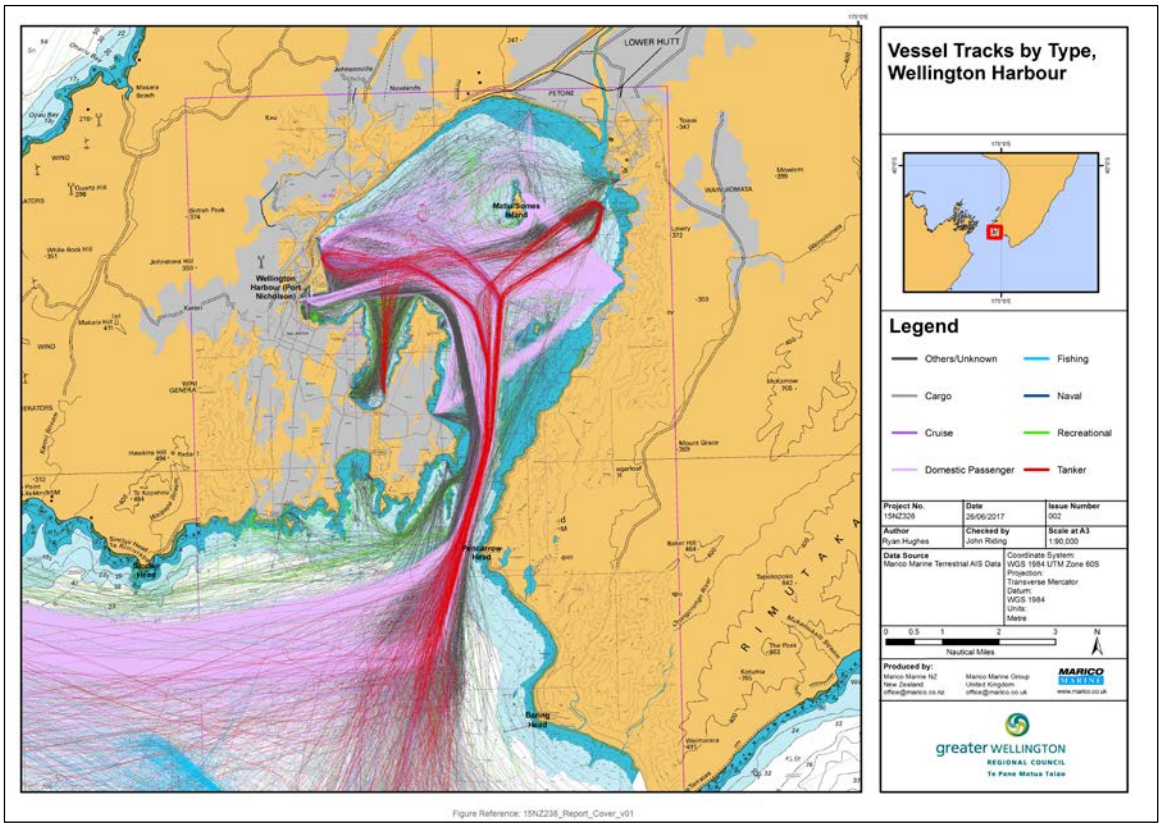
GREATER WELLINGTON REGIONAL COUNCIL

WELLINGTON HARBOUR NAVIGATIONAL RISK ASSESSMENT



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MARICO MARINE NEW ZEALAND LTD

GREATER WELLINGTON REGIONAL COUNCIL

WELLINGTON HARBOUR NAVIGATIONAL RISK ASSESSMENT

Prepared for: **Greater Wellington Regional Council**

Harbours Department
Shed 39
Meridian Building
Wellington

Author(s): **Ryan Hughes; John Riding; Dr Ed Ballard**

Checked By: **John Riding**

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Marico Marine NZ Ltd
Level 11
156 Willis Street
Wellington
6011
New Zealand

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ABBREVIATIONS

Abbreviation	Detail
AIS	Automatic Identification System
ALARP	As Low as Reasonably Practicable
CCTV	Closed Circuit Television
ECDIS	Electronic Chart Display & Information System
GT	Gross Tons. A measurement of a vessel's cargo carrying capacity as measured to the International Tonnage Convention, 1969 (ITC69). Note the word Tons is often interpreted to be a mass (i.e. Tonnes); it is not. The measure originates from the time when vessels were taxed on their ability to carry wine casks, which at the time were called "Tuns". GT is commonly used for ship registry and harbour conservancy dues.
GWRC	Greater Wellington Regional Council
HAZID	HAZard IDentification
HW	High Water
IMO	International Maritime Organization
ISM	International Safety Management system.
kt	Knot (unit of speed equal to nautical mile per hour, approximately 1.85 km/h)
LAT	Lowest Astronomical Tide
LINZ	Land Information New Zealand
LPS	Local Port Service
LW	Low Water
m	Metre
ML	Most Likely
nm	Nautical Mile
NRA	Navigation Risk Assessment
PEC	Pilotage Exemption Certificate – A master or similarly qualified navigator who has become qualified to provide the equivalent services of an authorised pilot through harbour waters where a pilot is required.
PWC	Personal Water Craft
RFT	Rail Ferry Terminal

Abbreviation	Detail
RHIB	Rigid Hulled Inflatable Boat
SMS	Safety Management System
SOLAS	Safety Of Life At Sea – a Convention of the IMO setting shipping standards that bind all IMO members (Contracting Governments). New Zealand is signatory to SOLAS.
SLA	Service Level Agreement
UKC	Under Keel Clearance
VHF	Very High Frequency (radio communication)
VTS	Vessel Traffic Service
WC	Worst Credible

SYNOPSIS

A Navigational Risk Assessment (NRA) for Wellington Harbour was first undertaken in 2006. This 2017 NRA represents a fundamental review and update of this record. Much has changed to harbour risk in the interim years; harbour use has grown significantly with large volume increases in cross harbour ferry commuter services and further increases in the level and types of recreational activities occurring on the water. The Harbour Risk Assessment details by hazards are available electronically online in the GWRC Hazman II risk management package.

The commercial ship traffic profile of Wellington Harbour has also changed, excluding data since the 2016 Kaikoura Earthquake. Large cargo vessel movements per annum have actually fallen since 2006, but underlying this is the reality of an important growth in the size of ships trading to Wellington. Even the Cook Strait has the largest RoRo ferries trading today that have ever been serving this crucial interisland trade link. The growth in ship size underlines the reason why CentrePort is seeking resource consent to deepen its entrance channel, which is effectively an ongoing trading opportunity cost it cannot afford to ignore. Cargo ships, especially container vessels, have grown in Gross Tons (GT) by about 40% and in length by close to 20%. Significantly larger vessels are already trading to NZ, a permanent change as existing tonnage is retired.

Cruise vessel visits stand out as movements with outstanding growth. In 2004/5 Wellington received 32 cruise liners, whereas for the forthcoming 2017-18 period 81 are programmed, an increase in visits of 250%. These occur in the four months of summer; since 2010, a cruise vessel arrival is almost a daily event. However, it is the growth in the size of cruise vessels that is most notable as they have gone from 200m in length to over 350m. The largest cruise vessels in the world have visited Wellington in 2017. In the order of 230,000 Cruise passenger visits were recorded in 2016, with up to 10,000 visitors in a day when two large cruise vessels visited together. This made an economic contribution to the Wellington region of about $66 Million. In 2017 the importance of marine trades to the Wellington regional economy have increased in significance, with CentrePort taking a crucial role. Cruise vessels do though bring their challenges; the windage load on their hulls, either when berthing or when alongside, is a thrust measured in hundreds of tonnes. Mooring systems and fendering along Aotea Quay have been upgraded where cruise vessels berth and CentrePort has prudently procured a second new tug, with 68 tonnes of bollard pull. Further safety investments have been made to pilot training and procedural systems, including simulator training to handle such large ships. Wellington has a challenging environment with Aotea Quay exposed to high

windspeeds, especially during a Southerly change. Damage to cruise vessels though has been virtually non-existent. However, the fact that other ship types are growing in size, especially container vessels, means that the ship handling and mooring loads across all terminals should be numerically evaluated and improvements planned to structures and mooring systems. There has been one mooring-breakout affecting a vehicle carrier at Aotea Quay. This recommendation also affects tanker terminals and options have been tabled in **Section 8**.

The Wellington Pilotage system was found to have an excellent Safety Management System and is a credit to the CentrePort Marine Manager. Such systems though rarely stand still and users have tabled a need to summarise key criteria in procedures, with detail in ensuing pages. Wellington Pilots exhibit a culture open to learning and are leading New Zealand in Bridge Resource Management (BRM) and Human Factors development, organising courses that cross fertilise across different transport industries. This is a pleasing finding of this risk assessment.

The number one ranked risk remains the grounding of a passenger RoRo ferry at the harbour entrance. This risk has decayed in the 10 years since the 2006 Wellington Harbour risk assessment, due in part to improvements in navigational precision of passenger RoRo ferries, which is borne out by analysis of ship track records. This is not though to say grounding risk response can be relaxed. The potential for other large vessels to ground in the entrance remains at risk rank 9, showing grounding risk for any large vessel type is still significant and accurately reflects the rate of near miss incidents. There has been at least one important near miss grounding at Wellington in recent years.

The largest rise in risk is related to the pilot launch getting into difficulties when boarding a vessel in the harbour approaches. This rose from rank 66 in 2006 to rank 2 in 2017, in part due to incidents with a back-up boat, unsuitable for such operations. However, CentrePort took delivery of a new and larger pilot boat in 2017; this report presents a rerun of that risk (**Section 5.7.1**), with a result showing risk mitigation by an order of magnitude. **Table 11**, shows the risk ranking at 19, with this mitigation in place. It is a prudent decision made by CentrePort at a time when the company is grappling with the recovery from the 2016 Kaikoura earthquake.

The second largest rise in risk is associated with cross harbour ferry services within the harbour. Grounding risk has risen from Rank 71 in 2006 to within the top 10 rankings in 2017, this result underpinned by incident records and track analysis. The analysis provides supporting evidence of the increase in grounding risk, which is in part linked to the growth of services. Operators are addressing changed transit practices and procedures, with options to

introduce improvements to electronic charting systems and training in their use, together with passage execution planning is recommended. It should be clearly noted here that a charting upgrade to name and chart an inshore rock may also be of assistance to risk mitigation.

Collision risk remains important in Wellington Harbour generally. Both hazards have risen in rank, although incidents involving tankers and RoRo vessels have risen considerably (Rank 15 in 2006; rank 5 in 2017). This is simply because there have been some important close quarter incident events.

A third risk of ongoing importance is that of berthing contact by passenger RoRo ferries, hazard number 9. Although this has only risen one place in ranking, the hazard in 2017 reflects contact berthing incidents across both passenger RoRo terminals. There have been some incidents involving hull penetration, although it is recognised that both passenger RoRo operators have improving systems.

A rising risk of critical importance to operations at the Port of Wellington is that associated with seismic events. A seismic risk is recorded in the navigational risk database, which has risen 10 places in ranking. However, the damage to port business from the 2016 Kaikoura event is much more significant than the risk to navigation.

A key recommendation of Authors is that the Beacon Hill traffic interface needs to become more proactive and engaged with vessels at the harbour entrance. Traffic conflicts of note have occurred as pilots boarding vessels have negotiated passing arrangements using the pilot boat VHF, with inbound vessels that are pilot exempt. This has shortcomings, where when the ship traffic situation changes during the time taken for a pilot to approach a vessel and board. The Beacon Hill monitoring station has the equipment, but not the training, to use its technical capabilities to best effect in mitigating this risk. There is a view that a more proactive Beacon Hill may attract liability for the Harbours Department and thus GWRC, but Author's professional opinion is that the opposite is true. There is enough risk based and track analysis evidence in this risk assessment to conclude that some simple traffic management strategies, such as policies to sequence movement priority by passengers and scheduled services, should be considered for delivery by Beacon Hill officers. This is not a recommendation for sudden change, rather a planned and gradual move to improve a key risk management system that the GWRC has already invested significantly into. The technical capabilities of Beacon Hill now need to be realised by Harbour Communication Officer training to international IALA standards. These standards have been in place by international agreement, under SOLAS Chapter V, for at least 20 years. Training to what is known as the V103-1 standard can be

obtained on site and one other NZ port has already delivered this training, with a traffic monitoring system of the same type as used at Beacon Hill. **Section 8.5** provides further information and details what needs to happen if the GRWC Harbours System elects to take this risk recommendation forward.

If this decision is taken, the boarding of pilots at the Delta location, which lies inside the harbour entrance channel (used when conditions offshore are unworkable) and involves the leading of vessels from the pilot boat, with the pilot using the pilot boat VHF, can be much better managed using the tracking and technical capabilities of Beacon Hill. With training, it would be possible for a second pilot to attend at Beacon Hill for a leading operation. This would bring Wellington in line with best practices in other ports where leading a vessel from a remote location is sometimes necessary. Leading a vessel through the Wellington entrance is a high risk operation and needs the mitigation that could be provided by Beacon Hill collaboration and training.

Adding radar coverage into Lambton Harbour, where most of the vessels/craft not carrying AIS transponders operate is recommended as part of this change. The possibility of loss of life is greater when smaller vessels are involved, yet without radar coverage, these are the vessels that the Beacon Hill monitoring station cannot receive. Modern radar technology combined with the software solutions already procured should be able to monitor small vessels in Lambton Harbour, which would be of benefit to SAR operations and tracking groups of kayakers. The cost of such technology has also fallen with time.

A comprehensive list of Conclusions and Recommendations are at **Section 8**.

1 INTRODUCTION

In 2006, a Navigational Risk Assessment for Wellington Harbour was completed as part of the introduction of the New Zealand Port and Harbour Marine Safety Code (the Code). This also initiated the development of a Navigational Safety Management System (NSMS), a further requirement of the Code. A period of time has passed since the initiating risk assessment and much has changed in the harbour and its marine traffic in the interim.

This Navigational Risk Assessment presents an appraisal, review and reassessment of the existing hazards and risk management system for Wellington Harbour. It has resulted in delivering a new risk assessment for the harbour, which differs significantly to that also stored online in the Hazman II software, allowing easy update in the future. The Greater Wellington Regional Council Harbours Office has been diligently recording Harbour Incidents for a number of years; these were also stored in Hazman II and have been a valuable resource in informing both the content of the risk assessment, as well as the quantification of harbour risk. The updated risk assessment report facilitates further development of the Wellington Harbour Navigational Safety Management System (NSMS).

This risk assessment has been conducted on behalf of Greater Wellington Regional Council (GWRC) and CentrePort. It has been facilitated by Marico Marine NZ in accordance with the requirements of the Code. Please note that chartlet extracts reproduced in this report are taken from LINZ official Charts, but are not reproduced to scale and should not be used for planning of or in any other way used for navigation.

1.1 PURPOSE AND SCOPE

The purpose of the assessment was to revise or identify key hazards associated with navigation of vessels, including smaller craft, within the Wellington Harbour Limits. Risk levels were then evaluated and ranked in order of relative risk, thus highlighting important risks to harbour safety. The risk management system effectiveness was then compared to the higher levels of risk and a gap analysis conducted.

The scope of this risk assessment also included a review of:

- Incident data and near-miss reports, collected by the Wellington Harbour Master;
- Incident rates associated with vessel types using harbour waters;
- The views of relevant harbour stakeholders, including recreational users, regarding navigational safety;

- The changing trade routes and commercial activities ongoing at Wellington Harbour;
- The varying environmental and meteorological conditions at specific locations at Wellington Harbour;
- The harbour organisation which operates across organisational boundaries;
- Operational systems and guidance for professional and recreational mariners.

The extents included harbour waters out to the Harbour/Pilotage limits, as defined in Maritime Rule Part 90 and the Wellington Bylaws[1]. A diagram of harbour extents is shown in **Figure 1**, below.

[1] **Greater Wellington Regional Council Navigation and Safety Bylaw 2012**

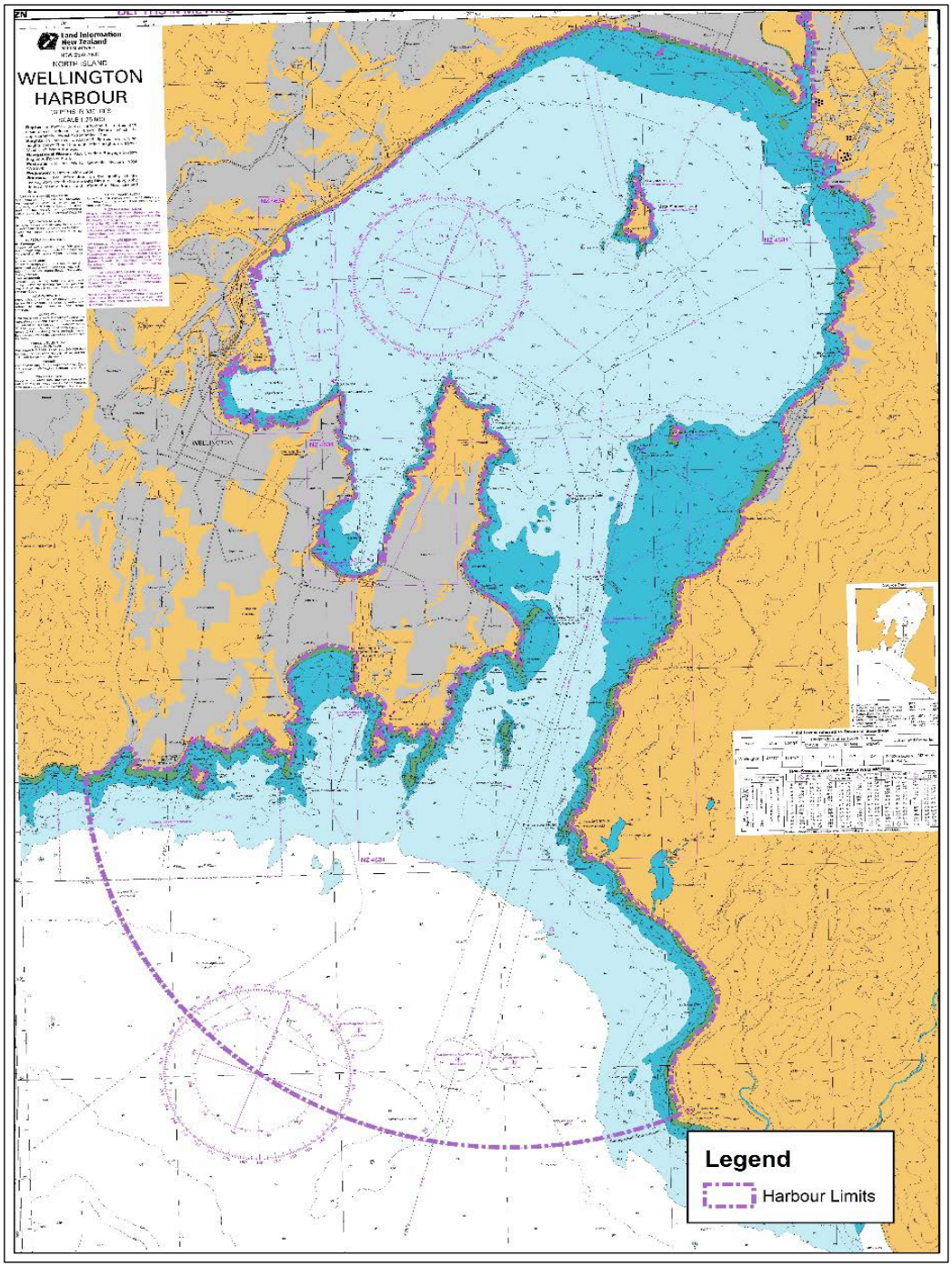

Figure 1: Harbour Limits of Wellington - Bylaws and Maritime Rule Part 90

1.2 THE NEW ZEALAND PORT AND HARBOUR MARINE SAFETY CODE

The New Zealand Port and Harbour Marine Safety Code (NZ PHMSC) was introduced by Maritime New Zealand in 2003/4 following the success of the UK Port Marine Safety Code. It is now in its

second edition, following a review by MNZ[2] and the new version published on their website. The "new" code is more robust than the old. The NZ PHMSC ("the Code"), like its UK counterpart remains a voluntary standard for harbour safety management.

Its status appears optional in terms of compliance, but its voluntary status belies its importance. Codes of this type (i.e. best practice) are commonly used for maritime regulation and the approach used in the Code is by no means unique. Marine Codes cover many aspects of both ship design and operation, including shipping interfaces, such as ports and terminals[3]. Some are mandatory by international agreement at IMO, others remain advisory best practice. Marine Codes rely on the fact that legal Due Diligence can only be satisfied by following the "best practice" of the day. Notwithstanding the statutory need for harbour water safety to be effectively managed, best practice is defined by the Code and not adopting its requirements presents a commercial liability to the Harbour Authority that it should seek to avoid, should the event occur in designated harbour waters[4]. Shipping casualties are by their nature expensive and cases involving harbour approaches and pilotage waters are high in terms of consequential impacts[5].

The Code requires every harbour in New Zealand to produce a harbour risk assessment. Wellington first did this in 2006 and this document is the first review of this, in 2016. In truth, so much has changed in 10 years, that it is almost a totally new risk assessment.

1.3 THE PUBLIC RIGHT TO NAVIGATE

As navigation through harbour waters from sea to a safe berth is the same as the public right of way created by a road on land, there is a need for a marine equivalent of the NZ Transport Agency in harbour waters, regulating transits, but not proscribing them without due reason. In New Zealand, this role has fallen to Regional or Unitary Councils alongside other riparian responsibilities. The Harbour Authority is responsible for "Safety of Navigation" through harbour waters. Harbour waters have limits, which are both gazetted and clearly marked on nautical charts.

Recent changes to NZ law have changed this responsibility to one of "Maritime Safety", which is explained below (1.3.2).

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[2] 2015 Edition as published by Maritime New Zealand

[3] The ISGOTT tanker and tank terminal safety guide is one example. The SIGGTO Gas carrier codes are others.

[4] Commercial liability has far greater financial loss implications than accrue out of fines under statute, although a fine under statute often results in a compensation claim.

[5] For example, the cost of the RENA disaster has recently been reported at NZ$900M by the Environment Court ("Tradewinds", 14 June 2017).

1.3.1 THE HARBOUR AUTHORITY AND THE HARBOUR MASTER

All harbours in the world have an equivalent to a "Harbour Authority" in some form; an entity, public or private, which is solely responsible for the standards of navigational safety management through harbour waters. They were originally there to facilitate the safe entry of vessels bringing trade or supplies into harbour waters. All harbours have jurisdictions, or defined harbour limits which should make clear the area of responsibility that a Harbour Authority has. In the case of Wellington Harbour, the limits of jurisdiction are clearly recorded in bylaws and are also gazetted.

In New Zealand, the Harbour Authority role has been passed to regional councils. In the case of Wellington, it is the Greater Wellington Regional Council. The Harbour Master was once the "agent" of a "*Harbour Board*". The Board, like any other, was a group of appointees whose focus was on the local management of navigational safety for vessels trading to the terminals managed by the port operator. The Board was thus charged with responsibility for delivering navigational safety and with some independent powers of Direction over navigation and shipping to achieve this. The New Zealand Harbour Master is much more a sole regulator, setting standards of navigation and with more comprehensive independent powers of Direction. Many requirements are written into Harbour Bylaws, approved by the Regional Council.

At least 150 years of legal precedent across many countries has laid down clear interpretations of the duties and obligations of Harbour Authorities. As far as shipping is concerned, international agreements in place allow a vessel operator to expect a similar level of risk management at every harbour they may trade into. One of the most important liabilities facing ports and harbours are unsafe port or unsafe berth claims, with case law today defining the duties and obligations of a Harbour Authority. Thus, legal rulings arising from a failing of harbour waters navigational safety management in one country **are** used in case law in another (especially pilotage matters). Costs, even in defence, can be significant. Both berths (or terminals) and harbours (ports) can be ruled unsafe not only because of the condition of their assets, but also because of failings in the way shipping movements are managed and navigation is regulated through harbour waters. If this occurs, the full cost of a casualty can become the responsibility of a Harbour Authority and not just a terminal operator or service provider. Pilotage is a good example of this, where a pilot may not face liability as an individual by Statute, but systems managing pilotage (e.g. SOPs, or training and authorisation processes) can be used as a focus of causation investigations, especially for commercial liability. Standards of training and systems of harbour traffic management are other examples.

1.3.2 THE NZ MARITIME TRANSPORT ACT 2013

Shortly before commencement of this risk review, Parliament released the Marine Legislation Bill introducing amendments to the Maritime Transport Act 1994, moving harbour legislation from the Local Government Act to the Maritime Transport Act. The Maritime Transport Amendment Act entered into the Statute in October 2013. The legislation has reconfirmed the Regional Council's (or Unitary Authority) role within Harbour Waters:

Section 33C - Functions of regional councils.

*"For the purpose of **ensuring maritime safety** in their regions, regional councils may regulate—*

"(a) the ports, harbours, and waters in their regions; and

(b) maritime-related activities in their regions."

The text is interesting as, where the role was previously defined solely as one of regulating navigational safety, the amendments to the Maritime Transport Act has widened the scope to one that is now described as "maritime safety". Although the term "*maritime safety*" remains undefined, the legislation defines 'maritime-related activities' as:

"any activity (including the use of land, buildings equipment or other property) that affects or is likely to affect maritime safety".

The impacts of this are, it seems, untested in a courtroom environment, but there is a clear difference between a Council role of "navigation safety" and one of "maritime safety". If anything, the scope of the Harbour Authority role and thus that of the Harbour Master has widened.

The scope of the Harbour Master's role to regulate all vessels capable of navigation is clarified under sections 33F(1)(c) to 33F(1)(f). For the first time, the role and powers of the Harbour Master are clarified in a single piece of legislation. It is also made clear that all types of recreational craft, including personal water craft, are considered as ships for the purposes of the Harbour Master role.

Thus, the scope of harbour maritime safety management by Council, discharged through its Harbour Master, includes all types of vessels or recreational craft capable of navigation.

Section 33F(2) of the Maritime Transport Act provides that the Harbour Master may exercise statutory powers with the assistance of any persons and equipment reasonably considered necessary in the circumstances. Therefore, a degree of budget setting powers can be inferred, provided the proposed expenditure is reasonable.

1.4 THE IMPORTANCE OF RISK ASSESSMENT TO PORTS AND HARBOURS

Of relevance to the Wellington Harbour Risk Assessment is the case of OCEAN VICTORY, which was a recent UK Court of Appeal and then Supreme Court ruling over an unsafe port. OCEAN VICTORY was a Capesize[6] bulk carrier which was forced to leave the port of Kashima, Japan in October 2006. With similarities to the grounding of JODY F MILLENNIUM at Gisborne, OCEAN VICTORY departed into the teeth of a severe gale, from an unusual direction, which deepened unexpectedly as it approached the Japanese coast. There was also a combination of unusual and heavy longwave swell, also from an unusual direction. The vessel was ordered by the port to leave, probably late against the arriving weather conditions. The vessel was wrecked at the port entrance breakwater, by heavy seas on the seaward side of the breakwater. The vessel made an unsafe port claim against charterers, which ultimately would have affected the liability of the port authority.

In the first instance, the trial judge found that Kashima was unsafe as neither of the two causes of the incident (long waves and severe northerly gales) was rare, but the Court of Appeal disagreed and found that the port was safe. This was because, although neither the long waves nor the severe northerly gales which caused the incident were uncommon in themselves, the combination of the two was extremely rare. The Port of Kashima had recognised the risk of each individual event, but had not sought to mitigate the risk of the combination of events, as this represented an unlikely but worst possible case.

This ruling is very relevant in that it established that a harbour which does a proper risk assessment, showing that all reasonable risks have been assessed and mitigated to an ALARP (As Low As Reasonably Practicable) standard, does deliver an appropriate level of due diligence that can be used in defence of a large marine claim. The *Most Likely* and *Worst Credible* approach used in this risk assessment does exclude the *Worst Possible* outcomes, because they would be extraordinary combinations of adverse events. The Kashima ruling shows that in Wellington the Hazman II system in use does allow ALARP to be defined. This takes into account the fact that Wellington has severe weather events, but that rare combinations resulting in really extreme effects are not something the port system should be expected to over-invest in and mitigate. Marico Marine were engaged as expert witnesses in the OCEAN VICTORY case.

A key role of the Harbour Authority is delivered by the Harbour Master. In its role of Harbour Authority, the Wellington Regional Council had appointed and maintained the position of Harbour

6. A "Capesize" bulk carrier is the largest size of bulk carrier that is commonly used to transport dry cargos in bulk. Bulk Carriers, the "wheelbarrows of the sea" are built in three common size ranges, Handy size, Panamax and Cape Size.

Master and provides a harbour office as well as Beacon Hill traffic communication centre[7]. The Harbour Master is in effect the "Agent" of the Harbour Authority, delivering on their standards, but also carrying personal (independent) powers of Direction.

The Harbour Master thus fulfils a key role in the harbour, setting standards for navigation of large vessels and recreational craft alike within the harbour jurisdiction. The Harbour Master role extends into the setting of standards for Marine Pilot training and authorisation, under NZ Maritime Rule part 90.

1.5 CENTREPORT AND WELLINGTON HARBOUR MASTER – SLA

In the New Zealand harbour management system, the Harbour Master is in the main separated from the port company operation. In order to make such an arrangement work, close communication and effective collaboration between the port operating company and the Harbour Master's department is essential[8]. To facilitate proper collaboration, CentrePort and GWRC have agreed a Service Level Agreement (SLA) that needs to be referenced at an early stage in this risk assessment. This interface document sets benchmark standards for marine services, including pilotage, traffic monitoring and berthing. This forms part of the Beacon Hill Operating Procedures in the case of the Harbour Master's side.

The SLA has been reviewed as part of the harbour risk assessment and has been found to present a clear set of working responsibilities, placing obligations on both parties in the interests of harbour safety and collaboration.

In addition to the SLA, Centreport provides significant support for the maintenance of the Navigation Aids and traffic monitoring at Beacon Hill, by way of an annual fee.

1.6 PREVIOUS RISK ASSESSMENT AND SMS DEVELOPMENT

The current Harbour Safety Management System (SMS) is based on the 2006 Risk Assessment of Wellington Harbour, with ongoing development as the port and its water-way users have developed. Users of the SMS include both the GWRC Harbours Department and CentrePort, both helping to implement the controls and procedures summarised in the SMS Manual. Whilst CentrePort

[7] **Centreport makes a significant contribution towards the operating costs of Beacon Hill.**

[8] **Some ports in New Zealand have retained a combined Harbour Master and Marine Manager role.**

maintains its own SMS Manual (and procedure manuals), the Harbour SMS acknowledges and interfaces with the SMS of CentrePort.

To differentiate between the definitions of a Risk Assessment and Safety Management System (SMS), the following should be noted[9]:

- A risk assessment defines the risks;
- A safety management system manages the risks.

The SMS will need to change and develop out of this risk assessment, which is to be expected. It is some 10 years since the original risk assessment, a time in which the harbour trade has changed considerably. Some risks will have fallen as trade changed, others will have risen. New risks will accrue. 10 years is a long time between risk reviews and a period of 5 years may be a better fit.

As the Safety Management system for the harbour will need to take account of new risk management strategies.

1.7 WELLINGTON HARBOUR SEISMIC RISK

Any harbour risk assessment of the Wellington harbour system must acknowledge and recognise the importance of a seismic event to the trading status of the port and its associated effect on vessel traffic. Strictly, such events are normally outside the scope of a navigational risk assessment, which focusses on the movements of vessels and recreational craft. However, in 2016, Wellington suffered a series of damaging earthquakes, which had a significant effect on port infrastructure and consequential impacts on vessel visits. For a time, only geared cargo vessels and passenger services could be accepted, due to damaged gantry crane support structures and piling, where the berth head along Aotea Quay had moved in relation to the main part of the berth. Therefore, such risks are acknowledged in the hazard analysis. Mitigation for these risks must focus on consequence management and therefore business recovery planning. The unpredictability of earthquakes (type, severity and depth) make this difficult, but such plans should be developed together with those of regular traders to the port, such as ferry operators.

As a result of the recent seismic events the importance of the port of Wellington and its infrastructure is recognised to extend beyond the commercial impacts to the Port company and the region, to the impact on the resilience and response capability of the region. After a large earthquake

[9] **Guidelines for Port & Harbour Risk Assessment and Safety Management Systems in New Zealand (Maritime New Zealand).**

sea freight is likely to be the most accessible means of movement of people and goods for recovery operations.

It is an accepted role of a Harbour Authority to ensure that adequate planning is in place for emergency response and recovery. It does not need to hold and be directly responsible for all such plans, but it does need to be aware they are in place, adequate and undergo periodic review and where appropriate, exercised. In Wellington, these plans have been tested and reviewed following the 2016 Kaikoura earthquake.

1.7.1 WELLINGTON FAULT LINES

Figure 2, (GNS Science), shows the fault lines affecting the harbour on a regional basis. The main Wellington fault passes through the Interislander RoRo terminal (**Figure 3**). There is an inherent uncertainly of the true extents of fault lines, but recent investigation (2010) of the main Wellington fault suggested its risk of slippage was lower than historically considered. It is reported to have last ruptured about 300 years ago and the return period was extended out to an estimated 900 years. However, the uncertainty of this provides a range of 500 to 1000 years between ruptures and GNS provide opinion that the "Wellington" fault is more likely than other Wellington area faults to rupture (**Figure 2**).

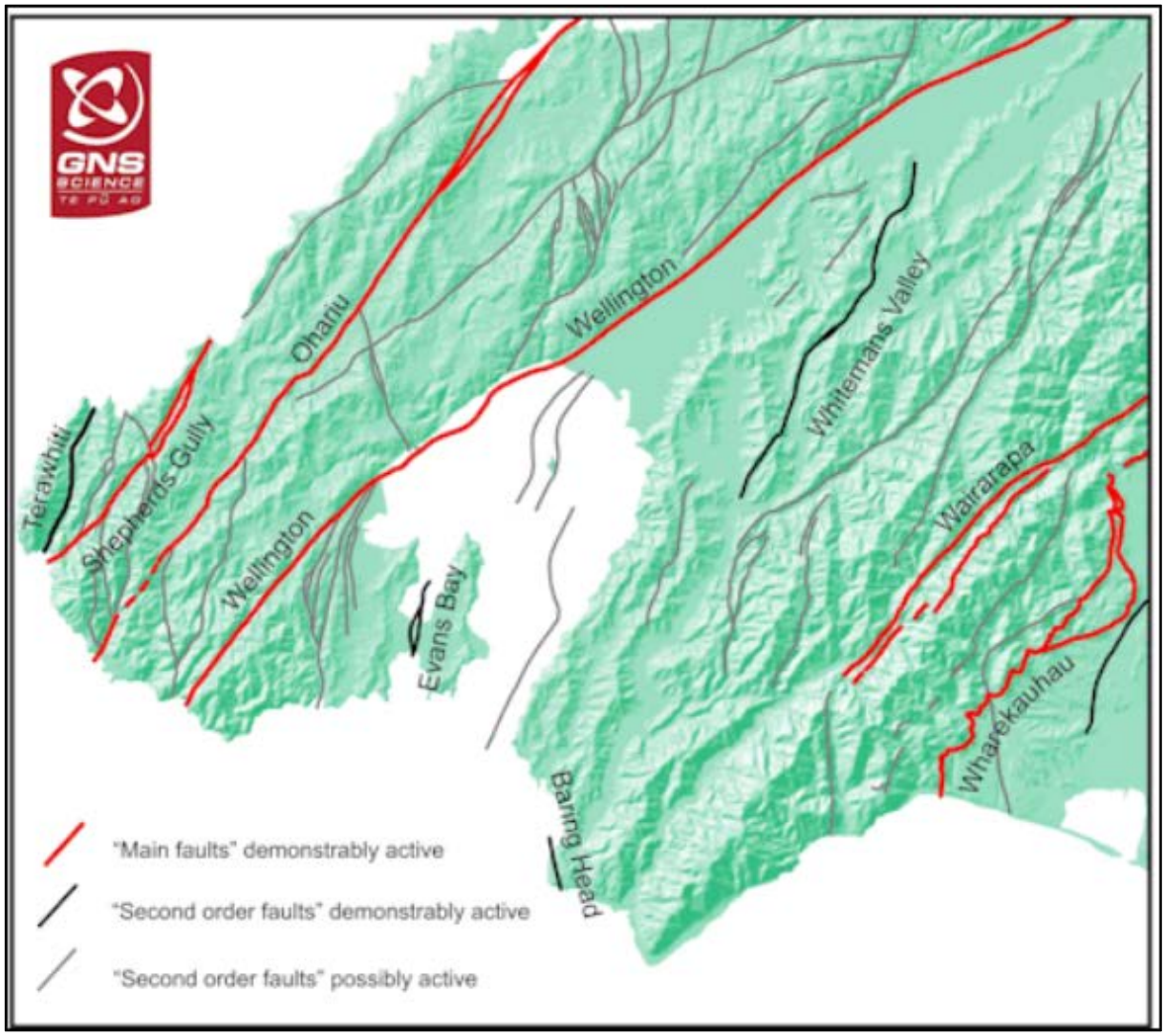


Figure 2 : Recorded Seismic Faults - Wellington Region (Source GNS Science)

However, a more recently discovered fault line called the Aotea Fault appears to run parallel to Aotea Quay (**Figure 3**), with its periphery endings unclear. This suggest that the main harbour area remains susceptible to a future seismic event. It is outside the Authors' expertise to interpret this information, although the need for a long- term port terminal recovery plan is a critical mitigating action. The recent Kaikoura earthquake's effect on the Wellington harbour infrastructure was unexpected, but significant. However, the event has reawakened an understanding of the importance the port and its facilities have to any post-quake recovery effort in the general area.

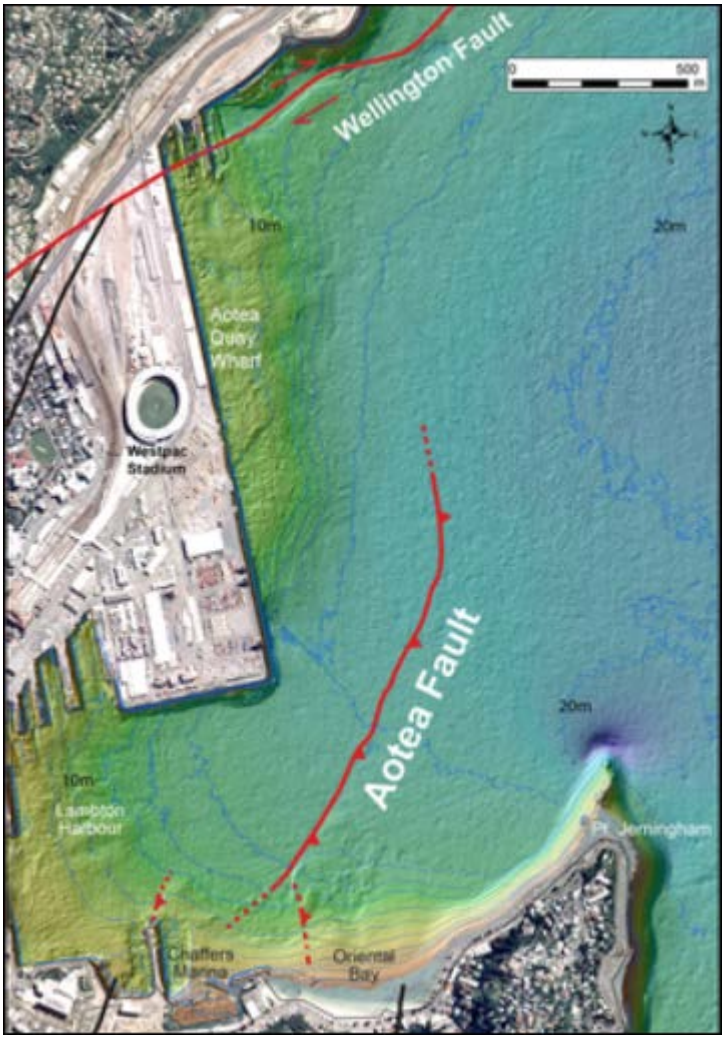


Figure 3 : Aotea Fault

Figure 3 shows how the Wellington Fault and the Aotea faults lie in relation to the harbour waters. Aotea Quay is close and there is no evidence that Authors could research to suggest that the Aotea Fault moved during the Kaikoura earthquake. However, the Aotea development is a combination of land recovery by infill and piling to support the Aotea Quay apron, cranes and cargoes being worked. This has been adversely affected by the seismic events, causing both quay movement and liquefaction.

2 METHODOLOGY

2.1 INTRODUCTION

The approach taken by Marico Marine in undertaking this Risk Assessment is based on the Guidelines of the Port and Harbour Risk Assessment and Safety Management Systems in New Zealand. However, Marico have applied the same methodology that the company uses for ports and harbours worldwide.

The methodology approach uses the online Hazman II harbour risk management software package, developed by Marico Marine. A key change to this risk assessment, compared to the 2006 Wellington harbour navigational risk assessment is that:-

- The reduction in risk associated with the harbour SMS systems has been taken into account (see Risk Definitions, below).
- The risk assessment is in 2017 more closely linked to the incident data of the harbour, which since 2006 has been recorded within the Hazman II software package. To achieve this, a pool of earlier incident records were obtained from Maritime New Zealand and manually added to the GRWC Hazman II incident database, to supplement the record generated by GWRC harbour staff. This larger pool of data has been used as a basis for determining frequency for risk calculations.

Overall risk assessment methodology comprises of five separate stages:

1. Data Gathering and systems assessment
2. Hazard Identification and preliminary assessment
3. Risk Analysis to refine the risk values using incident data.
4. Assessment of existing risk management strategies; development of new measures; assessment of overall control adequacy.
5. Managing and treating risk via the Harbour Safety Management system (SMS)

This report covers all review stages including discussion and recommendations for future navigational risk management decisions.

2.1.1 RISK TYPE DEFINITIONS

To understand how risk is measured and responded to, some definitions are needed. The risk assessment review starts with the Baseline Risk.

- The **Baseline Risk** is the calculated risk score at the time of the risk assessment. This includes all current risk controls.

With the Baseline Risk assessed, the concept of **Inherent Risk** needs to be considered.

- **Inherent Risk** is baseline risk score without any risk controls applied. Few harbours are totally new developments and risk assessments are undertaken with risk controls already in existence. Inherent risk is the risk result if all risk controls were removed; and

When new risk controls are developed out of the risk assessment, these result in further risk reduction, leaving a **Residual Risk** remainder.

- **Residual Risk** is the baseline risk score with additional mitigation measure in place that were not included when the risk assessment was undertaken**.**

2.2 STAGE 1 – DATA GATHERING AND SYSTEM ASSESSMENT

Hazard identification comprises a number of complementary processes that provide a significant review of the existing hazards. In the context of this analysis, these were:

- Gathering documented data, operational procedures, incident records and anecdotal evidence;
- Interviews with port, maritime and recreational stakeholders;
- Tripping with pilots;
- Familiarization and field trips, including Beacon Hill LPS;
- Review of operational procedures Beacon Hill and CentrePort;
- Electronic recording of vessel traffic movements within the port;
- Marine Traffic Analysis and Port Movement Statistics;
- Preparation of a draft Hazard List;
- Risk Scoring review using incident data;
- Development of a final Ranked Hazard List with the participation of stakeholders at a Hazard Identification and review meeting.

2.3 STAGE 2 – HAZARD IDENTIFICATION AND SCORING

When reviewing risks, incident records that had been maintained by the Harbour Masters' Safety Management System and reported to Maritime New Zealand were added to the online Hazman II record. These linked incidents to existing hazards and allowed a "gap analysis" to be performed. The incident records provided a factual record of frequency and therefore an opportunity to review either the "most likely" or the "worst credible" frequency scores of existing hazards. This influenced

the agenda of stakeholder meetings conducted as part of the risk assessment review, establishing harbour users' opinions of hazards identified in comparison with incident experienced.

Following the Stakeholder Group Meetings, an interface with both CentrePort and the GWRC Harbour Master's department was established.

The new hazard list was input into the Hazman II risk management software package. The Gap Analysis included an incident review compared against the existing hazards. Hazards were updated on an accident category basis, which provided a comparable output for the updated hazards.

Expert judgement is often necessary part of a risk scoring process and this has been used to some extent for both the 2006 and the 2017 risk assessments. However, the latter has been much better informed by a better quality of incident records. Assessing risk in a diverse harbour area can result in some subjectivity associated with individual perception of risk. In the case of the Wellington review, subjectivity has been addressed by referencing recorded incidents to hazards they relate to and using the incident frequency to inform the hazard return period.

Feedback and comments were encouraged from stakeholders when hazards were rescored based on Marico Marine's expertise.

2.4 STAGE 3 - RISK ANALYSIS AND HAZMAN II

To facilitate risk analysis, risk management software for ports and harbours, HAZMAN II, was utilised. The Wellington Harbour Master's Office uses HAZMAN II, to which Centreport has access and is a core component of the Wellington Harbour safety management system. Harbour incidents, as they occur are logged into Hazman II by the Harbour Master's Office. Centreport has an excellent record of immediate incident reporting.

HAZMAN II was used to finalise the Hazard List, derived from harbour visits and transits by Marico personnel, a HAZID review meeting and stakeholder interface. This includes hazard scoring reviews with various stakeholders able to contribute. Each hazard has been reviewed/modified or new hazards added and assessed in terms of Likelihood and Consequence. Likelihood was scored on a scale based on a number of frequency ranges (See Section 2.7 and **Annex A** for information about risk criteria). Consequence was assessed in respect of safety of people, impact on the environment, damage to infrastructure, and effect on port reputation/business. The assessment of Consequence was conducted for both the "Most Likely" (ML) and "Worst Case" (WC) scenarios.

The scores for both likelihood and consequence were added to HAZMAN II. This converts the hazard likelihood and consequence scores into risk for each hazard, outputting a linear scale of 1 to 10 which can be used for risk ranking.

2.4.1 Risk Scoring and Ranking System

Risk scoring and thus ranking, is best when driven by the incident records of the port. As introduced earlier, Wellington has now developed a very good record of incident data, residing within the Hazman II package. This provides a risk result which leaves incident records and their harbour impacts at the heart of the developing safety management system.

For risk ranking, the risk data for each of the four categories (People, Property, Environment and Stakeholders) was analysed by the software to obtain four indices for each hazard as follows:

1) The average risk value of the four categories in the 'most likely' set.
2) The average risk value of the four categories in the 'worst credible' set.
3) The maximum risk value of the four categories in the 'most likely' set.
4) The maximum risk value of the four categories in the 'worst credible' set.

Thus the Most-Likely and Worst-Case scenarios and for all categories of Consequence impact provide input into the risk ranking system. The resulting eight scores were then aggregated to produce the risk record for each hazard. The software orders the risks into a ranking to help to prioritise where risk management effort should be applied. Ranking can be by residual risk, inherent risk, or both (see **Section 2.1** for Risk Definitions). Average risk values are sensitive to hazards that score moderately or highly over a number of categories, whilst the maximum risk values are sensitive towards hazards which score particularly high in any category.

This list, comprising 80 hazards, is produced in full at **Annex B**. This Ranked Hazard List describes the Risk Profile of the Harbour with regard to navigational operations.

2.4.2 The Harbour Baseline

Ranking by risk is achieved first of all by what is termed the Harbour Baseline. The baseline scores represent what is happening in the harbour – the risk of today. The hazards are strongly related to the type of incidents which occur in the harbour and the risk baseline scores are strongly related to the rate of such incidents in the harbour. The baseline is calculated by Hazman II.

2.5 STAGE 4 – RISK CONTROL ASSESSMENT

The existing risk control measures were reviewed with respect to the ranked hazard list. These were then considered in relation to the key hazards as they appear at the top end of the ranked hazard list, taking account of changes since the 2006 risk assessment.

2.5.1 RISK MITIGATION - EXISTING CONTROLS

Risk control measures in place were added to the Hazman II record and their risk mitigation affect recorded. Recording the existing risk mitigation system brings out the inherent risk of a hazard that is being mitigated by the mitigation measure. To achieve this the existing risk mitigation is scored, by providing a percentage effect on consequence or frequency reduction. With the risk reduction assessed, the Inherent risk associated with a hazard can be calculated by adding this effect to the risk score of mitigated hazards.

In Hazman II, this is presented online by a Hazard-Risk plot which shows where a particular risk is against a shaded background, representing all of the risks in that category (the large shadow is the *profile*) and further shadows showing the calculated position assuming mitigation was not in place. The risk mitigation effect of an existing risk control can be appreciated pictorially in **Figure 4**.

