure 6. Locations of AtoNs to be installed in the London Passage

The above recommendations should potentially help to reduce the risk to as low as reasonably practicable.

The cost to implement this recommendation are as follows:

Recommendation	Amount (AUD)
1. Purchase and installation of 5 starboard and 5 port hand beacons with appropriate lights and day boards at the following locations: Port hand beacon No.4 Latitude: 01-58.627139N; Longitude: 157-28.506687W Port hand beacon No.6 Latitude: 01-58.675423N; Longitude: 157-28.316120W Port hand beacon No.8 Latitude: 01-58.793683N; Longitude: 157-28.188844W Port hand beacon No.10 Latitude: 01-58.933635N; Longitude: 157-28.129031W Port hand beacon No.12 Latitude: 01-58.961625N; Longitude: 157-28.219446W Starboard hand beacon No.3 Latitude: 01-58.538269N; Longitude: 157-28.542853W Starboard hand beacon No.5 Latitude: 01-58.593550N; Longitude: 157-28.279955W Starboard hand beacon No.7 Latitude: 01-58.761493N; Longitude: 157-28.138073W Starboard hand beacon No.9 Latitude: 01-58.958127N; Longitude: 157-28.076173W Starboard hand beacon No.11 Latitude: 01-59.027403N; Longitude: 157-28.223619W	200,000
2. Conduct safety awareness workshops	18,000
Maintenance cost	10,000

Recommendation 3 (addressing grounding scenario)

This recommendation addresses potential grounding of landing craft and other similar vessels along the London Passage.

This is mainly due to the seasonal nature of moving sand around the London coastline exposed to the ocean side. This is attributed to the currents present in the area and bad weather conditions, such as strong wind and waves.

This causes siltation along the passage and thus causes issues with available depth of navigable water that can potentially cause groundings.

It is recommended that an Environmental Impact Assessment (EIA) study to be carried out in order for the competent authority to make a decision on dredging the passage to a safe depth.

The above recommendations should potentially help to reduce the risk to as low as reasonably practicable.

The cost to implement this recommendation are as follows:

Recommendation	Amount (AUD)
Conduct Environmental Impact Assessment (EIA) for dredging the passage for solutions to allow ships to enter the Port of London	50,000

Recommendation 4 (addressing collision scenario)

This recommendation addresses potential collision of small fishing boats with each other near the bend called Tabonteke both during the day and at night.

This is mainly due to lack of awareness on the use of the London Passage and also lack of any visible lights on these small fishing vessels.

It is recommended that the Marine Division conduct a community awareness programme on basic collision regulation and encourage people to carry visible lights during night-time.

The above recommendations should potentially help to reduce the risk to as low as reasonably practicable.

The cost to implement this recommendation is as follows:

Recommendation	Amount (AUD)
Community awareness workshops on basic collision regulation	18,000

Recommendation 5 (addressing other grounding scenario)

This recommendation addresses potential grounding of vessels navigating along the coastline of Kiritimati Island. This is mainly due to lack of any landfall lights around the coastline of Kiritimati Island.

It is recommended that lights be installed on the two current telecommunications towers and also that two new towers be purchased and installed with appropriate lights at the North West Point and South West Point (Figure 7).