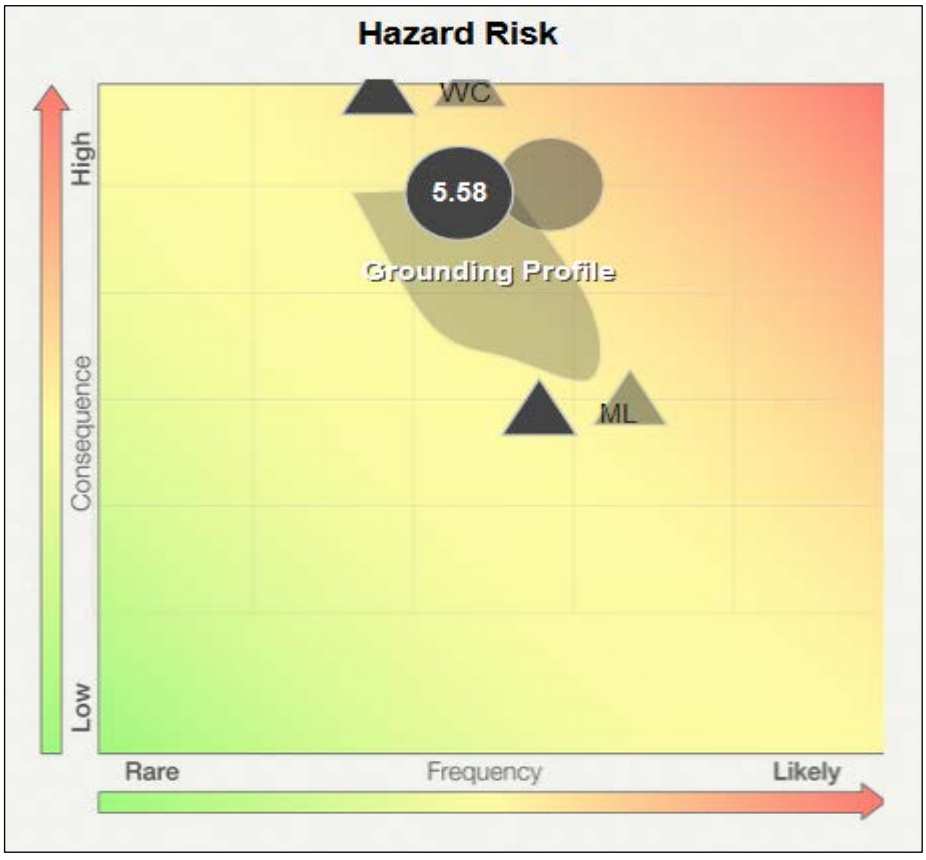


Figure 4 : Risk Plot Showing Risk Reduction

Risk Control effectiveness is scored within Hazman II according to the effect on frequency (return period) or effect on consequence of outcome. Mitigation associated with existing risk management measures helps to understand inherent risk (i.e. the risk without risk mitigation).

2.5.2 NEW RISK MITIGATION

Newly introduced risk management measures (e.g. a new pilot boat replacing a RHIB with airbags) reduce risk to a residual level.

The reviewed risk assessment process produced an updated prioritised list of hazards ranked by risk. Comparison of areas targeted by existing and new risk controls with the risk profile identified where additional risk management strategies can be developed.

2.6 STAGE 5 – REPORTING AND RISK MANAGEMENT RECOMMENDATIONS

Following evaluation of hazards and risk control measures, the reviewed risk profile was completed.

As incidents are representative of the Most Likely (ML) outcome, it is important to map and produce a risk profile based on factual records. On the other hand, serious incidents represent the Worst Credible (WC) outcome based on HAZID meetings, which discuss the parameters of such accidents to establish the WC outcome for Wellington Harbour. Following a review, remarks and feedback are produced in the Hazard Database and incident records are imported into HAZMAN Incident Database.

At this point, the risk profile can finally be assessed. This contains the baseline risk which includes the existing risk profile / residual risk after the 2006 Risk Assessment with new risk controls. The inherent risk is increased based on the recording effect of existing management system.

The needs for upgrading existing risk controls or adopting new risk management practices such as implementing new Bylaws are proposed within this assessment. The application of risk treatment is completed with final recommendation in this report.

2.7 RISK CRITERIA

Risk criteria are presented in full at **Annex A**. This section presents a summary.

2.7.1 RISK MATRIX

The Wellington Safety Management System uses the risk matrix design as shown in **Figure 5**. Using this risk matrix, which is set up set up within the Hazman II software, each hazard was scored on a scale of 1 to 10 for each of the four consequence categories within the NZ Risk Assessment Guidelines (i.e. impacts on: People; Property; Environment; Stakeholders).

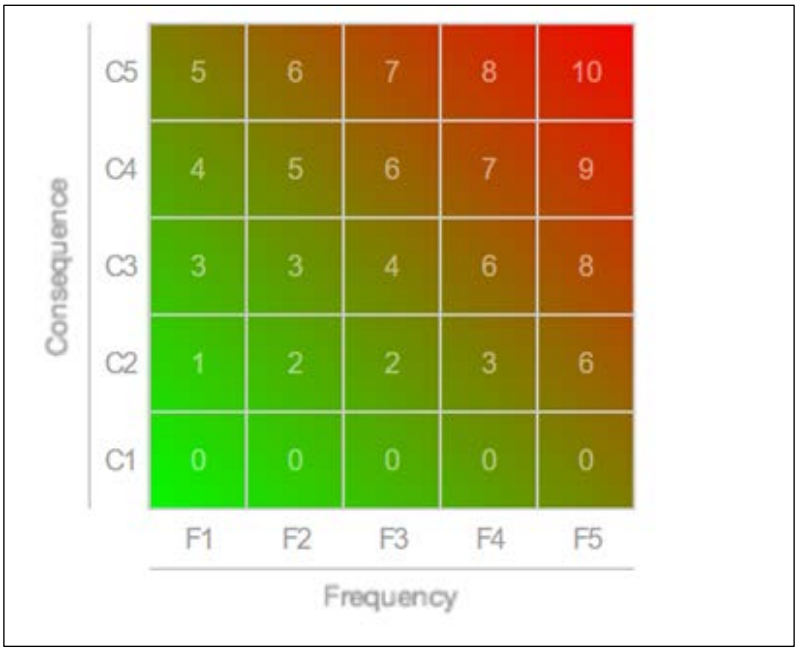


Figure 5: Risk Matrix Used for Wellington Harbour

Where, in scores out of 10:

5) **0 & 1** Negligible Risk
6) **2 & 3** Low risk
7) **4 - 5** Risk assessed to be in the ALARP region (see **Sections 2.7.2 & 2.8**)
8) **6** Heightened Risk (requiring review)
9) **7 - 8** Significant Risk (new control)
10) **9 & 10** High Risk (unacceptable)

Further details of risk criteria are presented at **Annex A**.

Risk scores were obtained for each hazard using these criteria, in both the 'most likely' and 'worst credible' scenarios (i.e. providing eight risk scores per hazard) from the frequency and consequence detailed data (**Annex A**). Each hazard was scored optimistically, to provide the risk assessment with a cautious approach when the average situation is taken into account.

It should be noted that the most likely scenarios can occasionally generate higher risk results than worst credible scenarios. This is due to the increased frequency (return period) naturally associated with a most likely event – the Hazman II software will promote frequent events, especially if there is an evidential record. Such risks appear in the upper levels (top 20 ranked) of the Wellington risk assessment.

The risk assessment methodology scores the risk associated with two different outcomes from the same initiating event. Hight risk results tends to occur when consequence levels are similar between most likely and worst case and lower scores will result where the frequency of the worst credible is very much less than that of the most likely, for similar consequence outcomes.

Occasions where the most likely event provides a higher risk level are worthy of special note. For example, in the case of berthing contact, it may be suggesting that a large number of small berthing contact damages are of greater loss significance than a single heavy contact at a much lesser frequency.

2.7.2 Risk Mitigation Action Criteria

Recording the value of the risk mitigation available, as shown above allows further risk mitigation measures to be assessed. The approach that was taken to risk mitigation, based on the developed risk profile, is shown in **Table 1**. The "As Low As Reasonably Practicable" (ALARP) principle of risk management has been used in the derivation of risk management recommendations. This can be applied for risks that should only be tolerated if the risk mitigation measures in place provide risk reduction into the ALARP region, and where they cannot be reduced further without grossly disproportionate cost or disruption.

For this risk assessment, the principles of reducing risk to ALARP needed to be applied for the longer term to ensure that risk reduction measures are considered for all identified risks. At this stage in the process of compliance with the Code, particular emphasis has been placed on identifying additional risk reduction measures for those risks that are found to be “significant”.

Matrix Outcome	Risk Definition	Action Taken
0 & 1	Negligible Risk	A level where operational safety is unaffected.
2 & 3	Low risk	A level where operational safety is assumed.
4 - 5	As Low As Reasonably Practicable (ALARP)	A level defined by Study at which risk control in place is reviewed for all scores above 5. It should be kept under review in the ensuing Harbour Safety Management System.
6	Heightened risk.	A level where existing risk control is reviewed with a view to introduce additional risk control if *appropriate*[10]. Generally, this applies to risk where loss of life could accrue.
7, 8	Significant Risk	A level where review of existing risk control mandatory. Heightened, then Significant risk can occur in the average case or in individual categories. New risk controls identified should be introduced in a timescale of two years.
9& 10	High Risk	An area where the Harbour Master needs to recommend rapid action.

Table 1 : Risk Management Action Criteria

2.8 USE OF THE CONCEPT OF ALARP IN THIS RISK ASSESSMENT

The NZ Port and Harbour Risk Assessment guidelines originally issued by Maritime New Zealand, recognise the concept of ALARP, but also recognise that risks need to be managed by a harbour authority in situations where the actual levels of risk are difficult to determine. Part of the reason for this difficulty is that whilst a Harbour Regulator (i.e. the Harbour Authority, as exercised in NZ through the office of the Harbour Master) will aim to reduce risk to ALARP, not all contributory factors and circumstances that lead to a vessel casualty or accident are under the harbour regulators' control. The Harbour Authority is also there to facilitate safe navigation in the interests of all navigators and has an "open port duty" to facilitate safe transit to any of the port's berths, especially

[10] ***"Appropriate"*** **means : New Risk Control Options are evaluated for cost effectiveness before the decision to implement. This connects both the likelihood of predicted risk reduction being achieved to the cost of the new measure and the timescales for effective implementation.**

in cases where a vessel needing a "Port of Refuge" may need access to prevent or mitigate a worse outcome in coastal waters[11].

A harbour regulator can only set risk control measures that, as far as is foreseeable, would reduce the navigational risk to ALARP levels, assuming that all vessels are seaworthy and crew properly trained, qualified and experienced. The obligation then is to monitor compliance and develop the harbour regulatory system from data, knowledge and feedback (staff and harbour users). Where risk levels in an independent risk assessment are found to be significant or high (i.e. clearly outside an accepted ALARP region), the Harbour Regulator needs to be in the position to influence an improvement in safety performance of vessels using the waterway within the Harbour Limits. It then needs to be in a position to monitor the effect of the improvement.

The use of ALARP in this study is therefore practical in nature, reflecting the real-world problems that a Harbour Regulator has in influencing the navigation of a vessel that may not itself be operated to an ALARP standard.

[11] **This is a complex area of law, involving international obligations to International Marine Conventions, powers of a NZ Harbour Master of Direction within a harbour jurisdiction, as well as potential conflict with the Powers of Direction of the Director of Maritime New Zealand within NZ territorial waters.**

3 RISK ASSESSMENT AREAS

For this risk assessment, the harbour was divided into areas associated with the type of vessel activity in that location. The areas were based initially on the 2006 Risk Assessment, with a new area being added based on feedback by the Harbours Office. Each area is described with respect to the topography of the harbour and its effect on incident potential. Incidents of note that have occurred in each area are also referenced. Some feedback from interviews with users and observations whilst on board ferries has been incorporated into this section. Six Risk Assessment Areas were derived and are shown in **Figure 6**.

- Area A: Harbour approaches and outer boarding areas.
- Area B: Entrance channel.
- Area C: Waters of the main harbour basin.
- Area D: Lambton Harbour.
- Area E: Evans Bay.
- Area F: Seaview and its surroundings (separate from Area C).

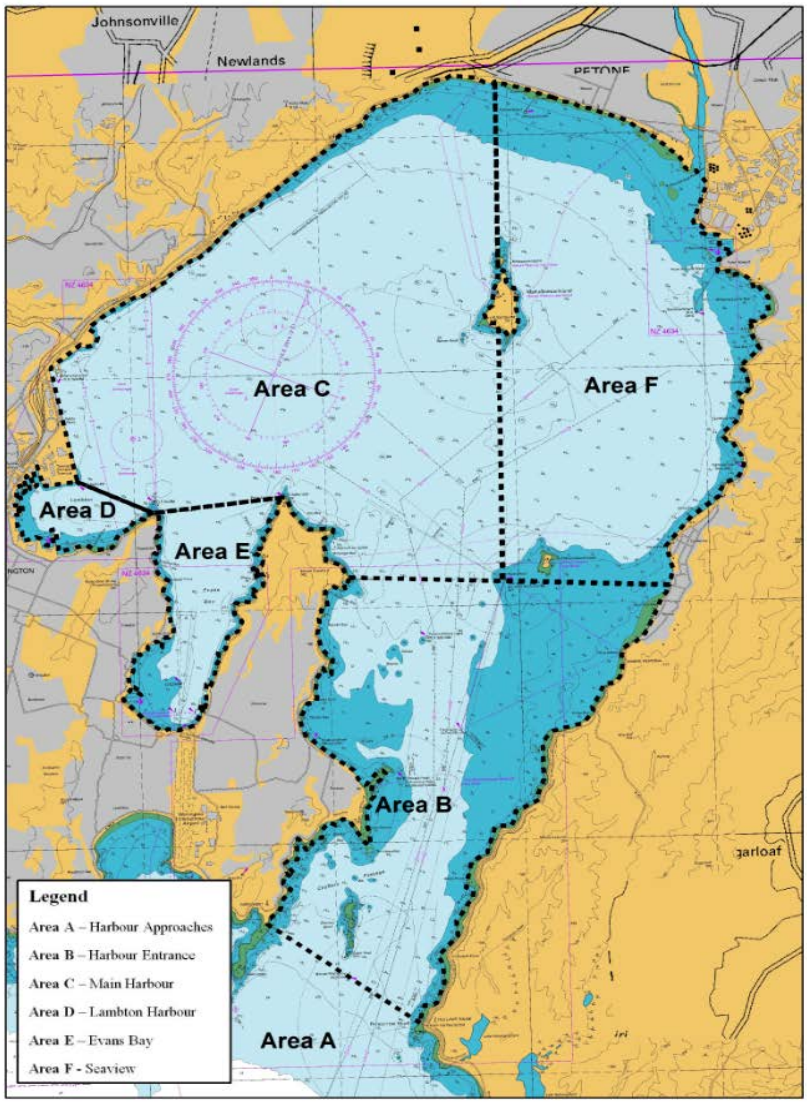


Figure 6: Risk Assessment Areas - Wellington Harbour

3.1 AREA A : APPROACHES

3.1.1 AREA A – PHYSICAL DESCRIPTION

This area represents the coastal margin of the Wellington Harbour Limits, the harbour approaches and outer boarding areas. The area is geographically part of Cook Strait where weather and sea conditions frequently present adverse conditions for all navigation categories, with potential for heavy seas, strong winds and tidal flows. Wellington's south-westerly facing aspect leaves it exposed to almost all weather systems and the entrance has no shelter from any sea and swell condition that comes from the south or west. The swell in a southerly storm is generally from a direction of 200^0.

The approaches to Wellington are relatively straightforward, when compared with some other New Zealand ports, with a bold coastline either side of the entrance providing good radar echoes - although the NZ Pilot does caution mariners that the high terrain inland of Baring Head can give a similar radar picture to the actual coastline and thus a misinterpretation of position (this was a reported cause of a grounding, years ago). Lyall Bay can provide a similar illusion if navigating by radar alone in restricted visibility. Wellington's Leading Lights are clear and have a good range to aid positive identification of the entrance. The leads can also be operated and clearly seen in daylight.

With the exception of Lyall Bay, which has a gently sloping sandy floor and extensive beach development, the coastline of the approaches is mostly backed by cliffs or rocky shores, providing an unforgiving shoreline for any vessel suffering loss of power or steering.

The coast to the east is generally free of outlying dangers with the exception of Arabella Rock, 0.4 miles West of Baring Head at 4.4 metres depth. Another rock lies at 8 metres depth, 3 cables South West of Pencarrow Head. As these dangers are respectively only 1.4 miles and approximately 3 cables from the nearest Pilot Boarding Area or line of the leads, there is not a significant margin of safety for boarding pilots if things go wrong.

To the west of the entrance the coast is indented with several bays and outlying dangers such as West Ledge, a reef extending 0.5 miles out from Palmer Head. There are many sunken rocks throughout. These dangers are located in areas outside normal trading vessel routes, but are relevant to small and recreational craft, making local knowledge vital for navigating close to shore.

Depth of water is in excess of 30 metres until approximately one mile south of the entrance. At this point the sea floor shelves relatively steeply to between 14 and 16 metres at the harbour entrance. Swell from the southerly quarter tends to become attenuated as it approaches the entrance with decrease of wavelength and increase in steepness.

There are no anchorages in Area A, although large vessels have successfully anchored in emergency and held for short periods of time[12], but the shelving nature and coarse gravel of the bottom make the area generally unsuitable. Shelter is available in northerly winds for small craft in Island Bay[13], 3 miles west of the entrance. Large vessels, if unable to enter the channel for any reason generally proceed (or are advised to) seek shelter elsewhere, this may be in Cloudy Bay on the other side of Cook Strait, or to the north of the Marlborough Sounds or in Tasman Bay.

During southerly conditions, vessels are approaching the harbour entrance and surrounding coast on a lee shore. Realistically, tug assistance is not available inside one hour in the event of a vessel drifting after losing power. Furthermore the Wellington port tugs are berthing tugs with no design capacity to tow over the stern, or with a hull form for seagoing transit; their out of port capability is thus extremely limited. It makes prompt call-out (or prompt standby notice) important for any event with search and rescue (SAR) implications, which should be reflected in MNZ standing orders.

3.1.2 Area A : Approaches – Current, Wind and Wave Climate

Wellington Harbour is well known for its rapidly changing weather profile and the worst effects of this appear at the harbour approaches and entrance. Currents in Cook Strait are strongly influenced by the wind, and it has been reported that wind induced currents may be up to 3% of wind speed during a prolonged gale or storm event. When increasing windspeed is opposed by tide (wind against tide), mountainous seas with short and steep wave forms can be formed in the south coast approach areas, such as the Karori Rip. Waveform and height change with tidal flow in such conditions and may be very different to those at the neck of the harbour entrance, which are affected by local wind and tide.

A southerly ground swell is present at least 80% of the time, onto which local wind generated waves are superimposed. Southerly winds blow over a greater fetch and are capable of generating large waves, to which a swell may also be added, with the net result of very high seas. This can have implications for pilot boarding at an outer area, as making a lee in such conditions is difficult.

The approaches are affected by currents which can be significant for vessels attempting to maintain position at a pilot station or approaching on the leads. The ebb tide can also cause considerable steepening of seas as occurs at the entrance (Area B).

A wave rider buoy is located off Baring Head which has provided wave data since 1999. The buoy is managed by NIWA under contract to GWRC, with the output after processing being sent to Beacon

[12] **Others have dragged anchor in this area though and one vessel has grounded when anchoring in a loss of power event.**
[13] **Small craft in this instance are considered to be under 15 metres length.**

Hill. Changes are in train for the Baring head buoy to commence transmitting an AIS message, which would supply wave rider data to any AIS station cable of processing this. These improvements are referenced later.

The buoy is situated in the proximity of pilot boarding stations Alpha, Bravo and Charlie. **Figure 7** shows the location of the buoy and these pilot boarding areas. The buoy reportedly has a data processing delay of up to 30 minutes, but is used to aid master's decision-making for arrival or departure.

There have been historical instances where low powered and light draught cargo vessels have struggled for hours to make headway; some have been blown about or have elected to return to the shelter of the harbour[14]. A vessel returning in such circumstances is likely to retain little ability to control its entrance transit.

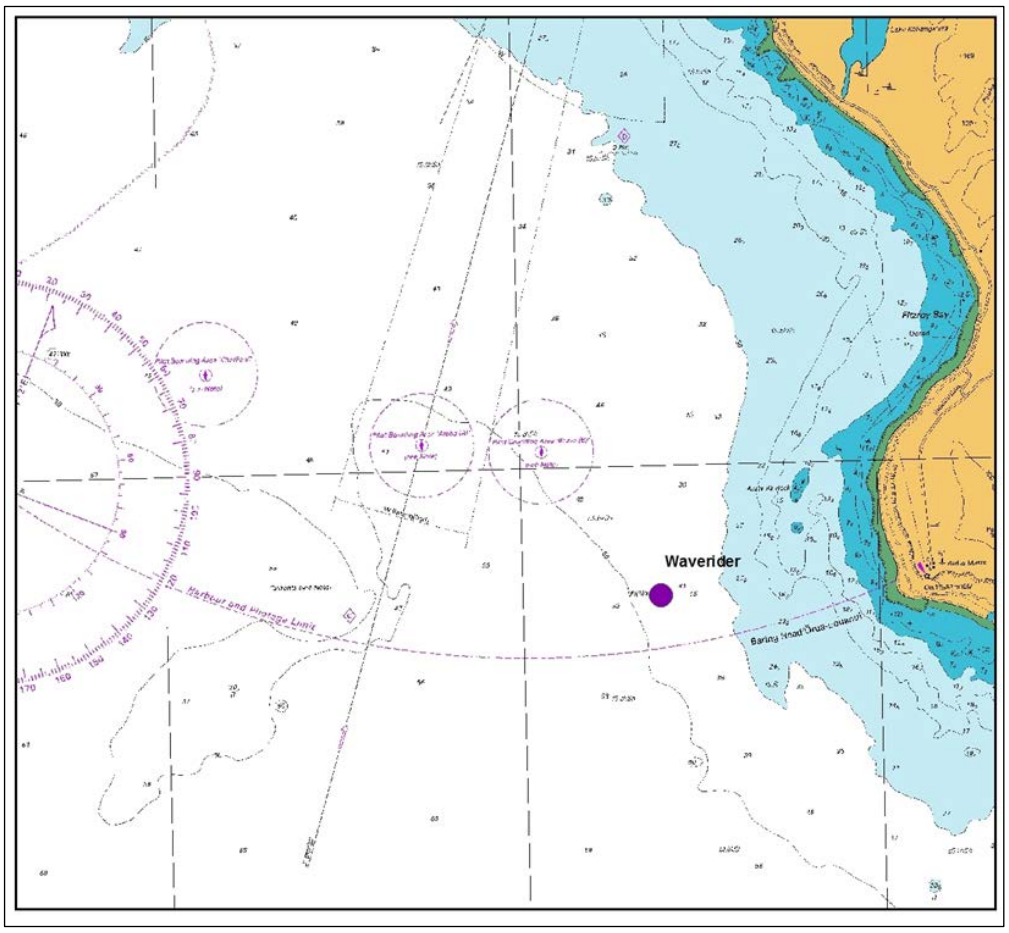


Figure 7: Location of Waverider at Baring Head

[14] **These are historic events and there have been no such problems reported in the 2006-2017 period of risk assessment at Wellington.**

There appears to be contradictory evidence as to which weather direction is the dominate in Wellington. It will not be news to Wellingtonians to find that Northerlies and Southerlies regularly occur. Most data sets suggest the southerly is prevalent at Wellington. For this risk study, Niwa data at Bearing Head has been referenced, which suggests Northerlies are more frequent at that location, with a mean speed of up to 30 knots. Southerlies produce the highest windspeed as fronts pass through. **Figure 8** illustrates this report, using windspeed and direction data from the period from 1998 to 2015. Overall, the fact that there is contradictory data, shows the unpredictability of Wellington entrance and the changeability of weather in the harbour approaches for transiting vessels. According to a wave analysis report for Wellington Harbour approaches[15], the maximum recorded wind speed in this timescale has been 77 knots (sustained) in storm conditions.

The historic record associated with the 'WAHINE Storm' of April 1968 loss suggests sustained gusts exceeded 100 knots and that a surface current of 2-4 knots was attained. It is not possible to comment today on the accuracy of this historic record.

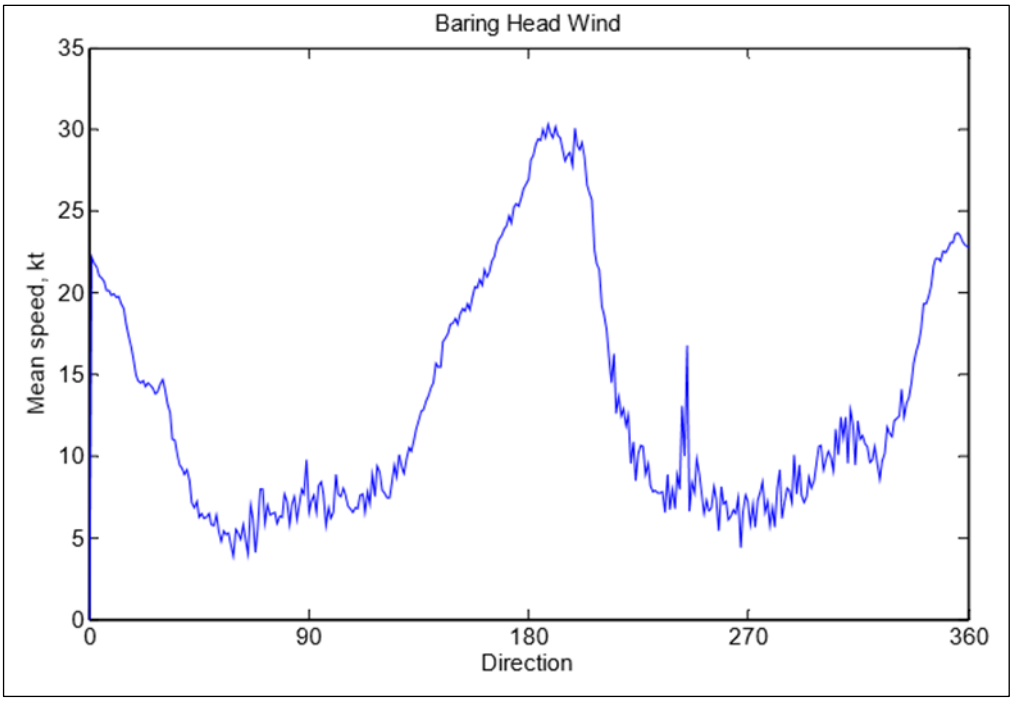


Figure 8: Mean Wind Speed as a Function of Wind Direction - Baring Head

Generally, winds from the South result in a heavy sea and swell, which during gales sometimes break across the entrance. **Figure 9** shows wave height readings ranged from 1998 to 2015 (again Bearing Head). The wave conditions are not always favourable and can be extreme for a short time. This

[15] **Wave Climate of Wellington Harbour Entrance Report prepared by NIWA for CentrePort**

extreme accounts for 1% of the time where a significant wave height (Hs) exceeds 4.5m. In some cases (rare), individual waves exceed 10m in height, have a very short period but last for only a short space of time. The buoy though has recorded waves in excess of 14 metres during southerly quarter gales. The Waverider records individual waves (Hmax) as a single statistical point from a spectrum over 30 minutes.

In northerly conditions, wave generation is limited by the relatively short fetch in the approaches. However, short seas hazardous to small vessels and craft can be generated, particularly in conjunction with an (opposing) flood tide.

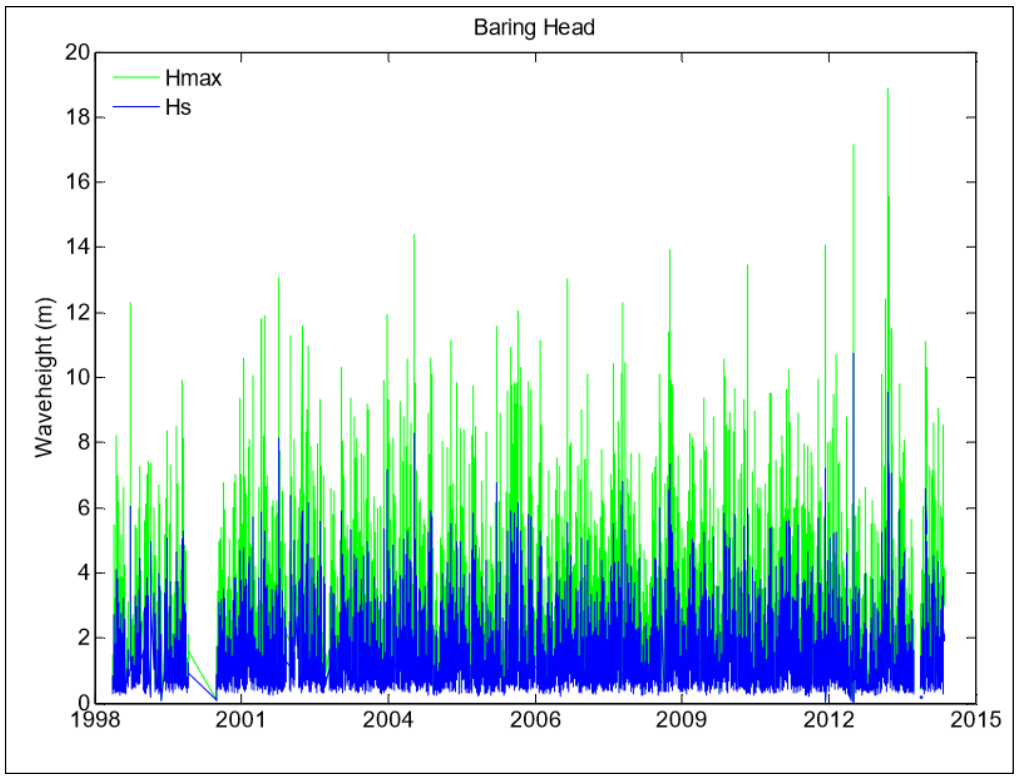


Figure 9: Baring Head Waverider - 1999 to July 2014, Significant & Max Waveheight

The approaches are influenced by currents. In particular, the ebb tide can cause considerable steepening of seas in the entrance channel (Area B) during southerly winds. Charted information in the form of tidal diamonds states the maximum set across the leads to be 2.3 knots in spring tides, while pilots report that a set across the entrance to the east can be significant at any time. A cause of the grounding of the PACIFIC CHARGER in 1981 at Baring Head was thought, in part, to be the bridge teams' lack of appreciation of the southeast set towards the coast while waiting for pilot boarding.

In northerly conditions wave generation is limited by a relatively short fetch in the approaches, but short seas which are hazardous to smaller vessels and craft can be generated, particularly in

conjunction with a contrary tidal flow. Winds from the northerly quarter are also subject to considerable orographic control through coastal valleys. Local accelerations, particularly off Sinclair Head and Owhiro Bay produce gusts over 70 knots, during gale force winds. Visibility may be affected on larger vessels by flying spray, while leisure craft, particularly yachts, are likely to be in trouble in such conditions.

3.1.3 AREA A : APPROACHES- NAVIGATIONAL USE

With approximately 4,000 commercial vessel visits[16] to the harbour entrance annually (i.e. 8,000 movements), the approaches can be relatively busy when traffic arrivals and sailings schedules coincide. There can be a number of large vessel wishing to transit the entrance (in and out) at the same time. Although the majority of vessel movements at Wellington are PEC[17] related; there are around 1,300 vessel movements a year requiring pilotage services. These figures do not take account of recent downturns in traffic levels as Wellington Port recovered from the affects of the Kaikoura earthquake.

The outer pilot boarding areas are located 3 miles south of the harbour entrance. The Alpha, Bravo and Charlie boarding areas (see **Figure 7**) are each used in different sea and weather direction conditions. The CentrePort pilotage service selects the best boarding position for the sea conditions on the day in question. As such the use of the three boarding areas is an inherent risk mitigator. A fourth boarding area, Delta, is located inside the harbour entrance and explained in the next section (Area B – Navigational use). Further information on use of boarding areas can also be found in **Section 6**.

Given the dominance of ferry traffic most vessels making for the entrance approach from the west to join the leads two miles south of the entrance.

The south coast generally is an important area for various forms of recreational activity including diving, surfing and fishing. There are trailer boat-launching ramps at several sites and provide access for both recreational vessels and the emergency craft of the Airport Fire Service and Police Maritime Unit. Island Bay serves as a base for local fishing vessels and craypots are commonly set along the coast relatively close to shore (but beyond the reserve area). Wellington yacht clubs also routinely set race courses both into and through this area several times a year (for example, an Island Bay Race twice a season). Although the most severe sea conditions occur during southerly gales, it is during

[16] **This Figure excludes recreational and leisure craft transits.**
[17] **PEC – Masters with Pilot Exempt Qualifications - see definitions/abbreviations, Page viii.**

rising northerly winds that most recreational users require assistance, most frequently due to engine failure or inadequate power to return to shore against a strong offshore wind.

The Taputeranga Marine Reserve was created in 2008. It covers an area of 854 hectares and extends from Houghton Bay westward to the old quarry. The decommissioned former RNZN frigate HMNZS WELLINGTON was sunk in 2005, seaward of Island Bay in 23 metres of water. This has resulted in an increase in the number of small craft navigating in the area for diving purposes.

3.1.4 AREA A: APPROACHES - HARBOUR LIMIT MODIFICATIONS

One of the recommendations of the 2006 risk assessment was adjustment of pilotage limits to align with harbour limits, ensuring a vessel was navigating in accordance with pilotage law at all times within harbour limits. Previously pilotage limits were inside harbour limits. Subsequent to the risk assessment, these were merged and nautical charts updated.

3.1.5 AREA A : APPROACHES – NAVIGATIONAL INCIDENTS OF NOTE

There are quite a number of historical records where vessels were wrecked on the Wellington approach shorelines. Mariners who experience difficulty in this area tend to report problems at an early stage - they are literally between a rock and a hard place if propulsion or steering problems occur. It is an area where planning for a rapid SAR response is justified.

Several close quarters incidents have occurred since the last review, highlighting the level of traffic and the confines of the harbour entrance nearby. These usually, though not always, involve larger vessels and incidents of note are presented at **Table 2**.

Year	Incident Summary
2016	Close quarters encounter between a Cook Strait ferry approaching the area and a naval vessel departing. The encounter was found to be a result of human error, and a collision was avoided by communication between the two vessels resulting in avoidance manoeuvres.
2015	Close quarters between an inbound Tanker after boarding a pilot and an inbound Passenger RoRo ferry. Resulted in the RoRo passing the west of the recommended track and closer to Barrett Reef reef than desirable as it passed ahead of the tanker to enter the port. Arrangements for the ferry to pass ahead had been verbally agreed.
2014	Close quarters encounter between an inbound Cook Strait ferry and an outbound tanker after pilot disembarkation. Communication between the two vessels results in the tanker refusing to adjust course. The ferry altered course under protest, leaving the leading line and passing at significantly less than 2 nm from Barrett Reef buoy.
2012	AAL BRISBANE was approaching the harbour entrance using ECDIS, and not backing up with terrestrial fixes. The GPS feed to the ECDIS was grossly in error (subsequently found to be 600 meters to the west of true position), putting the ship on track for a near-miss with Pencarrow Rock (Draft 7.4m, Rock 8.0m + tide 1.3m), and ultimately the shore beyond. When the pilot arrived on the bridge it was quickly ascertained using visual marks and radar, that the vessel was off the correct course. The course was immediately altered to port, towards the shipping channel. Using visual marks, the rest of the passage was uneventful.
2011	An anchored recreational vessel called a Cook Strait ferry after observing what it believed to be a collision course between the two vessels. The ferry undertook unplanned manoeuvres in order to avoid the recreational vessel.
2003	SEA HARVEST log carrier suffered steering failure on maiden voyage and narrowly missed grounding in Fitzroy Bay.
1981	PACIFIC CHARGER ran aground at Baring Head.

Table 2: Incidents of Note – Area A

Although not within the scope of this risk assessment, there have been a number of diving accidents along the south coast where divers have been swept away by strong tidal flows. This is similar to the poor recreational diving statistics of the Marlborough Sounds.

3.1.6 AREA A : INCIDENT CASE STUDY – AAL BRISBANE

AAL BRISBANE is a particularly important incident. It is indicative of the hidden pitfalls of modern electronics onboard vessels and crew dependency on presented information. The carriage of ECDIS is now a mandatory requirement on vessels of this type (Container), but the electronic screen presented is only as good as its inputs. This vessel had a GPS error of almost 600 metres, reportedly accidently introduced by a navigating officer during an on-board training exercise for cadets. The

vessel had more than one GPS, but the unit used for training was in use during the approach and had not been correctly set back up. The pilot reported that the bridge team were more focused on the ECDIS electronic output, which was incorrect, than looking out of the window and taking ranges and bearings. The ships positions were being plotted by a cadet alone, directly from the incorrect GPS output, which the second mate as watchkeeper was supposedly supervising. The incorrect ships position was displayed on the vessels ECDIS, but a secondary check using radar would readily have shown the land return and highlighted a problem in the vessel's true location. Although the pilot noticed this immediately on arrival on the bridge, none of the bridge team had, nor was the vessel's progress checked by more than one means. The AIS transmission from the vessel would have shown the vessel on a course taking it safely into the harbour, aligned with the leads on any positional device output (this would have been reproduced onboard the vessel or reproduced ashore). The vessel was heading ashore in the area of Pencarrow Rock (Pencarrow Head) and the light at Pencarrow may have been mistaken for the front lead for harbour entry.

In the event, the outbound pilot has noticed that there was a separation of radar and AIS targets showing upon the pilot boats radar and chart overlays. The pilot boarded in good visibility at the radar target position and once reaching the bridge, rapidly took the con and realigned the vessel into the correct approach. After a successful passage into the harbour, the second GPS receiver was switched to feed the vessels navigation system, and the positional error was resolved. Good navigational practice would have switched in the alternate GPS feeds each watch for a ship using ECDIS.

Beacon Hill had both radar and AIS reception and uses proper ship tracking software (VTS[18] software), by Transas Marine, which complies with the international IALA VTS standard for vessel tracking systems. The problem of difference between a radar target return and AIS positions is dealt with within the VTS software package – small discrepancies are common. Essentially, what happens is a "fusion" of the radar target position and AIS transmission, provided there is no large discrepancy. This displays one target with the ship's identification attached. As the vessel was initially tracked some 10 miles away, the GPS discrepancy was relatively small and the target may well have been "fused" in the Beacon Hill monitoring system display[19]. However, as the vessel approached, the targets would have separated. This provided confusion for the Beacon Hill operator, who considered the radar target as a separate small vessel. The above detail of how a software tracker works and

[18] **VTS = Vessel Traffic Services**
[19] **The replay of this does not show target fusion properly.**

how to troubleshoot this when it occurs, is one component of Traffic Monitoring personnel training to the IALA V103 standard. Such training has not, as yet, been undertaken for Beacon Hill personnel.

Figure 10 illustrates the recorded ship's track output from the (incorrect) GPS and illustrates a near grounding situation. The apparent course of the vessel is an illusion and the recorded track in the approaches is 600m to port of the vessels true track. The actual track taken by the pilot has been reproduced by applying a 600m offset.

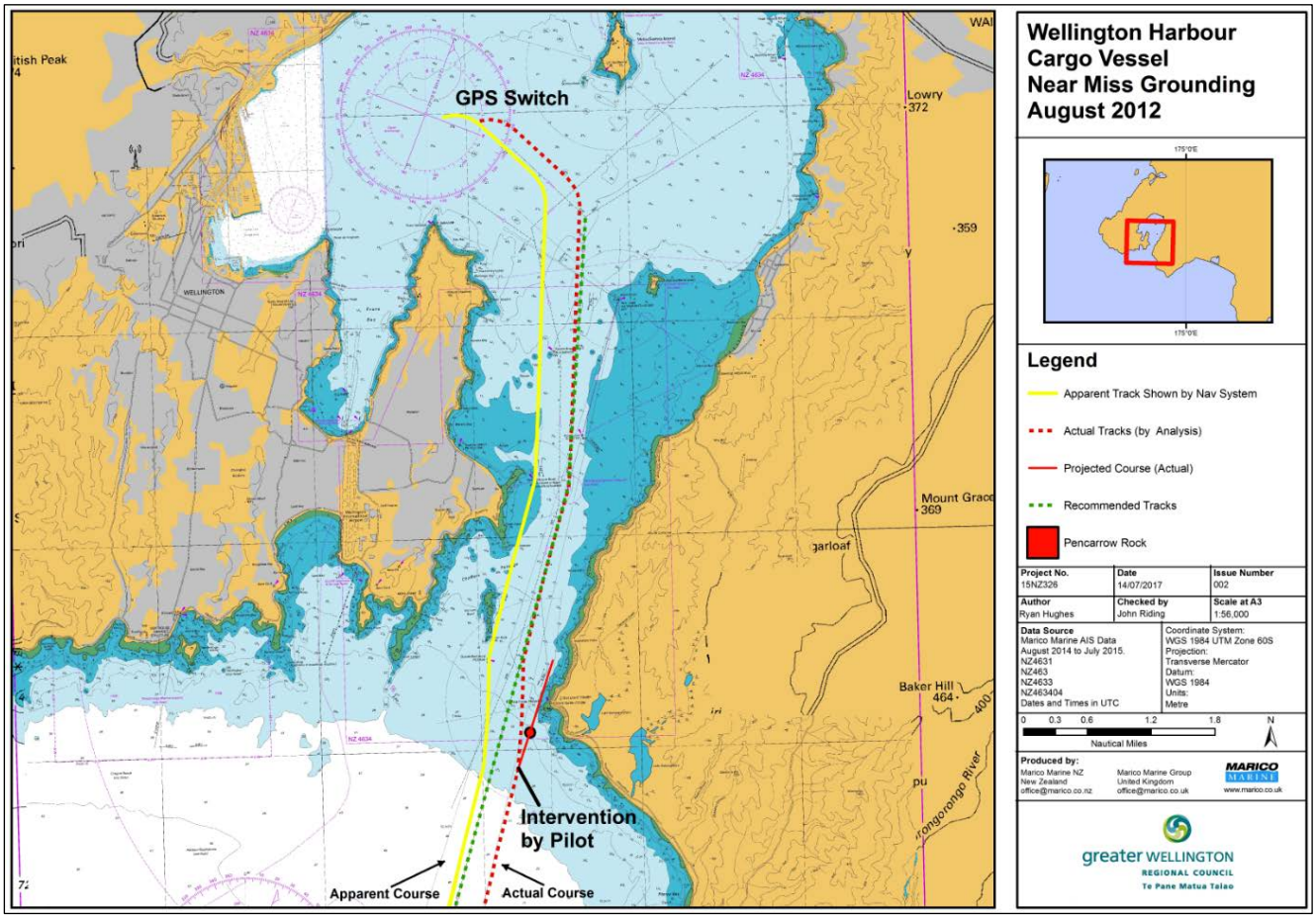


Figure 10: Near Miss Grounding at Wellington Harbour (2012)

3.1.7 AREA A : INCIDENT CASE STUDY – PASSENGER RORO AND INBOUND TANKER

Another incident of significance occurred in March 2015. An inbound passenger RoRo noted a tanker (FPMC 20) making an approach, but the pilot had not yet boarded. The RoRo master called the pilot boat and spoke to the pilot to clarify arrangements for the passing of the tanker/RoRo, with an expectation that the RoRo would enter the harbour ahead of the tanker. The tanker continued to proceed inbound on the leads. Some confusion arose in the time taken for the pilot to board the tanker and take the con of the tanker. The RoRo proceeding at service speed (20 knots) compared to the tanker's 10 knots advised Beacon Hill he would pass ahead of the tanker then join the leads

and proceed inward as normal. A changing situation resulted in the RoRo having to pass close to Barrett Reef, passing 70 metres from the buoy and remained to port (west) of the recommended track to Steeple Rock.

The present system of sequencing traffic within the harbour relies in part on the pilots to organise traffic. However, when a pilot has to board a vessel, this communication can become disconnected until the Pilot is on the bridge, updated himself and recovered situational awareness. It is important that vessels carrying passengers remain in a situation of minimal risk. To achieve this sequencing of traffic movements by more proactive traffic management from Beacon Hill is an option, with the risk assessment testing the need .

3.2 AREA B – ENTRANCE

3.2.1 AREA B – ENTRANCE – PHYSICAL DESCRIPTION

Area B essentially covers the entrance channel which lies between Palmer Head to the west and Pencarrow Head to the east. The entrance is divided into two channels by Barrett Reef, a rocky outcrop of approximately 5 cables length lying about 4 cables south of The Pinnacles in a north-south direction. The main channel, east of Barrett Reef, is approximately 7 cables wide, with depths varying between 11 and 16 metres.

A smaller secondary channel, Chaffers Passage, lies to the west of Barrett Reef. This separates Barrett Reef from the shoreline of The Pinnacles and Point Dorset. The controlling depth of this passage is 9.6 metres with a width of about 2 cables at its narrowest point, but there is at least one sunken rock and also kelp beds in the area. There are no Aids to Navigation for Chaffers Passage and local knowledge is essential[20]. In practice only pilotage boats, recreational craft, small commercial and fishing vessels use this passage (i.e. none requiring pilotage). This passage affords shelter in north-northwest winds, and also allows smaller craft to keep clear of larger vessels using the main channel. Chaffers Passage may be dangerous in strong southerly conditions, when a heavy swell is present.

The narrow bottle neck shape of the entrance channel runs north for a little under two miles between Barrett Reef Buoy and Steeple Rock Beacon, this area being known locally as “The Narrows”. The western shoreline is characterised by rocky ledges and pinnacles extending seaward from a wave cut

[20] **Placing AToNs in Chaffers Passage would encourage its use. This in inadvisable, given that it is only suitable for small vessels and would still need local knowledge.**

platform, while to the east a larger platform, under 10 metres depth, runs along the Eastbourne shore.

Makaro/Ward Island marks the northern extremity of this shoal area, while the Front and Rear leading lights help to mark its western boundaries. The navigable channel for large vessels (i.e. water depth over 10 metres), narrows as it goes north (around 7 cables at Barrett Reef to 4 cables off Steeple Rock Beacon).

The channel minimum spans across the channel about eight cables north of the entrance towards Falcon Shoals light and is 11 metres deep. Based on CentrePort operating procedures, the minimum chart datum depth at the Entrance is 11.3 metres, which occurs near the Front Lead but changes according to the movement of sand waves on the seafloor. Admiralty Sailing Directions state the controlling depth is 11 metres. Depths along the line of the leads and inward/outward tracks taken by large vessels vary between approximately 19 and 11 metres, the average being 14 metres. A width restriction is formed by the platforms on each side, although there is an effective channel width of six cables or less for large vessels until the deeper waters of the harbour basin are reached, **Area F**. The underkeel clearance (UKC) for large vessels transiting through the entrance channel is 1.5 metres to allow margins for safe passage based on calculated squat, ship motions and navigational allowances. In exceptional conditions, the UKC can be reduced. However, under operating procedures, a technical assessment would be needed to assess hazards for vessel entry into the harbour in these circumstances. A recent example is the arrival of cruise ship Queen Mary II with a gross tonnage of 145,000 in March, 2015. In this instance, the cruise visit was cancelled due to a combination of heavy weather conditions (with a significant wave height of over 7 metres at the entrance) and high winds. The vessel aborted due to a (small) risk of bottom contact with azipod propulsion, due to hull movement in the heavy swell. Although unlikely, it demonstrates how risk averse shipping operations can take unexpected decisions once they perceive their margin of safety is eroded.

A deep draught transit is defined for vessels with any draft in excess of 10.2 metres. Such vessels must follow Maritime Rule 22 and show the respective signals/lights.

3.2.2 AREA B: ENTRANCE - CHANNEL MORPHOLOGY

The channel section between the south end of Barrett Reef and Steeple Beacon is the shallowest area. If the seafloor profile was examined as a cross-section, it would be seen as a bar-like formation, connecting the deeper harbour approaches to the basin of the inner harbour area. Although the bar-like profile does influence the occurrence of heavy breaking waves, the seabed is stable, suggesting the shallowing has developed over the long term. Academics would therefore not refer

to Wellington as a bar harbour, but for navigation in severe southerly weather the effect can be the same.

The seafloor is generally fine sand and is mobile during storm events. However, survey has shown that this does not significantly affect depth, rather the pattern of sediment distribution changes. This provides the Port of Wellington with an advantage over some other New Zealand ports in that there is no need for ongoing maintenance dredging. Underlying gravel is exposed periodically, particularly in severe southerlies. Wave formations on the seafloor (sand-waves) occur off Steeple Beacon and have been measured at one metre amplitude by various studies. These formations are noticeable on echo sounders during transit and are a potential cause of an increase in squat. They are not thought significant except for those vessels operating with minimum under keel clearance for the port (1.5 metres static).

Following on from the 2006 Risk Assessment, the narrow channel is surveyed periodically. Survey ensures the safe passage of deep draught vessels, checking entrance channel profile variations over time.

3.2.3 Area B: Entrance - Wind and Wave Regime

Wave generating capacity is relatively limited in northerly winds due to the short fetch. Waves are probably limited to a significant height of around two metres, but can be hazardous for small vessels, especially near Steeple Rock in strong northerly winds and a flood tide. Wave height data is available at the Front Lead, a location inside the harbour entrance.

Well-developed waves and groundswell are incident on the entrance from the south. Southerly winds have a long fetch and both wave and swell can combine to produce heavy seas, particularly at the seaward limits of the entrance and the northern end of Barrett Reef. Pilots report that the short and steep seas experienced off Pencarrow moderate when a mile or so south of the entrance. It is considered that a wave period of less than 8 seconds is dangerous and a limiting factor for transit.

Significant southerly swells generated by depressions passing to the south of New Zealand can be experienced at the entrance even when the weather is fine and settled at Wellington. North of Steeple Beacon, waves and swell diminish rapidly in height as the channel opens out and energy is spent on the Eastbourne platform, of which Hope Shoal forms a part.

Since the 2006 Wellington Risk Assessment, equipment is now available which provides wind speed/direction and sea state measurements at the front lead. There is meteorological station installed at the Front Lead, although this does not provide tidal readings, although it does output

wave height and period information. Access to the data platform of the device is available electronically via the MetConnect system..

Beacon Hill radio staff provide information from the Waverider buoy located in Fitzroy Bay, as this is available at night and in restricted visibility. During daylight and in good visibility they can also provide an estimate by visual observation of Outer Rock. Outer Rock is located in the entrance, usefully providing observers at Beacon Hill with a reference point of known height on which to base practical observations. Records from the visual observations have suggested that the most frequent swell has a height of around 1.2 metres and 9 second period, with the mean swell being in the region of 3 metres and period of 11 seconds. Locally generated wind waves are added to any southerly ground swell which is thought to be present at least 80% of the time. However, northerlies can flatten the southerly swell, to varying degrees.

Deep water waves from the south reduce in length abruptly as the sea floor rises. They therefore increase in height and steepness, breaking right across the entrance in severe southerly gales. The rail ferry ARANUI, in service 1965-1984, was once witnessed in difficulties on a breaking wave in these conditions; the vessel lost steerage, was turned on the top of a wave and aborted the passage, returning to Wellington.

The 2006 risk assessment reported the difficult transit of an 84m Cook Strait ferry through the entrance in 2002, in waves reported at around 14 metres maximum height, illustrating the difficulties of the entrance.

Swell and wave direction in the channel is controlled by channel hydrography of north-south directions (with some variation only by a few degrees either side possible - generally the swell comes from a direction of 200^{o}). Waves are therefore incident to a vessel directly ahead or astern during transit of the channel, resulting in pitch and heave rather than roll. Container ships and cruise ships with a low GM will take on a long period of roll. In broad south-westerly or south-easterly conditions, wind and sea are on an approaching vessel's quarter, making course keeping difficult with significant yaw and roll. In these conditions, pilots advise they normally proceed at reduced engine speed allowing application of extra thrust should it be required to control excessive yaw. Cruise ships regularly depart with stabilisers out until north of the Front Lead.

Both sea state and wind can make progress difficult, even for ferries with a reasonably high power to displacement ratio. There is a danger of losing steerage while both in and outbound, through the effects of severe weather. The shallowness of the channel also has a negative effect due to seafloor interaction. The initial loss of control of the WAHINE incident (1968) is still not explicitly understood, but it is widely accepted that a factor was loss of rudder effect in heavy following seas. Vessels

routinely experience yawing while entering with a heavy following sea and occasional reports of broaching with regained control are available.

Northerly conditions do not present such a significant hazard as southerly conditions, given limited fetch for wave development. However, high windage vessels that have slow transit speed through Area B can find it more difficult to make course alterations due to wind pressure on the hull and superstructure, particularly where a vessel is poorly trimmed.

The moderate seas which develop through the entrance in a northerly can still be hazardous to small craft. Smaller vessels, particularly yachts attempting to tack, are vulnerable to weather from either direction.

3.2.4 AREA B : ENTRANCE - TIDAL REGIME

Normal tidal streams are reported to be no more than one knot in a northwest or southeast direction within the eastern limits of the channel, or a north or south direction through the entrance. Tidal rates and surface currents can be significantly affected by prolonged gales.

Tide levels for Wellington Harbour were checked and measured throughout the harbour in 2005. The results showed that the Queens Wharf tide height represents similar tide heights for any area of the harbour in any time period. Some pilots provided input into this risk assessment that they would still prefer tidal measurement in the entrance.

Wave height at the front lead is output, but not tidal current – this lead is also well inside the harbour entrance channel.

3.2.5 AREA B : ENTRANCE - NAVIGATIONAL USE

The main shipping channel provides transit for a wide range of vessel types, including recreational users. Based on the traffic analysis of this report, the entrance channel is (understandably) the densest in terms of vessel transits against other Wellington harbour areas (see Section 4.13).

There is a pilot boarding area in the entrance, Delta. The use of this is generally avoided, as it involves vessels being led to a safe location during times when safe pilot transfer offshore is not possible. CentrePort has procedures for boarding at Delta, but essentially a vessel is led in by the pilot launch with the pilot in VHF contact with the bridge team. This is a form of informal navigational assistance, but it is acceptable as the vessel is still under pilot's advice. This is discussed further in **Section 6.3.3**.

The entrance channel is a "Narrow Channel" where Maritime Rules Part 22.9 applies. This rule requires vessels of less than 20m in length, or a sailing vessel, not to impede the passage of a larger vessel passing through constrained waters. Additionally, a standard NZ Harbour Bylaw requires

vessels under 500GT not to impede navigation vessels of 500GT or more (the "500 ton rule"- Bylaw 6.3.1). In accordance with Bylaw 6.3.1, the Master of any vessel wishing to enter Wellington Harbour is obliged to inform Wellington Harbour Radio on VHF Ch14. Pleasure craft are not obliged to make this call during the hours of daylight and good visibility. Similarly, vessels without VHF or any other means of making contact with Beacon Hill (e.g. mobile phone) are not supposed to pass through the harbour entrance during the hours of darkness.

Schedule 6 of the Bylaws shows the harbour recommended routes, which all vessels over 18 metres in length must follow in and out of the Harbour.

The harbour ferry transits the entrance area to and from scheduled calls at Seatoun Wharf, thus providing an occasional crossing situation. There are a range of recreational activities taking place in the area generally that remain outside the main fairway. However, windsurfers and kitesurfes do cross the channel, usually in moderate to high winds. Racing yachts can also use this area either while going in and out of the harbour on longer races, or occasionally using the Front Lead as a turning mark in the race circuit.

Worser Bay yacht club, catering for racing centreboard dinghies, confines its activities to the west of the shipping channel. Recreational fishing vessels both transit and fish in the area. Those based in Seaview Marina on the north-eastern shore of the harbour tend to follow the eastern shoreline, passing to the east of Makaro/Ward Island. Recreational fishing boats also anchor in the western parts of Area B, particularly off Falcon Shoals, which is an area that can be navigated by vessels of less than 7.0 metres draught.

The western shoreline is popular with kayakers, shore divers and swimmers, as well as charter vessels, which cruise close to shore during summer months. The eastern shoreline is less appealing to most recreational users being barren and rocky. Small craft, including kayaks, are used to land on Makaro/Ward Island. Some fishing using set-nets occurs along this shoreline.

Windsurfers occasionally transit the channel, crossing from Seatoun Beach to the eastern shore, favouring fresh conditions. A small wharf at Seatoun is used occasionally by fishing vessels and small commercial vessels for crew exchange purposes, or by the pilot launch either to change pilots or await vessels. The East by West ferries are scheduled to call at this wharf three times a day.

3.2.6 AREA B : ENTRANCE – NAVIGATIONAL INCIDENTS OF NOTE

The original Wellington Navigational risk assessment illustrated the importance of incidents recorded during the 20th Century. These include the loss of the WAHINE on Barrett Reef, which occurred in 1968. Older past groundings and wrecks include EARL OF SOUTHESK in 1874, HUNTER in 1876 and

WANGANELLA in 1947. Many would suggest these events to be too old and now irrelevant to modern shipping, but they do underline the unforgiving nature of Wellington's approach. In 1986, the Police Launch LADY ELIZABETH II broached and capsized off Barrett Reef in breaking southerly swells. Two lives were lost.

Table 3 records recent incidents of note (across the Harbour in general). It shows that serious incidents can easily occur in Wellington Harbour waters. The implementation of recommended tracks has improved the certainty of transiting vessel locations. However, there are still close quarters encounters, mainly between Cook Strait ferries and piloted vessels. Grounding risk is also a prominent concern, highlighted by the recent case of a sailing vessel at Moa Point in 2016.

Year	Incident Summary
2006	Man lost overboard from vessel whist rigging combination ladder for pilot
2007	Barge capsized on the leads
2009	Near miss / Close quarters between Container and Passenger vessel.
2011	Bridge window of a harbour ferry stowed in off Scorching Bay
2011	Damage to boat due to heavy weather
2011	Near miss/close quarters between Cook Strait Ferry and a Yacht
2011	Extreme vessel movement at Seatoun wharf
2012	Mooring line failure at Seatoun Wharf
2012	Near miss / Close quarters between two commercial fishing vessels
2012	Near miss / Close quarters between Cook Strait Ferry and a Dry Cargo vessel
2012	Second Pilot boat (RHIB) heavy contact with inbound tanker whilst boarding pilots. RHIB side bag burst.
2013	Near miss / Close quarters between a Cook Strait Ferry and an unknown vessel type
2013	Pilot boat contact with log
2013	Navy vessel non-compliance with N & S Bylaws
2014	Near Miss/Close quarters with kayak off Falcon Shoal
2016	Grounding of a recreational boat at Moa Point
2017	Grounding/Striking of a rock off Karaka Point, April 2017 (South end of Karaka Bay). Apparent near miss also recorded, March 2017.

Table 3: Incidents of Note – Area B

3.2.7 AREA B : ENTRANCE – HARBOUR FERRY INCIDENT CASE STUDY

On March 1, 2011 a ferry was disabled by heavy breaking seas in Worser Bay with two people taken to hospital for treatment to minor injuries). This incident prompted the operator to fit Class B AIS transponders to enable rapid assistance. In April 2017a case of significance was recorded in the incident database, affecting the cross-harbour ferry service… One of the catamarans on the service to and from Seatoun, appears to have struck an isolated rock approximately 100m off Karaka Point. The ferry had a capacity of 100 people. The track record of the vessel is shown at **Figure 11** and shows a near miss had occurred earlier. The vessel reportedly suffered aft hull and rudder damage in the incident.

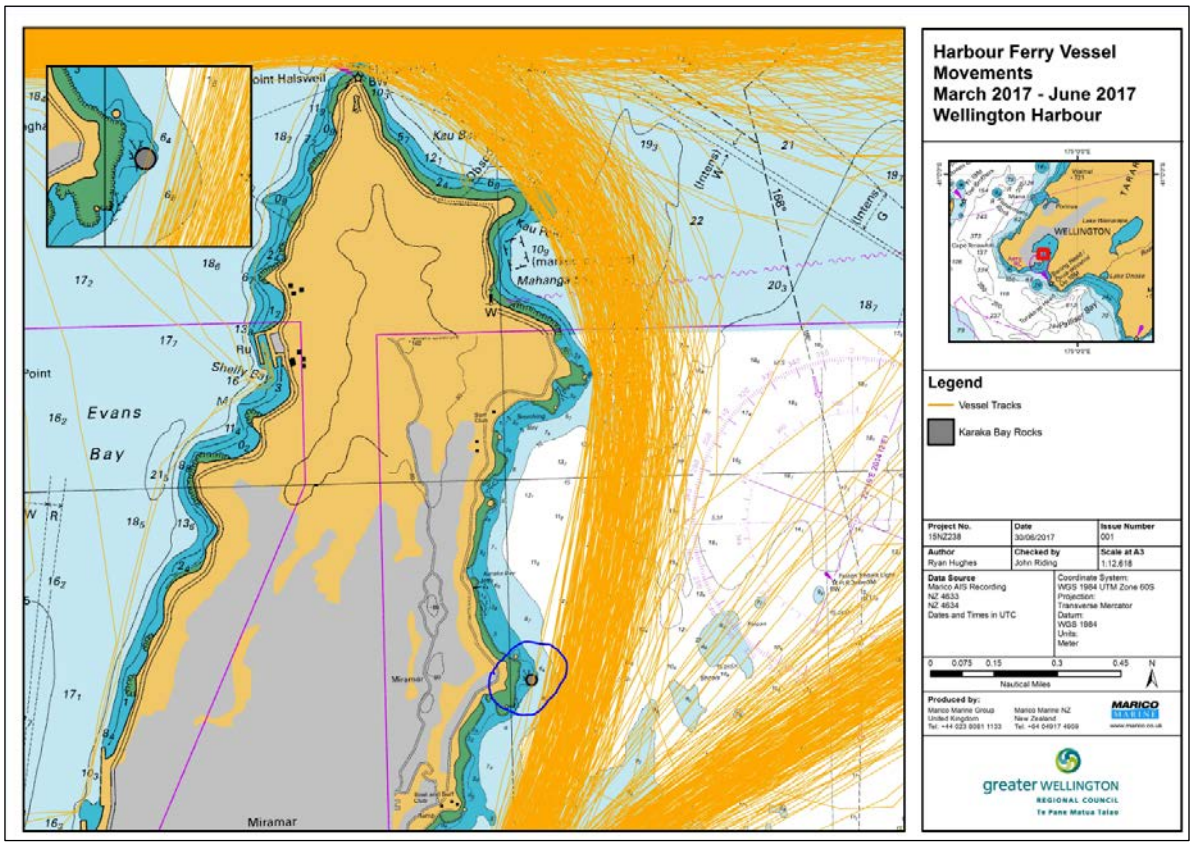


Figure 11 : Isolated Grounding of Cross Harbour Ferry Service – 2017

3.3 AREA C – MAIN HARBOUR

Area C encompassed a larger area in the 2006 review, with all of Seaview considered a part of the Main Harbour. For this risk assessment, the area has been split in two; Area C (Main Harbour) and Area F (Seaview), as increased shipping and recreational activity in Seaview merits its own focus. The boundary line between these two areas was drawn through Somes/Matiu Island.

3.3.1 AREA C : MAIN HARBOUR – PHYSICAL DESCRIPTION

The Main Harbour is essentially a roughly semi-circular basin with an area of approximately 45 square kilometres. There is extensive shallow water (less than 10 metres) off the northern shoreline, extending for approximately 4 cables seaward. Apart from this, Area C depths are generally between 16 and 22 metres, with isolated soundings of 31 metres. The bottom is a layer of soft silt overlaying hard clay, with fresh water springs issuing in several locations from the Hutt aquifer. It does not make for good holding ground for anchoring a vessel in in winds gusting over 50 knots. Somes Rock is the only isolated danger which is not visible at low water. It lies approximately three cables south west of Somes Light and has a charted depth of four metres. A further reef lies to the north of Mokopuna Island, but this is close inshore and does not pose risk to large vessels.

Somes/Matiu Island lies at the risk assessment area boundary and is administered as a reserve by the Department of Conversation and has resident staff.

3.3.2 AREA C : MAIN HARBOUR - WIND AND WAVE CLIMATE

Fetch is sufficient to allow the development of seas, reportedly two metres or more in prolonged strong winds. Southerly swells can also range up the harbour and although these are diminished greatly in height from those at the entrance, nevertheless contribute to a choppy sea state which can be challenging to small craft. There is some conjecture that the proposal for channel deepening may lead to greater swell penetration into the harbour, although there is little evidence either way.

Some areas are well sheltered depending on wind direction, such as Kau Bay in a southerly. Similarly the north-west shoreline is sheltered for up to one mile in winds from west to north.

The area is subject to heavy gusts off high land and funnelling down the Ngauranga and Kaiwharawhara gulleys which can affect small craft, particularly those under sail, and also larger vessels manoeuvring in strong winds.

3.3.3 AREA C : MAIN HARBOUR - TIDAL REGIME

No significant tidal streams occur in the harbour. Flow from the Hutt River during floods can be strong, but clear of the river mouth the fresh water forms a shallow layer over the salt water of the harbour and has a minor effect on deeper draught vessels.

3.3.4 AREA C : MAIN HARBOUR - NAVIGATIONAL USE

Large vessels transit Area C whilst in or outbound and the area also includes the Rail Ferry Terminal, Aotea Quay, Thorndon Container Terminal; all major wharf and berth facilities. Thorndon Container Terminal and Aotea Quay are interesting in that the geographical layout places the berth faces

approximately parallel with winds from the south or north, which are the predominant directions. Large vessels alongside are thus mostly head or stern to wind and pilots are adept at using wind forces acting on the hull for berthing or departing. Windage in swinging large ships when berthing at Aotea Quay has historically been an issue, but has also (correctly) focussed on cruise ships. In 2017, both car carriers and container ships have increased significantly in size and plans for channel deepening will likely increase the size of such vessels, and their windage. The western part of the area is not under radar monitoring or visual surveillance from Beacon Hill.

Large vessels transiting the harbour to and from the wharves are generally following the recommended tracks. These tracks occupy the south western part of Area C. Tankers and tugs routinely transit across the area when shifting between Seaview oil terminal and Aotea Quay or Burnham Wharf. Occasionally passenger vessels will transit the harbour outbound along the northern shoreline passing to the north and east of Matiu/Somes Island. The East by West ferry regularly transits across Area C, see **Section 4.2** for track plot.

Recreational craft of all types may be encountered throughout Area C, including yachts cruising or participating in races, and power driven craft engaged in water sports or fishing. Kayaks may be met with along the shorelines and around the islands and all types of recreational craft transit between marinas, launching ramps and other harbour areas and the open sea. A water ski access lane is provided in the northwest corner of Area C and no problems have been reported between different users in this area.

3.3.5 AREA C : MAIN HARBOUR - NAVIGATIONAL ISSUES AND INCIDENTS OF NOTE

The main stakeholder feedback arising out of consultation concerned the main harbour area. These are summarised as follows:

- Yacht race courses being set across recommended tracks;
- General recreational craft impeding passage of larger vessels;
- Larger vessels “cutting corners” off tracks and navigating close to the Miramar peninsula where recreational users are operating or small commercial/fishing vessels are transiting, or are at anchor – a sail training vessel occasionally anchors in Kau Bay during visits to Wellington and has been in close quarters situations with transiting ferries;
- Background shore lighting, particularly from the city, port and Hutt Motorway making it difficult for craft and vessels to detect one another by night. Outbound vessels can be particularly hard to see;
- Kau Bay is a multi-use area particularly in southerly conditions when it is well sheltered. It is a popular place for recreational craft to anchor, for shore diving, kayaking and there is a water-ski lane;

- Debris derived from the Hutt River during heavy rainfall presents a hazard to small craft and may damage small commercial vessels such as fishing vessels or the harbour ferries;
- Small craft and recreational fishing often anchor to the north of the Falcon Shoal pile and are occasionally in conflict with vessels following the outbound route west of the Falcon Shoal Pile light.

3.3.5.1 KAU POINT

One of the geographical hazards of the Harbour lies at Kau Point (at the interface between Areas B and C – Kau Point, in conjunction with Point Halswell and Point Gordon). This provides one of the key collision hazards of Wellington Harbour, where ships proceeding outbound from the main terminals are blind to inbound traffic as they approach Kau Point. This is especially the case if a vessel is proceeding close to the coastline through Scorching/Mahanga/Kau Bays. This occurs with small traffic, including the cross-harbour passenger ferries on their service link to Seatoun. Outbound vessels are thus recommended to increase passing clearance off Kau Point. Following the harbour recommended route outbound takes a vessel along a safe track to clear Kau Point by at least three cables and leaves margin for vessels or craft transiting close to the coast.

3.3.5.2 JACK UP RIG –POINT HALSWELL AND KAU BAY

In 2017 a small jack-up drilling rig was positioned off Point Halswell, exploring the extents of the fresh water aquifer that extends from the Hutt Valley into Wellington. This was to be drilling in a series of locations along a line between Kau Bay (North shore of Miramar peninsular) and Somes island. The drilling locations were mostly between the inbound and outbound traffic routes, although one location if used lay in the middle of the inbound traffic lane. The rig was fitted with lights, together with an AIS transponder.

The rig had to move off location during any storm event at which time any uncompleted drilling needed to be capped and abandoned. Thus, this hazard to navigation could appear in more than one location in a short timescale.

3.3.6 AREA C : MAIN HARBOUR – INCIDENTS OF NOTE

There have been a number of notable incidents that have occurred since the 2006 report, listed in

Table 4. Several conflicts between Cook Strait Ferries and Yachts have taken place within the Main Harbour, and severe weather has occasionally put vessels in jeopardy.

Year	Incident Summary
2014	Passenger RoRo ferry Berthing Contact with a mooring dolphin around the midsection. Shell plating holed above waterline.
2014	A Bulk Carrier anchor dragging during storm, vessel dragged into the approaches to Evans Bay. Pilot attended.
2014	A tanker Departing Evans Bay turned to exit the harbour and was in a close quarters conflict with an outbound Passenger RoRo ferry. Passenger RoRo ferries transit at much higher speed than a tanker.
2013	A vehicle carrier of 200 m length suffered severe mooring breakout whilst mooring alongside in gale conditions.
2013	A Harbour Ferry transit in severe weather with passengers on board with minor injury.
2010	The rapid onset of a storm force southerly caused a large number of yachts racing in the harbour to require SAR support. Rescue resources stretched. An outbound vessel returned to anchor at the same time.
2010	Cross harbour Ferry transiting Aotea to Days Bay suffered hull and windscreen damage by a large wave (Southerly Front)
2007, 2008, 2011	Conflicts between Cook Strait Ferry and Yachts within the Main Harbour
2009-2016	Various and regular records of mechanical failures during manoeuvring (passenger RoRo and cargo vessels).

Table 4: Incidents of Note Main Harbour – Area C

3.3.7 AREA C : INCIDENT CASE STUDY – CITRUS SPIRIT

An incident of note occurred in 2014 when a tanker was outbound from Burnham Wharf at the mouth of Evans Bay at about 11.5knots. A passenger RoRo ferry was also outbound in the area at about 17 knots. An inbound cruise vessel was also in the same area.

The tanker, aware of the traffic, exited Evans Bay and turned to starboard to proceed to the Harbour entrance. This placed the higher speed outbound passenger RoRo ferry, which was also increasing speed into a position of being a give-way vessel under the Collision Regulations. The faster passenger vessel committed to passing the tanker (against the collision regulations) or its outbound transit would have been reduced to the speed of the outbound tanker. The sea room needed for the inbound cruise vessel on the recommended route meant the passenger RoRo ferry had to pass close to the tanker. The exiting tanker had placed the passenger RoRo into being a give way vessel, yet it was proceeding at much higher speed and hence committed to overtake. In the event the passing was a close 0.3 Nm and the tanker passed close to Point Halswell (3.6 cables). A plot of the incident

from AIS data is shown below (**Figure 12**). There is still sea room in this passing, but the close quarter passing of a tanker by a RoRo presents an "at risk" behaviour from a human factors perspective. In this event two experienced professionals did not communicate effectively, each maintaining they were correct in managing the situation.

The present system of traffic management within the harbour relies in part on the pilots to organise traffic. However, RoRo PEC masters also possess similar local knowledge of the harbour and the informal traffic organisation by pilots is not readily understood by PEC operations.

It is important that vessels carrying passengers remain in a situation of minimal risk and many harbours have movement policies to support this. Traffic management providing a sequencing of traffic by priority would have caused the outbound tanker to have slowed allowing the passenger service to pass with increased sea room. To achieve this sequencing of traffic movements by more proactive traffic management is an option, especially to separate tankers and passenger services.

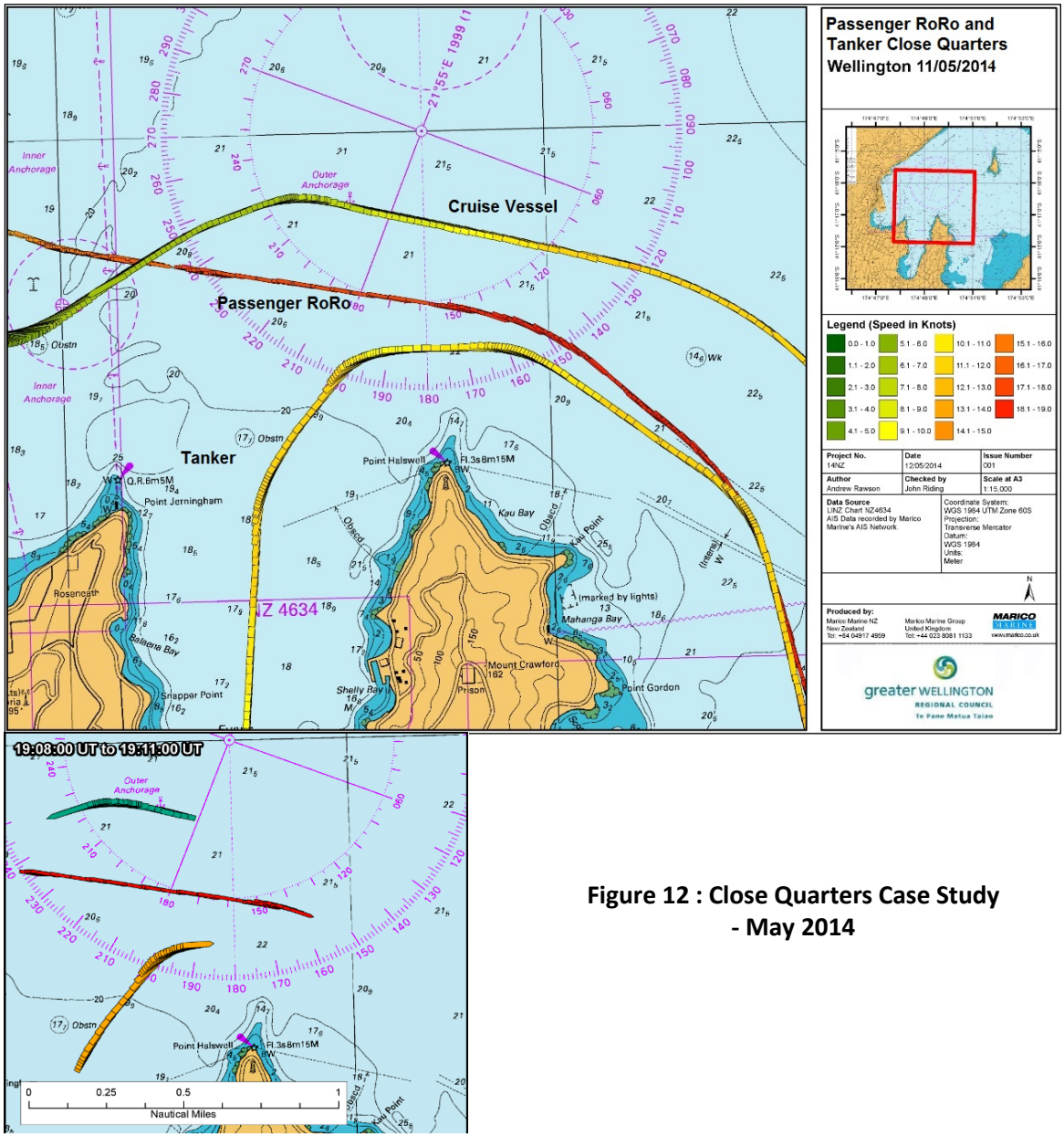


Figure 12 : Close Quarters Case Study - May 2014

With respect to **Figure 12**, it should be noted that such a close quarters situation was influenced by an inbound cruise vessel. The minimum approach of 0.29nm was achieved by the tanker turning close to Point Halswell. Large ships are slow to turn and such traffic situations are avoidable by traffic planning, the sequencing of which can only be delivered by a traffic management centre with the harbour overview.

3.4 AREA D : LAMBTON HARBOUR

This is an area of high navigational use, both recreational and commercial. Commercial activity is mostly concentrated in the northern part of the area, around the Ro-Ro berths and the harbour ferry jetty. Recreational facilities are located in the southern section with a rowing club, marina, boat harbour and a popular swimming beach with recreational amenities.

Potential for conflict between various users has been identified as significant in this area.

3.4.1 AREA D : LAMBTON HARBOUR PHYSICAL CHARACTERISTICS

This is the smallest of the study areas and essentially comprises a basin with depths over 10 metres for the most part. The following berths that are commercially available are:

- Inter-Island Terminal, berths for small vessels and harbour craft;
- Glasgow Wharf, which comprises two berths;
- Queens Wharf;
- Kings Wharf, where one berth is available for RoRO vessels.

The shoreline is composed largely of commercial wharves to the north and west and boat harbour or marina structures to the south. Oriental Bay, a popular beach with recreational amenities, extends along the southern shore from the Freyberg reclamation to Point Jerningham.

The area directly under the lee of Mount Victoria is largely sheltered from southerly winds but the commercial berths on the northern side are affected by winds from both north and south, making berthing difficult for high windage vessels such as Ro-Ro's. This is particularly the case when berthing down-wind in southerly gales. These funnel and accelerate through Evans Bay and the Newtown valley.

Wave development is generally more limited than other harbour areas due to the short fetch in prevailing northwest conditions and relative shelter in winds from the south. However, there is sufficient capacity for a choppy surface to develop which poses a hazard to low freeboard recreational craft, such as rowing skiffs or dragon boats.

3.4.2 AREA D : LAMBTON HARBOUR NAVIGATIONAL USE

This is a high use area of the harbour, with large and small commercial movements and a variety of types of recreational being heaviest during the busy tourist season and variable throughout the year. Because of its close proximity to the city Lambton Harbour is an attractive area in which to hold special events. Rowing regattas, dragon boat racing and swimming are regular events. Power boat races and Jet ski racing are occasionally held. The area is also frequently used for yacht races, both programmed club events and special events. This area is more exposed in the occasional north-easterly winds.

A speed restriction of 12 knots applies in Lambton Harbour, west of a line between the Carter Memorial Fountain and the Thorndon container terminal pile light.

Finger berths provide berthing for RoRo ferries operated by Strait Shipping. The waterway around these berths has been designated as a '*Restricted access area for non-commercial craft*' under the Regional Council Navigation and Safety Bylaws 2009. Non-commercial vessels may not enter this area without permission from the Harbour Master, which allows the large passenger RoRos to manoeuvre without conflict.

Large vessels approaching these berths may do so from either the north or south side of Lambton Harbour, depending on wind direction and master's preference. It is difficult for recreational users to predict which approach a vessel may take, but it is normal for smaller commercial vessels to communicate by VHF and negotiate safe passing. The southern side approach is less common, but is a viable option in the right weather conditions.

The wooden wharf structures in this area have provided over to 100 years of service; the structures have served Wellington well, but with an accrual of gradual deterioration and many repairs over the years, residual loading capacity is now below that which was originally installed. That is not to say that there has been no ongoing maintenance, there has been. Their use has changed too, from relatively small overseas ships berthing with tug assistance to RoRo services with frequent berthing events. In adverse conditions for berthing, the limited experience of tug handling by pilot exempt masters (PEC) is inevitably less proficient than by the pilots who use tugs daily (*Santa Regina* and *Toia* vs *Tarakina* – 22/2/2011).

The Lambton Harbour wharves experience a higher frequency of berthing and, as a result, records of contact berthing incidents are common. The wharves are probably outdated for the large ferry tonnage now using them and damage to Glasgow and King's Wharves has sometimes been substantial. These berths have noticeable lee and windward sides, presenting challenges for the ship handler. The fendering systems deployed have been unable to cope with the berthing of large RoRo ferries.

The option for a ferry to employ tug assistance is left to the discretion of the master, except in unusual circumstances where the vessel has a defect affecting manoeuvrability when it may then directed to take a tug, either as a result of Port Company requirement or by the Harbour Master.

There is no standard wind speed at which ferries will use a tug, each vessel having different characteristics and differing perception by the master of when a tug is required. Post Kaikoura earthquake ferry company guidelines prompt masters to use a tug in demanding weather conditions.

3.4.3 AREA D : LAMBTON HARBOUR BERTHING

Many of the berths in Lambton harbour have been given up to recreational use or residential development. The Overseas Passenger Terminal, a subject of the 2006 navigational risk assessment, has been developed into apartments and apart from the adjacent marina usage, is no longer used by vessels. In 2017, most large ships berth at Aotea Quay, although some smaller vessels, including "boutique" cruise vessels and warships of light displacement, still berth alongside the Queens Wharf Terminal.

Local small commercial vessels, harbour tugs, pilot launch, police launch, harbour ferries and charter vessels also berth in Lambton Harbour. Some berths on the southern side were used by laid up fishing vessels, but this has now ceased.

The most heavily used berth in Area D is Kings Wharf, where one Cook Strait service RoRo vessel operator bases its services. The Wellington finger wharves were designed in an era when vessels were much smaller than today, thus are tight for a large modern RoRo vessel manoeuvring.

3.4.4 AREA D : LAMBTON HARBOUR RECREATIONAL USE

Lambton Harbour is a high-use area for recreational craft, including organized clubs, hire craft and private recreational craft. Further information about clubs and recreational use of the harbour in general is presented at **Section 4.1.1**.

Occasionally, large vessels experience conflicts with recreational craft in the berthing approach at Aotea Quay. There can also be similar "close quarter" events with all manner of small craft in Lambton Harbour; **Figure 13** shows such an occasion (container vessel).

Figure 13: Sailing Activity in Lambton Harbour (Cruisers)

Chaffers Marina, located adjacent to the old Overseas Passenger Terminal[21] is a combined facility for recreational and small charter craft use, with capacity for around 250 craft of up to 20 metres length. There are rowing clubs, a keeler yacht club and a small craft hire operation (kayaks and paddle boats). Craft hire operations are subject to licensing by the Harbour Master, with set safety standards and conditions of operation. Freyberg Beach is popular with swimmers and small craft such as kayaks and dinghies can be launched from here. With reported incidents of swimmers coming into contact with rowers, the Harbour Master designated (informal) areas aiming to reduce conflict between these two activities.

Oriental Bay provides a popular anchorage for recreational craft. Sailing craft can also berth alongside the inner Queen's berths at dedicated yacht finger berths.

The area is subject to speed restrictions under Bylaws; the generic within 200m of the shore, 5 knot restriction (which is marked with buoys); and a 12 knot restriction which applies westward of a line between the Carter Memorial Fountain and theThorndon Container terminal pile light.

Oriental Bay is popular with swimmers and rowers, with both groups utilising the area for training and races. Lanes have been designated for each activity. However, the lanes used by both groups, have an area of crossover ad thus potential for conflict, **Figure 14**. These lanes are not a part of bylaws and used for both rowing and swimming as they are each ideal training distances for the respective sports. A swimming buoy was proposed for installation in 2016 outside of the current

[21] **The "terminal" itself, now Clyde Wharf has been developed for residential use.**

swimming lanes, in order to encourage swimmers to conduct activities away from rowing skiffs. This buoy was in the event deployed to mark the extents of the exclusion zone around the damaged Aotea Wharf, following the 2016 Earthquake. It is expected to be deployed, spring 2017.

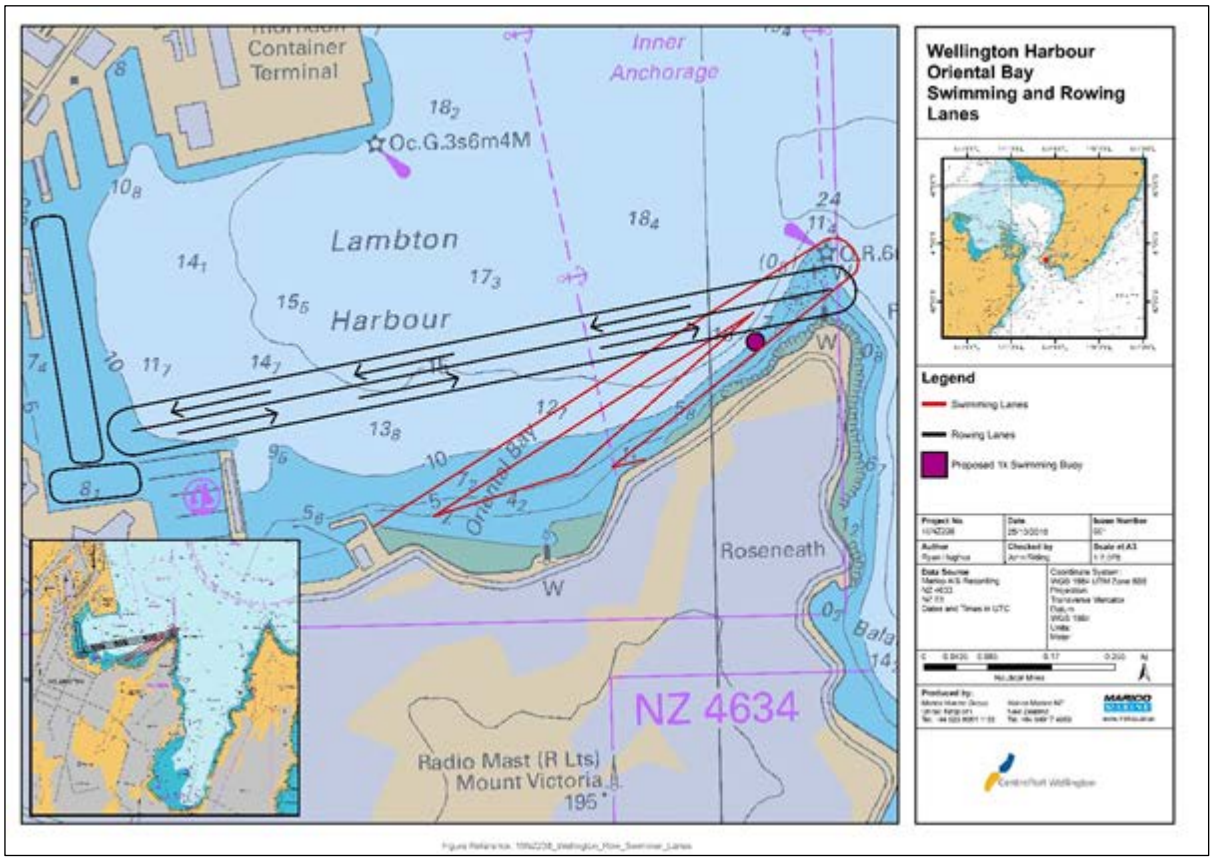


Figure 14: Recommended Swimming and Rowing Lanes - Oriental Bay

3.4.5 AREA D : LAMBTON HARBOUR - NAVIGATIONAL INCIDENTS OF NOTE

The majority of incidents at Lambton Harbour can be categorised as contact berthing, with mechanical failures or high cross winds being an important cause. **Table 5** presents these in summary form. In 2001, in a severe southerly, the freight RoRo KENT was holed in way of the engine room after contact with a moored barge and subsequently lost power. Tug assistance was required to deliver the vessel alongside the Overseas Passenger Terminal. In 2005, cumulative damage occurred to the inter-island wharf used as a temporary berth for the RoRo passenger ferry CHALLENGER (now KAITAKI). In one notable incident, April 2011, in high cross winds and rain, the RoRo vessel SANTA REGINA[22] damaged a derelict fishing vessel whilst reversing to connect with the linkspan at Glasgow Wharf. With the benefit of hindsight, engagement of tug assistance would have prevented the

[22] **SANTA REGINA has since retired from Cook Strait service and permanently departed Wellington.**

incident. There are no towage criteria in Wellington harbour and use of such assets is up to the master (or Pilot/PEC). Close quarter events of significance have been recorded, mainly due to relative high traffic density of recreational craft and commercial vessel movements.

A number of close quarters of note involve the potential for personal injury to swimmers in to conflict with rowing skiffs in Oriental Bay.

Year	Incident Summary
2009	Persons overboard (three passengers from a Passenger RoRo ferry).
2011	Cook Strait Ferry Contact with Fishing Vessel at Glasgow Wharf, whilst berthing.
2011	Near miss / close quarters between a Cook Strait Ferry, Tug and Pilot Boat.
2013	Passenger Cruise Vessel sustained minor fire in an electrical substation. Crew extinguished fire soon after it was discovered.
2014	Two Passenger RoRo contact berthing incidents.
2014	Weather related damage whilst alongside.
2014	Near-miss diving incident with pilot boat.
2014	Cook Strait Ferry Contact Berthing at Lambton Harbour.
2014	Cook Strait Ferry contact with berth at Lambton Harbour on sailing.
2014	Rowers obstructing Cook Strait Ferry, leaving berth.
2015	Close Quarters between a Kayak and Cook Strait Ferry.
2015	Near miss between a diver and Harbour Ferry.
2015	Injury of a swimmer by collision with a rowing skiff at Oriental Bay.
2015	Three rowing skiffs in close passing with a Passenger RoRo ferry.
2016	Two Kayakers in close quarters with a Passenger RoRo Ferry.
2017	Harbour Ferry in Close Quarters with Passenger RoRo returning from Days Bay to Queens Wharf in thick Fog (86 PoB).

Table 5: Incidents of Note – Lambton Harbour (Area D)

3.5 AREA E – EVANS BAY

Area E is an area of high recreational and commercial use. Commercial use involves monthly tanker movements and occasional visits by the research vessel TANGAROA. Burnham Wharf is located at the south-eastern head of the bay, one of three locations where bulk oil can be discharged in the harbour (Seaview Wharf, Aotea Quay 3 and Burnham Wharf).

An access lane for water skiers is provided at the southern end of the Evans Bay with the boundaries indicated in the Bylaws.

The Wellington airport runway is located immediately south of Evans Bay and vessels with an air draught exceeding 24 metres must report to Wellington Harbour Radio prior to transiting the bay, as such vessels may conflict with the glide slope for the airport. There are now restricted areas (the width of the runway and to 300 meters from the shore) at both ends of the runway for vessels of more than 13.5 metres air-draft for the Evans Bay restricted area and 6 metres air-draft for the Lyall Bay restricted area.

3.5.1 AREA E :- EVANS BAY PHYSICAL DESCRIPTION, MORPHOLOGY AND BATHYMETRY

Evans Bay runs in a north-south direction for two miles and is entered between Point Halswell and Point Jerningham, each of which is marked by light beacons. The entrance is approximately one mile in width but the bay narrows with distance south to 4 cables width between Greta Point reclamation and the Miramar Peninsula shoreline. After this point the bay widens to a roughly circular shape, but is shallow in the west with depths of less than 10 metres. Depths of about 12–19 metres exist in the eastern lower part of the bay, and this area is used for swinging and manoeuvring tankers or other large vessels onto the berth.

In common with much of the harbour, the rocky shoreline is characterised by a narrow wave cut platform which shelves rapidly. There are occasional small pebble beaches along the northern and eastern sides of the bay, but the lower south-western area is dominated by softer sediments and shoal water. The southern shoreline is reclaimed for road and airport development. It lacks any significant beach development and is edged with boulders to control erosion.

Evans Bay acts as a wind funnel causing local acceleration of wind from both the north and south. In northerly conditions, there is sufficient fetch for choppy seas to develop, which pose a hazard to small craft, particularly around the narrow section of the bay. Fetch is limited in southerly conditions but steep seas of approximately 1-1.5m in height and hazardous to small craft can develop at the entrance to the bay. Small craft, particularly yachts with small auxiliary motors, can find it difficult to progress against the wind. Occasionally, the rapid onset of storm force southerly can cause chaos amongst yachts racing in the bay and has stretched rescue resources (records from 1992 and 2010).

3.5.2 AREA E : EVANS BAY BERTHING – TANKERS

Strong winds result in restrictions on tanker movements in the bay, particularly in northwest winds which tend to cause a tanker to round up into the wind, and make it difficult to keep hull speed down. CentrePort standard operating procedures state that tankers are not to enter Evans Bay when the wind speed exceeds 40 knots without approval from the CentrePort Marine Manager. However, accelerated gusts are frequent and tankers can be committed to berthing when gusts arrive with peak speeds outside recommended limits. Swinging ability in strong winds was limited by available

tug power. The recent newbuild tugs have improved this, although operational failure of a tug while swinging leaves little room for recovery, as there is limited deep sea room.

Some pilots berthing tankers report swinging to starboard when at the south end of the bay, when making a final approach to the berth. Should anything go amiss in doing that turn, the vessel would be heading towards a muddy bottom and gentle grounding rather than heavy berth contact or a ballast-rock shore.

CentrePort's operating procedures provide operating limitations for berthing tankers in Evans Bay, including night berthing.

3.5.3 AREA E : EVANS BAY NAVIGATIONAL USE

There are more than 20 tanker visits per year to Burnham Wharf. The NIWA research vessel "TANGAROA" also berths regularly, when there are no tanker operations.

Evans Bay is a high recreational use area, with a range of activity types, including:-

- A yacht club, catering mainly for centreboard and trailer racing yachts;
- Evans Bay marina, administered by the Wellington City Council and catering for both private keeler yachts and launches as well as several inshore fishing vessels. The facility provides around 150 berths for craft up to 20 metres length;
- Sea Scout and Sea Cadet units operating whalers and other small craft;
- Public launching ramps for trailer craft;
- Waka-ama and kayak activity;
- Windsurfers launching from beaches in the centre portion of the bay, which then cross the bay at high speed.;
- Shore diving, particularly on the eastern shore.

There are number of swing moorings in the lower western area. Evans Bay is used mostly by recreational craft from moorings or clubs in the bay, for racing, fishing or pleasure. Windsurfers tend to cross the bay using its regular winds. Small craft sailing is mainly confined to the bay but may extend into the main harbour in favourable weather conditions.

Inshore fishing vessels and tankers may also transit during periods of high recreational use, although most tanker movements occur at night, avoiding conflict.

The Wellington Volunteer Coastguard base and launching site is located in the Evans Bay marina and two dedicated rescue craft operate from this site.

3.5.4 AREA E : EVANS BAY - NAVIGATIONAL INCIDENTS OF NOTE

Evans Bay has historically provided a low incident rate. This may be related to the low number of commercial vessel movements, when compared with other parts of the harbour. An incident of note occurring in 2014 was a close quarters/near miss situation between a rowing skiff and a water ski during a sports event. Recreational incidents occur mostly during summer periods.

A close quarters incident involving a tanker as it exited Evans Bay and conflicted with an outgoing Passenger RoRo ferry is reported at **Section 3.3.7** (Main Harbour).

3.6 AREA F : SEAVIEW

Area F has been separated into its own area for this 2016 risk assessment. For the 2006 review it was analysed with all of Seaview within the Main Harbour. This area has now been split in two; Area C (Main Harbour) and Area F (Seaview), as increased shipping activity to/from Seaview merits its own focus. The boundary line between these two areas was drawn North-South through Somes/Matiu Island.

3.6.1 AREA F : SEAVIEW - COASTAL MORPHOLOGY AND BATHYMETRY

Seaview is essentially a roughly semi-circular basin. The basin is shallower at the northern and eastern shorelines, where there is extensive beach development at Petone and a gradually prograding shoreline along the eastern bays. At the northern and eastern shoreline the area of shallow water (less than 10 metres) extends for approximately 4 cables seaward. For the most part depths are between 16 and 22 metres, with isolated soundings of 31 metres. The seafloor is comprised of soft silt on top of hard clay – with several fresh water springs emerging through the sediment. The bottom is a layer of soft silt overlaying hard clay, with fresh water springs issuing in several locations.

The Hutt River discharges at the northeast end of Petone Beach and can supply a considerable amount of debris into the harbour during flood events. This includes logs or trees, which present hazards to moving craft or vessels. The Hutt River also supplies most of the sediment load in the harbour with a smaller component brought in by longshore drift from the south coast. The flow is generally into Lowry Bay and then SW'ly past Seaview Wharf. The flow creates silt accretion on the southwest side of Seaview Wharf.

The two islands in Area F are administered as reserves by the Department of Conservation and the largest of these, Somes/Matiu Island, has resident staff.

3.6.2 AREA F : SEAVIEW - WIND AND WAVE CLIMATE

The basin in Area F is large enough for fetch to result in high swells, at times up to two metres in heavy winds. Although not as strong as at the harbour entrance, southerlies can still result in hazardous swells, particular to smaller craft. A significant surge can be reported by tankers berthed at Seaview Wharf. Mooring operations can be made challenging by prevailing northerlies, and tugs are kept on hand to allow larger craft to berth in adverse weather conditions.

3.6.3 AREA F : SEAVIEW - TIDAL REGIME

No significant tidal streams occur within the harbour, although surface currents can be affected by wind direction.. Flow from the Hutt River during floods can be strong, but clear of the river mouth the fresh water forms a shallow layer over the salt water of the harbour, providing a minor displacement effect on deeper draught vessels. However, the river outflow in conjunction with strong southerly winds can cause short steep waves locally. Seaview is also affected in a southerly gale and the short seas which form can affect the ability of a tug to push on. Seaview jetty is not aligned with the wind direction in a southerly, pilots are using a variety of berthing strategies that are part of CentrePort operational procedures. In addition to this, pilots also use PPU devices as a risk mitigation measure, which provide very accurate and independent positional and swinging information to the pilot.

3.6.4 AREA F : SEAVIEW - NAVIGATIONAL USE

The East by West ferry regularly transits across Area F (see Section 5.8 for further information). Large vessels also transit Area F whilst in or outbound as the area contains the Seaview Oil Terminal, a major wharf and berth facility. Tankers thus regularly cross these waters. Seaview has a lack of reference points in the approach, making berthing advisable by pilots with significant experience only. Centreport has SOP's in place for berthing large tankers at Seaview (wind limits, moorings etc). A berth alignment of 354^{o} generally has most winds blowing onto the berth. Winds with an easterly component can be dangerous.

Recommended tracks have been outlined in the regional council bylaws which direct large vessels inbound/outbound to the Seaview Terminal, as tankers and tugs routinely transit across the area when shifting between Seaview oil terminal and Aotea Quay or Burnham Wharf. On rare occasions, passenger vessels transit the harbour outbound along the northern shoreline passing to the north and east of Matiu/Somes Island.

However, recreational craft of all types may be encountered throughout Area F, including yachts both cruising and participating in races and power driven craft engaged in water sports or fishing.

Kayaks may be met with along the shorelines and around the islands and all types of recreational craft transit between marinas, launching ramps and other harbour areas and the open sea.

Seaview marina, located in the north east of Area F, has pontoon berths for around 130 craft of up to 20 metres length and parking space for 150 trailer boats, as well as a popular launching ramp. Lowry Bay Yacht Club is based in the marina and holds keeler races mainly in the Eastern and Northern areas of Area F. Centreboard yacht clubs are also active along the Petone foreshore and at Eastbourne.

Other organized activities are the Sea Cadets, Sea Scouts, Waka ama, a water ski club and a rowing club. These operate along the Petone foreshore or northwest corner of the harbour, and are generally clear of large commercial movements.

3.6.5 AREA F : SEAVIEW - NAVIGATIONAL INCIDENTS OF NOTE

The main stakeholder feedback arising out of consultation concerned the main harbour area. These are summarised as follows:

- Yacht races being set across recommended tracks;
- General recreational craft impeding passage of larger vessels;
- Background shore lighting, particularly from the port and Hutt Motorway making it difficult for craft and vessels to detect one another by night;
- Debris (logs) from the Hutt River during heavy rainfall present a hazard to small craft and may damage small commercial vessels such as fishing vessels or harbour ferries.

Year	Incident Summary
Annually	Logs and other debris exiting the Hutt River in flood.
2014	Tug and Tanker in Contact during Pilot Transfer to Tanker alongside the berth.
2014	Person overboard off Hutt river entrance after losing control in small dinghy (wind over current- chop).
2011	Kayaks capsize off Ward/Makaro island. One person missing assumed lost.
2010	Harbour Ferry in Contact Berthing at Somes Island.
2009	Cross Harbour Ferry flooding of engine space.