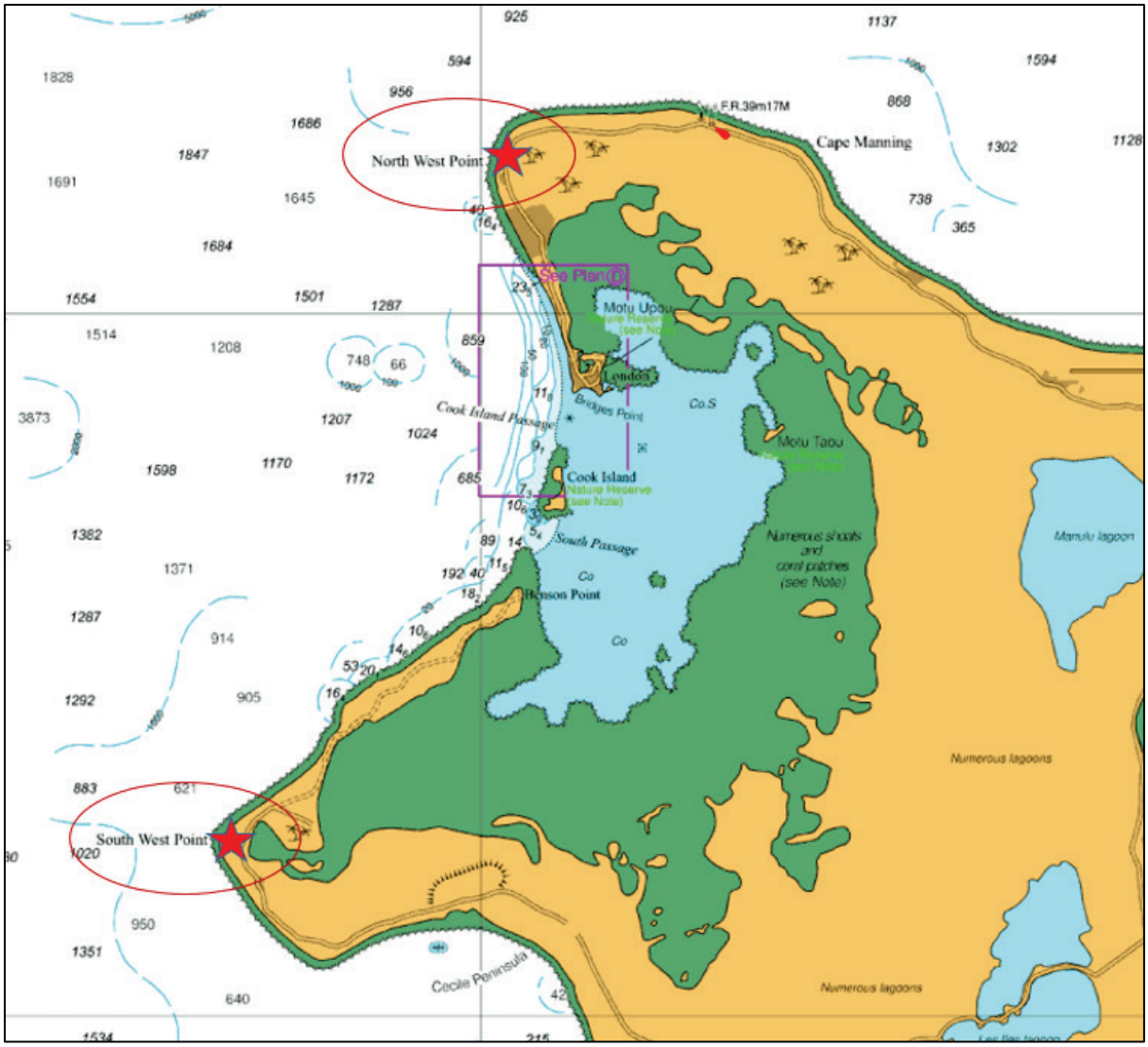

Figure 7. Locations of lights to be installed on the two telecommunications towers

The above recommendations should potentially help to reduce the risk to as low as reasonably practicable.

The costs to implement this recommendation are as follows:

Recommendation	**Amount (AUD)**
Installation of new lights on the present two telecommunication towers and purchase and installation of two new towers with landfall lights at the following locations: 1. North West Point Latitude: 02-02.185091N; Longitude: 157-29.705994W 2. South West Point Latitude: 01-52.466289N; Longitude: 157-33.656182W	100,000
Maintenance cost	5,000

11 Conclusion

This report completes the risk assessment process as required by Regulation 13 of the International Convention for the Safety of Life at Sea (SOLAS convention). It is also meant to guide the Kiribati Ministry of Information, Communication, Transport and Tourism Development, in delivering compliant AtoN services in the Port of London.

SPC can provide further support in relation to capacity development, AtoN services and management, governance, and budget management to assist Kiribati in offering safe maritime routes and meeting the country's international obligations.

It is suggested that a consistent and wider approach is taken by Kiribati to include the delivery of hydrographic, marine meteorology, maritime safety information and maritime Search and Rescue services in its governance processes.