Table 6 : Incident Summary Seaview – Area F

3.7 SUMMARY OF RISK ASSESSMENT AREAS

3.7.1 AREA A : APPROACHES

- Primarily for transit to/from inner harbour areas – which involves boarding/disembarking of pilots for piloted vessels;
- Very little shelter in adverse weather and can be subjected to high winds and tall waves;
- Pilotage and harbour limits have been merged since the 2006 risk assessment;
- Incidents of note include several close quarters between Cook Strait passenger ferries and other vessels, including tankers. Problems of onboard electronic equipment being fit for navigational purpose, especially incorrect GPS outputs being used unchecked for navigational positioning.

3.7.2 AREA B : ENTRANCE

- There is a main channel for shipping and a smaller, unmarked route for small, mostly local vessels (Chaffers Passage). Larger vessels traverse only the main channel.
- Traversing the entrance can be made difficult by both sea and wind state, even for larger vessels, and heavy swells are not uncommon;
- Contains an alternative pilot boarding area when weather in the approaches is too severe;
- Incidents of note include several near misses between vessels of varying size, as well as near miss groundings on the well documented and chartered Barrett Reef.

3.7.3 AREA C : MAIN HARBOUR

- Risk area is smaller than set for the 2006 review, with Seaview now comprising its own Risk Assessment Area;
- Southerly swells and fetch can be hazardous within the harbour;
- Large vessel paths are usually predefined by the recommended tracks;
- Contains berths for commercial activity, including cruise ships and Cook Strait ferries;
- Incidents of note include mooring breakouts and conflicts between Cook Strait Ferries and leisure craft.

3.7.4 AREA D : LAMBTON HARBOUR

- High levels of recreational and commercial use.
- Contains berths for Cook Strait ferries, Harbour ferries and commercial activity.
- Generally, more sheltered than facilities located within the main harbour.
- Incidents of note include conflicts between Cook Strait ferries and leisure craft, and near misses between vessels and commercial divers.

3.7.5 AREA E : EVANS BAY

- High levels of recreational use – includes some tanker movements and small local commercial vessels.
- Experiences limited fetch but can be subjected to high winds, with larger fetch in northerly winds.
- Incident rates are low due to low traffic movements, but the number and types of recreational use is increasing. Incidents include a near miss situation between a rowing skiff and water ski during a sporting event.

3.7.6 AREA F : SEAVIEW

- Considered part of the Main Harbour in the 2006 navigational Risk Assessment.
- Can generate troublesome seas and long wave surge, especially in a southerly storm event.
- Used by many recreational and commercial operators, including large tankers.
- Stakeholders have expressed lower concern for conflicts between recreational and commercial vessels in this area.
- There have always been issues and incidents associated with debris from the Hutt River following heavy rainfall.

4 WELLINGTON TRAFFIC PROFILE ANALYSIS

4.1 INTRODUCTION

Marine traffic statistics are analysed and track records plotted of the harbour routes taken by different vessel types, in order to generate a traffic profile for Wellington Harbour. Wellington has a diverse range of traffic using its harbour and it presents a very interesting profile.

Traffic analysis is vital for a port such as Wellington, where a high volume of PEC movements exist and traffic monitoring is passive. This section also provides information of value to the future delivery of the Beacon Hill Signal Station services.

Traffic data records from visits to the CentrePort berths have also been analysed. CentrePort keeps comprehensive records of vessels using their services, wharves and terminals and kindly released this data for the risk assessment. Analysis has used criteria such as gross tonnage (GT), number of vessels piloted, growth in vessel numbers, and vessel length overall (LOA). Data in terms of movements is related to piloted vessels.

Growth Analysis mostly use the year 2004 as a baseline from which a growth comparison can be made. Analysis compares recent years to the 2004 baseline, rather than year by year. This resulted in a traffic profile that highlights how Wellington Harbour traffic has changed since completion of the first risk assessment.

4.2 RECORD OF ALL VESSEL TRACKS - WELLINGTON HARBOUR

Figure 15 illustrates the combined tracks of all vessels with AIS transponders using Wellington Harbour from August 2014 – July 2015. This data period has been selected as it represents traffic levels prior to the earthquake that caused serious damage to CentrePort wharves and facilities. The data period is representative and the plot presents vessel type by differing track colours.

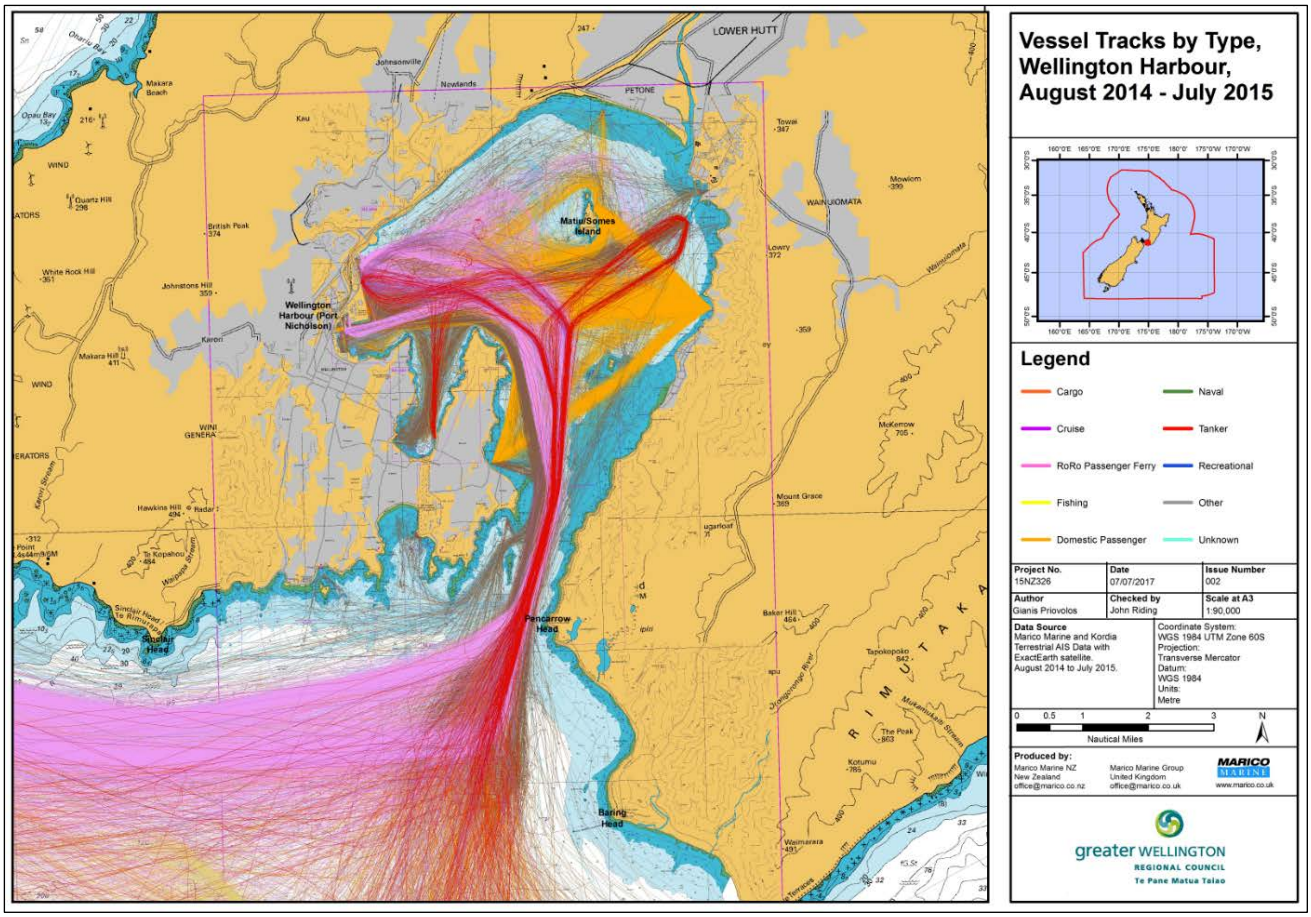


Figure 15 : All Vessel Tracks by Type – Wellington Harbour

For the purposes of traffic analysis, vessels using Wellington Harbour have been categorised into the following types:-

- Cook Strait Passenger RoRo;
- Cruise;
- Cargo;
- Tanker;
- Cross Harbour Ferry;
- Commercial Fishing;
- Recreational;
- Others.

It should be noted that most local commercial fishing vessels and a majority of recreational craft do not have AIS so cannot be represented in this plot.

Wellington Harbour entrance channel is constrained by Barrett Reef and vessels need to align with entrance leads at an early stage in the inbound transit. The harbour has recommended routes to

each of the berths or tanker terminals and these are clearly apparent from the plot, tankers especially. An analysis of each of these vessel groups can be found in the subsections that follow.

Recommended routes are publicly available and found in both in the navigational bylaws and can be downloaded from the CentrePort Website[23].

4.3 TRAFFIC PROFILE VARIATIONS

This section analyses the traffic volumes using Wellington Harbour. Movements through the harbour entrance have averaged about 8,400 per year, including piloted vessels and PEC/ RoRo ferry movements. A movement is not a visit, it is a transit in or out of the harbour by a commercial vessel, so a visit by a vessel comprises two movements. Movement numbers do not include the regular harbour ferry crossings, charter vessel operations or recreational movements operating solely within harbour limits.

Table, 7, below, separates out the total number of piloted vessel visits and Cook Strait ferry arrivals at Wellington Harbour, using 2004 – 2005 as the baseline year, shown pictorially in **Figure 16**. The number of piloted vessels peaked at 2004 –2005, but the fall off in numbers since is related to the increase in ship size, not a fall in cargo through the port (See **Figure 17**, later). The number of passenger ferry movements increased above the baseline from 2007 to 2016.

It can be readily appreciated that RoRo ferry movements are a significant part of Wellington's traffic profile. Due to interisland traffic growth, movements of Cook Strait passenger RoRo services increased from the 2005 baseline, but increasing vessel size has resulted in a moderate fall in transits in recent years . The number of passengers crossing to/from the North Island is predicted to reach 1.5 million per year from 2017 onwards. Cook Strait Ferry capacity by vessel ranges from 400 to 1650 passengers, although a trend to larger tonnage is already apparent and inevitable. RoRo ferries generally are increasing in size to service an increasing volume of freight and passengers worldwide on most ferry routes.

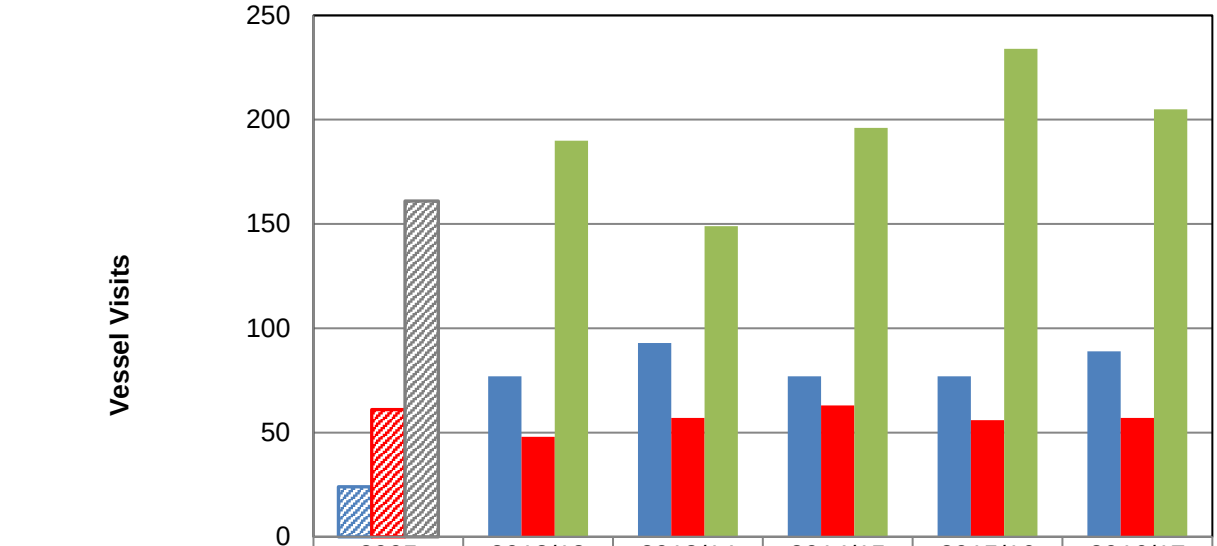
[23] http://www.centreport.co.nz/index.php/facilities-and-services/marine

Period	Piloted Vessel Arrivals	RoRo Ferry Arrivals	Totals
2004 – 2005	1,412	3,610	3966
2006 - 2007	1,204	3,753	4957
2007 – 2008	1,246	3,850	5096
2008 – 2009	1,260	3,467	4727
2009 – 2010	1,301	3,678	4,979
2010 – 2011	1,317	3,591	4,908
2011 – 2012	1,167	3,541	4,708
2012 – 2013	1,194	3,429	4,623
2013 - 2014	1,205	3,322	4,527
2014 - 2015	1,270	3,557	4,827
2015 - 2016	1,382	3,336	4,718

Table 7 : Piloted Vessels and RoRo Ferry Arrivals per Year

Figure 16 provides a breakdown of commercial movements to the CentrePort berths. Data uses 2004-2005 figures as a baseline. Traffic has been broken down by Cruise, Tanker and Container vessels. The data period is based on the cruise season, which occurs across the summer months.

The data shows just how much cruise vessel visits have increased, with Wellington almost mirroring the New Zealand cruise industry growth in recent years (meaning almost all cruise vessels arriving in New Zealand are also calling at Wellington). Tanker and container vessel visits have remained at comparable levels to one another since 2005. Container vessel movements had decreased significantly since the November 2016 earthquake but are increasing rapidly towards previous levels after September 2017, when the TCW2 berth became operational again.



	2005	2012/13	2013/14	2014/15	2015/16	2016/17
Cruise Vessel Visits	24	77	93	77	77	89
Tanker Vessel Visits	61	48	57	63	56	57
Container Vessel Visits	161	190	149	196	234	205

Figure 16: Vessel Movements Comparison by Vessel Type - 2005 as Baseline

4.4 GROSS TONNAGE PATTERNS

Table 8 illustrates movement data by piloted vessels, and breaks down arrivals by the average gross tonnage (GT) using2005 as a baseline year[24]. Arrivals data has been used as this removes transits within the harbour (i.e. berth to anchor to anchor and vice versa). This shows that although vessel visits have fallen by number, the average gross tonnage has risen significantly, confirming the size increase of vessels using Wellington Harbour.

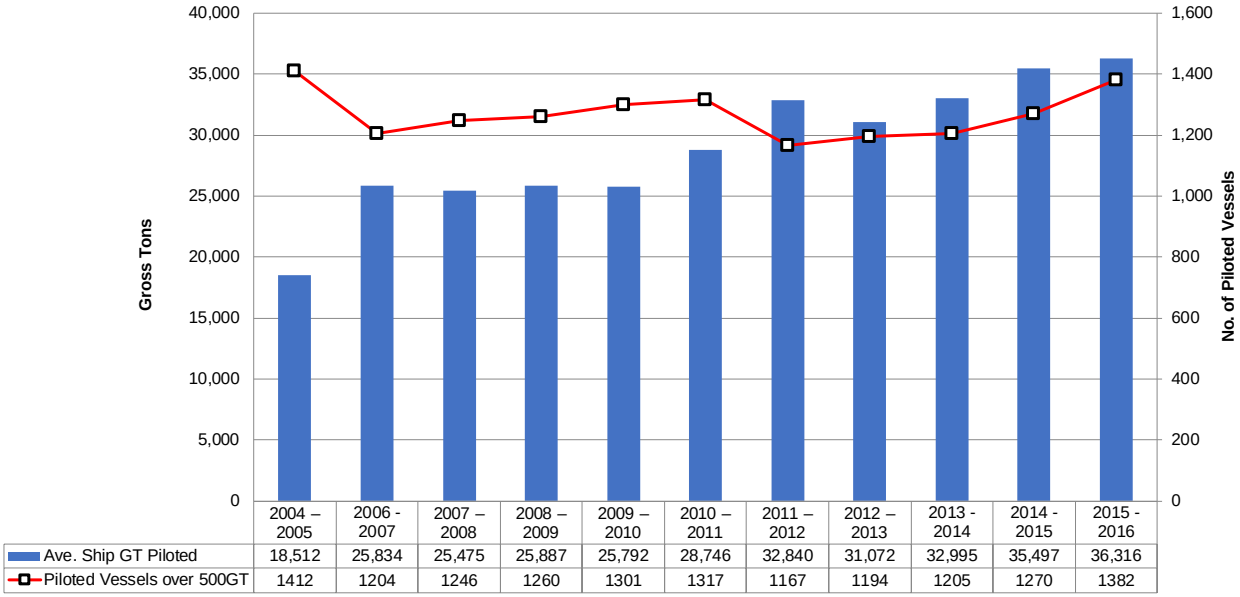
Period	Piloted Vessel Arrivals	Ave. Gross Tonnage (GT)
2004 – 2005	1,412	18 512
2006 -2007	1,204	25,834
2007 – 2008	1,246	25,475
2008 – 2009	1,267	25,887
2009 – 2010	1,301	25,792
2010 – 2011	1,317	28,746
2011 – 2012	1,167	32,840
2012 – 2013	1,194	31,072

24 Data provided by the Harbour Master's office.

Period	Piloted Vessel Arrivals	Ave. Gross Tonnage (GT)
2013 - 2014	1,205	32,995
2014 - 2015	1,270	35,497
2015 - 2016	1,382	36,316

Table 8: Piloted Vessel Arrivals with Average Gross Tonnage

Figure 17, below shows this pictorially.



	2004 – 2005	2006 - 2007	2007 – 2008	2008 – 2009	2009 – 2010	2010 – 2011	2011 – 2012	2012 – 2013	2013 - 2014	2014 - 2015	2015 - 2016
Ave. Ship GT Piloted	18,512	25,834	25,475	25,887	25,792	28,746	32,840	31,072	32,995	35,497	36,316
Piloted Vessels over 500GT	1412	1204	1246	1260	1301	1317	1167	1194	1205	1270	1382

Figure 17: Average Piloted Vessel Gross Tonnage - 2008 to 2016 (Baseline 2005)

Figure 17 shows that the average size of piloted vessels visiting Wellington Harbour has increased significantly (96%), from a baseline of 2005. This reflects a general trend in shipbuilding to larger capacity vessels. The fact that the size increase represents almost double is something of note[25].

4.5 COOK STRAIT PASSENGER ROROS

The Cook Strait Ferries comprise a major component of the vessel traffic within the Wellington Harbour. The tracks for all of these vessels are illustrated in **Figure 18**. The Cook Strait ferry route was serviced by a total of 5 RoRo vessels during this data period plotted (October 2014 - March 2015).

[25] **The 2006 risk assessment concluded a need for towage capability improvements, with one replacement tug ordered and a second delivered in 2016. The increase in vessel size since has underpinned this finding and facilitated the port's ability to expand.**

Each vessel carried both passengers and freight, whereas in 2007 some dedicated freight RoRos remained. These vessels have increased in size over time, the current maximum length is 186m.

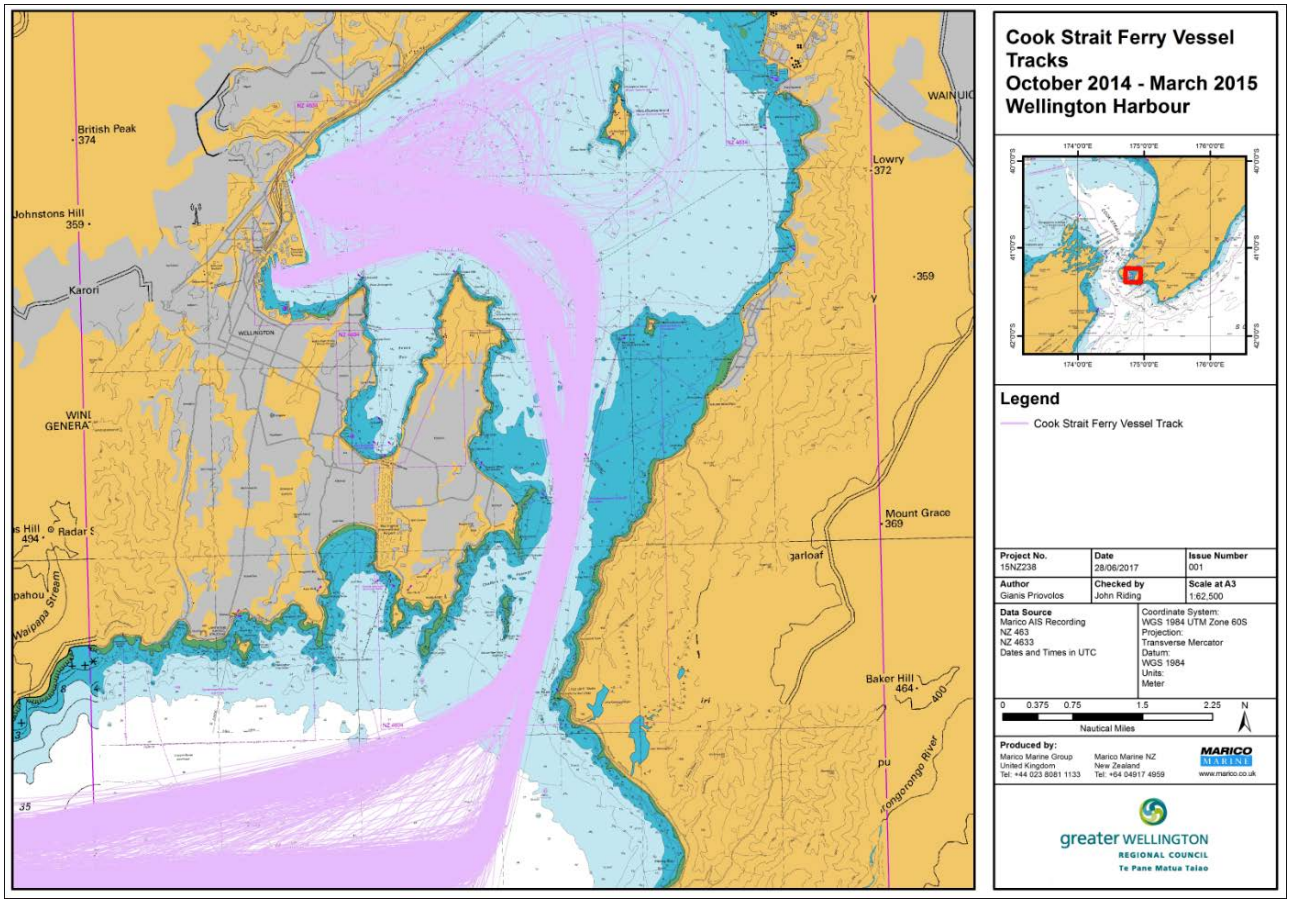


Figure 18 : Cook Strait Passenger RoRo Tracks

Passenger RoRo ferries make several round trips each day through Wellington Harbour waters and, as such, contend with other vessels, and each other, for space in the Wellington Harbour approaches. Ferries show good compliance overall with the Wellington Harbour recommended routes, which minimise the likelihood of close quarters incidents, providing some separation of inbound and outbound traffic.

Figure 19 shows a separation of inbound and outbound tracks and shows a majority of inbound vessels take an approach aligning with the harbour leads, following the recommended route into Wellington. Passages within the harbour also show a variance across different passenger RoRo vessels and the same ship can take different routes outbound, both sides of Falcon Shoal[26]. There is some track variance by RoRo ferries when inbound at the Harbour approaches.

[26] **A vessel with draught less than 7 metres is allowed by bylaw to cross Falcon Shoal, so the observation is not raising a problem.**

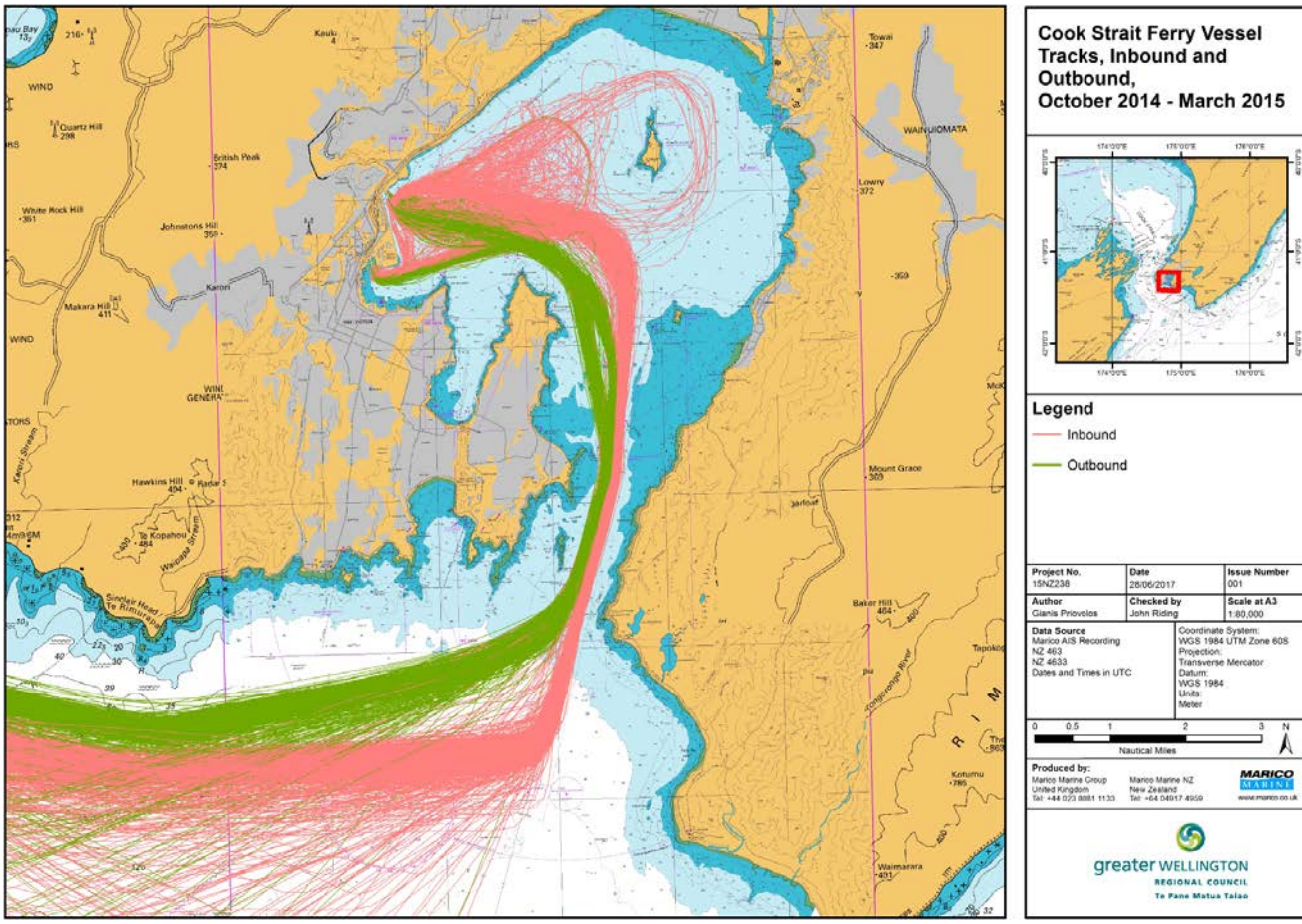


Figure 19 : Cook Strait Ferry Tracks - Inbound and Outbound

The dominance of the Cook Strait ferry services as a portion of the harbour trade is interesting. Their transits are mostly well defined, although plots show that passenger RoRos also use much of the harbour extents. The track record shows that RoRo ferries are also a ship type that makes use of the inner harbour waters for anchoring or layby reasons. There is no evidence to suggest there will be any future changes to this traffic pattern and the recent Government strategic studies of the use of Clifford Bay as the South Island route terminus would not have affected RoRo traffic into Wellington. The shorter route may though have increased the traffic frequency.

4.5.1 Cook Strait RoRo Traffic Movements Analysis

Since the 2006 risk assessment, the older ferries KENT, MONTE STELLO, SANTA REGINA, PURBECK and ARAHURA have been retired from the Wellington to Picton Ferry service and larger ferries have replaced these vessels. The service to Christchurch provided by SPIRIT OF COMPETITION ceased in 2007. The Kaikoura Earthquake has highlighted the benefits of such a service, at least in the short term.

At the time of this Risk Assessment (2017), five Cook Strait Passenger RoRos were operating into Wellington Harbour. The two ferry operators provide a schedule on a daily basis up to 7 trips during summer period, but the number can vary due to operational needs. One operator is more schedule driven due to rail timetable parameters, but both operators have increased capacity on the route in recent years.

Table 9, over a long period, shows the number of ferry transits through Wellington Harbour has reduced, but the number of passengers has increased. This is a result of larger RoRo ferries in Cook Strait service as both operators procured larger tonnage to accommodate increased demand.

Financial Year	Cook Strait RoRo Arrivals
1997 - 1998	4,255
1998 - 1999	4,459
1999 - 2000	5,031
2000 - 2001	4,103
2001 - 2002	4,299
2002 - 2003	3,474
2003 - 2004	3,788
2004 - 2005	3,610
2005 - 2006	3,456
2006 - 2007	3,753
2007 – 2008	3,850
2008 – 2009	3,467
2009 – 2010	3,678
2010 – 2011	3,591
2011 – 2012	3,541
2012 – 2013	3,429
2013 - 2014	3,322
2014 - 2015	3,557
2015 - 2016	3,336
2016 - 2017	3,017

Table 9: Cook Strait RoRo Numbers (1998-2017)

Adverse weather conditions, berthing delays and vessels sailing at different speeds have an effect of RoRo ferries meeting other vessels within harbour limits, which is presently random in nature. Track data for Wellington shows that crossings, overtaking or a ferry merging in relative close quarters to take a lead position is quite common in the harbour approaches, between ferries as well as other types of vessels. These events have sometimes led to reports of close encounters to Beacon Hill. The Harbour Master keeps records of such incidents, which are entered into the port risk management software HAZMAN II. Such incidents are factual records that greatly assist with the

quantification of the risk assessment. The Most Likely Risk outcomes in the risk assessment reflect minor incidents, with the frequency component review and inform the hazard assessment.

4.6 CRUISE VESSELS

Cruise vessels visiting the Wellington Harbour have increased significantly over the last 5 years in both number and size. The importance of this growing trade to Wellington (i.e. as well as the harbour) is recognised in the region and their contribution to the Wellington regional GDP has been evaluated, showing the economic significance of these vessel visits in 2017. The largest cruise vessels visiting Wellington by the 2017-2018 season are significantly over 300 metres in length and can carry up to 6,000 people. The trend to larger cruise vessels visiting Wellington is predicted to increase each year. There are no cruise vessels presently using Wellington harbour who have Masters who qualify for pilotage exemption status (PEC). However, with a small number of cruise vessels now using Auckland as a summer home port, it is possible that this could change in the future. Wellington has a requirement for an qualified pilot to be present for any two tug movement two tugs. However some thought should be given to PEC criteria for the future. Authors are aware of a number of ports where large passenger cruise vessels have mandatory requirements for use of pilots (channel islands), or others where tripping requirements to gain PEC qualifications are

Figure 20 presents tracks of cruise vessels using the harbour. It confirms that most cruise vessels berth at Aotea Quay, which can experience multiple arrivals in any one day. Smaller cruise vessels only berth at Queens Wharf, in the centre of Wellington (the jetty has size limitations). The largest vessel to enter Wellington Harbour during October 2014 - March 2015 was the cruise ship with a Gross Tonnage of 137,276. In contrast and showing the ongoing size increase, in 2016 the cruise ship *Ovation of The Seas* visited, at 168,666 gross tons and 348 metres in length.

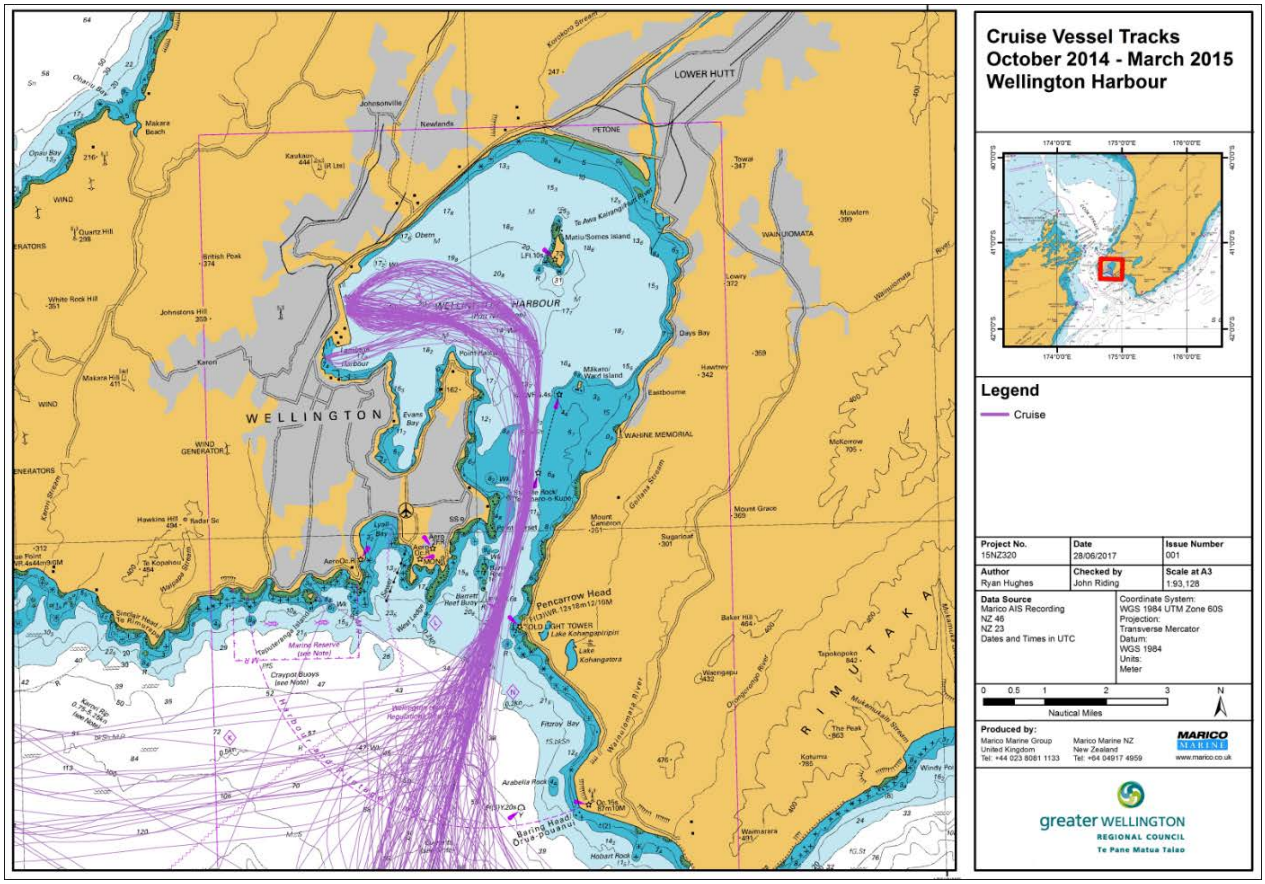


Figure 20 : Cruise Vessel Tracks

Cruise vessels rarely anchor in the harbour, with their transit needs providing for an arrival time alongside close to 07:30hrs and a departure early evening, allowing passengers to maximise their day in Wellington. Cruise vessels depart to make an overnight passage to the next tour destination. All cruise vessels are piloted.

4.6.1 CRUISE TRAFFIC DATA

The cruise market for Australia and New Zealand accounts for 3.6% [27] of the global cruise market. Statistics from Cruise New Zealand suggest 130%[28] growth in recent years, for both Australia and New Zealand. The increase in cruise vessel visits to Wellington Harbour aligns with the Cruise New Zealand statistics. For the purposes of the risk assessment, Cruise Vessels have a complement of up to 4000 people. As a reference, the largest ship to berth at the Wellington Aotea cruise terminal, 2012-2014 was QUEEN MARY 2, at a registered size 149,215 Gross Tons; length overall of 315 metres, with a capacity of 3,948 people (2,695 passenger and 1253 crew). OVATION OF THE SEAS

27 Based on data for 2013 – Cruise New Zealand
28 2013 figure – Cruise New Zealand

visited in 2016 and 2017, at a registered size of 168,666 Gross Tons, length overall of 348 metres and a capacity of about 5,600 people (4,180 passengers and 1500 crew).

Figure 21 shows the increase in cruise vessel visits over the time period since the last risk assessment. This uses average Gross Tons as an indicator of the change in vessel size. It should be noted that vessel length, which is relevant to rate of swing for piloting and manoeuvring, has also dramatically increased. Cruise vessels are though more manoeuvrable than was the case in 2005-6 as azimuth thrusters have been developed, which

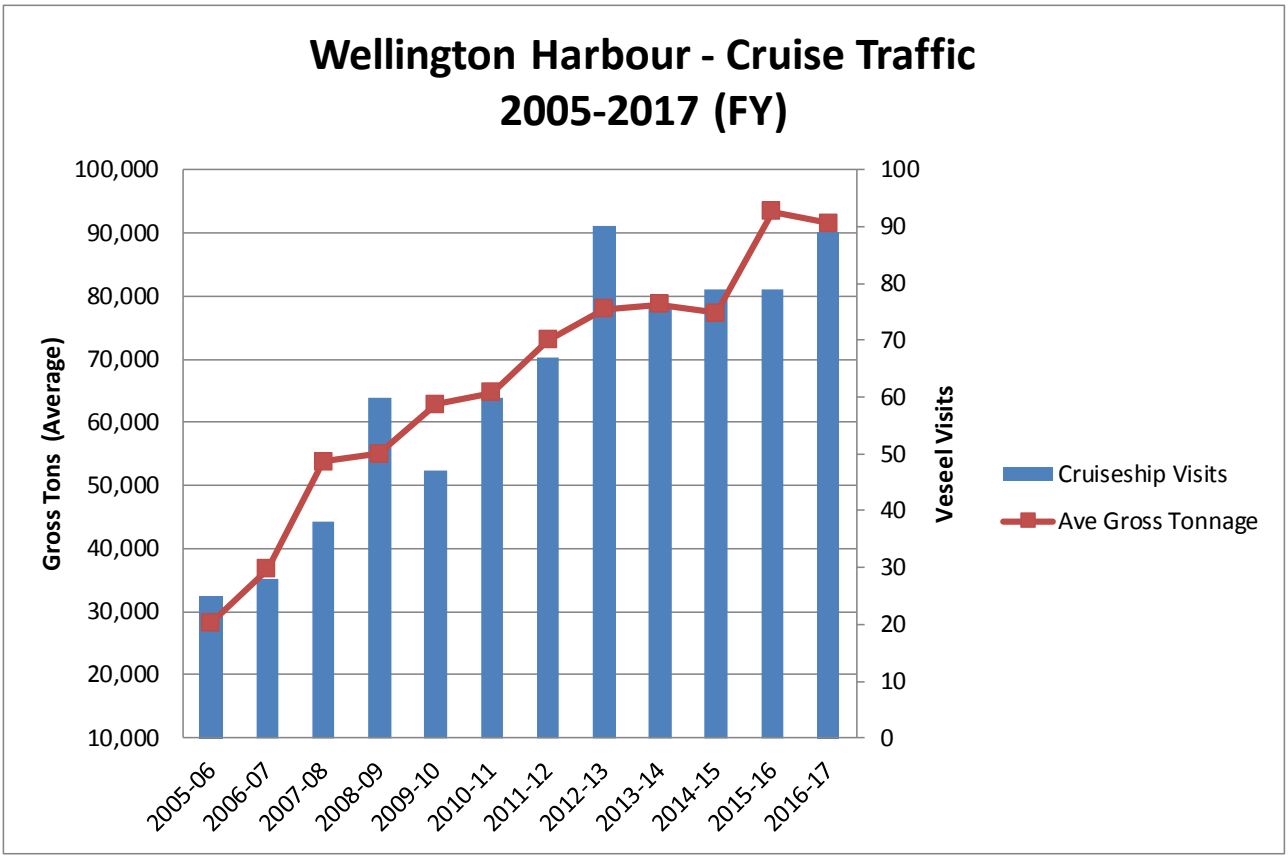


Figure 21: Cruise Vessel Percentage Change of Cruise Vessels Relative to 2005

4.7 CARGO VESSELS

Like other reporting vessels, cargo vessels are required to follow the recommended harbour routeing when entering Wellington Harbour, following the instigation of Bylaw 6.1.4 by the GWRC. Vessel tracks of Cargo Vessels using Wellington Harbour are illustrated in **Figure 22**.

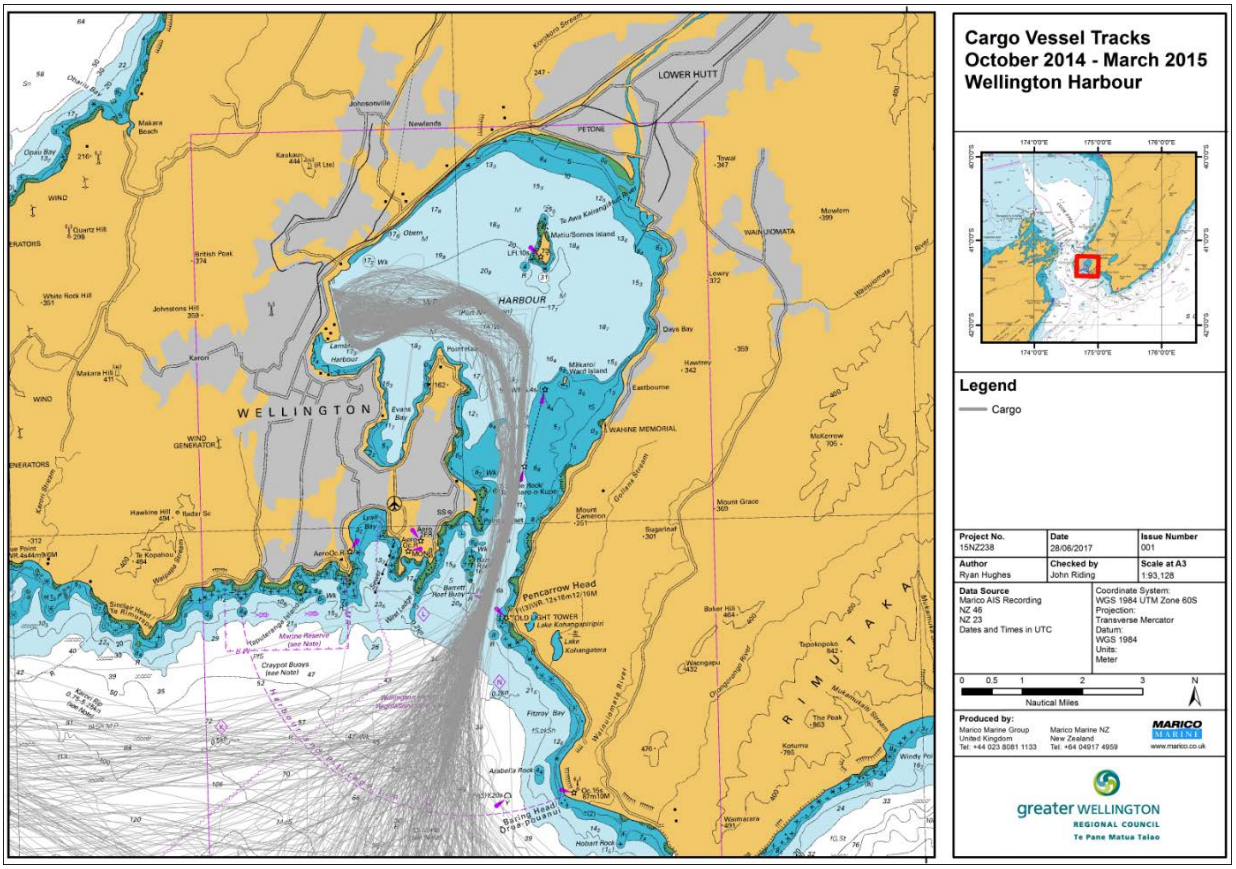


Figure 22 : Plot of Cargo Vessels - Wellington Harbour

4.7.1 INCREASE IN CARGO VESSEL SIZE

Cargo vessels serving Wellington are growing in size more than other non-passenger vessels types, e.g., tankers. Some of the largest increases in size have affected Container Vessels, where strong international competition on some routes has influenced owners to seek lower slot (per container) costs by a large increase in vessel size. Indeed, vessels of a size that are truly economic for service to an isolated country, the size of New Zealand, have not been built for some time. In 2017, containerships of up to 350 metres in length are beginning to enter New Zealand trades. This provides most New Zealand ports with a commercial conundrum. Such vessels are unlikely for a number of years to reach their laden capacity, given the container volumes leaving New Zealand. However, their size means most ports have, at a minimum, to deepen entry channels to facilitate

access to port terminals. Deepening is necessary at Wellington in order to maintain a port system that can be used by larger vessels.

Figure 22 represents the tracks of mostly bulk carriers and container vessels, with occasional car carrier arrivals. Almost all cargo vessels carry pilots and tracks show their direct access to Aotea Quay and good compliance with the Wellington harbour recommended transit routes.

4.7.2 CONTAINER TRAFFIC DATA

Container vessels are the second-most frequent vessel type visiting Wellington Harbour. Container throughput has been increasing steadily and appears to be consistent with the increase in Gross Tons since 2005. The number of Twenty-Foot Equivalent Units (TEU) loaded and discharged was approximately 115,000 in 2015/2016[29], which compares with 89,000 in 2004/2005[30]. This illustrates a healthy development of cargo operations over the decade since the last harbour risk assessment. By national standards, and notwithstanding the damage to container handling capability arising out of the November 2016 earthquake, Wellington Harbour is positioned in the top 6 container ports of New Zealand. It should be noted that the container terminal had to suspend operations in 2016, thus container vessels ceased to visit, unless they were fitted with cranes capable of handling their cargo. Analysis has thus been limited to the last complete year of data.

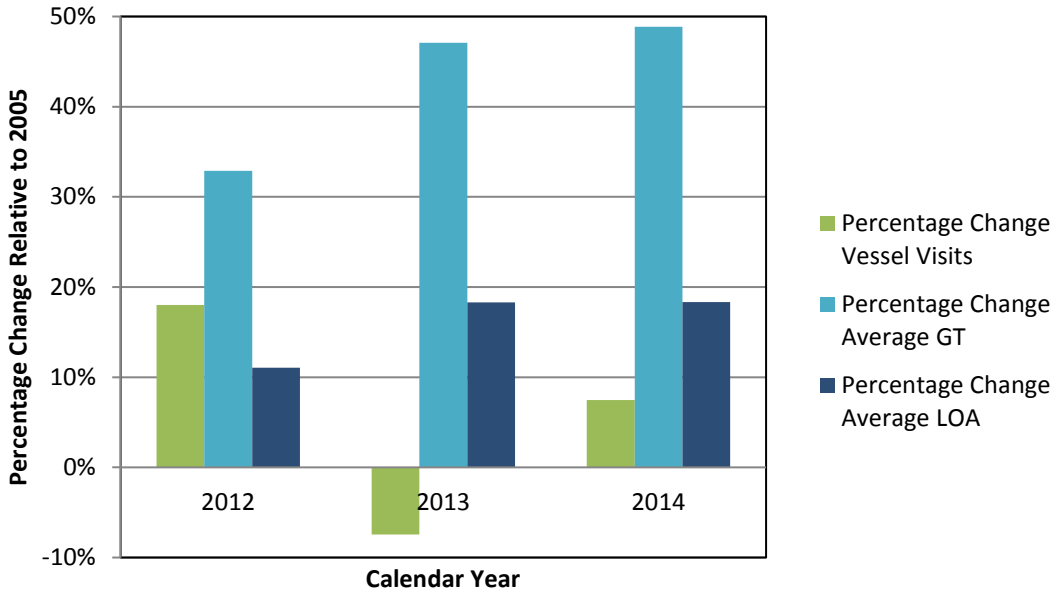


Figure 23: Percentage Change in Container Vessel Size - 2005 Baseline

29 In 2016, the Wellington earthquake caused the container terminal to close. This analysis has thus been limited to the 2014-2015 year. ffigures by the Freight Information Gathering System
30 2006 Wellington Harbour Risk Assessment

4.8 TANKER TRAFFIC

To demonstrate this development, **Figure 23** illustrates the constant increase of container size (GT and LOA) for 2012-2015, using 2005 as the baseline year (the year in which the first navigational risk assessment analysed traffic). The tracks for all Tanker vessels using Wellington Harbour, 2014-2015 are illustrated in **Figure 24**.

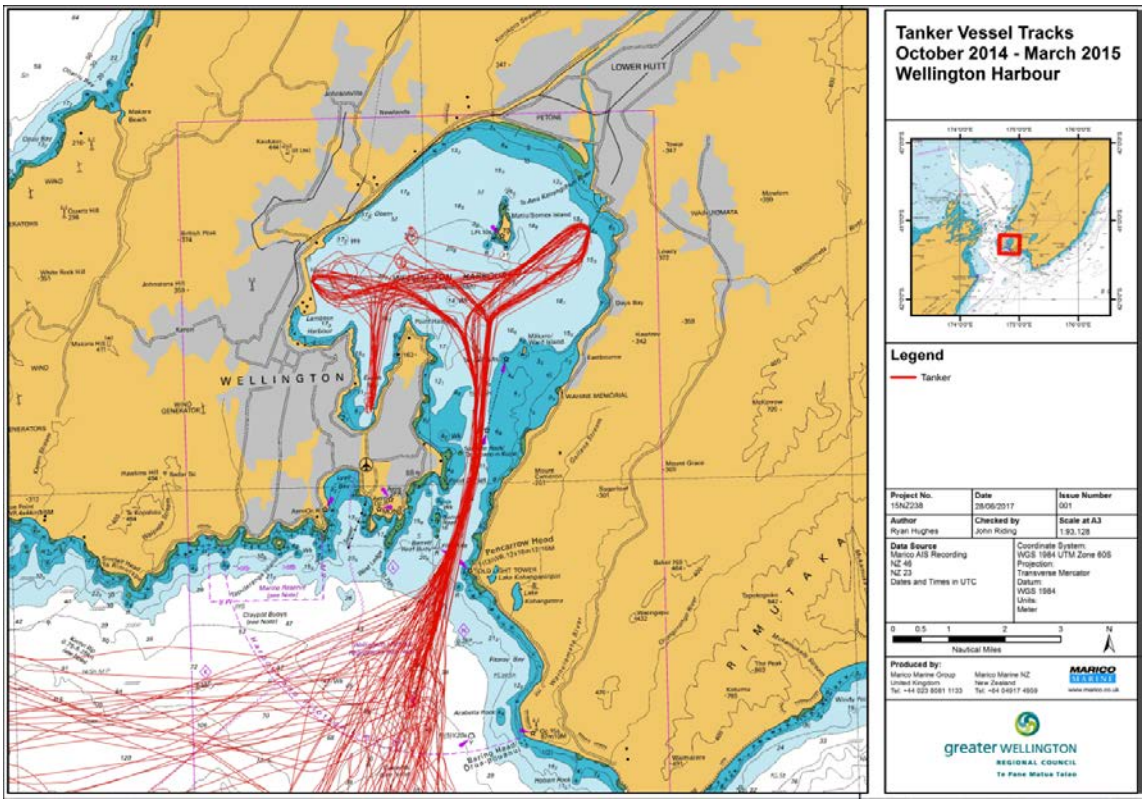


Figure 24 : Tanker Vessel Tracks

There are three locations within the harbour which can work tanker cargoes, Burnham Wharf (Evans Bay), Aotea Quay, and Seaview Terminal. The terminal at Aotea Quay handles diesel and light fuel oil; Evans Bay for avgas and the Seaview terminal handles petrol, diesel, and any chemicals – **Figure 25** shows a tanker alongside Seaview. Tankers, like other large vessels, are required to follow the recommended routes through the harbour, published on nautical charts, with their use proscribed by Wellington Regional Council navigation bylaws. The recommended routes are publicly available and found in both in the navigational bylaws and can be downloaded from the CentrePort Website[31]. The track plot from ships AIS transmissions shows that tankers do, on the whole, follow these to their respective terminals. Tankers using Wellington are mostly small in comparison with tankers trading

[31] http://www.centreport.co.nz/index.php/facilities-and-services/marine

internationally; the berths at Burnham and Seaview limit the size ships that call here. The majority of the cargo is light fuel oil, petrol, diesel and avgas. There are occasional visits by LPG gas carriers, however, these are for bunkers and do not work cargo. An example of the size of such vessels (taken from the October 2014 – March 2015 vessel data set) is "*Chembulk Wellington",* which at 8,270 Gross Tons (14,300 tonnes deadweight) and length 125 metres, is small by 2017 standards. Tankers of this size fit the Wellington terminals and berth infrastructure well.

However, much larger tankers have traded to Wellington. In mid-2008, the first of larger product tankers arrived at New Zealand ports. In May, 2008, *Torm Venture* (42,048GT, 228.6 metres length overall and built 2007) discharged at Seaview. This remains the largest trading tanker ever to have berthed at Wellington (2017). *Breezy Victoria* (40,964 GT, built 2007) was 228.0 metres in length, calling at Wellington in June 2008. Both were about 75,000 tonnes deadweight, much larger than the current 46,000 tonnes deadweight "standard" size tanker being used to transport oil products.

Figure 25 : Tanker Alongside Seaview Terminal – 36,168 GT 183m Length, 40m Beam

There is some evidence in the ship track records of tankers doing 360 degree turns when inbound in the harbour approaches, possibly waiting for pilot boarding. This suggests an important improvement has occurred since the 2006 risk record, where such vessels were proceeding inbound

on the leads and sometimes boarding a pilot after being committed to the entrance transit. Currently any approaching ship is requested to wait south of the pilot boarding grounds, for pilot advice for boarding.

4.8.1 TANKER TRAFFIC MOVEMENTS ANALYSIS

Tanker movement analysis has also used 2005 as the baseline, with sample years of 2012 and 2017 being analysed. **Figure 26** shows this in 3 separate images, with number of tanker calls and average Gross Tons, with percentage changes below. Tanker visits have varied with a fall during 2012, but by 2017, there is a marginal growth overall in the number of tanker visits of 5.4%. However, the size of tankers visiting (Gross Tons) has increased almost year on year, with an average increase of 2000 gross tons between 2005 and 2017. Although this is a marginal increase of 5.4%, reflecting international trends, there examples of larger vessels, such as *Stena Provence* at 36,168GT. It is clear that both visit numbers and the size of cargo parcels delivered have increased.

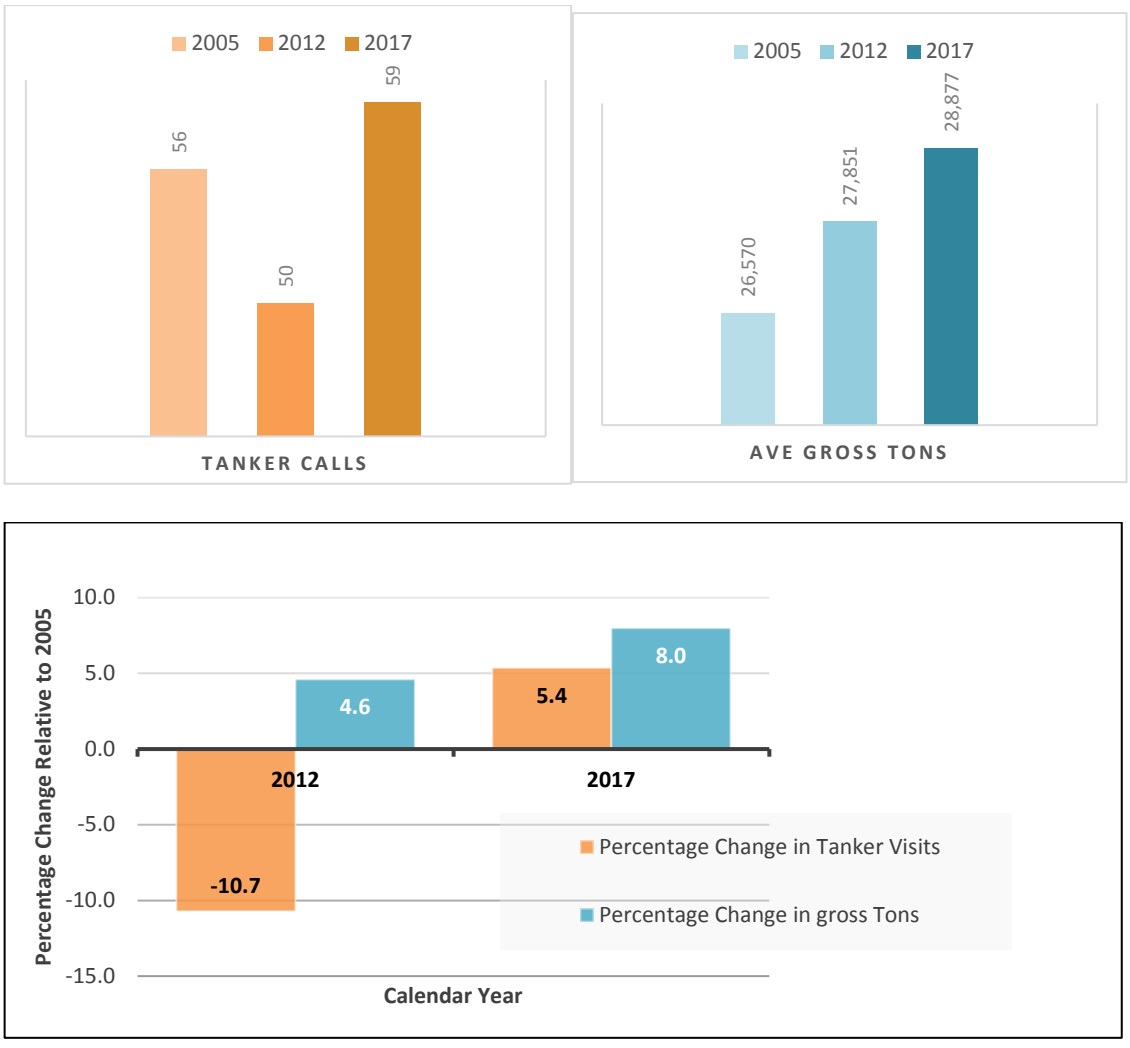


Figure 26: Changes in Tanker Traffic 2012 and 2017 Relative to 2005

4.9 CROSS HARBOUR FERRY ROUTES

4.9.1 CROSS HARBOUR FERRY MOVEMENTS

The harbour ferry service is part of the public transport network that connects the inner harbour area to Wellington destinations. A cross harbour ferry service has been operating within the Harbour for nearly 30 years, transporting passengers between Queens Wharf and Days Bay. Overall, it has a good safety record. This service has added at Matiu/Somes Island, Petone, Days Bay and Seatoun. The weekday and weekend schedule comprise 16 and 8 return cross harbour trips respectively. The main ferry jetty is located at Queens Wharf, Wellington with connections to Days Bay, Seatoun and Somes Island on a daily basis. A service to Petone was is added at weekends but is not currently used due to wharf damage. The service is weather dependant and cancellations occur on safety grounds, especially during the winter period. The routes of the harbour ferry are illustrated in **Figure 27** (not to scale).

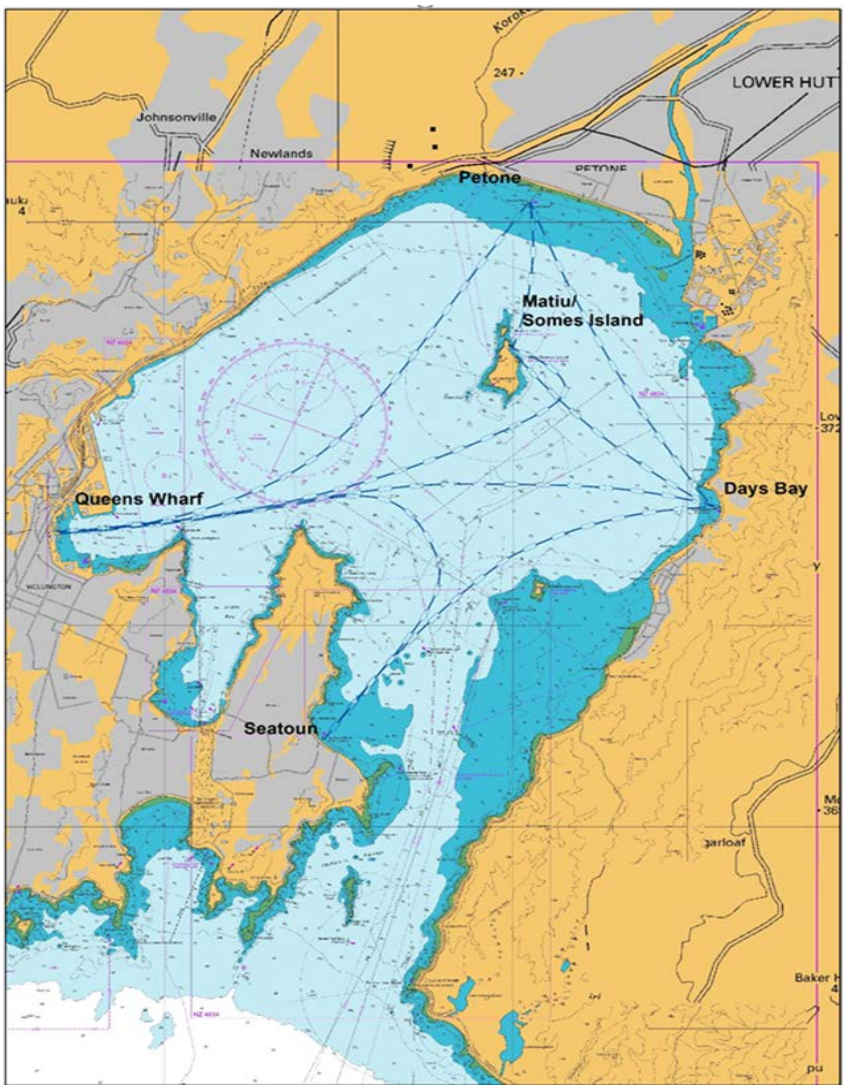


Figure 27: Chartlet Showing Cross Harbour Passenger Ferry Routes

Currently, the ferry service operates two catamarans. *City Cat* carries 91 passengers with service speed of about 20 knots. *Cobar Cat* has a capacity of 99 passengers, service speed 22 knots. Both vessels carry AIS transponders, allowing Beacon Hill to monitor the ferry's movements and helping large vessels to be aware of these relatively small craft.

The average annual capacity was reported to be in the order of 200,000 passengers, which is a significant increase since 2006. The harbour ferry crosses the harbour recommended routes in several locations, which is inevitable for a passenger service operating cross-harbour. Recommended routes are publicly available and found in both in the harbour navigational bylaws and can be downloaded from the CentrePort Website[32]. Some close quarters events have been reported by Cook Strait ferries in their transits in and out of the harbour, although what defines close quarters is unclear. The Harbour ferries do though frequently communicate via radio with larger vessels to manage potential conflicts and close quarters situations..

4.9.2 Cross Harbour Ferry Route Analysis

The tracks for all Harbour Ferries operating in Wellington Harbour are illustrated in **Figure 28,** below. The number of cross harbour transits by commuter ferries has risen significantly since the 2006 navigational risk assessment. The Seatoun transit link is firmly established and the cross harbour ferry routes have developed into an integrated part of the Wellington passenger transport system. The plot shows a mostly clear definition of routes, although when it comes to the main harbour basin, there is considerable traffic spread associated with harbour ferries.

[32] http://www.centreport.co.nz/index.php/facilities-and-services/marine

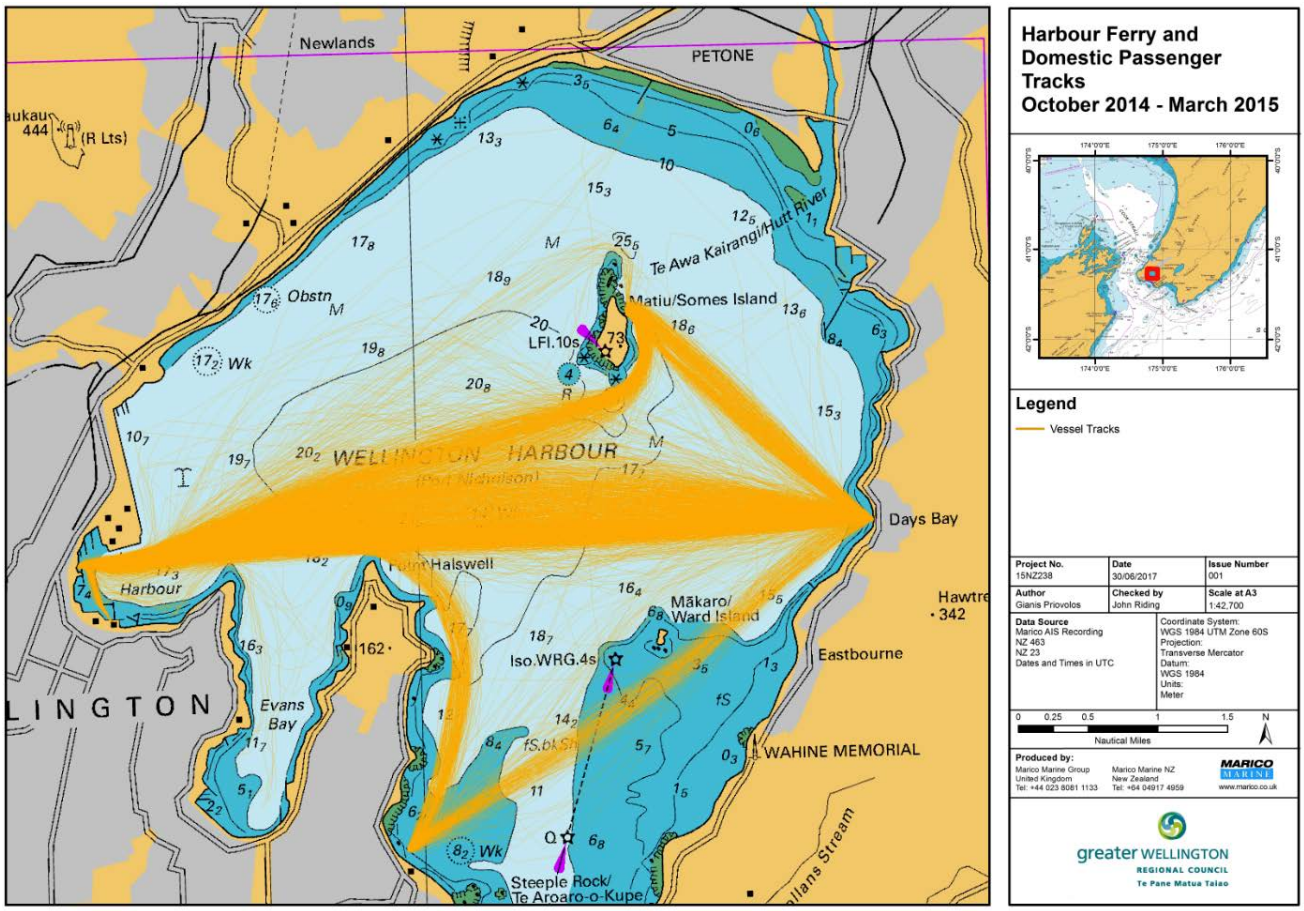


Figure 28 : Harbour Ferry Domestic Passenger Tracks

Reference has been made at **Section 3.2.7** (Area B – Incidents of Note), to a grounding incident at service speed affecting the cross harbour ferry service. It also refers to a 2011 heavy weather event that became the prompt for both of these vessel to have AIS transponders fitted.

4.10 COMMERCIAL FISHING VESSELS

Figure 29, illustrates the tracks of Commercial Fishing Vessels fitted with AIS transponders, transiting Wellington Harbour. Wellington has a small fleet of commercial fishing vessels based in Island Bay Evans Bay, Seaview Marina and the inner harbour wharves; which are not fitted with AIS transponders. Larger fishing vessels,. which are generally fitted with AIS transponders berth at Aotea Quay. Fishing in the Wellington Area occurs year-round, including along the Southern Coast and in the Cook Strait. The track records show that in 2017, larger fishing vessels are a small part of the overall harbour traffic, although it should be noted that the majority of the local vessels are not recorded.

In the past, there have been incidents involving fishing vessels. However, based on the falling number of incident or near-miss reports, risk associated with these vessels is decaying as the number operating out of Wellington reduces.

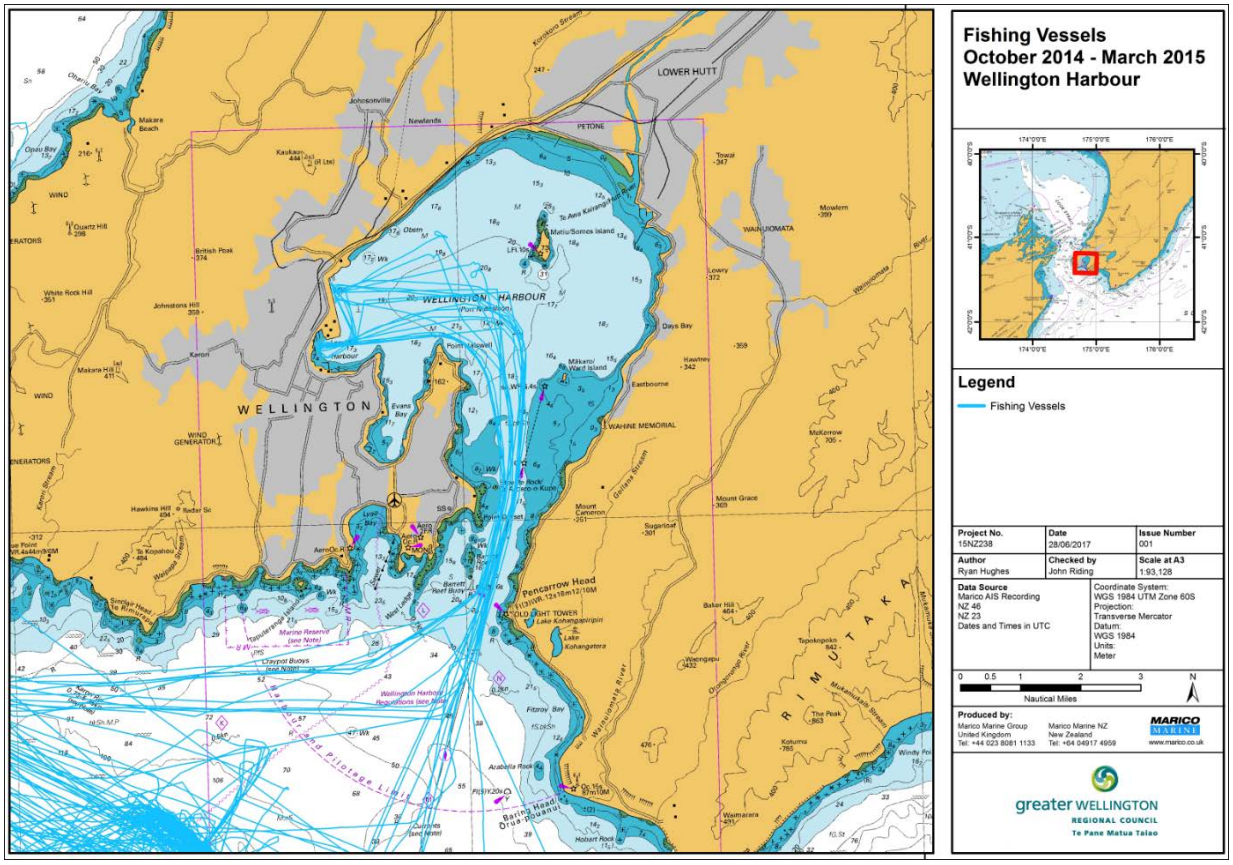


Figure 29 : Commercial Fishing Vessel Tracks

4.11 RECREATIONAL CRAFT

Recreational matters are included as a separate section, as many hazards within the harbour are related to recreational use. While some such hazards formed part of the 2006 risk assessment, recreational use in 2017 is very different to what it was in 2006. Wellington Harbour is home to many recreational activities, including:-

- Organized yacht racing from centreboard dinghies to keelers;
- Kayaking, both under hire and individual private owners;
- Cruising yachts and launches;
- Water-skiing and Personal Water Craft use;
- Rowing skiffs;
- Dragon boating and waka-ama;

- Windsurfing and kitesurfing;
- Recreational fishing;
- Diving, both from shore and boat;
- Swimming, including multi-sport events and training.

The majority of the coastline is accessible to the public by road and there are many launching ramps where trailer craft can be launched directly into Cook Strait or within the inner harbour areas. Several marinas cater for a resident population of larger yachts and launches, while small craft such as kayaks are easily launched from beaches around the coastline. Leisure activity is naturally highest between October and April, although many activities (e.g. rowing, kayaking, sailing and fishing) do carry on throughout the year.

4.11.1 WELLINGTON YACHT CLUBS

Yacht clubs are located in all harbour areas, except Area A. In general, centreboard yacht activity occurs away from the navigational tracks of shipping, except in Evans Bay where occasional tanker movements occur. In practice most tanker movements occur at night when centreboard yachts are not active.

The two clubs which cater for keeler yachts are located in Lambton Harbour (the Royal Port Nicholson Yacht Club (RPNYC)) and Seaview Marina (Lowry Bay Yacht Club). The Lowry Bay yacht club generally race in the northern and eastern side of the harbour[33]. Potential for conflict with large vessel movements is again mainly related to tankers, which are relatively low in frequency. RNPYC have more extensive courses which often start in Lambton Harbour and may extend to any part of the main harbour, including races to Island Bay which include transit of the entrance. Offshore races are also held throughout the season, which start from the harbour and either return to the harbour or finish outside Wellington harbour limits. Races are held on weeknights, often Wednesday evenings, and also weekends.

Yacht club policy for course setting is to minimize conflict with shipping, on the basis that avoiding conflict is better than a race area being constrained by regulation. All yacht clubs appear to have good liaison with the Harbour Master through the Harbour Rangers, and meetings have been held pre-season between the RPNYC and the GRWC Harbours Department, Police Maritime Unit and CentrePort to discuss safety issues.

[33] **Lowry Bay advised confining their race courses to a line approximately east of Matiu/Somes and Makaro/Ward islands, where it is feasible to do this.**

As part of attempts to minimize yacht and shipping conflict, the club policy is for the Race Officer to advise Beacon Hill of the course in use and planned start time. Thereafter the Race Officer will monitor the port working VHF channels and time the start to avoid shipping conflict. In practice it is reported that most Beacon Hill Communications Officers will update the Race Officer with delays or amendments to shipping, although this is not uniform practice.

It is inevitable that, although the race may start without conflict, racing yachts are still likely to cross Recommended Tracks at some point throughout the duration of the race, with the potential for conflict. The clubs are positive in working with GWRC if an incident occurs. They will identify craft involved and provide information, but will also police their own activities, with infringing craft often penalised in terms of race results by a sailing club's sailing committee. This is a sign of a mature and responsible race management system.

4.11.2 Wellington Rowing Clubs

Rowing is still strong in the harbour, although like all clubs numbers rise and fall. Stakeholder feedback does suggest a rise in rowing activity in the 10 years since the last harbour risk assessment. Wellington has had a rowing club since formation in 1885. Rowing is based at two locations at Petone and in Lambton Harbour, taking place throughout the year. In general, rowing skiffs are accompanied by a support boat, although they do not carry VHF radios. They are thus outside of the Wellington harbour Radio normal traffic communication system.

4.11.3 Special Events - Recreational

Organisations seeking to hold special events generally inform the Harbour Master via the Special Events form. This is used for events like a yachting regatta, large swimming event, dragon boat racing and promotional activities. If the event requires an uplifting of the bylaws or exclusive use of a part of the harbour organisers apply under Bylaw 3.11 to obtain Harbour Master agreement for this to happen. This is usually for race events for powered vessels, e.g., offshore powerboats, water-skiing, etc. A large number of special events are held annually, although relatively few require an uplifting of Bylaw requirements. Lambton Harbour is the most popular location as it provides a good vantage point for spectators ashore; this can be challenging in an already busy part of the harbour. Liaison between the event organizer and the harbour management system occurs, and information such as location, duration, number and type of craft involved, requirement for a temporary speed uplifting or exclusion zones are transmitted to navigational users generally. Some events attract large flotillas of spectator craft, such as major yacht races and the Police Maritime Unit assisted by local coastguard provide vessels to manage observers. Annual fireworks displays are organised from moored barges

in Oriental Bay. Leisure craft traffic can be heavy at these times, but the events have a good safety record and are well organised.

4.11.4 Recreational Craft Track Records

The tracks for recreational vessels, fitted with AIS transponders, that use the Wellington Harbour waters are illustrated in **Figure 30**. As such, it should be noted that a majority of recreational craft are not recorded and radar coverage does not extend into Lambton harbour. Recreational vessels and craft make up an increasing part of marine traffic in Wellington Harbour, few are fitted with AIS, although this is slowly increasing. Such use is not as dense as Marlborough Sounds or some of the north island harbours in the North, however, Wellington does represent an estimated 12% of NZ recreational vessel owners based within it. Recreational vessels may berth within the Harbour at Chaffer's (Lambton Harbour), Evans Bay and Seaview marinas.

Small vessels generally remain within harbour confines, while larger recreational vessels capable of transiting Cook Strait may weather the trip to the South Island. The South Coast is frequented by recreational craft for fishing and diving, which appears to be one of the most popular maritime recreational activities in the Greater Wellington area.

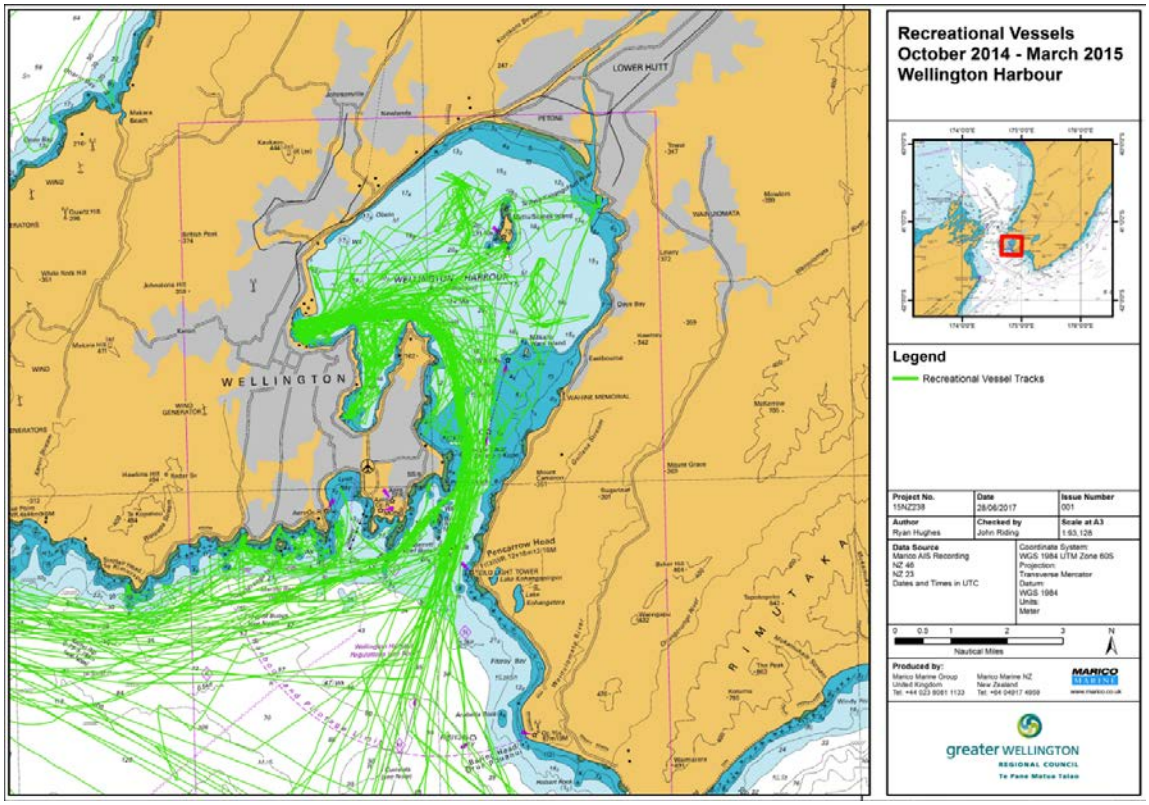


Figure 30 : Recreational Vessel Tracks (AIS transponder fitted)

4.11.5 RECREATIONAL INCIDENTS

The high energy wind climate and resulting development of steep waters have been contributing factors in a number of fatalities over the years. Despite observations that general leisure use has increased by around 8 times compared with 30 years ago, the number of fatalities as a proportion may be reducing. Leisure users in Wellington have been required to carry lifejackets for a number of years and evidence is that they are used.

Relatively few incidents involving commercial movements and leisure craft are reported. Changing harbour use, both commercial and recreational, increased education and awareness by recreational skippers and differing levels of tolerance from commercial Masters mean levels of complaints, especially around close quarters situations, tend to fluctuate over time. Although commercial masters

The physical lay-out of the Harbour does help, where generally vessels can sight one another with time to take avoiding action or navigate appropriately. Most recreational activity takes place during daylight hours, which also assists. The low frequency of incidents is also likely to be due to the GWRC harbours team, which both educates users and enforces Bylaws and other regulations. However, it should be noted that there has been a stronger adherence to the recommended routes by commercial shipping, which provides the recreational user with some predictability of where they may encounter large vessels transiting.

The Wellington Police Maritime Unit attend the majority of leisure related incidents. Engine failure or lack of fuel is a reported cause in around a third of incidents. Failure to obtain a weather forecast and suitability of the craft for the conditions are also referenced. Sailing craft and power driven craft appear to rank equally in terms of craft assisted.

Close quarter situations between racing yachts and ferries or large vessels feature less often than previously; it is typically racing keelers involved in these incidents. A collision was recorded over 20 years ago, when the harbour ferry encountered an unlit dinghy, which passed between the ferry hulls at slow speed. Since then several close quarters incidents have been reported between passenger RoRo ferries and recreational craft. The cross harbour ferry also reports regular conflict with swimmers and occasionally rowing skiffs near the Days Bay and Queens wharf berths.

4.12 OTHER VESSELS

The tracks of vessels listed as “Other” are illustrated in **Figure 31.** This includes: pilot vessels, law enforcement vessels, offshore support vessels, offshore tug supply vessels, port tenders, research/survey vessels, search and rescue vessels, service ships, towing vessels, diving operations

vessels and workboats. These comprise the vessel traffic not included in previous subsections, and have been amalgamated into a single vessel group. The extents of the pilot vessel deployment for boarding vessels in the harbour approaches is evident in this traffic plot.

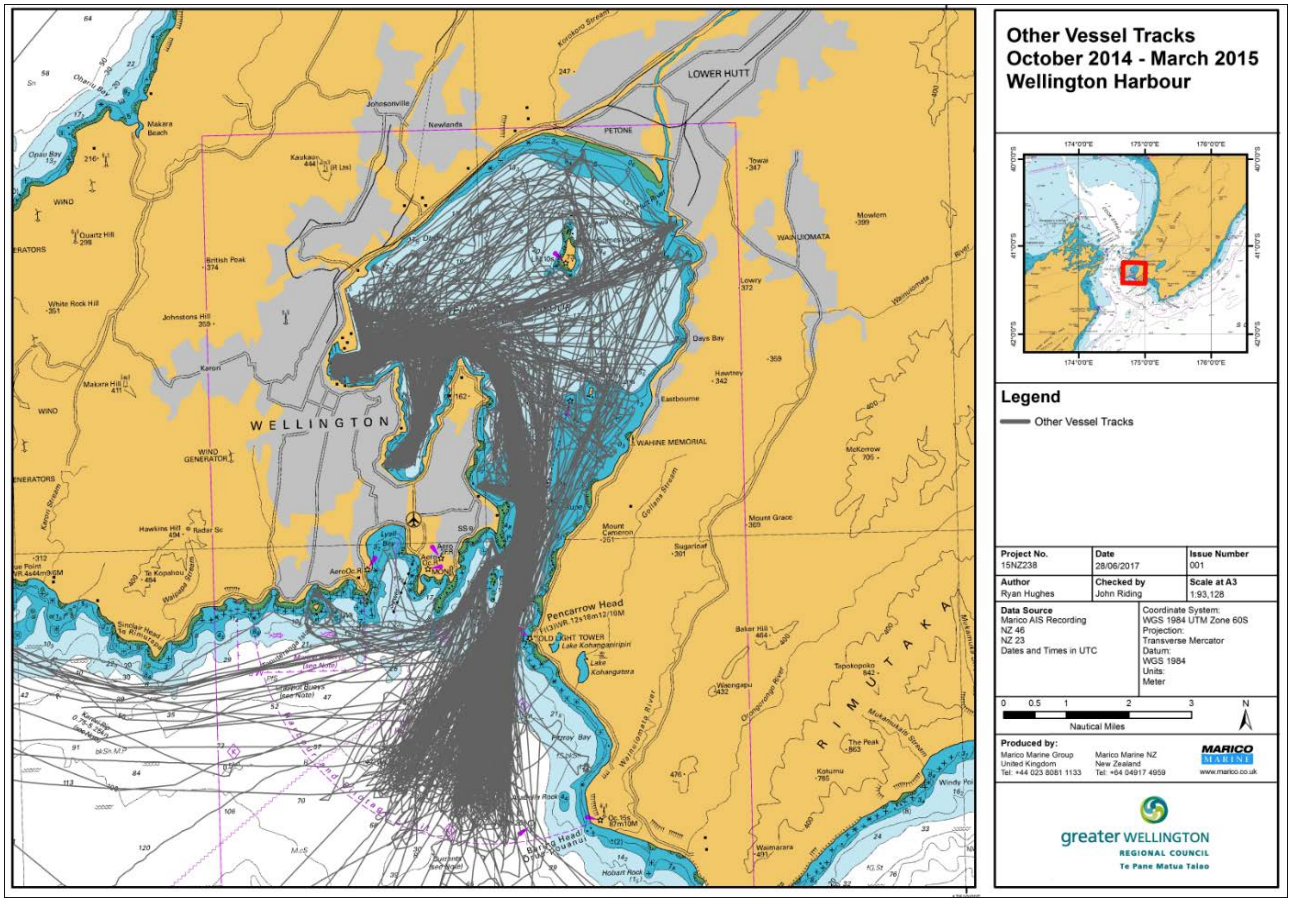


Figure 31 : "Other" Vessel Tracks

4.13 TRAFFIC DENSITY

Figure 32 illustrates the shipping traffic routes through Wellington Harbour by track density. The plot highlights where routes lie by using a density count of the number of vessels overall passing through a point location. It should be noted that vessel traffic in the entrance has to remain in the designated channel and traffic also in general follows the recommended harbour route well. The dominant vessel type is the Cook Strait passenger RoRos with these providing the highest number of inbound and outbound runs on a daily, monthly or annual basis. However, the rising importance of the cross-harbour ferry is also apparent, as are these services' points of crossing the harbour recommended routes, or joining other established transits. Ferry routes to and from the central harbour to Somes Island, Days Bay and Seatoun terminals (jetties) are clear. There is a line of increased density running from the harbour entrance then inshore and to port of the recommended

routes. This is almost entirely the track record made by the CentrePort Pilot Launch, which steers well clear of headlands.

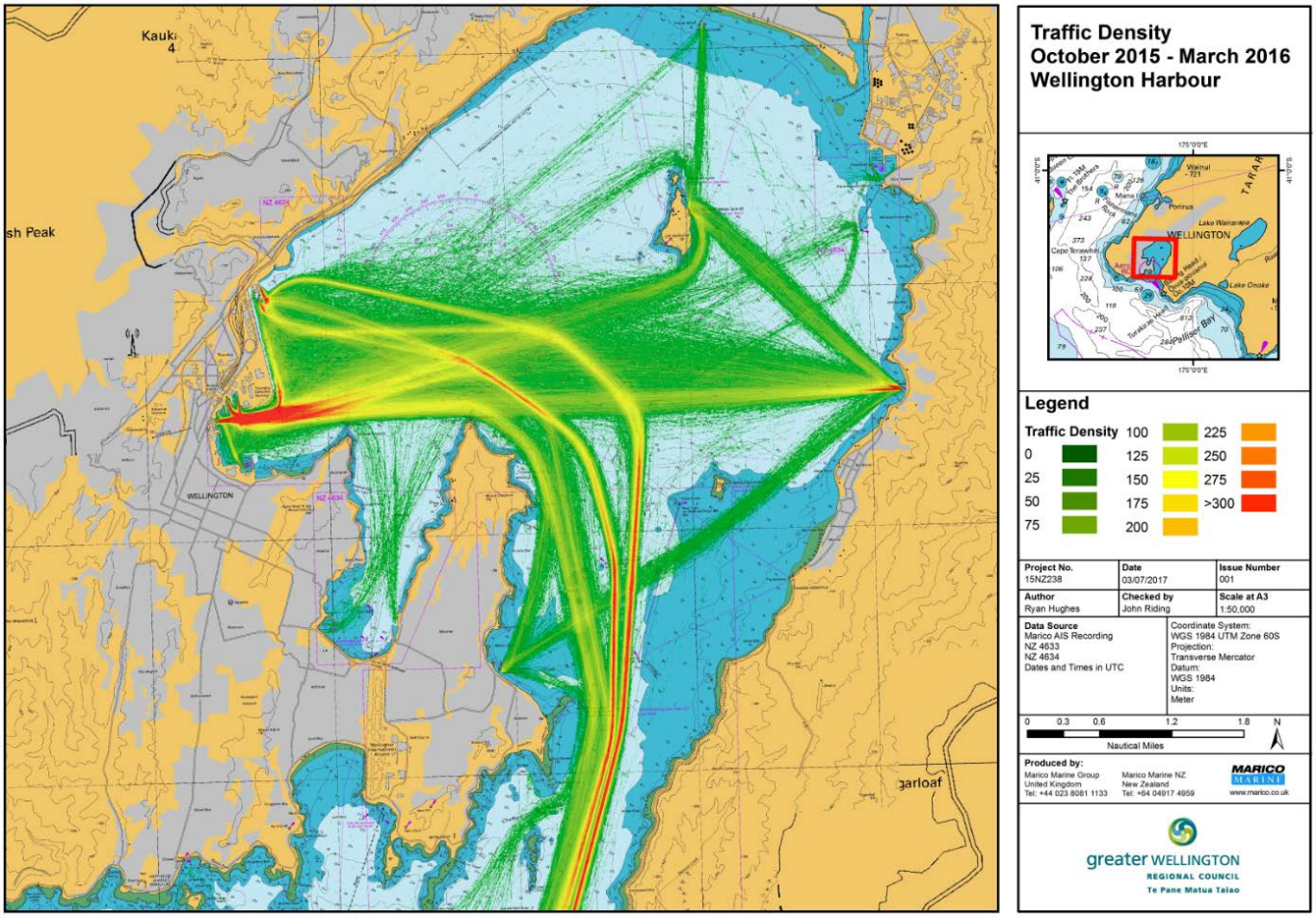


Figure 32: Traffic Density Plot - Wellington Harbour

4.14 HARBOUR SPEED ANALYSIS

Wellington Harbour is large and there is no overall speed limit within harbour limits, which is logical. Bylaw 3.2 and its sibling rules do though limit speed within 50m of another vessel or where there is a swimmer or within 200m of shore or fixed structure. Collision risk, like any risk is made up of component of probability and consequence of outcome. Consequence of outcome for a collision is, apart from those with a very fine angle of blow, speed related.

Figure 33 presents speed analysis for Wellington Harbour. The passenger RoRo ferries provide the highest harbour speeds, especially outbound; This is understandable, given the need to maintain a passenger schedule. Tankers generally proceed at the lowest harbour speeds. The highest speed records are provided by pilot vessel operations. The new pilot launch (2017) has an operating speed of 25 knots so will also feature in the future at a higher speed.

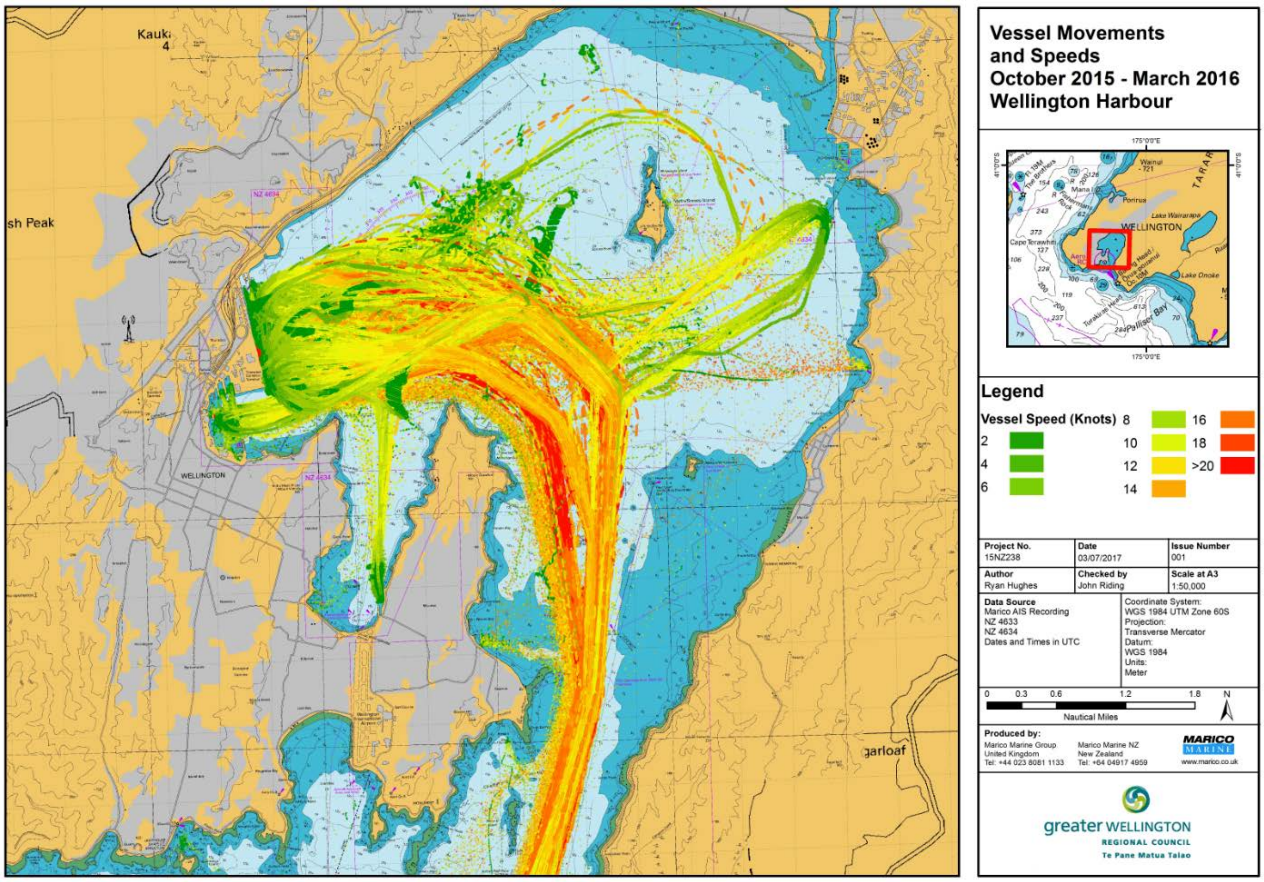


Figure 33 : Plot of Vessel Speed Variation in Wellington Harbour

4.15 CONCLUSIONS – TRAFFIC DATA RECORDS ANALYSIS

1. There has been a comprehensive analysis of Wellington Harbour traffic undertaken in support of this risk assessment.
2. The plots taken from track records clearly show the use of the Wellington Harbour waterways and the key crossing points within the harbour.
3. The traffic of Wellington harbour has changed substantially since the 2006 risk assessment.
4. Wellington Harbour has an increasing volume of traffic in its waters overall. However, the increase in numbers is represented mostly by new trades; cruise vessels; increased cross-harbour ferry transits; and types of recreational users.
5. Vessel movements through Wellington show a decrease over time, which could be interpreted as falling trade. However, the Gross Tons and Length Overall of vessels visiting Wellington have consistently increased, reflecting global industry trends. The average TEU capacity of container vessels has also increased. This shows that the harbour is receiving larger vessels with increasing cargo or passenger capacities. Thus, although visiting vessel movements have decreased, cargo throughput at the port has been increasing as vessels increased in size.

6. There has been an increase in the size of commercial vessels in general, coupled with marginal fall in the number of such harbour transits. Cargo levels are up overall if the effects of the 2016 Kaikoura Earthquake are discounted.
7. A similar situation exists with Cook Strait RoRo Ferry movements, which have gradually decreased in number since the last risk assessment, but the ferries themselves have increased in size, with an associated increase in available passenger capacity Cook Strait route.
8. The Cross-Harbour ferry services have become part of an integrated transport network, with passenger volumes increasing significantly since the 2006 harbour risk assessment. Although perhaps inevitable in a crossing situation, stakeholder feedback from RoRo ferry masters does suggest events do occur, but formal reports to GWRC equally do not appear to in the records.
9. Tankers show tracks which route tankers to the specialist terminals handling their cargoes.
10. Wellington Harbour mitigates some navigational hazards by the Bylaw requirement for large vessels to transit via recommended routes. Plots constructed using data from October 2014 – March 2015 (i.e. Prior to the Kaikoura earthquake) indicate that vessels do comply well with these routes.
11. The plots confirm the dominance of the Cook Strait RoRo ferry trades to Wellington Harbour. This is unlikely to change in the foreseeable future. These vessels show a good adherence to the harbour recommended routes in general.
12. The rise in importance of Cruise vessels is very apparent, with their transits universally taking a route direct to the designated berths for passenger disembarkation. These vessels are piloted and show good adherence to the harbour recommended routes.

5 RISK RESULTS

5.1 INTRODUCTION

The risk analysis and results are online in the Hazman II risk management package and only a summary can be presented here. A total of 80 hazards were either newly identified or modified to reflect the changed status of navigation in Wellington Harbour. Some hazards from the 2006 risk assessment were combined where it was logical. For example, the berthing contact damage hazards associated with Cook Strait interisland services were previously separated by the berths they operated from (in 2006, there remained a high speed craft service in operation). A single hazard represents this in 2017, which is partly because much better records of incidents exist.

As introduced in the methodology (**Section 2.1.1**), navigational risk is assessed in three ways within the Hazman II software package:-

- **Baseline Risk**: The calculated risk score at the time of the risk assessment. This is the risk that is associated with the package of risk controls in place. Essentially the risk of today.
- **Inherent Risk**: The baseline risk score without any risk controls applied. The Inherent Risk can be calculated once the risk mitigation effectiveness of the present risk controls are assessed. Essentially, Inherent Risk is the risk to navigation in the harbour if no controls were in place.
- **Residual Risk**: The baseline risk score with risk mitigation measures in place. Residual risk will have further decay by the application of improvements to existing risk management systems, or the introduction of new risk control measures. Options for such are included in this report.

5.2 INCIDENT RATE ANALYSIS

Since the 2006 Wellington Harbour risk assessment, there has been a dramatic improvement in the recording of incidents. This has been facilitated by the introduction of Hazman II, where they form a reliable and permanent record – this risk assessment has completed the incident record by adding incidents from Maritime New Zealand data. Incidents appear across all areas of the harbour and it is the total record over the years that assists in making the risk assessment accurate. These help to inform not just the risk assessment, but also the further development of the existing navigational safety management system (SMS). Of particular note are close quarters incidents involving vessels carrying passengers and the repeating evidence of vessels electronic navigational systems failing or being incorrectly set up.