Annex A. Stakeholders in the Port of London risk assessment

Safety of Navigation Risk Assessment Stakeholder Meeting (Phase II) - Kiritimati, Kiribati, 28 November 2019						
	Name	**Job Title**	**Organisation**	**Gender**	**Telephone number**	**Email Address**
1	Tairaa Kauteta	Fishing Guide	Banana Fishing Community	M	73001982	
2	Iobu Teuei	Fisherman	Tabwakea Fishing Association	M	73014330	
3	Ben Teanibo	Ag OIC	Central Pacific Producers Ltd (CPPL)	M	73087810	ben10teanibo@gmail.com
4	Tekonaba Teburea	OIC	Tourism Authority of Kiribati	M	75125050	tteburea@kiribatitourism.gov.ki
5	Ata Binoka	Environment Officer	Environment and Conservation Division - MELAD	M	7301962	atab@environment.gov.ki
6	Kaititi Tengata	Senior Marine Radio Officer	Kiritimati Marine Division - MICTTD	M	73015883	kaititi tengata12@gmail.com
7	Karebwa Tebano	Assistant Customs Officer	Kiribati Customs Administration and Enforcement	M	73034282	karltebano@gmail.com
8	Kirikori Baoro	BM	Kiribati Ports Authority (KPA)	M	73018834	simbakatai@gmail.com

Annex B. Hazards identified for Port of London

HAZARDS		Value	Remarks
Natural	Safe Minimum Depth (m)	0.3	When entering Port of London. Need to dredge to a reasonable depth
	Proximity of danger (NM)	0	Underwater rock, depth unknown. Marked with + in the London Passage
	Tide, wind, wave and tidal flow effect	3.67	Strong easterly wind combined with the tidal flow can have an effect on vessels entering/leaving the port
	Low sun issues	Y	For vessels entering the passage, the sun reflects on the water. Sunset light can cause visibility issues too when leaving the passage
Economic	Insufficient AtoN funding	Y	Light dues are collected from all ships, but they go to the government account and are not used for AtoN funding
Technical	Quality and validity of charted information	Y	Charts not updated
	Loss of vessel control	Y	But rare
	AtoN failures	Y	Lack of maintenance, vandalism, collision and no AtoN at the moment
Human	Crew competency	Y	Small boat owners need training on and awareness of basic rules of the road to avoid collision in the passages
	Safety culture	Y	Do not really care about safety. It is a habit
	Influence of alcohol and/or drugs	Y	Common issues with crews/alcohol problems have caused groundings previously
	Availability and competency of pilotage	Y	One pilot available for KPA wharf and local pilot for tender boats
	Political issues?	Y	Control of vessel maintenance by government
	Culture or language issues	Y	Foreign nationals (Chinese crews) visiting the ports have issues with communications
Operational	Impact of small vessels	Y	Not compliant with port control procedures during vessel movement
	Fishing activities	Y	Can cause collisions
	Poor passage planning	Y	Vessels not complying with SOPs
	Poor communication of MSI	Y	Charts need to be updated
	Poor response to marking new danger	Y	No suitable officer on the island. Lack of internet communication to share information
Maritime Space	The existence of wrecks and new dangers	Y	Wrecks and missing lights
	Crowded waterway issues	Y	Limited anchorage for international vessels

Annex C: Possible scenarios identified for Port of London

SCENARIOS		Remarks
Groundings	Grounding on rock	1. Local vessel grounding near entrance due to absence of AtoN 2. Some small craft and fishing boats grounding at Peak Point 3. Vessels grounding along the coastline of Kiritimati while trying to access the Kiritimati ports
	Grounding on soft bottom	Local vessel accessing Port of London grounding on soft bottom due to siltation
Collision	Collision of two boats	Two boats colliding with each other near the bend called Tabonteke (Port of London). Collision due to no AtoNs marking the channel. Collision due to lack of knowledge on rules of the road (COLREG)