Incident records are also critical to the accurate and independent assessment of harbour risk. In this risk assessment, stakeholder feedback was used to develop hazards and then undertake preliminary

risk scoring. The finalisation of risk scoring was more directly associated with the pool of incident data.

The GWRC harbour team have been populating the Hazman II incident database since the introduction of an online incident module. For the harbour risk assessment process, a further historic record was obtained from Maritime New Zealand, which covered the period for 2009 to 2015. All of these records were added into the HAZMAN II incident database for Wellington. For each incident, further data useful to the risk assessment was added, such as a correct incident category. The location of each incident was agreed with the Harbours Department and linked to the same harbour-area breakdown to that of the risk assessment. This allowed incident rates per area of the harbour to be assessed and considered alongside the activity in the Harbour. **Table 10** summarises hazards and incidents by their respective accident categories used in the harbour risk assessment. By incident rate, the prominent Wellington Harbour category is collision (close quarters) followed records of personal injury. Equipment failure is often recorded at a high rate in the marine environment and Wellington is no different to many other harbours in this respect.

Incident Category	Hazard Reference (Hazman II)	Linked Incident Reference Number (Hazman II)	Incident Volume
Collision (Including near miss and close quarters reports)	15, 16, 17, 18, 20, 21, 23, 28, 34, 83	6, 17, 19, 40, 41, 44, 52, 56, 64, 68, 76, 78, 82, 83, 96, 111, 116, 117, 131, 148, 153, 160, 163, 164, 164, 168, 177, 183, 184, 194, 41, 44, 52, 153, 165, 168, 177, 183	38
Contact Berthing	46, 47, 48, 78	14, 22, 36, 37, 47, 83, 120, 121, 141, 146	10
Contact Navigation	19	53, 176	2
Equipment Failure	79	9, 11, 17, 24, 26, 45, 59, 63, 70, 84, 89, 92, 119, 132, 152, 157, 158, 161	18
Fire/Explosion	67, 70	28, 79, 104, 122	4
Foundering	57, 59	33	1
Grounding	1, 5, 9, 76	15, 72	2
Mooring Breakout	53, 54, 81	62, 93, 95, 178	4
Personal Injury	8, 63, 64	13, 18, 42, 65, 66, 75, 77, 81, 94, 103, 105, 108, 136, 144, 175, 181	16

Table 10 : Number of Incidents and their link to Hazard Return Period

5.3 RANKED HAZARD LIST

The hazard list is presented in full at **Annex B**. This list, which comprises 80 key navigational risks for Wellington Harbour, is ranked by residual risk score. Ranking this way takes account of the risk mitigation strategies already applied.

The ALARP region is defined on a weighted average basis as showing a rating of 4 and 5 (out of 10), using the criteria in **Section 2.3**. However, a number of risks in the top 30 still have notable scores in individual risk categories. The difference between the level of inherent risk and residual risk is important for any one hazard, as it shows the importance of the risk management measures in managing that risk (Inherent risk is the risk level assuming no risk reduction). Where the risk reduction is large, it means that risk management systems are more important and need to be performing well. Thus, the recoding of baseline, residual and inherent are measures that considerably assist in justifying the development of additional risk control.

In many cases the hazards score highly due to the potential for injury and loss of life, should a risk be realised. Following risk assessment scoring policy, the Most Likely risks have been linked to the most likely incident records and scored optimistically (i.e. most likely consequences have often been scored with minor outcomes). This is because a large number of near misses (near-hits) are recorded in the data and near misses by their nature do not result in damage, but are key to understanding risk. However, this can misrepresent the frequency of incident reports where a light contact occurred.

5.3.1 TOP RISK RANKED HAZARDS – WELLINGTON HARBOUR

Table 11, presents the upper half of the Navigational Risk ranking for Wellington Harbour, presenting 38 hazards in ranked order. The table presents ranking by residual risk (i.e., the risk after mitigation is applied), but also records Inherent Risk (the risk assuming no risk control) and Baseline Risk (the harbour risk of 2017), based on the risk mitigation systems in place and the reality of the frequency of incidents. It can be seen that with risk mitigation in place, all hazards below 5.0 clearly enter the ALARP criteria. However, this relies on the risk control in place working as planned, which implies a review of the relevant risk control systems to ensure they are fit for purpose.

Table 11 includes a re-assessment of risks associated with pilot boarding operations, following the delivery of the new Wellington Pilot boat. As such, it presents risk is slightly different ranking order than the raw ranked hazard list (**Annex B**).

Rank	Hazard Ref.	Accident Category	Hazard Title	Residual Risk	Inherent Risk	Baseline Risk
1	5	Grounding	RoRo Ferry Grounding, Entrance	5.58	6.46	6.03
2	20	Collision	RoRo Ferry and large vessel in Conflict (Within Harbour Waters)	5.01	5.92	5.77
3	46	Contact Berthing	Contact Berthing, Pilot Exempt Vessel (RoRo Ferry).	4.9	5.71	5.59
4	28	Collision	RoRo Ferry and Tanker in conflict within harbour.	4.88	5.83	5.5
5	83	Collision	Rowing Skiff and Swimmer Collision	4.76	4.95	4.9
6	78	Contact Berthing	Tanker Contact Berthing - Seaview Jetty	4.61	5.33	5.27
7	1	Grounding	Large vessel Grounding in Harbour Entrance/ Approach	4.59	5.44	5.26
8	70	Fire/Explosion	Fire on RoRo Ferry Within Harbour Limits	4.54	4.9	4.84
9	19	Collision	Pilot Launch and Vessel in Heavy Landing During Transfer Operations	4.46	5.34	5.16
10	79	Equipment Failure	Personnel Injury during Life Boat Deployment	4.45	4.47	4.45
11	81	Mooring Breakout	Mooring Breakout (Seaview Jetty)	4.43	5.14	4.94
12	76	Grounding	Deep Draught Vessel Grounding (greater than 9m draught)	4.42	5.04	4.94
14	18	Collision	RoRo Ferry and Large Vessel Conflict, Harbour Approaches	4.35	5.44	5.28
15	21	Collision	RoRo Ferry and RoRo Ferry in Conflict	4.3	5	4.78
16	67	Fire/Explosion	Fire On Small Passenger Vessel	4.28	4.66	4.61
17	15	Collision	RoRo Ferry and Large or Deep Draught Vessel Collision	4.27	5.14	5.05
18	59	Foundering	Recreational Craft Foundering	4.2	4.56	4.56
19	64	Personal Injury	Personal Injury, Pilot Operations, Outer Boarding Areas	4.18	4.71	4.71
20	23	Collision	Harbour Ferry in Conflict with Larger Vessel	4.14	4.92	4.89
21	14	Grounding	Dragging Anchor - Main Harbour Area	4.13	4.89	4.19
22	34	Collision	Rowing skiff and vessel in conflict	4.11	4.43	4.4
23	57	Foundering	Fishing Vessel Foundering	4.1	4.19	4.17

Rank	Hazard Ref.	Accident Category	Hazard Title	Residual Risk	Inherent Risk	Baseline Risk
24	53	Mooring Breakout	Mooring Breakout - Finger Berth	4.09	4.47	4.43
25	82	Mooring Failure	RoRo Ferry in mooring failure	4.09	4.33	4.09
26	69	Fire/Explosion	Fire -Tanker operations	4.08	4.2	4.08
27	54	Mooring Breakout	Mooring Breakout (Main Terminals)	4.06	4.67	4.61
28	65	Personal Injury	Personal Injury, Pilot Operations at Inner Boarding	3.98	4.11	3.98
29	41	Contact Navigation	Contact with vessels at anchor, in Harbour	3.96	4.07	3.96
30	43	Contact Berthing	Tanker Contact Berthing	3.96	4.2	3.96
31	17	Collision	RoRo Ferry / Large Vessel and Fishing Vessel Conflict.	3.87	4.8	4.61
32	84	Fire/Explosion	Fire on a Cruise Vessel	3.87	4.09	3.87
33	11	Grounding	Tanker Grounding Harbour (Evans Bay)	3.84	3.84	3.84
34	48	Contact Berthing	Contact with Container Crane	3.82	4.28	4.24
35	47	Contact Berthing	Vessel in Contact Berthing - Aotea Quay	3.79	4.65	4.63
36	24	Collision	Large Vessel or RoRo Ferry and Naval Vessel in Conflict	3.77	3.82	3.77
37	33	Collision	Small Commercial Vessel /RoRo Ferry in Conflict	3.74	3.82	3.74
38	3	Grounding	Small Fishing Vessel Grounding, Approaches	3.74	3.74	3.74

Table 11 : Top Ranked Risks (38) – Wellington Harbour

Wellington presents an interesting but demanding risk profile, with one risk, passenger RoRo Grounding at the entrance, remaining on the borderline of what has been defined as “ALARP” in the harbour. This is partly because of the history of incidents, partly because the Cook Strait RoRo ferry services represent the most significant volume of movements transiting Wellington harbour waters and partly because of a number of ongoing incidents affecting RoRo passenger vessels in the harbour jurisdiction. Some of these are the results of traffic conflict reports.

Those risks with a residual score above 5.0 need review and closer monitoring by the NSMS system. There are also a number of risks in general, lying within the ALARP region, that need to be reviewed,

because of their inherent risk or associated high consequence of outcome. NSMS review ensures the risk control system provides the necessary risk reduction.

The importance of the Hazard of Grounding at the entrance to Wellington Harbour remains clear.

5.3.2 Rising and Falling Risks

A table of rising and falling risks is presented at **Annex C,** which presents a comparison between the risks in 2006 and those of 2016/2017. This table also highlights new hazards introduced into the data set, although this doesn't show that almost all hazards have been changed in some way to reflect the harbour use of 2016-17.

In summary :-

- The number one ranked hazard of grounding at the harbour entrance has decayed in risk quantum in the 10 years since the 2006 harbour risk assessment. As the science of harbour risk assessment has developed, it has taken account of the effect of risk mitigation by risk controls. The comparison is one of comparing the single risk numbers of 2006 with the inherent risk number of 2017. In the case of a passenger RoRo grounding, due consideration has been given to improvements in passage planning and Bridge Resource Management (BRM) that authors have reviewed, whist transiting onboard RoRo ferries. Although it remains at the top ranking its lead over other risks has diminished. This particular risk is analysed further in **Section 5.5.4**.
- The potential for other large vessels to ground in the entrance remains in the top ten rankings (rank no.7). This is still significant, but accurately reflects the rate of incidents. There have been at least one important near miss grounding at Wellington in recent years (see **Section 3.1.5/6**).
- The largest rise in risk ranking from **Annex D,** was hazard number 19, which is the risk of the pilot launch getting into difficulties whilst boarding a vessel in the harbour approaches. In the draft risk assessment, this had risen from Rank 66 in 2006 to Rank 2 in 2017. It is dealt with specifically in **Section 5.7** as CentrePort has taken delivery of a new and larger pilot boat. **Section 5.7** considers the 2017 risk result before this delivery occurred and the result presented in this risk assessment. Reasoning for the increase prior to the new delivery is twofold and supported by the incident record.
    1. Pilots board vessels in the entrance further out than they did in 2006, thus it is more difficult for a vessel to make a good lee for boarding.
    2. Pilot boat damage and downtime has required the use of a back-up craft, which is more susceptible to incidents.
- The second largest rise in risk is associated with small passenger operations within the harbour – i.e. cross harbour ferries. Grounding risk has risen from Rank 71 in 2006 to Rank 6 in 2017. This is an interesting result which is in part reflecting a significant increase in the volume of the cross-harbour ferry movements, adding additional routes and in part reflecting incident records and traffic analysis (see **Section 3.2.7** and **Section 6** analysis).

- Close quarters conflict (i.e. Collision hazards) between passenger RoRos and other large vessels rank 3 and 5 respectively. Collision risk remains important in Wellington Harbour generally. Both hazards have risen in rank, although incidents involving tankers and roro vessels have risen considerably (Rank 15 in 2006; rank 5 in 2017). This is simply because there have been some important close quarter incident events involving tankers and passenger RoRos, vessel types that any Harbour Authority wishes to keep apart. Incident events of particular relevance are at **Section 3.1.6 and 3.3.8)**
- A third risk of ongoing importance is that of berthing contact by passenger RoRo ferries, Hazard number 9. Although this has only risen one place in ranking, the hazard in 2017 reflects Contact berthing incidents across both passenger RoRo terminals. There have been as number of incidents involving hull breaches, one of which resulted in damage to another vessel (albeit laid up).
- A rising risk of critical importance to commercial operations at the Port of Wellington is that associated with Seismic events. A seismic risk is recorded in the navigational risk database, which has risen 10 places in ranking. Navigational risk may be underscored, when Tsunami events such as occurred in Japan are considered and a rising harbour floor can also make navigation by deep draught vessels uncertain. However, the damage to port business from the 2016 Kaikoura event is much more significant than the risk effect to Navigation. This is referenced in **Section 1.7** and **Section 6**.

5.4 RANKED GROUNDING RISKS DISCUSSION – WELLINGTON HARBOUR

Table 12, below provides a summary of the top grounding risk results and how the present risk of Grounding affects the top of the harbour risk profile.

The risk of grounding in the Wellington Harbour approaches or entrance remains one of the key risks to harbour navigation and small passenger vessel operations have risen in risk significance. Both are discussed further in the Gap Analysis, **Section 6**. Grounding risk remains at the upper end of the ALARP region and a category that the SMS system needs to consider first.

Rank	Hazard Ref.	Accident Category	Hazard Title	Residual Risk	Inherent Risk	Baseline Risk
1	5	Grounding	RoRo Ferry Grounding, Entrance	5.58	6.46	6.03
7	1	Grounding	Large vessel Grounding in Harbour Entrance/ Approach	4.59	5.44	5.26
12	76	Grounding	Deep Draught Vessel Grounding (greater than 9m draught)	4.42	5.04	4.94
20	14	Grounding	Dragging Anchor - Main Harbour Area	4.13	4.89	4.19
32	11	Grounding	Tanker Grounding Harbour (Evans Bay)	3.84	3.84	3.84
37	3	Grounding	Small Fishing Vessel Grounding, Approaches	3.74	3.74	3.74
42	2	Grounding	Foreign flagged FV less than 500GT Grounding, approaches	3.6	3.97	3.93
43	6	Grounding	Tug and tow grounding, Entrance	3.53	3.53	3.53
49	7	Grounding	Grounding - High Windage Vessel - Approaches	3.36	3.36	3.36
58	9	Grounding	Harbour Craft (Commercial Service) Grounding	2.89	4.6	4.49
59	12	Grounding	Small Passenger Vessel Grounding	2.85	5.01	4.77
64	10	Grounding	Grounding High Windage Vessel	2.74	2.74	2.74
70	4	Grounding	Leisure Craft Grounding, Approaches / Entrance	2.52	2.52	2.52
72	13	Grounding	Leisure Craft Grounding	2.36	2.38	2.37

Table 12 : Ranked Grounding Risks

5.5 INDIVIDUAL RISK REPORTS - GROUNDING

Some of the highlighted grounding risks are explored further in this section, together with the recorded risk control. Grounding risk remains important overall to Wellington and risk score overall is driven by ongoing incidents of note.

5.5.1 GROUNDING OF PASSENGER RORO – ENTRANCE

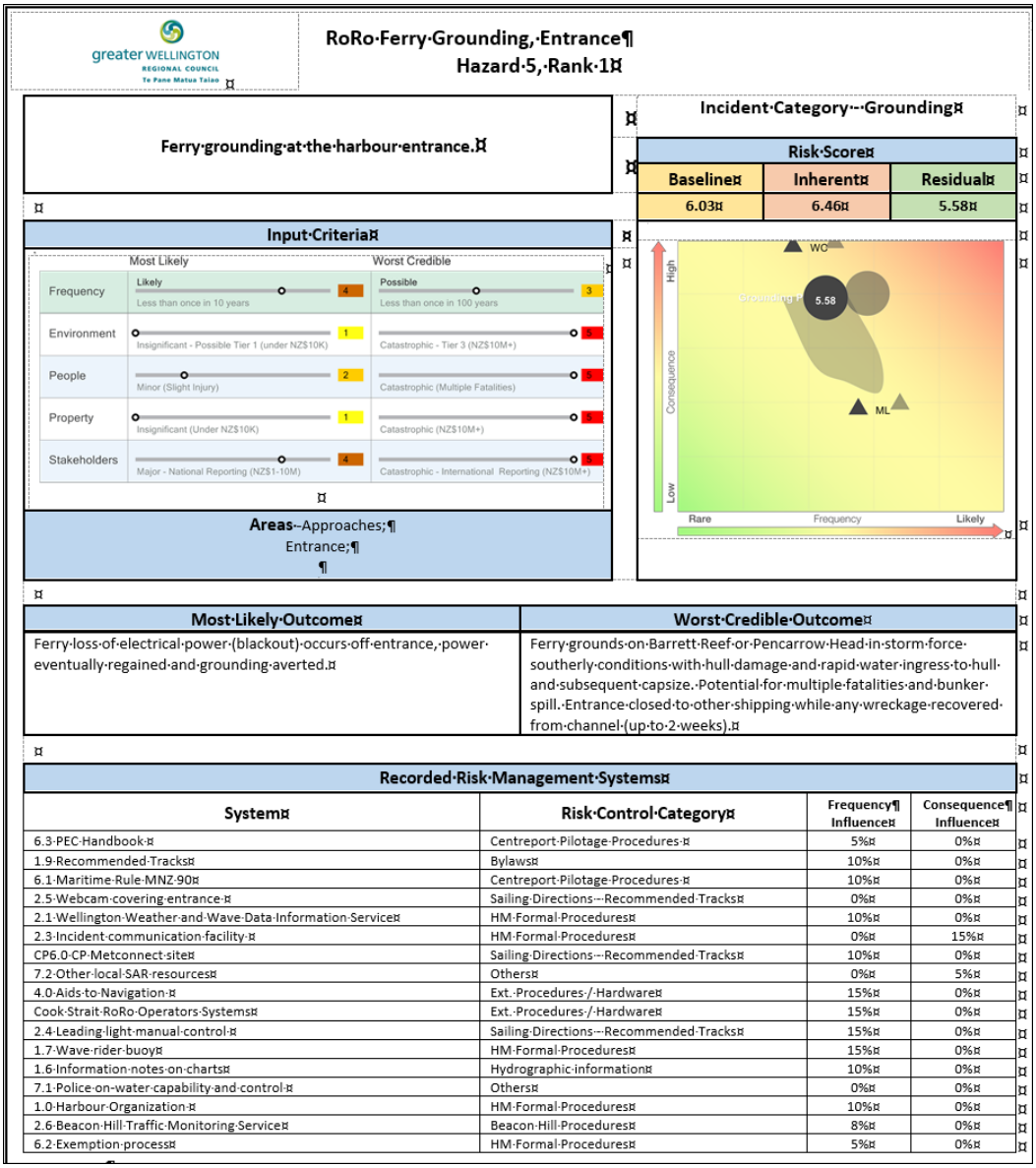


Figure 34 : Risk Record for Passenger RoRo Vessel Grounding

5.5.2 HARBOUR APPROACH ANALYSIS - COOK STRAIT PASSENGER RORO S

There was some stakeholder feedback about alignment of PEC RoRo ferries to the harbour leads when inbound and thus compliance with the recommended routes and alignment with the leading lines in the harbour approaches. A close quarters incident with an inbound tanker also provided some indication. However, the risk study team tested the view that although grounding risk was still the most important risk, the improvement in Cook Strait RoRo operator procedural systems (under ISM[34]) has resulted in a decaying risk.

[34] **ISM = International Safety Management System; required for all SOLAS standard vessels.**

Any vessel on the harbour approach leads has good knowledge of any vectoring off the track. The further the leads are apart, the more sensitive they are. A Pell light has a fixed reference by a changing light colour with a measured variance from the optimum track. To test the system, track data for inbound RoRo ferries was extracted and plotted, using a density analysis technique to determine the percentage number of vessels that followed the same route. The results are shown in **Figure 35,** which presents a data period from January to May, 2017. The plot shows that there is generally a good compliance by Passenger RoRos with the Harbour Master's recommendations for harbour entry. There could be reasons such as poor sea conditions or traffic to explain the recorded short cuts.

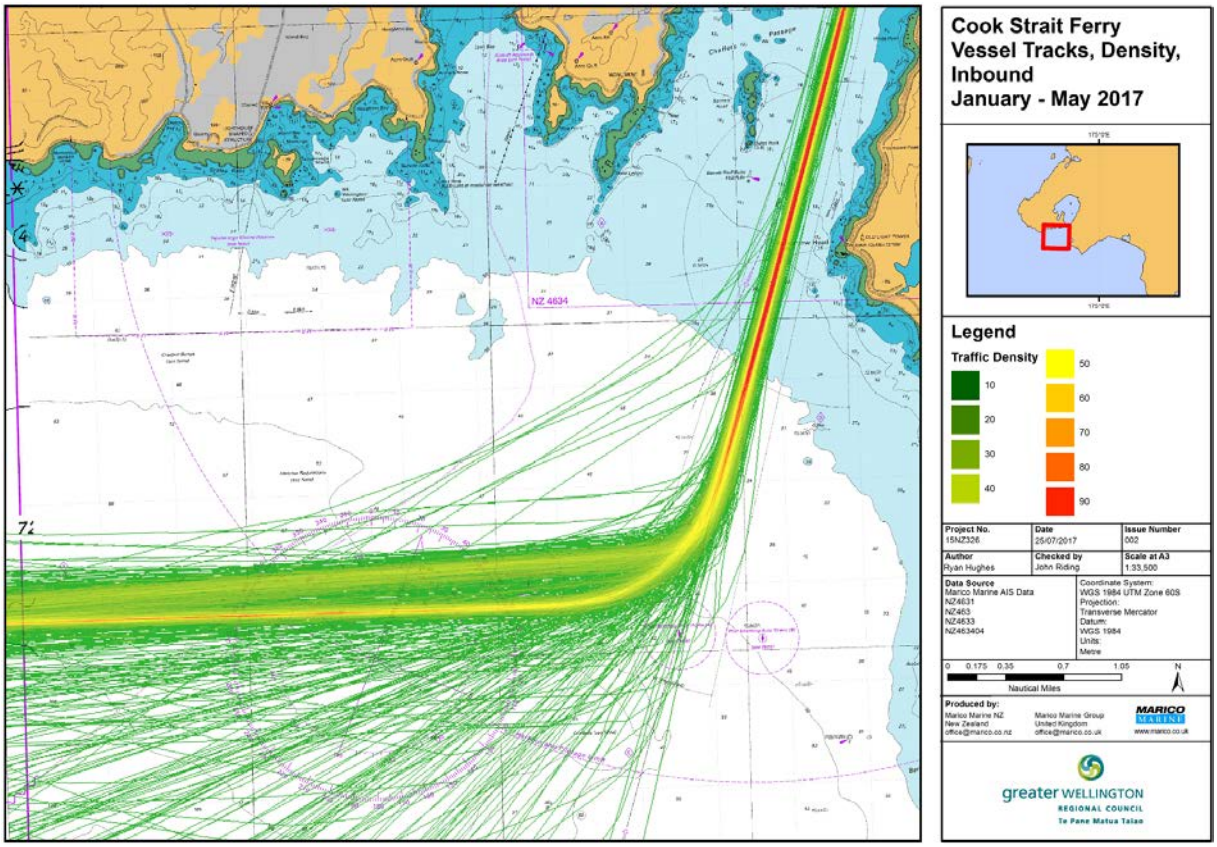


Figure 35 : Inbound RoRo Ferries - Alignment with Leads and Recommended Route

Although some tracks have deviated, taking a "short cut", the majority of transits are accurately aligned. There is no doubt that navigational precision and therefore bridge team BRM practices have improved since the 2006 risk assessment. The area of highest track density offshore is made by the transits of just one of the two Cook Strait operators, showing a consistency of harbour approach across more than one if their vessels. The fact that the repeatability of harbour approach by one of the Cook Strait companies shows up clearly in a density plot is evidence enough that the decayed risk score between the 2006 and 2016 risk assessment is justified.

There was some stakeholder feedback to suggest that traffic or sea conditions at the entrance may sometimes dictate a need for PEC navigators to be on the bridge of an inbound Cook Strait RoRo ferry in enough time to assess traffic situation and liaise with Beacon Hill. However, on the other hand there is no direct information to say this is not already occurring. The risk control for this is a more proactive Beacon Hill, with training to Harbour Communication Officers, see **Section 6.2**.

5.5.3 RoRo Operators Decision to Sail : Information of Swell and Weather

Sea and weather conditions contribute significantly to the consequence of outcome for almost any maritime casualty, except perhaps fire and explosion. Key to risk management of grounding (or foundering) risks is the information available for decision making when it comes to making the call to not sail, when there is a schedule in place to do so. on board ships.

The harbour entrance, like the approaches, is under visual, AIS and radar surveillance from the Beacon Hill Monitoring station. Beacon Hill is also a centre of information of use to masters or operators in navigational decision making. For many years, there has been a wave rider buoy off Baring head, which reports via a website output calculations of maximum and significant wave height. The website has a 30 minute delay and more significantly it only provides a 30 minute average of the wave rider buoy readings. However, there is an up to the minute display at Beacon Hill which can be relayed to shipping.

The operating limits for ferry operations[35] are intentionally flexible, meaning that it is a responsible master's decision to sail from a terminal in Wellington to cross the Cook Strait. This is perfectly correct and reflects best practice in many ports where Harbour Authority's role is to advise and promulgate, as well as deliver on open-port duty. In the case of the Cook Strait RoRo services, where management is close to the operation, their guiding parameters are critical, but in practice the decision to sail is the Master's sole decision, which is informed by the Baring Head wave rider, local weather forecast, the weather forecast at Kaikoura and Wellington Harbour Radio. Kaikoura is reported by RoRo bridge teams as often useful as it represents the weather conditions that are heading for the Cook Strait.

The Harbour Master always has the option to make advisory recommendations, when conditions at the harbour entrance are particularly adverse. Beacon Hill records show that Harbour Master warnings of entrance conditions were sent five times in the year of the risk assessment review, representing only a small percentage of operating time.

[35] **Cook Strait Ferry Services have informal operational limits during adverse weather conditions.**

In practice, operators of RoRo passenger services in 2016-7 plan to cease operations based on weather forecasts for Cook Strait much earlier than they did in 2006, although one operator normally ceases operations before another. There is little doubt that in the past there have been occasions where vessels have proceeded in extremely adverse conditions, well beyond the capability of harbour tugs to render assistance and/or life-saving appliances aboard to be effective. It is a pleasing finding of this 2017 risk assessment to note some robust decision to sail procedures have been implemented in these trades. This further justifies the record of a decaying grounding risk.

5.5.4 GROUNDING AT ENTRANCE - LARGE VESSEL

Grounding of other SOLAS vessel types at the Harbour entrance are an equally important risk to Wellington harbour. The 1981 grounding of PACIFIC CHARGER was due to bridge team confusion in the approach for one reason and grounded at Baring Head. The near grounding of AAL BRISBANE at Pencarrow Head was bridge team confusion for another reason, this time technical equipment. The only difference was the technology causing the confusion; the latter being a GPS receiver offset.

The AAL BRISBANE incident (See **Section 3.1.5**) showed how some confusion in the Wellington approaches can easily lead to a serious grounding. The 1981 grounding of PACIFIC CHARGER and the rudder failure of SEA HARVEST in 2003 into Fitzroy Bay, shows that the probability of grounding of a large vessel has a return period at Wellington of about 20 years. The Hazman II software can record such a return period accurately. **Figure 36** shows the risk record associated with a large vessel grounding. It ranks at 9 and as such should be considered equally as important as any other grounding anywhere in the harbour. It shows how much the Wellington Harbour system cannot afford to be complacent.

Passenger RoRos provide a higher consequence to life score, which is why the risk result is higher in the risk ranking.

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Large vessel Grounding in Harbour Entrance/ Approach
Hazard 1, Rank 9

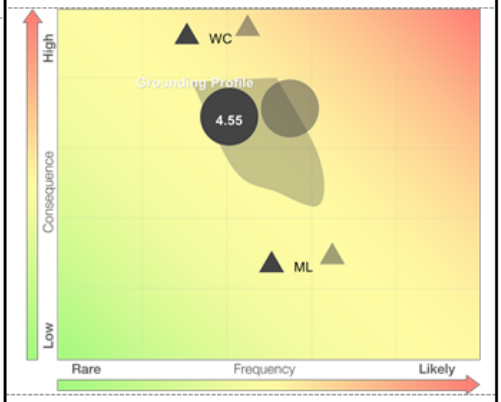
Inbound large vessel (> 500GT) in grounding situation in adverse southerly conditions

Incident Category - Grounding

Risk Score		
Baseline	**Inherent**	**Residual**
5.28	5.47	4.55

Input Criteria

	Most Likely	Worst Credible
Frequency	Likely — Less than once in 10 years — 4	Possible — Less than once in 100 years — 3
Environment	Insignificant - Possible Tier 1 (under NZ$10K) — 1	Catastrophic - Tier 3 (NZ$10M+) — 5
People	Insignificant (e.g Possible Bruise) — 1	Major (Major Injuries or Single Fatality) — 4
Property	Insignificant (Under NZ$10K) — 1	Catastrophic (NZ$10M+) — 5
Stakeholders	Moderate - Widespread Reporting (NZ$100K-1M) — 3	Catastrophic - International Reporting (NZ$10M+) — 5



Areas -Approaches; Entrance;

Most Likely Outcome	Worst Credible Outcome
Near grounding averted.	Large vessel suffers blackout while awaiting pilot at position Bravo in fresh SW and drags anchor to ground in Fitzroy Bay. Major salvage operation to refloat, potential loss of bunkers to sea.

Recorded Risk Management Systems

System	Risk Control Category	Frequency Influence	Consequence Influence
CP2.5 Leading vessels to/from Area Delta	Centreport Pilotage Procedures	0%	0%
7.2 Other local SAR resources	Others	0%	0%
CP2.6 Use of outer boarding areas	Centreport Pilotage Procedures	5%	0%
2.1 Wellington Weather and Wave Data Information Service	HM Formal Procedures	10%	0%
2.5 Webcam covering entrance	Sailing Directions - Recommended Tracks	0%	0%
CP3.2 Management Practice	Custom and Practice	0%	0%
2.6 Beacon Hill Traffic Monitoring Service	Beacon Hill Procedures	10%	0%
1.5 Tide Gauge	HM Formal Procedures	5%	0%
CP2.2 Pilot/Master exchange	Centreport Pilotage Procedures	20%	0%
CP3.1 Marine Personnel experience and expertise	Training / Education	0%	0%
6.1 Maritime Rule MNZ 90	Centreport Pilotage Procedures	0%	0%
7.1 Police on-water capability and control	Others	0%	0%
3.4 Directions for harbour navigation	Bylaws	10%	0%
CP3.3 Interface with yacht clubs	Custom and Practice	5%	0%
1.0 Harbour Organization	HM Formal Procedures	5%	0%
4.0 Aids to Navigation	Ext. Procedures / Hardware	15%	0%
1.4 Hydrographical survey	Others	10%	0%
1.6 Information notes on charts	Hydrographic information	10%	0%
2.3 Incident communication facility	HM Formal Procedures	0%	15%
CP2.3 Recommended track compliance	Training / Education	5%	0%
2.4 Leading light manual control	Sailing Directions - Recommended Tracks	5%	0%
1.7 Wave rider buoy	HM Formal Procedures	15%	0%
CP6.0 CP Metconnect site	Sailing Directions - Recommended Tracks	10%	0%
CP2.11 Portable Pilot Unit	Centreport Pilotage Procedures	15%	10%

Figure 36 : Single Hazard Report – Large SOLAS Vessel Grounding

5.5.5 GROUNDING – CROSS HARBOUR FERRY

Grounding of a small passenger vessels is ranked at no.5 and the hazard summary is shown at **Figure 37**.

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Small Passenger Vessel Grounding
Hazard 12, Rank 5

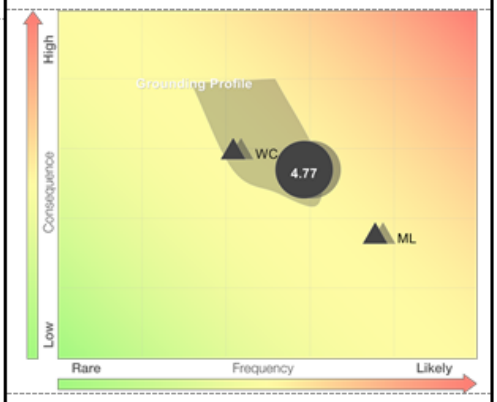
Harbour passenger vessel in grounding situation on passage or near berth.

Incident Category - Grounding

Risk Score		
Baseline	Inherent	Residual
4.77	4.94	4.77

Input Criteria

	Most Likely		Worst Credible	
Frequency	Frequent Less than once in 2 year	4.60	Possible Less than once in 100 years	3
Environment	Insignificant - Possible Tier 1 (under NZ$10K)	1.16	Minor - Tier 1 To Tier 2 criteria Met (NZ$10-100K)	2
People	Minor (Slight Injury)	2	Moderate(Minor Injuries or Single Major)	3
Property	Minor (NZ$10K-100K)	2	Moderate (NZ$100K-1M)	3
Stakeholders	Minor - Local Publicity (NZ$10-100K)	2	Major - National Reporting (NZ$1-10M)	4



Areas -Entrance;
Main Harbour;
Lambton Harbour;
Evans Bay;

Most Likely Outcome	Worst Credible Outcome
Vessel's keel touches seafloor off Petone beach during slow speed harbour cruise. Able to back off without damage. Alternatively catamaran harbour ferry runs over isolated rock within the 200m line from shore. Moderate damage to one hull and rudder, light damage to other. One minor passenger injury (bruise) and vessel remains afloat and able to navigate. Vessel requires removal from water fro repairs and out of service for up to one month.	Harbour ferry or other passenger vessel surges heavily on lines during adverse Southerly conditions at exposed wharf. Line or lines part with persons falling from gangway into water, potential for major injuries or fatality. Ferry grounds on beach with damage to hull and propellers/rudders, out of service for up to 30 days to repair. Alternatively, Harbour ferry strikes underwater obstruction (rock) and opens one hull in all compartments. Ferry remains afloat, but requires evacuation. One or more Passengers enter water. Hypothermia. Close nature of response recovers all without loss of life.

Recorded Risk Management Systems

System	Risk Control Category	Frequency Influence	Consequence Influence
3.5 Restricted Areas	Bylaws	0%	0%
3.7 Speed restrictions	Bylaws	0%	0%
1.2 Education	HM Formal Procedures	0%	0%
1.5 Tide Gauge	HM Formal Procedures	5%	0%
3.9 Carriage of lifejackets	Bylaws	0%	0%
4.0 Aids to Navigation	Ext. Procedures / Hardware	15%	0%

Figure 37 : Single Hazard Record - Small Passenger Vessel Grounding

Some further analysis of the cross Harbour ferry operation has been undertaken, **Figure 37**. Closer examination of the track records for March-June 2017 show a spread of tracks along the Miramar

Peninsular. However, the tracks also show a number of transits at service speed and passing close at headlands and coastal zones. The accuracy of tracks as recorded in the Marico System is subject to the accuracy of the equipment fitted to the vessel, which is transmitting the positions. The standard of GPS fitted affects this. Other errors can be created by the Class B AIS transponder which provides a transmission rate depending on vessel speed, **Table 14**.

Class B "SO" shipborne mobile equipment moving 2-14 knots	30 secs
Class B "SO" shipborne mobile equipment moving 14-23 knots	15 secs
Class B "SO" shipborne mobile equipment moving > 23 knots	5 secs

Table 13 : Class B Transponder Transmission Rates

Thus, a ferry slowing for a turn, such as round a headland may provide a lower accuracy because transmission rate is lower and spurious data positions can also be present as transmitting aerials pass obstacles between the point of transmission and the point of reception. The Marico AIS systems seek to resolve this in Wellington Harbour by having more than one reception site. However, it does mean that AIS tracks are an indication, with point data being more representative than connected points generated in a GIS system. The difference between a grounding showing on one day and a near miss on another may also be related to the accuracy of the on board equipment. The repeatability of the tracks presented though does suggest data accuracy is relatively good at the location where the grounding was reported.

When considering the coastline as a whole, the grounding that occurred may have been the result of a chart plotter recording a previous track transiting the same location and this track then being repeated on another occasion.

Grounding appears to have occurred on a known but unnamed rock, which should now be named and recorded on the harbour chart. Passages at Point Halswell, Kau Point and Point Gordon may have been passed at service speed at inadvisably close distances off the coastline. That having been said, the tracks at Point Halswell are most likely to be suffering from data error and lower vessels speed.

Track records from the East coastline of the Miramar peninsular are less frequent, but also appear close to coastline features. The inaccuracies in the plot data, referenced above (Class B transponders and low accuracy GPS equipment), may provide a coarse course-line when plotted. However, taking such errors into account, the plot of tracks around the Miramar Peninsular suggests a portion of transits are passing close to headlands and skippers may not be aware of limits in the underlying chart accuracy.

There will be benefit from skipper training and a good Safety Management System will be able to use the information above to improve and develop. **Figure 38** shows the plotted tracks.

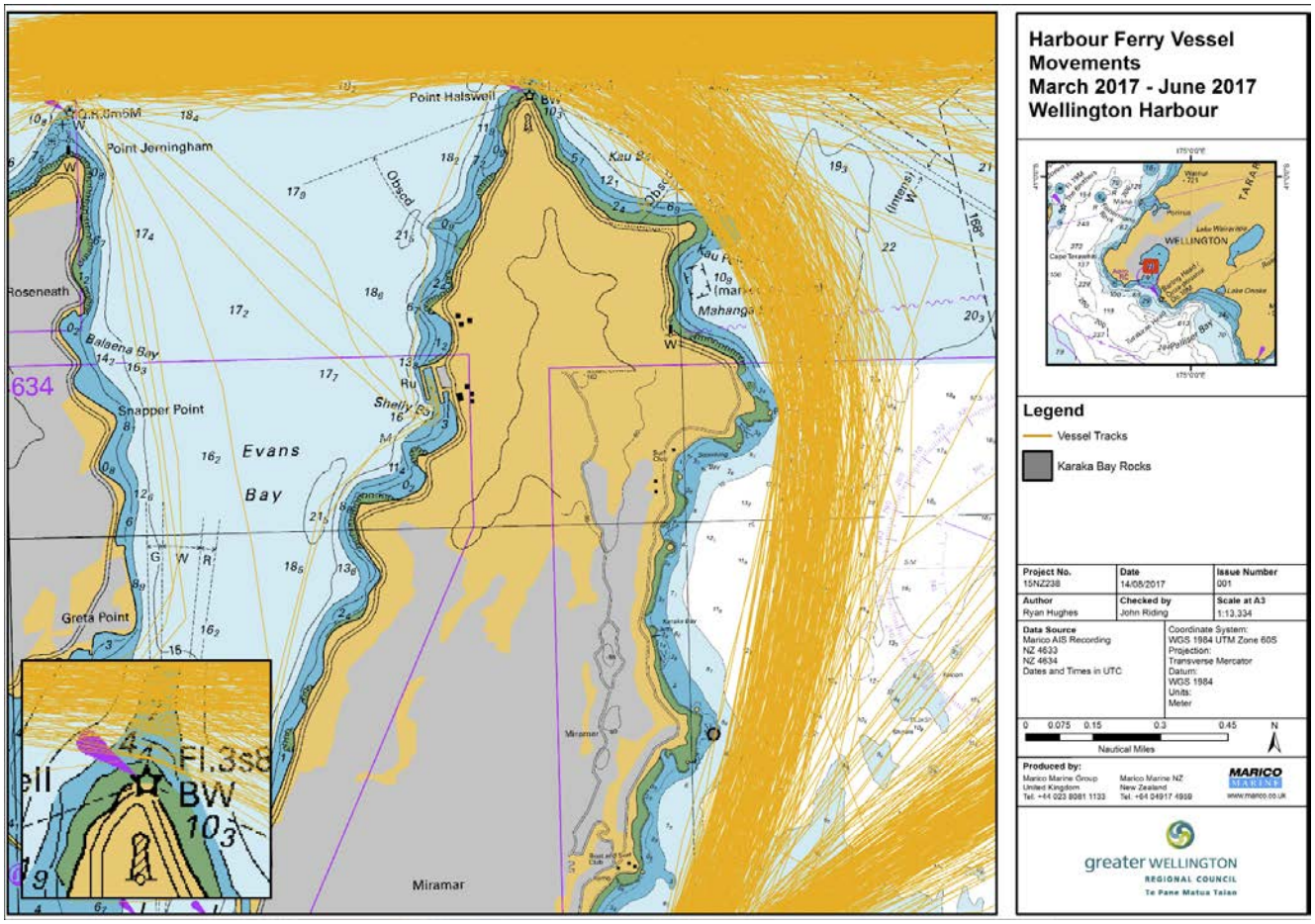


Figure 38 : Cross Harbour Ferry Tracks - Miramar Coastline

The insert in the plot is a zoom onto the Point Halswell area and shows transits of the harbour ferry passing close, accepting that an error allowance is needed for the potential error in transmitted AIS data. The 5 knot rule within 200m of coastline is relevant and a detached view from Authors is that a grounding at speed was likely – this being with the benefit of data analysis. From a risk perspective, the position of this grounding hazard at rank 5 is justified by the evidence. The inherent risk score of 4.96 is still within the ALARP criteria, but may well be an optimistically scored risk, given the evidence of some further track data investigation.

Risk control and SMS development is recommended for this operation, given its passenger carrying status – Cross harbour ferries can carry up to 100 passengers. Systems under the Maritime New Zealand MOSS certification do not lay out minimum standards, which would be helpful to the operator. Improvements to passage planning, possibly upgrades to onboard electronic plotting systems and clear procedural advice to skippers having the con of these services may also be of benefit. Passage plans should make clear distance recommendations for transit around headlands and other coastal features.

All of the cross harbour ferries carry AIS transponders, so by definition will have a GPS receiver onboard. This may be accurate, it may not be, depending on the type of equipment fitted. All of the plotted data accuracy depends on the equipment fitted to a vessel.

If not fitted already, electronic charting and a track plotting software should be in use, such that the position of the ferry is known onboard at all times and masters employed in the service should be trained in its use. Although this recommendation is made, regulation of these vessels is not the responsibility of the Harbours Department (as harbour authority), so this recommendation can only be passed onto the Cross Harbour Ferry operating company. There is though a more common law obligation on the harbour authority to monitor, which Beacon Hill provides.

The Rock on which the ferry grounded appears to be known about, but un-named. A Harbour nautical charting update removed it, as positional accuracy may not have been properly known and charting displays a shoal area instead. On the basis that a vessel proceeding at even 5 knots in the 100m offshore area is likely to strike the rock, it is recommended that the rock position and depth be established and re-charted as an Isolated danger.

The option exists to review the need for an Aid to Navigation (Cardinal Mark) in this area, although the cost benefit needs to be assessed.

The benefit of analysis of accumulated track records is demonstrated by this plot especially. The Harbours Office should consider annual track plots of vessel tyres to assess the compliance overall with the Wellington Navigational Bylaw requirements. Vessel types of any size operating passenger services should be a priority. Such analysis can usefully inform the Safety Management System and provide statistical advice about alignment with the Harbour entrance leads, or, as in this case, assessment of the safety margin provided by transits of the smaller cross harbour ferries.

5.6 RANKED COLLISIONS RISKS DISUSSION – WELLINGTON HARBOUR

Table 12 suggests that Collision risk overall lies in the ALARP region, although the risk result is reliant on a number of risk controls that are operated by Harbour stakeholders. An example of these are bridge navigational systems operated by the (dominant) PEC based RoRo traffic. As introduced earlier, inherent risk is essentially the raw risk, which assumes that nothing is in place. Inherent risk can be the more accurate score if the risk mitigation in place is not delivering to its intended level or is poor. There are collision risks with scores at the end of the ALARP region and a category that the SMS system needs to consider equally to that of grounding.

Rank	Hazard Ref.	Accident Category	Hazard Title	Residual Risk	Inherent Risk	Baseline Risk
3	20	Collision	RoRo Ferry and large vessel in Conflict (Within Harbour Waters)	5.01	5.83	5.77
4	28	Collision	RoRo Ferry and Tanker in conflict within harbour	4.88	5.72	5.5
6	83	Collision	Rowing Skiff and Swimmer Collision	4.76	4.95	4.9
8	19	Collision	Pilot Launch and Vessel in Heavy Landing During Transfer Operations	4.58	5.34	5.16
15	18	Collision	RoRo Ferry and Large Vessel Conflict, Harbour Approaches	4.35	5.39	5.28
17	21	Collision	RoRo Ferry and RoRo Ferry in Conflict	4.3	4.9	4.78
19	15	Collision	RoRo Ferry and Large or Deep Draught Vessel Collision	4.27	5.09	5.05
22	23	Collision	Harbour Ferry in Conflict with Larger Vessel	4.14	4.92	4.89
23	34	Collision	Rowing skiff and vessel in conflict	4.11	4.43	4.4
33	17	Collision	RoRo Ferry / Large Vessel and Fishing Vessel Conflict.	3.89	4.7	4.61
37	24	Collision	Large Vessel or RoRo Ferry and Naval Vessel in Conflict	3.77	3.77	3.77
38	33	Collision	Small Commercial Vessel /RoRo Ferry in Conflict	3.74	3.74	3.74
42	16	Collision	RoRo Ferry and Leisure Craft Conflict	3.68	4.19	4.11
43	77	Collision	Leisure Craft and Small Commercial Vessel Conflict	3.66	3.66	3.66
50	26	Collision	Leisure Craft and Vessel in Conflict	3.39	3.53	3.51
51	31	Collision	Leisure Craft in Conflict	3.38	3.81	3.37
60	37	Collision	Vessel in conflict with Windsurfer or similar Craft	2.78	2.78	2.78

Rank	Hazard Ref.	Accident Category	Hazard Title	Residual Risk	Inherent Risk	Baseline Risk
61	25	Collision	Leisure Craft and Kayak in Conflict	**2.78**	**2.78**	**2.78**
62	35	Collision	Leisure Craft and Water-ski in Conflict	**2.78**	**2.78**	**2.78**
63	32	Collision	Kayak and other vessel in Conflict	**2.78**	**2.78**	**2.78**
65	36	Collision	Leisure Craft and Waka in Conflict	**2.71**	**2.71**	**2.71**
66	73	Collision	Small Commercial and Recreational Craft Conflict	**2.69**	**2.94**	**2.78**
68	29	Collision	Tug in collision with vessel being assisted	**2.65**	**2.65**	**2.65**
69	30	Collision	Small Commercial Vessels in Conflict	**2.56**	**2.56**	**2.56**
71	27	Collision	Yacht and ferry or large vessel in Conflict.	**2.48**	**2.83**	**2.79**

Table 14 : Collision Risks – Wellington Harbour

The importance of the hazard of Collision to Wellington may be fading in perception over time, but the risk data suggests otherwise, with collision risk still ranking at the top of the risk profile (no.3, 4 and 6) for the harbour. The port last experienced a serious collision, involving loss of life in 1996 (the containership *Sydney Express* and fishing vessel *Maria Louisa).* Whilst the probability of a collision involving a fishing vessel has reduced – because the number of commercial fishing vessels operating out of Wellington has reduced, the risk assessment found evidence that collision risk associated with other vessel types cannot be relaxed. There are, for example, two instances of passenger RoRo vessels and tankers entering into unwanted close quarter encounters. Although there will be differing viewpoints as to risk significance, only a traffic management policy to provide separation by the sequencing of movements can improve matters, which involves the Beacon Hill traffic monitoring role.

5.6.1 Rowers and Swimmers Collision – Gap Analysis

The ongoing development of recreational use on the harbour has also brought a new hazard associated with rowing activities and swimmers using the same stretch of harbour waters. This risk has appeared because of the incident record; noting that rowers cannot (normally) face in the direction their craft is moving.

Figure 14, Section 3.4.4 shows a plot the recommended lanes for rowers and swimmers, which cross Oriental Bay. Although these are presently informal, they reflect the reality of an overlap of present

harbour usage at Point Jerningham. The Risk record of this hazard, Rank 6 is shown in **Figure 38**. Its ranking is related to the incident record.

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Rowing Skiff and Swimmer Collision
Hazard 83, Rank 6

Rowing Skiff and Swimmer in collision in the Lambton Harbour area. Both in recommended lanes for the activity.