Annex D: Risk assessment matrix for Port of London

Scenario		Description of Incident	Root Cause(s) (Hazards)	Description of Consequences (Short-term and Long-term)	Existing Risk Control Measures	Probability Score	Consequence Score	Risk Score	Cost of Incident (AUD)	Further Risk Control Options	New Probability Score	New Consequence Score	New Risk Score	Cost of RCO (AUD)	Remarks
1. GROUNDINGS															
1.1	Grounding on Rock 1 (LC Linnix and other similar vessels)	Grounding at the entrance	Shallow water, narrow passage and missing AtoN	Damage to ship's underwater hull and engine	Vessels are not permitted to arrive during night-time	3	3	9	1.9 M	Purchase and install port hand beacon south of Bridges Point Purchase and install starboard hand beacon near north point of Cochrane Reef at the entrance	1	3	3	40,000	ALARP
1.2	Grounding on Rock 2 (small boats)	Small boat grounding at Peak Point during sunrise and sunset due to low sun issues.	Sun issues	Damage to ship's hull and engine	None	3	2	6	1.9 M	Conduct community awareness meetings on the use of London Passage Purchase and install 5 starboard hand and 5 port hand AtoNs along the London Passage	1	2	2	218,000	ALARP
1.3	Grounding on soft bottom (LC Linnix and other similar vessels)	Local vessel accessing Port of London grounding on soft bottom due to siltation in the passage	Too shallow inside and at the entrance of the channel	Damage to ship's engine	It is preferred that vessels enter port during high tide	2	2	4	1.9 M	Conduct Environmental Impact Assessment (EIA) for dredging the channel to allow ships to enter the Port of London	1	3	3	50,000	ALARP
2. COLLISION															
2.1	Collision of small fishing boats	Small boats collide with each other	Collision due to no AtoNs in the channel and	Damage to bow and hull Minor injury	None	3	3	9	550,000	Conduct community awareness	1	3	3	18,000	ALARP

		near the bend called Tabonteke, both during the day and at night	lack of knowledge on rules of the road (COLREG)	occurred to fishers						workshops on basic collision regulation and encourage people to carry visible lights during night-time Distribute safety pamphlets					
3. OTHER															
3.1	Grounding of vessels along the coast of Kiritimati	Grounding of vessels along the coast of Kiritimati Island while coming into the port	No visible lights on communication towers and no landfall lights around the coast	Damage to ships, environment and personnel	None	3	3	9	34 M	Purchase and install lights on two telecommunication towers, and install two new towers with landfall lights at North West Point and South West Point	1	3	3	100,000	ALARP

Scenario		Description of Incident	Root Cause(s) (Hazards)	Description of Consequences (Short-term and Long-term)	Existing Risk Control Measures	Probability Score	Consequence Score	Risk Score	Cost of Incident (AUD)	Further Risk Control Options	New Probability Score	New Consequence Score	New Risk Score	Cost of RCO (AUD)	Remarks
1. GROUNDING															
1.1	Grounding on Rock 1 (LC Linnix and other similar vessels)	Grounding at the entrance	Shallow water, narrow passage and missing AtoN	Damage to ship's underwater hull and engine	Vessels are not permitted to arrive during night-time	3	3	9	1.9 M	Purchase and install port hand beacon south of Bridges Point Purchase and install starboard hand beacon near north point of Cochrane Reef at the entrance	1	3	3	40,000	ALARP
1.2	Grounding on Rock 2 (small boats)	Small boat grounding at peak point during sunrise and sunset due to low sun issues.	Sun issues	Damage to ship's hull and engine	None	3	2	6	1.9 M	Conduct community awareness meetings on the use of London Passage Purchase and install 5 starboard hand and 5 port hand AtoNs along the London Passage	1	2	2	218,000	ALARP
1.3	Grounding on soft bottom (LC Linnix and other similar vessels)	Local vessel accessing Port of London grounding on soft bottom due to siltation in the passage	Too shallow inside and at the entrance of the channel	Damage to ship's engine	It is preferred that vessels enter port during high tide	2	2	4	1.9 M	Conduct Environmental Impact Assessment (EIA) for dredging the channel to allow ships to enter the Port of London	1	3	3	50,000	ALARP
2. COLLISION															
2.1	Collision of small fishing boats	Small boats collide with each other near the bend called Tabonteke, both during the day and at night	Collision due to no AtoNs in the channel and lack of knowledge on rules of the road (COLREG)	Damage to bow and hull Minor injury occurred to fishers	None	3	3	9	550,000	Conduct community awareness workshops on basic collision regulation and encourage people to carry visible lights during night-time Distribute safety pamphlets	1	3	3	18,000	ALARP
3. OTHER															
3.1	Grounding of vessels along the coast of Kiritimiti Island	Grounding of vessels along the coast of Kiritimati Island while coming into the port	No visible lights on communication towers and no landfall lights around the coast	Damage to ships, environment and personnel	None	3	3	9	34 M	Purchase and install lights on two telecommunication towers, and install two new towers with landfall lights at North West Point and South West Point	1	3	3	100,000	ALARP

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