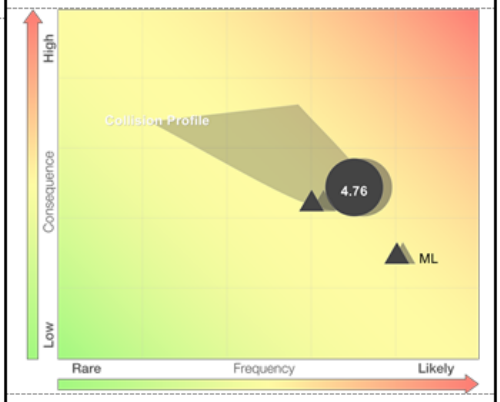
Incident Category - Collision

Risk Score		
Baseline	**Inherent**	**Residual**
4.9	4.95	4.76

Input Criteria

	Most Likely	Worst Credible
Frequency	Frequent – Less than once in 1 year – 5	Likely – Less than once in 10 years – 3.95
Environment	Insignificant - Possible Tier 1 (under NZ$10K) – 1	Insignificant - Possible Tier 1 (under NZ$10K) – 1
People	Minor (Slight Injury) – 2	Major (Major Injuries or Single Fatality) – 4
Property	Insignificant (Under NZ$10K) – 1	Insignificant (Under NZ$10K) – 1
Stakeholders	Minor - Local Publicity (NZ$10-100K) – 2	Moderate - Widespread Reporting (NZ$100K-1M) – 3

Areas -Lambton Harbour;

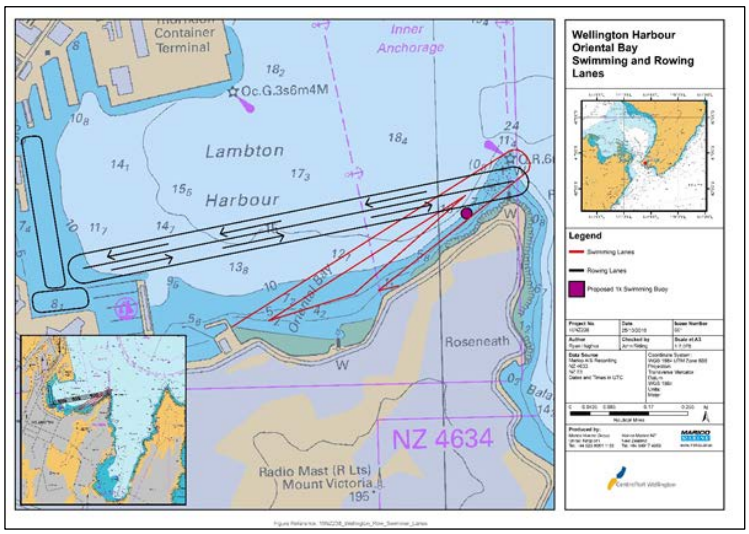


Most Likely Outcome	Worst Credible Outcome
Rowing skiff in very near miss. Swimmer hit by oar. Safety boat in rapid attendance.	Rowing skiff in collision with swimmer. Swimmer struck by prow of skiff in head. Swimmer unconscious in water. No safety boat nearby.

Recorded Risk Management Systems

System	Risk Control Category	Frequency Influence	Consequence Influence
4.1 Upcoming Buoy Installation for Recommended Swimming Lanes	Hardware and Equipment	15%	0%
1.0 Harbour Organization	HM Formal Procedures	15%	0%

Figure 39 : Rowing Skiff and Swimmer Collision



The layout of the two lane orientations above is shown as a repeat of **Figure 14**. Both activities wish to use the same area and the incident that occurred was probably inevitable. The harbour masters department is to install a buoy to mark the presence of the swimmers lanes, but it appears to Authors that either the activities need to be separated by timing, or the activities need to be separated by design. A risk such as this, where head injury of a swimmer can occur, needs to be isolated as opposed to mitigated.

Note that swimming around the cross harbour ferry harbour terminus also occurs in the Summer months, a concern to the operators of the cross harbour ferry.

5.7 PILOT BOARDING RISKS – WELLINGTON HARBOUR

One of the significant rising risks of today's risk profile is that of the pilot launch and pilot transfer to vessels in the harbour entrance. For valid reasons of traffic management and to allow a pilot to board a vessel prior to it being committed to an entrance transit[36], pilots in 2017 tend to board further out than occurred in 2006. On one hand, this reduces risk of grounding or traffic conflict as the pilot is onboard the vessel. However, there is a trade off in that boarding for pilots can be more hazardous. Sea conditions further out are more exposed both to weather and the higher swell patterns entering the Cook Strait.

A pilot launch is intended to make a controlled collision with the hull of a vessel to board a pilot and the pilot boat engine thrust is used to hold it alongside the vessel on its belting, to help the pilot safely step onto the pilot ladder.

CentrePorts' existing pilot launch, *Tarakena* was built in 1993, with a service speed of 15 knots. At a length of about 14 metres, it is a relatively short vessel for the swells off Wellington entrance. However, the vessel's relatively broad beam for its length makes it a useful and stable platform for boarding. It continues to serve the port well.

[36] **It was also a recommendation of the 2006 Navigational Risk Assessment**

Figure 40 :Wellington Pilot Boat, *Tarakena.*

A significant damage incident when *Tarakena* was alongside occurred in 2011, placing this main pilot launch in a unexpectedly long period of repair. The port company subsequently used a RHIB[37] as a back-up pilot launch, which they share with a local charity, where it has a potentially useful role in marine search and rescue.

RHIBs are generally not the best option for pilotage purposes, as they lack the mass and seakeeping abilities of a plot boat for boarding, although some New Zealand ports and pilotage services have used them. They are relatively lightweight and "thrown around" in choppy seas, making a difficult platform for pilot boarding up the slab side of a larger vessel. In a heavy landing alongside a vessel's hull, airbags absorb the impact of a heavy landing, but often outside their design capability resulting in burst bags. Such incidents have occurred in other New Zealand ports, besides Wellington. The Wellington RHIB suffered two recorded incidents of burst airbags, one when boarding a tanker at Bravo. These incidents also resulted in structural damage forward in one case and to the accommodation superstructure in another.

The risk of a pilot boat damage incident when coming alongside an inbound vessel for pilot transfer rose significantly, to be ranked no 2, based on user feedback as well as incident records (note **Annex B**). The outcome of hazard realisation is significant damage to the pilot vessel, type dependant, but injury or worse to a pilot could also ensue. There had been a rise in the number of heavy landings with the pilot boats, including an event referenced above where the backup pilot RHIB ended up damaged with burst flotation bags. Pilots quite rightly board further out, which allows time for a master/pilot exchange to take place and a vessel to become aligned correctly to the entrance leads under the con of the pilot.

[37] **RHIB = Rigid Hulled Inflatable Boat**

The single hazard result (Hazard 19, Rank 3) for the 2016-7 risk assessment is shown at **Figure 40**, below. With an inherent risk score of 5.34. With all the mitigation in place with the present standard of pilot boats in use, a residual score of 5.16 has resulted. On one hand, these risks are not in the unacceptable range, but on the other they provide a risk score (5.16) the end of the ALARP criteria. Where personal injury potential (OSH) criteria are considered, options to ensure risk mitigation need to be considered. There are already operational limits in place for the current pilot boat during adverse weather conditions, which the risk assessment took into account. The high risk is not due just to the use of a RHIB as backup, it is the fact that the pilotage service needs to board further out in 2017, than it did in 2006. The present pilot vessel can achieve that, but is short in length for the type of swell period that can take place at the designated pilot boarding locations offshore.

Risk reduction in the existing situation could be improved by a greater use of the Delta boarding location. Delta is though inside the harbour limit and pilotage jurisdiction, albeit well away from the worst swell conditions at the main boarding areas. Leading a vessel remotely is not viewed as good practice in many jurisdictions and there is good evidence of expensive groundings as a result of leading by pilots from a pilot boat[38]. Besides, ports and harbours have developed further to use VTS techniques, where a Traffic monitoring officer, with IALA approved training works with the pilot to provide mitigation for such scenarios. The use of Delta is discussed further in **Section 6.3.3**, under Pilotage, as boarding at Delta should in the future involve the tracking capabilities of Beacon Hill (**Section 6.2**).

With the existing pilot vessel, it takes approximately 45 mins to reach the pilot boarding areas from the CentrePort base. Boat crews often work longer than pilots as they shuttle different duty pilots to berth or across the harbour for a vessel shift. The operational requirements can impinge on the time the pilot boat is alongside for a coxswain and crew rest period. Feedback of crew fatigue was provided during consultation.

[38] **The grounding of the cruise vessel ALBATROSS in the UK's Isles of Scilly was the result of a pilot leading the vessel from the pilot launch.**

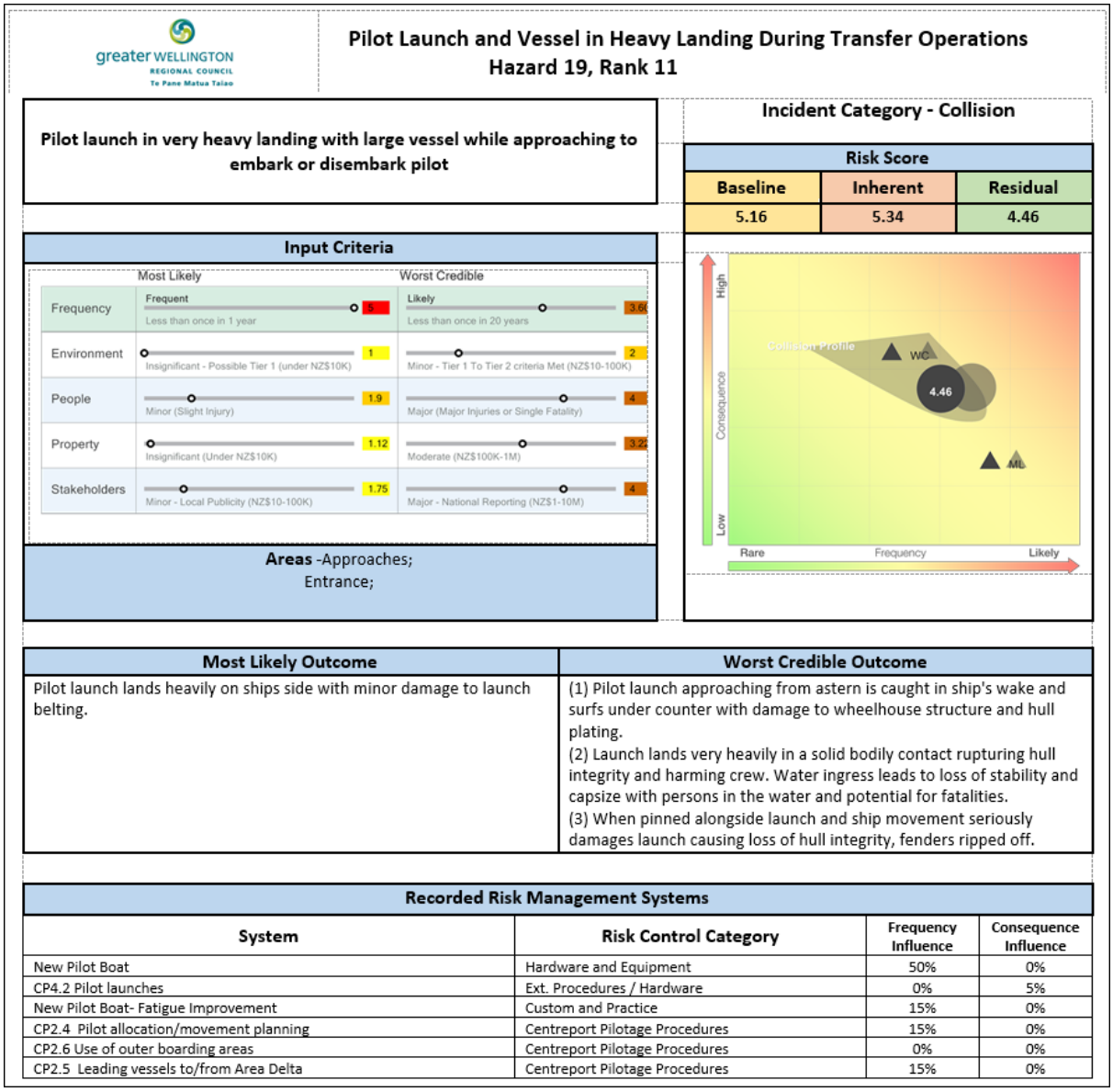


Figure 41 : Pilot Boat Collision Risk - New Procurement

5.7.1 PILOT BOARDING RISK MITIGATION - PILOT BOAT PROCUREMENT GAP ANALYSIS

To resolve the issue, CentrePort took the prudent decision to order a new and larger pilot boat, more suited to the type of pilot boarding operations occurring in 2016-7. The new design is close to 20 metres in length and a proven design in rougher seas. It is a UK design, by Calmarc. Like *Tarakena,* the new pilot boat is built by Key West builders, Wanganui. Delivery occurred early September, 2017.

Given the delivery, this hazard was run again in the Hazman II software[39]. The risk reduction effect of procuring a pilot boat more suited to the environmental conditions at Wellington harbour

[39] **It should be noted that the Ranked Hazard summary tables were updated (Tables xx to yy) to reflect this rerun result, but the raw ranked hazard list in Annex B presents the original result.**

entrance is also shown in **Figure 41**. It is an order of magnitude and an important delivery for Wellington Harbour.

5.7.2 IMPROVEMENTS TO PILOT VESSEL CREW FATIGUE

Pilot vessel crew fatigue was raised during risk assessment consultation. The pilot boat crew can face a complex day when the port is busy. There can be a number of pilot transfers occurring in sequence, which may not necessarily all be at the harbour entrance. Pilots are often transferred between one vessel after arrival to another vessel which may be shifting. This creates irregular working hours for pilot boat coxswain and crew. Rest periods are also therefore irregular. The new pilot boat has a design service speed of 24 knots, which is significantly greater than the existing vessel at 17 knots and reduce the present 45 mins transit time to the boarding area significantly. The improved speed should increase the availability and length of rest periods for the pilot boat crew. The risk scoring has taken account of this, see again, **Figure 40**.

The residual risk score of 4.46 (out of a possible 10) suggests that the new pilot boat will produce almost an order of magnitude reduction in risk (5.16 vs 4.46). It has also reduced its risk ranking from no.2 to no.11. The new boat's increased service speed should also provide for pilot deployment efficiencies.

6 HARBOUR NAVIGATIONAL SAFETY MANAGEMENT SYSTEM

Following the 2006 Risk Assessment a Navigational Safety Management System was developed for Wellington Harbour, which implemented the NZ Port and Harbour Marine Safety Code. At its core is a SMS document, which describes all the systems of the harbour which manage safety and how the GRWC Harbours department interfaces and consults with both CentrePort and the various vessel operators, clubs and interests around the harbour. As such, it is a core record of the interface between CentrePorts' maritime operations department and the GRWC Harbours Department. The review by Marico acknowledges just how close and collaborative this interface is.

The SMS document itself is in need of update and review to reflect the changes in harbour operation. There is also a harbour safety plan that accompanies the harbour SMS. The safety plan takes the risk assessment outcomes that the Harbour Authority (GWRC) wish to take forward and lays milestones for their implementation. The SMS needs to set timescales for the risk assessment review as one of the findings of this study is about just how much has changed in Wellington in the 10 years since the initiating risk assessment.

The SMS though is by its nature an overview document. The procedural systems of CentrePort are a very important component in this. This system has developed into an all-encompassing system since the 2006 risk assessment and the detail that has been developed is impressive. CentrePorts' systems also provide for operating parameters in a number of areas, e.g. requirements for berthing at Seaview. However, with such a comprehensive proceduralised system in place, benefit may be found from some summary material, providing parameters that pilots and boat crews can use for immediate guidance.

There was some pilotage stakeholder feedback of the CentrePort SMS citing the size for the documentation and number of SOPs. Views were expressed for some separation of key information from detail in the procedures. This is a healthy sign, showing users are engaged with the system and want to help improve it.

Further advice would need a more extensive review of the CentrePort Operating SMS system detail and the risk assessment has considered the CentrePort system at an overview. As part of SMS implementation, it is a good time to take stock and a procedural review should be undertaken involving users and feedback recorded. This will help to keep the user buy-in to CentrePort SMS system, and may provide constructive assistance to future structure.

6.1 REVIEW OF PAST RISK ASSESSMENT RECOMMENDATIONS

The 2006 Risk Assessment recommended new risk control options and mitigations in order to enhance navigational safety in Wellington Harbour. Since then, there have been numerous improvements that involved hardware and software equipment for both the Greater Regional Wellington Council and CentrePort. Significant changes to the harbour safety management also arose out of the 2006 risk assessment. A summary of 8 significant improvements are listed below in **Table 16.**

No.	2006 Operational Risk Assessment Key Recommendations	2016 Status
1	A Harbour Navigational Safety Management System needs to be developed for Wellington harbour	A SMS document was subsequently developed to describe the systems managing navigational safety by the GRWC Harbours department. The Hazman II online risk management was introduced to record risks as well as incidents as they occurred. CentrePort developed a comprehensive set of operating procedures, which have been reviewed and developed further over the interim 10 year period. An enhanced programme of pilot training using simulators has been implemented for all serving pilots, which is also used for harbour development.
2	Tug power is due for an upgrade in Wellington as available bollard pull is no longer sufficient to handle the largest windage vessels in the changeable conditions at Wellington, without further environmental limitations being considered.	February 2008 - One of the Voith tugs was replaced with an ASD tug with a bollard pull of 68 tonnes and a second tug of the same design and bollard pull was delivered in April 2013. This provided the port with a modern tug fleet that could manage all of the larger tonnage using the port. In 2017, Wellington still has three tugs available.
3	A strong conclusion by Authors from this risk assessment is that the future role of Wellington Harbour Radio Signal Station needs to be defined and its equipment improved.	October 2010 - Both Building facilities and equipment were renewed. The equipment was replaced with a Transas Navi-Harbour system. Recommendations for its future role is commented on in this report.
4	A Service Level Agreement (SLA) between the two key organisations involved in running the harbour could be one way to facilitate a professional link between the pilotage service of CentrePort and movement management by the Harbour Master system.	There is an active SLA in place Included in the Procedures Manual at Beacon Hill and the SLA was again updated in September 2016

No.	2006 Operational Risk Assessment Key Recommendations	2016 Status
5	The pilotage jurisdiction requires redesigning and introduction of a system of Pilotage Directions is recommended, which would be approved by MNZ. This represents a change to the approach presently used by Maritime Rules and may be applicable to other harbours in New Zealand.	Pilotage jurisdiction is redesigned – Wellington Nautical Charts are updated where appropriate
6	Recommended Tracks require formalising for use by all and referred to in bylaws.	July 2009 - Incorporated in the Bylaw Amendments and on the Nautical Charts in 2015. Pilotage Plan electronically available by CentrePort.
7	Improvements in the present frequency of Hydrographic survey and the use of risk-based techniques to develop a dredging programme based on known accretion rates are recommended.	CentrePort and LINZ have completed two hydrographic surveys, 2014 and 2008 respectively.
8	The implementation of wind, tide and wave measuring equipment on the Front Lead, measuring the environment at the most critical part of a deep draught vessel's transit is encouraged. With this in place data interpolation between this and measurements made by the offshore buoy would allow conditions anywhere in the entrance to be determined.	A continuous harbour met observation system is now in place with wind speed & direction reads from the Front Lead (including sea state), Seaview Wharf, Ferry Terminal, Aotea Wharf and Burnham Wharf. In the same line, wind speed & direction (amongst other info's) are now continuously available from Kaikoura, Cape Campbell and Tongue Point giving early warning of an S'ly change. The Met Connect web address is - http://www.metconnect.co.nz/

Table 15, Significant Changes Following 2006 Risk Assessment Recommendations

6.2 THE IMPORTANCE OF BEACON HILL TRAFFIC MONITORING SERVICE

The 2006 risk assessment recognised the importance to Wellington Harbour of Beacon Hill, given harbour topography and large volume of PEC passenger RoRo vessels that represent the Cook Strait passenger services. Recommendations were made to upgrade the systems and services at the Beacon Hill traffic monitoring station, such that it could take a role in providing a modern traffic interface to the then developing VTS standard[40]. Council not only subsequently invested in both hardware and ship tracking software, by 2010 a whole new Beacon Hill operating station was designed and built, with an upgrade of all hardware and software facilities. This included the installation of a new radar, monitoring the approaches and entrance channel, AIS data reception and upgrading of the weather information system. The existing radar equipment was replaced with a

Figure 42 : Beacon Hill Signal Station

[40] **VTS = Vessel Transit Services. A formal traffic service delivered to a set standard requirement of a harbour**

Transas Navi-Harbour system, that is able to monitor vessel movements by AIS transmission throughout the harbour, with radar coverage in the approaches and entrance. However, there is no radar coverage of the inner harbour wharf areas and Beacon Hill relies on AIS transmissions to monitor shipping traffic into every part of the harbour. Thus, vessels or craft not fitted with AIS transponders cannot be tracked everywhere in harbour waters, although the system does receive CCTV coverage.

With its technical upgrade, Beacon Hill has grown quite significantly in importance to Wellington Harbour since the 2006 risk assessment. Its existence is a tribute to the outgoing Wellington Harbour Master who for many years counselled for its retention and development. Its role does not include monitoring the waters of the Cook Strait, but its location and coverage does mean it has the potential capability to make an important contribution to assist a vessel in trouble in that area and a SAR response.

There has been considerable growth in Wellington Harbour in 10 years, which includes cross harbour passenger services, organised competitive rowing, recreational usage including yacht and motor cruising club growth and Beacon Hills importance as the eyes and ears should now be recognised in its future development.

6.2.1 HARBOUR INFORMATION RECEIVED BY BEACON HILL

Beacon Hill also receives and can promulgate: -

- Weather forecasts:- twice a day at around 0500 and 1700hrs Beacon Hill receives a Forecast from MetService via email;
- Weather Charts:- twice a day weather charts are received from MetService at around 0300hrs and 1500hrs;
- Swell Forecast:- a MetOcean swell forecast for Wellington Heads is received twice daily by email;
- Wave rider at Tory Channel entrance :- data is received from the wave rider buoy in Raukawa Bay near Tory Channel entrance;
- Readout of wind strength and direction at Baring head;
- Readout of wind strength and direction at Kaikoura and Cape Campbell.

CPL Metconnect Link is also available to Beacon Hill and provides:-

11) 1. 1 and 10 minute wind observations from set locations around the harbour;
12) 2. Hourly observations;
13) 3. Tides and sea states;

14) 4. Access to wave rider data;

15) 5. Inshore/coastal forecasts;

16) 6. Pressure / temperature data;

17) 7. Hourly forecasting models;

18) 8. Southerly Wind Changes (Kaikoura, Cape Campbell, Wellington, Tongue Pt & Brothers).

The Baring Head buoy is to be upgraded to provide an AIS readout, which will allow raw wave data to be received by any AIS transponder. Results could then be output anywhere, provided an analytical package is available to process the received data. NIWA has recently deployed a wave rider buoy in Wellington Harbour and AIS transmission of data is planned (AIS protocols have a message type for such use). AIS transmission would allow real time data to be used to any vessels which can receive it and BH should be able to see the info on the Navi-Harbour screen.

6.2.2 BEACON HILL - WHERE TO NEXT?

Beacon Hill presently delivers its services by dedicated staff, many of whom have been serving the communications needs of the harbour for many years and thus have considerable knowledge of the Wellington waterways. Beacon Hill is well liked. A tanker master servicing the NZ Coastal fuel services provided very complimentary feedback about the Wellington Beacon Hill interface.

"*Beacon Hill is acknowledged by my bridge team as being the leading port radio for giving out detailed instructions and information regarding pilot boarding times, courses and speeds required and confirming that the pilot will contact the ship with confirmation of instructions prior to boarding. Most other ports do not do this*"….And "*It is the leading port radio station, with Tauranga & Dunedin snapping at their heels*".

That is not to say that Beacon Hill does not have criticism; it does. Candid stakeholder feedback references an uneven quality of delivery between different Harbour Communication watchkeepers. Although Beacon Hill is connected to the best available weather data sources, visual observation does not always occur or is not promulgated accurately.

There is little reported proactive communication from Beacon Hill for the ship movement interface. VHF Channel 14 use has little management and a RoRo Ferry exchange can take time when the Pilotage service is needing to commence a Master Pilot Exchange in the approaches. Feedback about CH14 VHF use is provided not only by pilots and tanker masters, but also by one RoRo bridge team. A need for independent traffic management is also tabled by some stakeholders, especially with respect to basic movement sequencing. There is a constructive view from CentrePort that a policy to deliver a more proactive communication role from Beacon Hill would be of benefit, combined with a policy move towards training would assist in their operational interface.

Beacon Hill has not been declared with any status in terms of its traffic role internationally, which it should under the IALA system for Port Authorities. Some ports in New Zealand promulgate themselves as a Local Port Service (LPS), which is a level beneath the lowest form of the Association of Lighthouse Authorities (IALA) guidelines for Vessel Transiting Services (VTS)[41] in port waters. In fact, this is a designation which actually means no service at all, with no requirement for an electronic traffic image or much other than a VHF portable radio. LPS is a service delivery, normally by VHF radio for coordinating the services provided by a port company (pilotage and berthing times, etc); essentially the CentrePort duty pilot desk. A number of NZ ports deliver exactly this from their pilot service co-ordinator or security gatehouse or port gate entry kiosk, some with just a radio co-ordinator. Some have declared an LPS service in the World Ports Guide, a publication that all SOLAS vessels carry.

Beacon Hill is a 24-7 shift-manned station already in effect providing a VTS standard Traffic Information Service, using its radar and electronic tracking equipment, including an AIS base station, that in terms of its equipment is fully complaint with IALA standards. It is hardly an "LPS" standard of equipment. The need to deliver a traffic management service is an international obligation that Port Authorities have (in this case GRWC) under SOLAS Chapter 5, Regulation 12. The only reason not to deliver a traffic interface is where risk is so low that a traffic interface is not justified. In Authors experience, the number of port movements where the delivery of a traffic interface is both economically viable and worthwhile based on risk is about 1,200-1,600 general cargo shipping movements per annum. Wellington has close to 6000 passenger RoRo vessels movements per annum and is now handling close to 100 cruise ship visits (200 movements), amongst which are some of the largest cruise vessels in the world. Ports handling tankers almost universally provide a traffic interface to VTS standards, Wellington has two dedicated tanker terminals and Aotea Quay. In essence, by international agreement, VTS is to be established where either the volume of traffic volume OR the degree of risk justifies it. This is not to say that Wellington is doing anything unusual in New Zealand; all ports work against this background. There are also no National Guidelines for Vessel Traffic Services in New Zealand, yet all that needs to happen is for the IALA VTS Guidelines to be adopted – there have been IALA Guidelines since at least 2000[42].

Clearly, there is a traffic profile of significant volume at Wellington as well as an entrance which has adequate evidence of risk, which does justify the investment that has already been made in the

[41] **The Association of Lighthouse Authorities (IALA) provide the VTS standard for ports worldwide, which implements SOLAS R5 Chapter 12 requirements.**
[42] **The latest IALA VTS Guidelines were released in 2016.**

Beacon Hill station. Its operators also have the respect of some of the most regular traders visiting the port, with their feedback placing its service as *class leading* in New Zealand.

Given the ongoing occurrence of close quarter incidents between Passenger RoRo ferries and tankers as well as the volume of passengers transiting the entrance, the Authors are of the opinion that is now time that GRWC Harbours Department started planning the introduction of training to IALA standards for its Beacon Hill watchkeeping staff. In reality, very little would change, but the first step would be made to turning all the technical capability already in operation into the leading traffic management interface in New Zealand. This is done by commencing the training of personnel to the IALA V013-1 standard. It is an incremental and planned change.

Wellington will not be the first Port in New Zealand to introduce IALA standard training if it did. Northport, who also purchased the same Transas VTS software for their traffic management purposes, have introduced training for their staff to the IALA V103-1 standard. This is despite there being no national guidelines in NZ for Vessel Traffic Services as yet.

If the Harbours Department elect to proceed, harbour risk management can be delivered by traffic policies in a number of effective ways.

6.2.3 WHAT ARE THE BENEFITS OF IALA VTS TRAINING?

The answer to this question lies in some of the near miss incidents.

1. In the case of AAL BRISBANE (**Section 3.1.6**), a near-miss grounding in the Wellington approach was successfully averted by the pilot on arrival onboard. However, the Beacon Hill station had both radar and AIS reception. It equally had the equipment to determine, if used by a trained operator, that there was a separation of the radar target and the AIS transmitted position of that target. A trained operator would have been able to establish a problem and converse with the bridge team as to what his system was showing and what that could mean. That does not mean taking on any liability, it means advising a bridge team that the traffic image at Beacon Hill is showing something unexpected, given that there was only one vessel out there. Professional seafarers, with an appropriate prompt to check would have established for themselves that they were off course and that their electronics were not aligned with the radar overlay. This was something the pilot picked up immediately he arrived. However, the arrival of the pilot was the last opportunity to recover the situation, a trained watchkeeper provided the opportunity for recovery at a much earlier stage.

2. There have been a number of traffic close quarter interfaces between Tankers and Passenger RoRo ferries. With training in Beacon Hill, some traffic policies could be set. These would be

simple in nature and essentially facilitate a priority of the sequencing of ship movements towards those vessels carrying passengers and ultimately those vessels on scheduled services carrying large passenger complements. This addresses some of the key collision risks of the harbour and also ensure separation of vessels carrying hazardous and inflammable cargoes from vessels carrying passengers.

3. A policy to sequence vessels by type priority would allow movement planning to be introduced to the harbour. Sequencing vessels is easy in that a vessel waits at the berth until its turn in sequence. Thus a departing log carrier from Aotea would wait if there was a Passenger RoRo scheduled and on time to leave. A 10 minute additional time alongside for a bulk carrier makes no difference at all to the timing of its voyage progression, when the distances involved are considered. Equally, a tanker departing from Burnham wharf would be given a slot time to arrive at the Evans Bay entrance, such that an inbound or outbound passenger vessel (Cruise or passenger RoRo) would have passed. The Transas software readily calculates the time needed for a vessel to arrive at any harbour waypoint that is set, so it is quite a simple matter to set a results-orientated request of waypoint timing also to the tanker. The tanker bridge team and pilot has the choice of how to achieve this, either wait alongside or slow speed through the bay.

4. Pilot boarding of vessels inbound, aligned with the leads and committed to the entrance would all but cease, as a trained operator would advise an inbound vessel simply to wait at the pilot boarding station and go around if the pilot vessel is later than predicted.

5. There is a system in the Transas tracking software in Beacon Hill, which allows an electronic "ring fence" to be placed around an anchored vessel. Wellington harbour has areas where the bottom is soft and secure anchoring difficult. A vessel dragging anchor was attended to by a pilot in recent years, but only because another pilot visually noticed that an anchored vessel had moved. In the recent past, RoRo Ferries unable to berth due to high windspeed and/or propulsion limitations have also dragged anchor. With training, a Beacon Hill watchkeeper could have set the tracking system up to automatically alert if an anchored vessel moved off station. Beacon Hill is also then in an immediate position to alert CentrePort, who own the towage assets.

6. Risk Management at the Delta boarding location can be improved with a more engaged Beacon Hill Operation (see **Section 6.3.3**).

Thus, if Beacon Hill personnel are trained to IALA standard, risk control that is in 2017 important to risk mitigation could be implemented (i.e. Traffic policies of vessel type for movement priority; automatic monitoring of anchored vessels, improvements to VHF radio traffic; proactive monitoring, etc). Practically it makes little sense for a passenger RoRo on a schedule, capable of 18 knots

outbound to follow a departing tanker out of the harbour that can achieve 12 knots. Equally, inbound passenger RoRos crossing Cook Strait at 20 knots would proceed through the entrance prior to an inbound cargo vessel having just boarded a pilot. Situations where an inbound tanker aligned with the port entry channel leads is overtaken by an inbound passenger RoRo Ferry, which had cut between Barrett Reef and the tanker, will cease to occur.

6.2.4 What Needs to Occur to Train Beacon Hill Operators

Maritime New Zealand, as the Government Agency for maritime matters needs to be encouraged to develop national guidelines, based on the 2016 IALA VTS publication. This provides the environment for future change and recognition of qualifications.

However, there is nothing preventing training of Harbour Communication Officers to the V103-1 IALA qualification. The IALA VTS "system" is widely in use in Australia and training providers are available, who would travel to site to deliver the basic V103-1 training. Then a period of developing experience and some on-the-job training. The traffic interface and service from Beacon Hill can be declared in the Worlds Ports Guide[43], as an LPS undergoing training and preparation to deliver a Traffic Information Service.

A Traffic Information Service under the VTS system is just that. The upgraded Beacon Hill provides information to vessel traffic; essentially, the Harbour Communication Officers are already delivering this form of service. With V102-1 training, the Beacon Hill service delivery can only be enhanced.

6.2.5 The Need to Improve Radar Coverage

If Beacon Hill is to improve its capabilities by training, it needs to also improve its harbour coverage by radar. Inside the Harbour, tracking is by AIS only, yet the inner harbour area is where the greatest number of smaller craft without AIS transponders operate. A second radar is needed to make the vessel tracking capability complete within Wellington Harbour.

6.3 PILOTAGE SYSTEM

CentrePort operates a pilotage system that has been found to be technically well-engaged with emerging technology and is extremely proactive in the NZ industry environment. The marine team is comprised of well-established and trained pilots with a solid local knowledge of Wellington Harbour. The Marine Manager has been in post for many years and provides CentrePort with a stable and knowledgeable resource, as well as pilots who are committed to Continuous Personal

[43] **The World Ports Guide is mandatory carriage for all SOLAS vessels**

Improvement (CPI). Although the Kaikoura Earthquake has provided many challenges for CentrePort as a business, the experience of marine services team have been vital to the changes the business has needed to make for recovery.

Wellington Pilots provide professional leadership to New Zealand pilots in general through the New Zealand Pilots Association, which is committed to furthering their profession. Professional training for pilots, especially in the more difficult fields of human factors and interfacing with bridge teams of differing nationalities.

Pilots have been tripped with and provided open discussion and contributed significantly to the 2016-7 risk assessment. The pilotage service has been able to procure a new pilot vessel at a time when the CentrePort fiscal view must be tight.

6.3.1 Operations and Procedures

6.3.1.1 Description

To improve marine operations for vessels transiting Wellington Harbour, both CentrePort and the Harbours Department have established operating procedures published either in the Bylaws or port operations guidance.

The establishment of comprehensive procedures influences marine operations, as the human element can be considered a catalyst in safety management. Wellington Harbour has shown evidence of operational improvements since the last risk assessment and these have been applied by either modifying existing, or implementing new, risk control measures. The availability of navigational information, usage of hardware/software solutions, and implementation of operating procedures are key components of a safety system which minimises risks during marine operations.

6.3.1.2 Relevant Risks

Based on feedback from stakeholders, collision and grounding hazards are classed as key risks for Wellington Harbour. Lesser risks include contact berthing, mooring failures, and fire on-board vessels.

Incidents that occur in the Wellington Harbour incident profile reflect the key risks. Close encounters involving both commercial and recreational vessel types occur frequently in areas that include charted recommendation tracks. The near miss grounding (**Figure 10**) that occurred in 2012 is a perfect example of the unsafe navigation of a cargo vessel and indicates ISM compliance failures.

During the data gathering and hazard review the following issues were discerned:

- UKC and Controlling Depth information are not advised correctly in Admiralty publications[44];
- Recommended Tracks are not mentioned in the Admiralty publications, but they are readily available in New Zealand nautical charts and online via CentrePort;
- ISM compliance failure of navigational equipment during pilotage; and
- Vessel crew fatigue is a significant cause of incidents, especially in contact berthing incidents.

6.3.2 Pilotage Services – Risk Controls

With over 1200 pilot trips per year on average, navigational safety is of great importance at Wellington Harbour. Significant improvements have been made, based on recommendations proposed in the 2006 risk assessment. In summary, these improvements are:

- The pilotage jurisdiction has been modified so that it aligns with Harbour Limits;
- The Recommended Harbour Transit Routes have been formalised into a requirement by Bylaw 6.1.4, affecting vessels of 18 metres or more in length. These have been published on Wellington Harbour Nautical Charts, 2009 onwards;
- A Pilotage Passage Plan, already in use, has been improved and further information added; Pilotage and berth plans are available for every terminal as well as environmental information;
- Training for all pilots using marine simulator technology and the testing of movement safe parameters for berthing, as well as emergency response and recovery;
- The use of Portable Pilot Units (PPUs), which provide positional and heading information independent of the vessel and to a greater accuracy. Used either with IPADs or rugged PCs;
- A Pilotage Risk Assessment is undertaken for deep draught vessels;
- Use of Delta Boarding has reduced significantly.

  In addition, CentrePort has amended many of its operating procedures to adapt to the marine traffic profile as it has grown since 2006. Its SMS system is thus learning and developing and in the independence of the review team is as good as any port that has been visited.

6.3.3 Delta Pilot Boarding Location

Section 5.7 introduced the Delta boarding position. A discussion of the arrangements for Delta needed to proceed after the report section discussing Beacon Hill improvements. Wellington has four pilot stations, three of which are shown in **Figure 7** and located within the harbour approaches. The forth, Delta, is located within the entrance and it is designed for use on occasions when it is too rough to board an inbound vessel offshore[45], see **Figure 43**. The location of pilot station D is in

[44] **NP 51 states that the UKC and controlling depth for Wellington Harbour is 0.9m and 11m, respectively.**
[45] **Wave information acquired from the Baring Head waverider buoy shows strong southerly winds and opposing tide commonly produce large and steep waves, providing difficulty for a vessel making a lee for safe boarding.**

sheltered waters inside the harbour entrance channel. To use Delta for boarding though, a pilot has to lead a vessel into the harbour entrance channel and in doing so, pass some of the most important grounding hazards of the harbour. There are many harbour viewpoints around the world, risk based and pilot viewpoints, that frown over the leading of vessels. On the other hand Pilotage Acts (i.e. Legislation) around the world are equally careful not to disallow leading of a vessel. The New Zealand

Maritime Rule Part 90 (Pilotage) also explicitly facilitates leading. This is because historically it was impractical with small pilot boats to board vessels in rough seas. Today, even with larger and better designed pilot boats, boarding in rough seas remains hazardous, with smaller vessels often unable to make a safe lee. Further, there are always occasions where a vessel needs to enter a port for safe refuge and leading to a safe place to board is a lesser risk than turning the vessel back to sea.

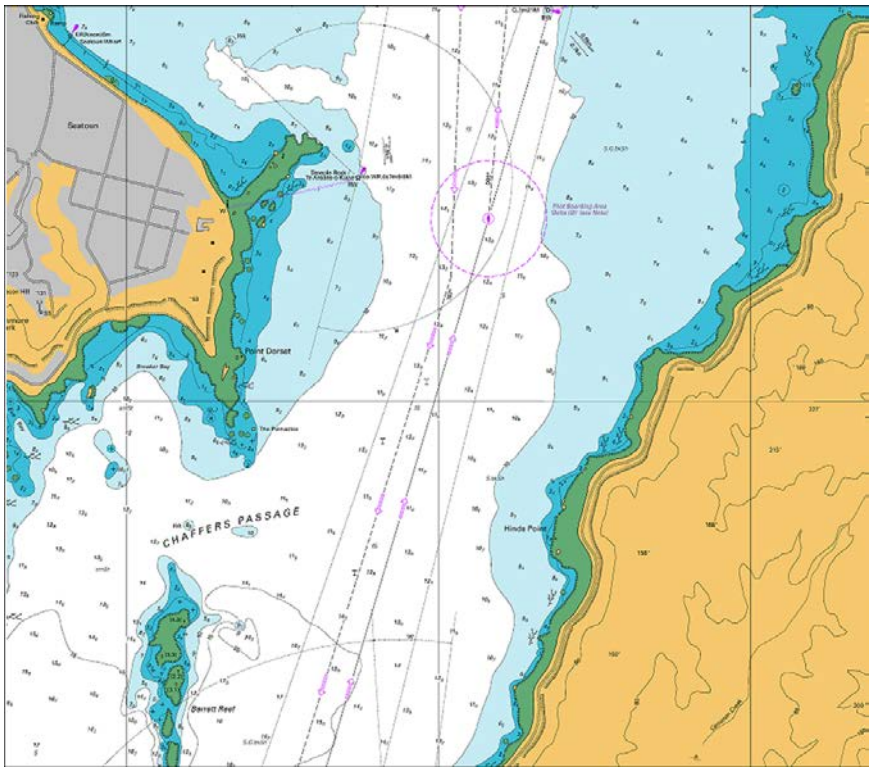


Figure 43 : Delta Boarding Location

Wellington has always had the Delta boarding location and the pilotage limit used to lie at, or about, Delta. Pilots with long service at Wellington were thus trained for boarding at Delta and comfortable in its use, whereas pilots without such long service recognise the need to interface with and understand the bridge team before the hazards of the Wellington entrance are transited.

Wellington is a port which needs a planned back-up boarding location, so the Authors of this review are positive about the need. However, modern port authority thinking over leading vessels also needs to be considered, to ensure Due Diligence. Ports conducting leading today almost always use

the capabilities of their Harbour VTS (shore based ship tracking, such as with the equipment beacon Hill possesses) system[46], in conjunction with a deployed pilot, to ensure communication is clear and that the tracking overview of a movement being led is working. VTS tracking systems are significantly superior to the standard available from a pilot boat chart plotter. CentrePort already has detailed SOPs for Delta (both for boarding and disembarking), including written support for pilot decision-making.

The limitations of leading from the pilot boat are:-

- There may be a technical fault with navigation systems on board the vessel, which a pilot may diagnose on arrival (this has occurred).
- There may be low standards of competency on-board and it is not possible to truly assess that without a presence on board;
- There may be poor communication skills, onboard or ship to pilot vessels or ship to shore;
- Unfamiliarity with pilot station D by the vessel's bridge team;.
- There have been issues with pilots departing early and a vessel bridge team becoming later confused whilst still in pilotage waters (*Idas Bulker*);
- There is no real time tidal flow measurement at the harbour entrance, so a pilot remote from the vessel cannot be sure of the likely alignment needs of a vessel;
- The pilot boat only has limited electronic equipment to accurately measure the progress of an inbound vessel;
- When seas are rough, it is also rough onboard the pilot boat and difficult to be sure of the track a vessel is taking (and AIS output is only as good as the vessel equipment it is connected to);
- Once a pilot finally boards at Delta and arrives on the bridge, there is no time for a proper master pilot exchange, or for the pilot to familiarise himself with the bridge equipment;

It is also true that the new pilot boat will have significantly better sea performance in the sea conditions at Wellington entrance.

[46] **The Port of London for example introduced leading from one of its outer entrances to a safe place to board using a pilot providing advice from the ports VTS. This included channel modification to provide a straight transit and occulting markers.**

Aspects that presently help reduce risk in favour leading are:-

- The capabilities of the equipment installed at Beacon Hill can track a vessel (and future waypoint times) much more accurately today (but not without staff training);
- The pilot training system is technically much better that it has been historically. This includes BRM training, which helps a pilot manage the communication of instructions to the vessel and obtain confirmation;
- By July 2018, all vessels will be required to carry ECDIS equipment, which can be used to help a vessel align with the leads and monitor progression. This has to be tempered by a backlog in training of seafarers to use ECDIS equipment effectively;
- Wellington has exceptionally clear leads, which are sensitive to a vessel vectoring off track;
- A vessel passing through the Alpha boarding diamond on the chart is by location aligned with the Wellington harbour entrance leads. The transit from the outer pilot boarding area is straight and relatively straightforward (but would be more difficult in heavy swell states);
- The port entrance channel is straight to the location of Delta;
- There are already SOPs in place to prompt the pilot for the information required, including use of the English language, before agreeing to lead a vessel;
- Pilots are already doing a mini risk assessment to establish their own satisfaction that leading is necessary and safe.

Options to mitigate the risk of a Delta Boarding

- To designate only senior pilots for boarding at Delta in poor weather conditions (May have resource planning implications);
- Limiting the state of the tide, especially the Ebb in a strong Southerly for leading operations;
- Undertake leading operations in daylight only;
- Set clear requirements not only for English, but for a navigational decision maker to have at least some familiarity with the Port of Wellington (this would allow coastal tankers, for example to be led, and prevent other vessels types from being eligible);
- Place a pilot in Beacon Hill to use the capabilities of the tracking equipment and improved;
- Use trained Beacon Hill staff to assist the pilot in establishing via VHF that the Bridge team are fully conversant in English, prior to the vessel making an approach;

- Make improvements to the sea state and tidal data available in the entrance, by deploying a wave rider buoy with AIS data output, measuring both wave height and current. This could be most useful in the Barrett Reef buoy area;
- Use Beacon Hill Equipment to test the accuracy of a vessels ECDIS tracking in the approaches before leading is accepted (requires training of Beacon Hill personnel or use of a second pilot).

6.4 TOWAGE CAPABILITY

Towage is a vital service for the Port of Wellington; its rapidly changing weather conditions mean that tug power needs to be available at short notice. Two modern and matched bollard pull tugs are available to the Port; *Tiaki*, built 2007 and *Tapuh*i, built 2013. These are critically important assets that serve the port well, although they are berthing tugs. The port does not possess offshore towage capability any longer. Provision of assistance to tow an immobilised vessel in the Wellington offshore area or approaches for example would not be possible in all but the calmest Cook Strait conditions.

Although Wellington has tugs each with a rated 68 tonnes capacity, these are not going to provide their rated bollard pull in all conditions of with all ship types. Deep draught vessels for example (laden tankers) practically limit the water flow entering the tugs stern drive systems, because water has to flow under a hull deep in the water. This can affect pushing up for berthing.

Wellington, in 2017, needs to use both its tugs for berthing large vessels. Guaranteeing service availability for almost every berthing occasion drives a need for proactive maintenance as well as arrangements in place to charter a backup tug for maintenance docking.

6.5 MOORING OPERATIONS

Mooring operations at the Wellington Harbour come with a series of risks that the CentrePort operation already recognises and has undertaken berth infrastructure assessments and mooring upgrade work already. An example is the Mooring Breakout hazard at Seaview, **Figure 43**, which ranks 13 overall.

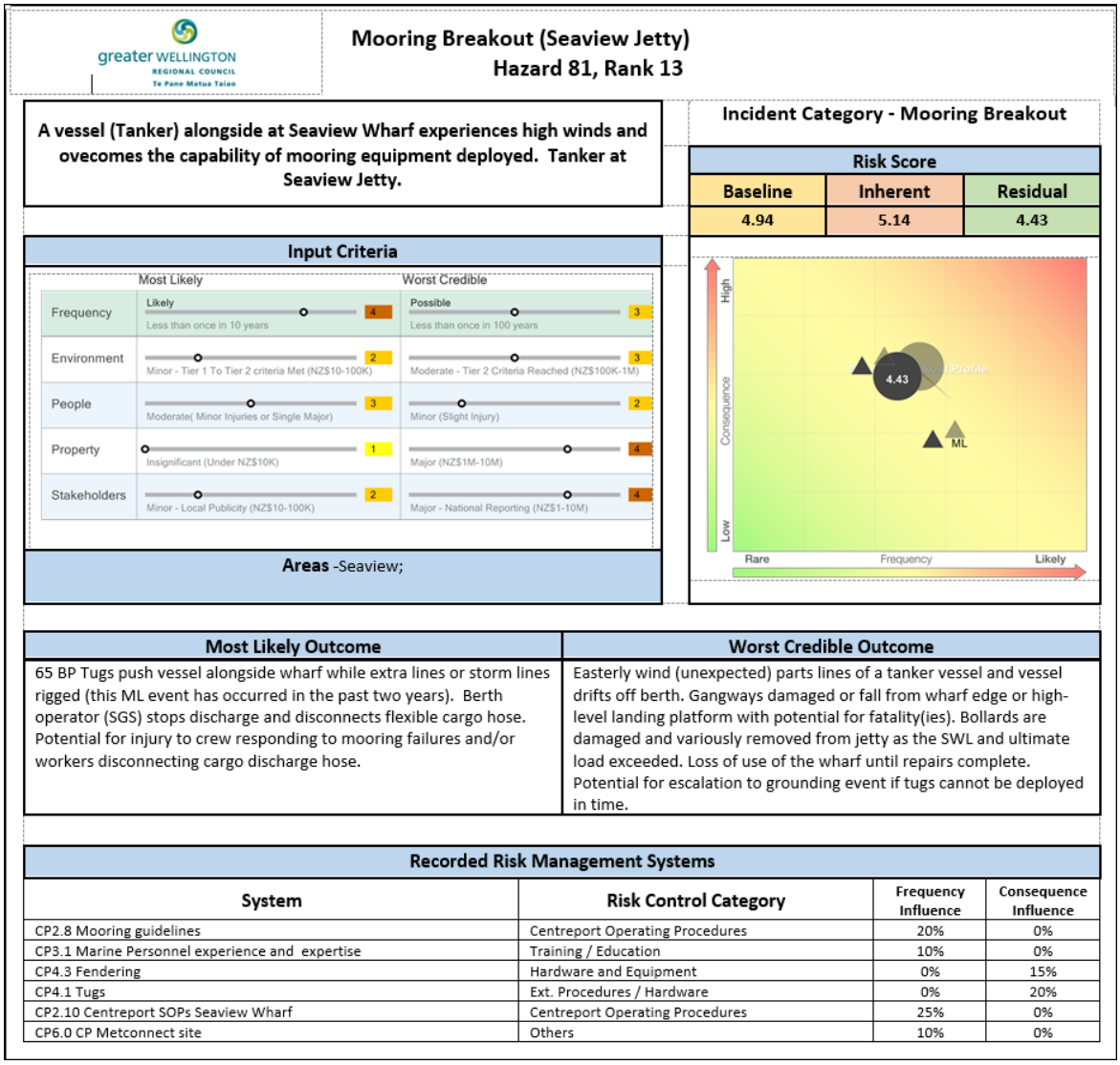


Figure 44 : Hazard Summary - Mooring Breakout Seaview Jetty

6.5.1 MOORING BREAKOUT

The capacity of shore moorings is a subject which has been challenging many of the worlds ports, as ships have increased in size. The Wellington terminals do suffer from limited bollard load capacity in relation to the increasing size and windage of vessels now visiting the port. In high winds, the potential for bollards to break is a notable risk when vessels of high windage are attached. Lambton Harbour with its old wharves now mostly service only small vessels, including the smallest of the cruise ship visitors and naval ships (Queens Wharf). However, Glasgow Wharf still services vessels of one of the Cook Strait RoRo ferry operators, which includes the largest passenger RoRo on the service. The Wellington oil jetties are older structures and mooring arrangements are generally more difficult to upgrade than at Aotea Quay.

6.5.2 LINES CREW INJURY

The handling of ships lines is a hazardous role. For cost reasons, cargo and passenger ships continue to use mooring ropes and tankers mostly use wires which snap-back with very high energy if parted under load. Lines crew are trained to national standards and progress as experience and competence are gained and, at CentrePort, there are few reports of injury. Crew working on mooring lines are contractually obliged to avoid working while fatigued. CentrePort procedures prevent line crews from operating in winds of 40knots or more. This is a high windspeed and practically container cranes would have difficulty operating in windspeeds over 35 knots. However, there are no general windspeed limits for the berthing and unberthing of ships in Wellington, which has been historic.

Equally, the handling of tug towage lines can be just as dangerous. However, modern lines used in NZ ports, including Wellington, do not store elastic energy and fall harmlessly if a parting occurs. Ships lines are not used for towing.

6.6 GAP ANALYSIS - SEAVIEW AND BURNHAM MOORING ASSESSMENTS

This section recognises that there has been few reports of damage at the tanker terminals, which is a tribute to the safety management measures taken, as well as the expertise of pilots and tug masters. Seaview tanker jetty has undergone a recent structural load assessment of its mooring bits and fixtures. There has also been an ongoing and incremental increase in tanker size since Seaview Wharf was constructed, in the 1970s. The terminal was designed for tankers at the time of about 29,000 tonnes displacement, about half the size of the tankers that Seaview Wharf handles today, about 60,000 tonnes displacement. Globally, ship sizes are increasing, which in turn increases windage and the tension placed on mooring or towage lines. The assessment included the dolphins, which are placed in the water to take tanker head and stern lines, allowing the manifold to align with the jetty[47] and the mooring system to safely provide the purchase needed to retain the tanker alongside. The mooring assessment[48] concluded that the dolphins had bollards mounted on them, with safe working loads below that of the parting load of any attached tanker lines. In other words, the bollards would fail before the ship wires in a mooring breakout situation. Given that more than one ships line can be attached to a dolphin, this is practically a significant limitation.

This assessment calculated an “Ultimate Limit State” of potential wind conditions in the area and concluded that situations of high consequence (e.g. breakouts) could be predicted. Windspeed thresholds that produced Safe Working Loads (SWL) on moorings were calculated (assuming a

[47] **Hoses are used for cargo discharge, which are hoisted aboard the tanker by its manifold crane.**
[48] **Holmes Consultancy Group.**

representative tanker design), with Easterly direction providing this load at 45-59 knots, as the wind would then be on the beam. The predominant Northerly needed 68-93 knots to produce the SWL of the mooring system. Although the easterly is the least likely direction, if a low is passing through the wind swings through this direction. The mooring software "Optimoor" was used, a package recognised by OCIMF[49] which is also used by Marico Marine in Europe.

When analysing the recorded windspeed data, one occurrence of windspeed creating conditions exceeding mooring system Safe Working Load was reported from 9 months of data history. The assessment appeared to have use a 3 second gust period to assess windspeed loadings, which may not fully model conditions at the location.

Section 4.8 has refenced that large tankers have already been accommodated at the Wellington terminals. Tankers of 75,000 tonnes deadweight and 228metres in length (overall) are worryingly large for the Seaview jetty and mooring arrangements to accommodate. However, even the "regular" tankers now being used to transport oil products to Wellington are in the order of 46,000 tonnes deadweight. A heavy landing, or even a mooring breakout, due to increased windage load, as a tanker transits from the loaded to ballast condition could damage this terminal. Vessels of this length also "overhang" the mooring system. The consequences at Burnham and Seaview Wharves are different; Burnham supplies Wellington Airport with Avgas; Seaview takes a number of different fuel types (gasoline and gasoil). Loss of utility in either though may affect fuel supplies to the Wellington region, recognising that there is a third tanker facility at Aotea Quay (although this only handles light fuel oil (LFO) burned by the Cook Strait ferries and gasoil).

Authors of this risk assessment report, with their independence, express some caution that Seaview as a minimum needs some thought given to upgrading in the medium term, as the Holmes structural report is hinting at an underlying structural weakness "at the component level". Compliance with the various standards for oil jetties and their mooring systems is not inherent.

A cost effective option may be dolphin upgrades to provide better holding capacity. However, there are also many mooring system options. These include a mooring system located on the wharf which uses a load-cell to pay-out the mooring when a severe wind gust impact occurs. The system automatically hauls in and recovers the mooring tension after the wind load has passed (this is an expensive option though).

The problem is that should mooring breakout occur, it takes about 90 minutes for a tug to arrive on station at Seaview. The location of the jetty also means that in some gales, the short seas that form

[49] **Oil Companies International Marine Forum**

can affect the ability of a tug to push up at full load on a vessel. There are presently no requirements for a tug to attend tanker terminals during times of high windspeed, a policy which may be in need of review with larger tankers.

Although there are a number of accepted tanker mooring system standards (OCIMF [50] or BS4649/AS4997), they are consistent with each other. Practically, ships will not get smaller and although Authors recognise that CentrePort are considering upgrading the existing bollards, further load assessment work should be considered with respect to mooring systems and upgrade options developed.

CentrePort Standard Operating Procedures (SOP) take into account the problems that easterly wind conditions pose for tankers using Seaview Jetty. The option always exists for discharge to be halted and vessels to temporarily move away. Berthing is also strictly controlled by procedures, which recognise the problems of structure.

Pilots in 2017 still report some issues with fendering quality at Burnham Wharf. While this wharf is not as busy as the two other Wellington tanker terminals, Evans Bay is particularly susceptible to high windspeeds, which can make berthing at Burnham challenging. The condition of fendering was a subject also of the 2006 risk assessment.

6.6.1 Tanker Terminals – Risk Control Summary and Options

6.6.1.1 Risk Controls – Tanker Terminals

- Berthing using towage is mandatory for the tanker terminals;
- Tanker closing speeds are limited by pilotage procedures;
- Use of Portable Pilot Units (PPUs) to monitor terminal closing speeds;
- Only pilots experienced and qualified to unlimited status berth tankers;
- Use of MetConnect, providing up-to-date information on weather and tide conditions;
- Fendering – Limited capability, but it is fitted.

6.6.1.2 New Options – Berthing at Tanker Terminals

Instances of failing mooring bollards feature in New Zealand ports and Wellington with its high windspeeds is susceptible. Mooring ropes and wires, suddenly freed from high loads, whip with high energy. Other legislative drives exist such as new OSH legislation.

[50] **Oil Companies International Marine Forum**

1. The work by Holmes Consulting is by their expertise structural and a holistic approach. The option exists to conduct a more extensive mooring study using the Optimoor Software to explore improvement options;

2. Consider, by procedure, allocating a tug to attend discharging tankers at times of high windspeed (set criteria);

3. Consider formal towage criteria for tankers in general, recognising that CentrePort's SMS system already requires tugs to berth;

4. Consider setting limiting windspeed parameters for berthing at different berths, based on their worst exposure direction and the size of vessel using them;

5. Consider installing equipment to provide closing speed readouts at tanker terminals or make improvements to the standard of pilot PPU sensitivity (e.g. Harbour Pilot, if Navicom Brand);

6. The Aotea Quay tanker discharge terminal is close to the berthing location of Cruise Vessels. As the repair of Aotea quay progresses, the option appears to exist to berth Cruise vessels further north along Aotea Quay. This would increase the separation of passenger operations from a tanker discharging fuel.

6.7 IMPROVEMENTS TO MOORING SYSTEM - AOTEA QUAY

In recent years, a mooring breakout has occurred at Aotea Quay, involving a vehicle carrier with high hull area (windage). The mooring system has also undergone an important upgrade to accommodate the rise in cruise vessel visits and sizes. Cruise vessels provide large slab side and surface areas. Balconies also act as sails, especially when vessels are swinging[51]. The loads created by wind can be hundreds of tonnes (which changes with the angle of incidence to the wind). With a rising number of cruise vessel visits and a rapid increase in size, additional sunken mooring points, inboard from the quay face, were installed at the cruise vessel berths along Aotea Quay (see **Figure 44**), providing increased capability to withstand the high loads possible when large cruise vessels are berthed. The arrangement provides purchase at right angle to the vessel alignment alongside, which traditional mooring systems cannot achieve. Fenders on this wharf have also been renewed. The new bollards and fenders have significantly improved safety for cruise ship berthing and staying alongside. This is

[51] **Wellington does have an advantage to other NZ ports in that it is not necessary to swing a vessel fully on arrival or departure, as there is sea room for a vessel to come alongside port side to. The increased towage capability is able to control, push vessels alongside, or pull off for a departure.**

a substantial improvement for this vessel type, but it means that flexibility of use is limited to the location where the new mooring sockets are fitted.

Figure 45: Aotea Quay Improvements to Mooring Systems - Cruise vessels

Tankers also berth adjacent to the section of Aotea Quay designated for cruise vessels and the improvements to mooring security also benefit this ship type. Positive feedback about the improvements has been provided by Tanker masters serving on the NZ coastal service.

The southern end of Aotea quay was badly damaged by the Kaikoura earthquake, meaning that a large portion of the apron is in need of dismantling, re-piling and reconstruction, including container crane load bearing areas and rails. The addition of further mooring sockets would be possible as part of this repair and is recommended. The location and capability of these mooring sockets should be determined with account taken of the expected growth in the size of container vessels visiting Wellington.

6.8 COOK STRAIT RORO FERRY TERMINALS

The rail ferry terminal (RFT), which handles RoRo ferry traffic exclusively, has had its fendering systems upgraded. For rapid berthing of RoRo ferries, the jetty is fitted with pneumatic suction securing, rather than moorings. The Cavotec system can absorb some shock loads from wind gusts, although its design is for rapid securing of vessels.

The recovery of passenger RoRo operations took time following the Kaikoura earthquake and disaster recovery planning for an emergency passenger RoRo discharge location may need to be reviewed, especially the availability of an alternative temporary RoRo linkspan solution.

From a navigational risk management perspective, the option exists to consider an option to moving the Cook Strait operation out of Glasgow Wharf, which removes the interaction of large vessels with the recreational users, who used Lambton Harbour in growing numbers. The navigational risk benefit of such measures is marginal though - the hazard of collision in this area has a rank of 43 and a residual risk score of 3.68 out of a possible 10.

6.9 VESSEL WINDAGE ANALYSIS

Historically, windage analysis in Wellington has focussed on Cruise Vessels to determine towage capacity and mooring standards needed. All vessel types in the port are growing in size, apart from perhaps containerships. However a successful channel deepening project will almost certainly result also in visits by larger container vessels.

For the most part, the ships berthed within the Main Terminal/Lambton Harbour can withstand strong north/south winds, as the wharves themselves are aligned north-to-south, meaning that berthed ships are likely to experience wind loading at either their bow or stern. While the terminals of the Main Harbour and the finger berths of Lambton Harbour are parallel in alignment, facilities in the Main Harbour are much more exposed to extreme weather, with the finger berths located within the more sheltered inner harbour.

In 2013 two mooring breakouts occurred at the main terminals. In June, a passenger RoRo ferry experienced a mooring failure while berthing due to very high winds, followed by a car carrier experiencing a mooring breakout one month later, with 60 knot winds reported on the beam from Aotea Quay. Car carriers provide a high slab side and always fitted with low installed power (thruster and main propulsion). The car carrier had to be pushed alongside with the assistance of tugs. In both cases there were no injuries or damage, though both incidents were considered high risk. By contrast, few recorded mooring breakouts have occurred in Lambton Harbour, more because of the limited vessel size (although bollards have been pulled out).

It is worthwhile reviewing the likely size of car carriers and container vessels using the port and undertaking new windage calculations based on their dimensions. This should be informed by expectations of cargo vessel sizes expected arising from channel deepening. The work done for cruise ships was beneficial, but it was not necessarily representative of the cruise vessels that then began to frequent the port.

6.9.1 WINDAGE – RISK CONTROL OPTIONS

- Review the likely size of car carriers and container vessels using the port and properly calculate their windage load, using a representative hull form. This should be further informed by expectations of cargo vessel sizes and increased hull size/type configurations that are likely to visit Wellington after channel deepening;
- Consider the need for windage load analysis associated with other vessel types (Container and Car carriers);
- Consider the need to set some windage limits (load or wind speed) for specific berths and terminals. Wellington already has these for container cranes and it is recommended that such controls may be necessary with harbour deepening. These may be procedures or they may be formal guidelines;
- Investigate the options to increase the number of high load mooring sockets along AOTEA quay, as referenced in **Section 6.3.4** locations, the same 90 degree angle, to provide direct purchase countering windage load.

6.10 ENVIRONMENTAL MONITORING

The environmental conditions in the approaches and harbour provide a catalyst for many marine incidents. As such it is a causal factor in many of the hazards of the harbour. Severe weather conditions and strong offshore currents in the approaches are a reality of Wellington Harbour. Rapid changes in windage at the CentrePort berths are well documented and dealt with by both pilot and PEC experience and is detailed in CentrePort SOPs. However, the ready availability of wind, wave and current information to mariners and pilots is vital for the decision to depart Wellington Harbour or safe navigation of a vessel.

6.11 ENVIRONMENTAL MONITORING - GAP ANALYSIS

6.11.1 ENVIRONMENTAL MONITORING - IMPROVEMENTS ALREADY MADE

The 2006 Risk Assessment recommendations emphasized the need for an upgrade of environmental monitoring capability in the harbour. Since then, there have been significant improvements, including hardware and software facilities. There is now equipment that measures wind and sea state at the Front Lead of Wellington Entrance as there is a power supply there. A subscription to MetConnect gives direct access to meteorological information affecting Wellington Harbour. Both the GRWC Harbours Department and CentrePort are users.

For Channel Deepening much research has been undertaken to improve the understanding of swell and wave propagation through the harbour. In 2017, NIWA have a wave rider monitoring buoy taking data from different harbour locations.

6.11.2 Environmental Monitoring – Improvement Options

Although the front lead is representative of the sea state in the entrance channel and as it is close to the Delta pilot boarding point it also underpins the knowledge that a vessel can be safely boarded at Delta. However, the sea state in the entrance channel is not truly representative of that at the harbour entrance, because the front lead location is well inside the harbour entrance channel and on the other side of the rise in sea bed which forms the Wellington Bar. Authors understand that tidal flow is not measured at that location, although a tidal flow measurement at the front lead may not be of much utility, as the current at the entrance is what will be creating heavy seas in a northerly/southerly.

Given the single wave-rider buoy in the approaches (Baring Head) being not that representative of local sea conditions, the option to deploy a wave rider buoy in the harbour entrance was discussed in the 2006 risk assessment. Given the potential for a channel deepening project to proceed, there is, in 2017, a more pressing need to obtain such data and undertake an accurate post-dredge underkeel clearance study for the entrance channel to Wellington. This is much easier to do now, as the larger ship hull designs have become less diverse and wave rider technology cheaper, with data processing and extract more efficient (wave rider buoy data output can be delivered by AIS transmissions, something with NIWA is rolling out already). Present wave response calculations in the entrance, including for channel deepening, rely on translation methodologies which are difficult and cannot accurately relate to the widely varying sea conditions that occur at Wellington Harbour entrance. A wave rider device located at or about the Barrett Reef Buoy would be a useful deployment. Improvements that can be made to wave and tidal flow data taken at the entrance would be of benefit to users.

Tidal height is measured from within the harbour at Aotea Quay, but it is not clear if the tidal height at the harbour entrance is the same as that measured at Aotea Quay.

6.11.3 Ship Movement Response Benefits from Improvements to Data

Correlation of wave data offshore to conditions within the inner part of the entrance would be of value to analysis of vessel responses when transiting Wellington entrance. The most restricted part of the entrance channel is the most crucial part for the transit into the harbour in adverse conditions (i.e. the point of highest risk). At present, allowance for dynamic motion is made within a minimum

static underkeel clearance criteria (UKC) of 1.5 metres in the channel, but there is little knowledge of ship motions that may occur at the time of the entrance and channel transit.

The generation of such data would be of use to many stakeholder interests, including those considering new tonnage for Cook Strait service.

6.12 RECREATIONAL RISKS

The potential for recreational incidents is notable, as many conflict with commercial and passenger services. Recreational craft are typically quite small, and as such are more susceptible to hazardous weather conditions. Recreational operators may also have little-to-no knowledge of the local area and or its bylaws if they own/lease their craft, and may operate without the guidance of local authorities or recreational clubs. It is worth noting that this is not due to any lack of information or interactions provided by these parties – rather that operators have the choice to conduct activities without them.

There have been many recreational incidents since the last assessment in 2005, including four instances of leisure craft foundering, usually as a result of severe weather conditions. Conflicts between rowing skiffs and larger vessels were relatively common – with five conflicts between rowers, sometimes several at a time, obstructing the path of a Cook Strait Ferry. By comparison, only one conflict was recorded between a Cook Strait RoRo Ferry and a recreational craft. Two conflicts were recorded between RoRos and yachts under sail. Speeds in Lambton Harbour are lower, so risk of a serious collision is also reduced.

Several close quarters incidents of recreational craft with each other have occurred, as well as five collisions. The type of craft involved in the collision varies, and includes Jetskis, Yachts, Waka and yachts racing. One close quarters incident between a tug and a recreational power boat was also reported.

The swamping or capsizing of recreational craft is also recorded, due to the most part from adverse weather conditions, or from training during marginal conditions for rowing.

6.12.1 RECREATIONAL - RISK CONTROLS

There is currently a system of active interaction between recreational clubs/operators and the harbours office. The regular liaison maintains understanding of harbour hazards. Both reoccurring and one-off recreational events are discussed amongst user groups, in order to avoid conflicts and provide a general understanding of their usual areas of operation. Good communication links exist

between the GWRC Harbours Office and users, such that maritime officers often know what activities are occurring in the harbour given the weather conditions on the day.

The swimming lanes in Oriental Bay overlap with those lanes used by rowing clubs and there have been more than one conflict between rowing skiffs and ocean swimmers. The 1km marker buoy[52] to be deployed by the swimming lanes is being tried to encourage swimmers to move away from the rowing club training lanes. See (**Section 3.4.4**) for more details.

Access lanes and reserved water areas for Jetskis or waterskis have been created since the 2006 risk assessment. This provides for safe segregation under Schedule 3 of the Navigation and Safety Bylaws. Water ski access lanes can be found in Seatoun, Kau Bay, Evans Bay, Petone Beach (West), and Days Bay Access Lanes/Reserved areas for personal water craft/jetskis are located at Petone Beach (East). A flagged area of 100m^2 is also present in Lyall Bay for the use of swimming and body boarding only.

Other controls are:-

- Increased signage and marina speed restriction buoys;
- Access Lanes and reserved areas clearly marked and recorded in Bylaws;
- Training liaison between pilots and yacht clubs over interaction of recreational and large traffic situations. At these meetings, the harbour recommended tracks which large vessels adhere to are shown to club members.

19)

[52] **Based on Harbour Ranger Feedback during 2016**

7 DISCUSSION – FUTURE DIRECTION OF WELLINGTON HARBOUR

7.1 EARTHQUAKE DAMAGE RECOVERY

The 2016 Kaikoura earthquake caused significant damage to CentrePort facilities and thus cargo operations. The original Aotea Quay reclamation involved both dredging and infill, with much of the waterfront apron supported by piles. The quay area suffered both liquefaction and uplift, with the container terminal being rendered inoperative by severe uplift at its Southern end. Much of the wharf area requires dismantling, re-piling and the apron and gantry crane rail support structures reconstructing. There was also extensive building damage, including recent (2006-12) constructions as the Port Company increased its commercial property portfolio. Many of the older buildings in the port, including some sheds are in the process of being demolished.

The earthquake had a serious impact on the ability of Wellington to handle cargo, with its capability being limited only to ships fitted with cranes for self-discharge or loading. This placed the container terminal into a state of shutdown.

The Cook Strait RoRo operation took time to move to the position where all vehicles could be discharged, as damage to the RFT link spans had to be repaired.

With the benefit of hindsight, Critical Port Infrastructure Business recovery plans are needed, especially in the recovery of the vital trading links between the South and North Island. This having been said, the port had to deal with a difficult and very challenging damage situation.

7.2 THE POSSIBILITY OF PORT RECONFIGURATION

The main Wellington Fault runs close to the Rail Ferry Terminal, but the return period when this fault may next slip seems to be uncertain with some research opinion suggesting it may still be 100s of years before this fault slips again, with others reporting fault shift is overdue. There are though pressures from the need to ease Wellington road traffic congestion and allow two lanes of traffic to exit State Highway One along the Aotea Quay road. Both the rail ferry terminal and cement handling infrastructure lie in the way of such development.

Given with the significant damage arising out of the earthquake, the option does exist to look at the cost choices to move the Ferry Terminal and provide for a single “common use” passenger terminal, that both Cook Strait operators sail from. With Cook Strait passenger RoRo ferries operated by both operators becoming significantly larger, there may be mooring break out risk reduction options from such a development. There may also be collision risk improvements as large RoRos would no longer

need to transit Lambton Harbour, although collision risk improvements may be marginal according to the risk assessment (Rank 43 out of 80).

Better use of Aotea wharf space would occur if the separation between cruise vessels and tankers discharging fuel cold be increased. This could be achieved by moving the cruise berthing location further to the north. New, stronger, mooring inset bollards would need to be installed. Manoeuvring conflicts between ferries swinging and cruise vessels alongside may need to be considered.

Wellington further faces the problem that many ports associated with city development have to address. The Port created the city in the first place, but there comes a time when population growth creates a land value which can be incompatible with its use for berthing unloading of ships. Other Harbours in New Zealand face the same problem, as are those in Australia; Sydney Ports move to Botany Bay is an example. The solutions are always difficult, but there is useful water frontage available at Kaiwharawhara and round the Wellington Harbour coastline, that could facilitate a planned move, with little or no navigational risk impacts. This is though a long term development option.

7.3 CHANNEL DEEPENING

The Port of Wellington (CentrePort) has embarked on a project to deepen the harbour entrance channel to facilitate entry by larger commercial vessels, including container ships. For Wellington, placing regulatory Resource Management Act approval aside, this is a relatively straightforward deepening operation and thus more cost effective in Wellington than is the case for other New Zealand ports. This is because Wellington has natural deep water at its berths and its limiting draught is at the harbour entrance. The port has not had to undertake dredging in the past.

In order to remain competitive, Wellington has little option but to deepen, because larger ships (Container vessels) are already trading to New Zealand and the smaller ships that presently serve Wellington are ageing and will be scrapped in the timescale of about 10 years. In order to participate in a container market where the same larger ships need to access a number of NZ ports, there is an opportunity cost of channel deepening to continue to participate in these trades, long term. The export of logs by Handy Size bulk carriers will be increasingly taken over by the Handymax size of bulk carriers, which are using Wellington already. Both of these ship types would need more water depth availability at the entrance in order to load to their laden capacity draught. The Navigational Risk associated with larger ships should be readily managed, but their arrival means another reason for the Beacon Hill operation to undergo the changes recommended by this risk assessment (**Section**

6.2). Traffic movement policies are more strongly recommended in the event the project gains the regulatory approval to proceed. Such important developments are recommended to be risk based, from the navigational perspective.

8 CONCLUSIONS AND RECOMMENDATIONS

This section brings together conclusions from all areas of this risk assessment report. It combines conclusions and recommendations, where recommendations should be taken forwards as risk management options to define the future development of the SMS system. This is the first major risk assessment review of Wellington Harbour waters since 2006 and a number of recommendations and observations are inevitable.

8.1 NAVIGATIONAL RISK LEVELS

1. The number one ranked risk remains a passenger RoRo ferry grounding at the harbour entrance. This risk has decayed in quantum in the 10 years since the 2006 harbour risk assessment, due in part to improvements in the navigational precision of passenger RoRo ferries . As the science of harbour risk assessment has developed, it has taken account of the effect of risk mitigation by risk controls. The decay in grounding risk is borne out by ship track analysis from AIS data.
2. This is not though to say grounding risk response can be relaxed. The Authors recommend that the Beacon Hill monitoring station needs to become more proactive, especially at the entrance. The monitoring station has the equipment, but not the training to use its technical capabilities to best effect in mitigating this risk.
3. The potential for other large vessels to ground in the entrance remains ranked within the top 10. This is still significant, but accurately reflects the rate of incidents. There have been at least one important near miss grounding at Wellington in recent years.
4. The largest rise in risk ranking**,** is hazard 19, pilot launch getting into difficulties boarding a vessel in the harbour approaches. This has risen from Rank 66 in 2006 to Rank 2 in 2017. However, CentrePort is soon to take delivery of a new and larger pilot boat and the risk result reflects 2017 before this delivery occurred. Reasoning for this is analysed and supported by the incident record.
5. The second largest rise in risk is associated with small passenger operations within the harbour – i.e. cross harbour ferries. Grounding risk has risen from Rank 71 in 2006 to within the top 10 in 2017.
6. Close quarters conflict (i.e. Collision hazards) between passenger RoRos and other large vessels rank 3 and 5 respectively. Collision risk remains important in Wellington Harbour generally. Both hazards have risen in rank, although incidents involving tankers and roro vessels have risen considerably (Rank 15 in 2006; rank 5 in 2017). This is simply because there have been some important close quarter incident events.
7. A third risk of ongoing importance is that of berthing contact by passenger RoRo ferries, Hazard number 9. Although this has only risen one place in ranking, the hazard in 2017 reflects Contact berthing incidents across both passenger RoRo terminals. There have been some incidents involving hull penetration.

8. A rising risk of critical importance to operations at the Port of Wellington is that associated with seismic events. A seismic risk is recorded in the navigational risk database, which has risen 10 places in ranking. However, the damage to port business from the 2016 Kaikoura event is much more significant than the risk to Navigation.

8.2 HARBOUR SAFETY MANAGEMENT SYSTEM (SMS)

9. The review part of this risk assessment has found that both CentrePort and GRWC harbours Department are running an effective safety management system. There is excellent collaboration on all sides with a well-funded system of risk management having been developed since the initiating risk assessment, finalised in 2006.

10. This risk assessment makes a number of recommendations that allow the SMS for Wellington harbour to be further developed. The SMS document is an important interface document that records all stakeholder interfaces, as well as the close working relationship that CentrePort and the GRWC Harbours team have, which when considering that Wellington Harbour exhibits some really important navigational risks, is of great benefit to Wellington Harbour as a whole. This is an important conclusion.

11. An update to the SMS will be required out of the risk assessment, as well as a new Harbour Safety Plan. This should encompass the plans for harbour development and channel deepening.

12. The SMS should specify the periods between which the Harbour Risk Assessment is reviewed. The 10 year interim between the initiating risk assessment may be too long a timescale. That is not to say that risk assessment work has not been done since, CentrePort provides plenty of evidence of that. However, this navigational risk assessment provides the overview that should link and inform the harbour regulators and strategists for development. A 5 year period is suggested.

13. The Harbour Safety Management System is informed by the Hazman II Harbour Risk package. This 2017 risk assessment work has added in all known incidents to the incident database, adding to the record that Harbours Staff have made. The information provided to the risk project by the incident data record is critically important to understanding harbour Risk. Hazman II has capability to store and review many marine risk assessments as well as manage incident data. Its capabilities need to be further utilised, which as no cost implications. CentrePort, for example, could add a number of its own risk assessments for pilotage or navigation into the Hazman II software package.

14. SMS Policies need to be reviewed, especially with a view to introducing traffic management policies. Introducing the sequencing of vessel movement and prioritising passenger services, especially scheduled, over the movements of cargo vessels and tankers would address some of the present collision and grounding risks. The key objective would be separating vessels with hazardous cargoes from interaction with those carrying passengers.

8.3 TRAFFIC ANALYSIS

15. There has been a comprehensive analysis of Wellington Harbour traffic undertaken in support of this risk assessment. The traffic of Wellington harbour has changed dramatically since the 2006 risk assessment. This means the risks have also changed.

16. Wellington Harbour has a gradual increase in traffic in its waters overall. However, the increase in numbers is represented mostly by new trades such as cruise vessels, with a more significant contribution to traffic being made by increased cross-harbour ferry transits and recreational users.

17. Commercial vessel movements through Wellington show a slight decrease in over time, which could be interpreted as falling trade. However, the Gross Tons and Length Overall of vessels visiting Wellington have consistently increased, reflecting global industry trends. The average TEU capacity of container vessels has also increased. This shows that the harbour is receiving larger vessels with increasing cargo or passenger capacities. Thus, although visiting vessel movements have decreased, cargo throughput at the port has been increasing as vessels increased in size.

18. There has been an increase in the size of commercial vessels in general, which has resulted in a marginal fall in the number of such harbour transits. Cargo levels are up overall if the effects of the 2016 Kaikoura Earthquake are discounted.

19. A similar situation exists with Cook Strait RoRo Ferry movements, which have gradually decreased in number since the last risk assessment, but the ferries themselves have increased in size, with an associated increase in available passenger and freight capacity in the Cook Strait route.

20. The Cross-Harbour ferry services have become part of an integrated transport network, with passenger volumes increasing significantly since the 2006 harbour risk assessment. Although perhaps inevitable in a crossing situation, there are close quarters reports mostly involving transiting ferries.

21. Tankers show clear routes to the specialist terminals handling their cargoes and good compliance with recommended routes through the harbour.

22. Wellington Harbour mitigates some navigational hazards by the Bylaw requirement for large vessels to transit via recommended routes. Plots constructed using data from October 2014 – March 2015 (i.e. prior to the Kaikoura earthquake) indicate that vessels do comply well with these routes.

23. Plots of the traffic record confirm the dominance of the Cook Strait RoRo ferry trades to Wellington Harbour. This is unlikely to change in the foreseeable future. These vessels show a good adherence to the harbour recommended routes in general.

24. The rise in importance of Cruise vessels is very apparent, with their transits universally taking a route direct to the designated berths for passenger disembarkation. These vessels are piloted, but also show good adherence to the harbour recommended routes.

25. The harbours Department is recommended to consider undertaking an annual analysis of track data by vessel type, to provide it with an SMS feedback loop to monitory bylaw compliance.

8.4 PILOT VESSEL REPLACEMENT

26. CentrePort took a prudent decision to procure a replacement pilot boat. It needs to be acknowledged that it was proceeded with at a time of commercial turmoil for the port operation. The net result on delivery (September 2017) showed be an order of magnitude reduction in risk associated with boarding in the approaches to Wellington. The increase in service speed is also likely to deliver improvements to fatigue amongst the pilot vessel crew.

27. The ranked hazard summary (**Table 11**) shows the net effect on the risk profile, whereas **Annex B** presents the ranked Risk Assessment in its raw form, prior to upgraded pilot vessel delivery.

8.5 BEACON HILL HARBOUR MONITORING SERVICE

28. The Beacon Hill Signal Station has in recent years been extensively upgraded. This included construction of a new traffic monitoring centre, leaving the old heritage-status building intact at its rear. The Vessel Monitoring centre now has IALA compliant vessel tracking equipment[53]. However, remaining risk levels suggest there is now a need to deliver staff training to the IALA V103-1 standard, in order to prepare for a more-proactive role in managing harbour traffic. The V103-1 qualification training can be readily obtained and even though national VTS standards have not been developed for NZ, the systems that Beacon Hill has are accepted as a vital component of any modern harbour[54].

29. The role of Beacon Hill needs to be better defined. Its ability to contribute effectively to vessel traffic management will remain low until the Safety Management System raises its profile to one with a role in managing the sequence of movements. With this capability, Beacon Hill could in future deliver significant collision risk mitigation for Wellington Harbour.

30. With training, including pilots, Beacon Hill could provide a very important participatory role when a vessel needs to be lead in by a pilot in the pilot boat, to board at the Delta location inside the entrance. A pilot trained in the use of Beacon Hill equipment, with an operator training to V103-1 standard would allow the significantly better tracking capabilities of Beacon Hill to be used in such circumstances.

31. Add a second radar to the Beacon Hill system, to provide coverage into Lambton Harbour. Presently the system relies on AIS transmissions for inner harbour coverage. However, Lambton Harbour has the highest concentration of small craft, which do not carry AIS transponders and thus cannot be tracked without radar coverage. If GRWC adopt the risk

[53] **The International Association of Lighthouse Authorities (IALA) is a Non-Governmental Organisation (NGO) that sets standards for systems that assist vessels to navigate through coastal and harbour waters. IALA provides a standard for harbour monitoring equipment, recommended for any system of Harbour Waters. The IALA standards additionally provide for the training and qualification needs of personnel operating such systems.**

[54] **Northport has become the first NZ port operator to undertake VTS standard training for its gatehouse staff, after installing equipment similar to that fitted to Beacon Hill. It still provides a declared LPS service under the IALA system.**

assessment recommendations to begin a change of status for Beacon Hill, the addition of a second radar is necessary (but note that the tracking software licence should accommodate this at no additional cost).

32. Adding Radar Coverage into Lambton harbour would allow Beacon Hill to participate more effectively with SAR responses in Lambton harbour. The right radar technology would allow groups of kayakers to be located.

8.6 MOORING OPERATIONS AND FENDERING

33. Investigate the possibility of upgrading the moorings or bollard capacity at Seaview and consider further work with mooring layout analysis to assess improvement options.
34. With a view to the port facilitating entry by larger ships, an upgrade of fendering at Seaview, Burnham and possibly the remainder of Aotea Quay wharfs (Container and Car Carrier terminals) may be required. The tanker terminals though may well be unlikely to receive larger vessels.

8.7 WINDAGE AND BERTHING

35. Review the likely size of car carriers and container vessels using the port and their windage. This should be informed by expectations of cargo vessel sizes expected arising from channel deepening. Undertake a windage load analysis associated with the hull form of vessel types, including cargo configuration for Container ships and hull area windage for Car carriers.
36. Consider setting limiting windspeed parameters for berthing at specific berths and terminals, based on their worst exposure direction and vessel size using them (load or wind speed). Wellington already has these for container cranes and it is recommended that such controls may be necessary with further increase in vessel size. These may be procedures or they may be formal guidelines.
37. Investigate the options to increase the number of high load mooring sockets along Aotea Quay, to provide direct purchase countering windage load.
38. The work by Holmes Consulting on jetty structures is by their expertise structural and holistic. The option exists to conduct a more extensive mooring study using Optimoor or other software to explore cost effective mooring improvement options at Tanker terminals.
39. Develop improvements to bollard capacity at tanker jetty terminals (Seaview and Burnham).
40. Consider allocating a tug to attend with discharging tankers at times of high windspeed.
41. Consider the development of formal towage criteria referenced by Harbour Bylaws.

8.8 ENVIRONMENTAL INSTRUMENTS – ENTRANCE

42. The generation of improved data about environmental conditions at the Wellington Harbour entrance transit is wanted by pilot stakeholders. NIWA already collect wave and current data in the harbour, but it may in 2017 be possible to position a wave rider buoy in the entrance, perhaps in the approaches to Barrett Reef. If so, the use of AIS as the transmission medium is recommended. Such a deployment would significantly enhance the use of the Delta Boarding location.
43. A study on swell and tide for the last decade is not publicly available and present information is limited to wind and wave conditions.

8.9 PROCEDURES AND INFORMATION

44. Update navigational information in official publications. Recommended Tracks do not appear to be published in the NP51 New Zealand Pilot publication – needs updating and formalizing in Admiralty Publications.
45. Update the Wellington Harbour SMS document and Harbour Safety plan, to reflect the findings of this risk assessment.

8.10 "DELTA" PILOT BOARDING LOCATION

46. Section 6.3.3 has reviewed the Delta pilot boarding location and its use for adverse condition boarding after leading a vessel through the entrance.
47. A number of options for improving the risk management have been suggested. A workshop is recommended to review and take forward the options. The deployment of a new pilot vessel may reduce the need to board at Delta.

8.11 CENTREPORT FUTURE - EARTHQUAKE

48. CentrePort is recovering from severe damage to its key Aotea Quay assets affecting cargo handling capability, with severe damage to the container wharf at its southern end disrupting container gantry crane rails.
49. The recovery of the passenger RoRo services, post-earthquake, posed problems from damaged linkspans. Disaster recovery plans may need to be further developed to provide an emergency unloading option to limit cargo and passenger handling downtime with this vital interisland trade link.
50. The earthquake damage provides the port with a rare opportunity to redesign its operating areas. The option to combine passenger RoRo services from a common user terminal exist. This allows moving what are now large ferries to one location. The navigational collision risk argument though for moving Cook Strait RoRo operations out of Glasgow Wharf though is low (hazard ranks 43 out of 80).

51. The improved capacity of Aotea Quay inboard and sunken mooring bollards for cruise ships has also benefited the berthing and enhanced securing of tankers alongside. A reconfiguration of Aotea Quay could deliver an improved separation of Cruise Vessels and their passengers from tankers potentially discharging fuels at an adjacent berth. The present requirements are related to a separation distance by vessels, but not by passengers being present on an adjacent quay area. This could be achieved by moving the berthing of Cruise vessels more to the North, thus further separating the Aotea Tanker discharging area from the movement of people.

52. The wider option for the future of the port, such as plans for a development at Kaiwharawhara are outside the scope of this report, but to Authors appear logical. Like all Harbour Cities, population growth results in spatial needs for city development and CentrePort is not the only port in the world needing a long-term plan in place to develop its vital operations, whilst giving up space to a thriving City of Wellington.

8.12 CROSS HARBOUR FERRY OPERATION

53. Track analysis around the Miramar Peninsular shows some transits of the Cross-Harbour ferry are passing close to headlands at what appears to be service speed. A grounding on an unnamed rock with minor damage has occurred in the area, with the track data suggesting an earlier near miss. Although this is not a direct responsibility of GRWC as Harbour Authority, nevertheless, given the fact that up to 100 passengers could be involved, it is recommended that the operation reviews its passage planning advice to its masters.

54. If not already fitted, the Cross harbour ferry service should be encouraged to make better use of electronic track plotters and train in their use.

55. A core function of any Harbour Authority is to monitor and promulgate. It is probably too early a stage for Beacon Hill to make proactive advisory calls, but effective navigational safety has a checking function and Beacon Hill possesses the necessary equipment.

56. It is recommended that the Wellington Harbours Office starts to plot accumulated vessel track data either annually or following a Summer period. This should prioritise passenger services of any type to determine compliance with both the harbour entrance alignment as well as, in this case, Bylaw compliance.

57. The Rock on which the ferry grounded appears to be known about, but un-named. A Harbour nautical chart update removed it, as positional accuracy may not have been properly known; charting now displays a shoal area instead. On the basis that a vessel proceeding at even 5 knots in the 100m offshore area is likely to strike the rock, it is recommended that the rock position and depth be established and re-charted as an Isolated danger.

58. The option exists to review the need for an Aid to Navigation (Cardinal Mark) in this area, although the cost may not be justified.

8.13 RECREATIONAL

59. Presently, recreational craft have no obligation to inform Beacon Hill of an intent to transit the entrance, because of VHF carriage limitations. However, Portable VHF is now both cost effective and in many cases waterproof. Consider encouraging the carriage of VHF, for transit of the Harbour entrance by recreational craft.

60. Consider placing an obligation (recommendation) on recreational craft to communicate such intention to Beacon Hill. This is of relevance to commercial fishing craft heading out of and returning to Island Bay and across the harbour entrance.

61. Rowing and Swimming in Oriental Bay is by designated lanes, but both activities converge at Point Jerningham. There has been one important collision recorded with a skiff and swimmer, with a number of more minor events. The harbour safety management system is to install a buoy to mark the presence of lanes, but there seems to be a case to explore further the option to separate activities by timing, or by design.

Annex A Risk Criteria – Wellington Harbour

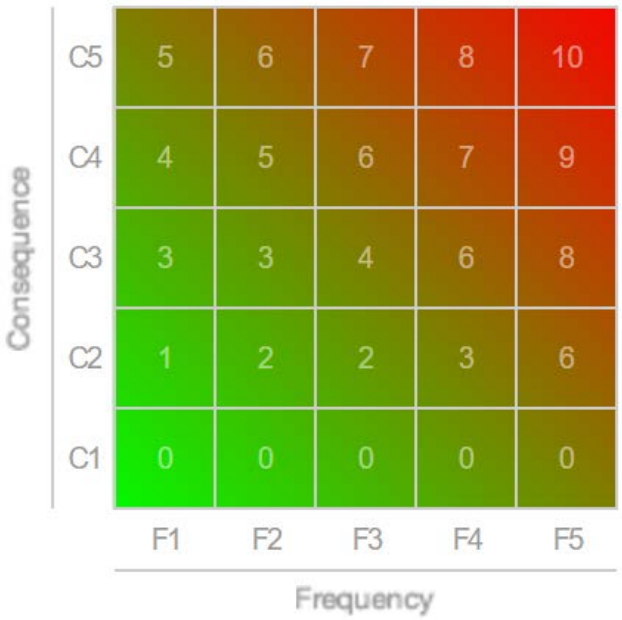


Figure 46 : Risk Matrix Used to Score this Risk Assessment

Category	Description (AS/NZS 3100 2009)	Definition	Operational Interpretation
F1	Frequent	An event occurring in the range once a week to once an operating year.	yearly
F2	Likely	An event occurring in the range once a year to once every 10 operating years.	1 - 9 years
F3	Possible	An event occurring in the range once every 10 operating years to once in 100 operating years.	10 – 99 years
F4	Unlikely	An event occurring in the range less than once in 100 operating years (i.e. if relevant, it may have occurred in another New Zealand harbour).	100 – 999 years
F5	Rare	Considered to occur less than once in 1000 operating years (e.g. it may have occurred at a similar port or harbour elsewhere in the world).	>1000 years

Table 16 : Frequency Definitions Used in this Risk Assessment

Scale	People	Property	Environment	Harbour Stakeholders
C1	Insignificant Possible very minor injury (e.g. bruise).	Insignificant (NZ$0-10,000).	Insignificant Negligible environmental impact. Tier 1 may be declared but criteria not necessarily met. (NZ$0-10,000).	Insignificant (NZ$0-10,000).
C2	Minor Single slight injury.	Minor (NZ$10K-100K).	Minor Tier 1 to Tier 2 criteria reached. (small operational spill). (NZ$10K-100K).	Minor Bad local publicity or short-term loss of revenue, etc. (NZ$10K-100K).
C3	Moderate multiple minor or single major injury.	Moderate (NZ$100K-1M).	Moderate Tier 2 Spill criteria Reached, capable of being limited to immediate area within harbour or port zone. (NZ$100K-1M).	Moderate Bad widespread publicity, temporary navigation closure or prolonged restriction of navigation (NZ$100K-1M).
C4	Major Multiple major injuries or single fatality.	Major (NZ$1M-10M).	Major Lower Tier 3 criteria reached, with pollution outside harbour or port zone expected. Chemical spillage or small gas release. Potential loss of environmental amenity. (NZ$1M-10M).	Major National Publicity Harbour faces temporary closure of a navigation channel affecting movements to a port or ports for several days. Ensuing loss of trade. (NZ$1M-10M).
C5	Catastrophic Multiple fatalities.	Catastrophic (NZ$10M+).	Catastrophic Tier 3 criteria oil spill reached with support from international clean up funds. Widespread beach contamination or serious chemical\gas release. Significant threat to environmental amenity. (NZ$10M+).	Catastrophic International media publicity. Port closes, navigation seriously disrupted for an extended period. Serious and long term loss of trade. (NZ$10M+).

Annex B Ranked Hazard List

Table 18 : Full Ranked Hazard List – Ranked by Residual Risk

Rank	Hazard Ref.	Affected Areas	Accident Category	Hazard Title	Hazard Detail	Affected Vessel Types	Affected Stakeholders	Possible Causes	Consequence Descriptions		Risk By Consequence Category								Risk Overall	Remarks
									Most Likely (ML)	Worst Credible (WC)	ML				WC					
											Environment	People	Property	Stakeholders	Environment	People	Property	Stakeholders		
1	5	Approaches, Entrance	Grounding	RoRo Ferry Grounding, Entrance	Ferry grounding at the harbour entrance	Passenger Vessel	Beacon Hill Monitoring Station, CentrePort, IWI, National Maritime Regulator, Passengers, Seafarers, Vessel Owners, Wellington Regional Council	Adverse Visibility e.g. Fog/Mist/ or Heavy Rain Squall, Adverse Wind (Force and Direction) , Anchors Not Cleared, Communications Failure (Equipment), Equipment Failure (Propulsion or Steering), Equipment Quality, Excessive Speed (with Respect to Sea Conditions), Failure of Maintenance Systems , Failure to comply with Harbour Regulations, Failure to Monitor Position or Vessels Progress Onboard, Failure to Use Vessel's Nav Aids , Human Error Control/Operational, Human Error Judgement, Human Fatigue (Working Hours), Inadequate Communication/Misinterpretation or Miscommunication , Inattention to Local Weather Forecast, Ineffective Master/Pilot Exchange (MPX), Information Transfer Failure, Interaction with Barrett Reef , Lack of Local Knowledge/Experience , Lack of Support/Monitoring by Beacon Hill, Limitations of Crew Onboard Training, Loss of Electrical Power (Blackout), Loss of Situational Awareness (At Night/Restricted Visibility in Heavy Weather), Malicious Action by Third Party, Manning Levels, Miscalculated Manoeuvres , Misuse of Drugs or Alcohol , Not Adjusting to Safety Margins for Adverse Weather , Not Following Pilotage Procedures, Not Following Rules and/or Bylaws and/or SOP, Not Monitoring Port Operating VHF Channels , PPU Operating with Fault Condition , Problems with Vessel/Beacon Hill Liaison During Transit , Quality and Qualifications of Onboard Crew , Standing-in too Close to Navigational Hazards, Sub-optimal BRM Environment Onboard the Vessel, Traffic Density, Tug Assistance Not Immediately Available , Tug Operational Failure , Tug Unable to Assist due to Severe Weather Conditions , Unmarked Navigational Hazard , Vessel Departs from the Wellington Harbour Recommended Route , Violation of VTS Recommendations , Wind Over Tide Conditions - Harbour Entrance Steep Swells Vessel joins leads too late to get appreciation of vessel handling when the line of leads in southerly weather/ Not appreciating set and drift in the harbour approaches and entrance. Differing perception of safety margin between harbour authority and shipping operator. Master fatigued with limited support on board or limited/no liaison with Beacon Hill (VTS). Not appreciating set and drift in the harbour entrance.	Ferry loss of electrical power (blackout) occurs off entrance, power eventually regained and grounding averted.	Ferry grounds on Barrett Reef or Pencarrow Head in storm force southerly conditions with hull damage and rapid water ingress to hull and subsequent capsize. Potential for multiple fatalities and bunker spill. Entrance closed to other shipping while any wreckage recovered from channel.	0	3	0	7	7	7	7	7	5.58	**2015**: The RoRo Ferry movements are slightly decreasing over the five years 2010-2015, but the reported incident profile has changed with a relatively high incidence of equipment and machinery failures reported within Wellington Harbour. This may be due to better reporting, but remains an important factor. The port's placement of met stations around the harbour (including the front lead) has made it possible to provide detailed weather information. Ferries have increased significantly in size and LOA. **2015**: The RoRo Ferry movements are slightly decreasing over the five years 2010-2015, but the reported incident profile has changed with a relatively high incidence of equipment and machinery failures reported within Wellington Harbour. This is an important hazard due to the high numbers of equipment and machinery failures within Wellington Harbour. It remains an important candidate for review. The port's placement of met stations around the harbour (including the front lead) has made it possible to provide detailed weather information. Ferries have increased significantly in size and LOA. Simulators are being used for training, but extent of extreme situations investigated on the simulator is unknown. There is no instrumentation fitted in Wellington Harbour to immediately provide height of swell at the harbour entrance or the tidal current. **2005**: Passenger ferry companies generally cease operations in adverse southerly weather for passenger comfort but cargo shipping services may continue to operate in all but the severest weather conditions. Ferries have been reported to have lost steerage and been broached while transiting the entrance in heavy seas. Larger ferries are planned for the inter-island run with the possibility that operating limits with regard to weather may be increased. In southerly weather the inward vessel should join the leads further out to check ship handling and allow time to abort entrance transit if required.

Rank	Hazard Ref.	Affected Areas	Accident Category	Hazard Title	Hazard Detail	Affected Vessel Types	Affected Stakeholders	Possible Causes	Consequence Descriptions		Risk By Consequence Category								Risk Overall	Remarks
									Most Likely (ML)	Worst Credible (WC)	ML				WC					
											Environment	People	Property	Stakeholders	Environment	People	Property	Stakeholders		
2	19	Approaches, Entrance	Contact Navigation	Pilot Launch Vessel Contact During Transfer Operations	Pilot launch in contact with large vessel while approaching to embark or disembark pilot	Pilot Boat	CentrePort , Seafarers	Adverse Visibility e.g. Fog/Mist/ or Heavy Rain Squall, Adverse Wind (Force and Direction) , Communications Failure (Equipment), Equipment Failure (Propulsion or Steering), Equipment Quality, Excessive Speed (with Respect to Sea Conditions), Failure of Maintenance Systems , Failure to Monitor Position or Vessels Progress Onboard, Failure to Use Vessel's Nav Aids , Human Error Control/Operational, Human Error Judgement, Human Fatigue (Working Hours), Inadequate Communication/Misinterpretation or Miscommunication , Inattention to Local Weather Forecast, Information Transfer Failure, Interaction - Ship to Pilot Vessel , Limitations of Crew Onboard Training, Loss of Electrical Power (Blackout), Loss of Situational Awareness (At Night/Restricted Visibility in Heavy Weather), Manning Levels, Miscalculated Manoeuvres , Not Adjusting to Safety Margins for Adverse Weather , Not Following Pilotage Procedures, Not Following Rules and/or Bylaws and/or SOP, Not Monitoring Port Operating VHF Channels , Quality and Qualifications of Onboard Crew , Sub-optimal BRM Environment Onboard the Vessel, Wind Over Tide Conditions - Harbour Entrance Steep Swells Radar or floodlighting failure at critical time. Launchmaster does not appreciate effects of cross swell or wake/wash from own approach or passing vessel. Best lee not made or speed inappropriate for conditions and ship does not achieve the requested heading (through getting into irons or misjudgement of helm and engine speed required to affect turn or misunderstands instructions) or alters speed substantially during the launch's approach. Sea-sickness impairs judgment of launchmaster. Launchmaster misjudges line of approach to the vessel, timing and misjudges effects of interaction between vessels. Launch gets caught in negative water flow of vessel i.e. sucked into the vessel's quarter. Launch comes too far ahead of midship position with a ship turning inwards towards launch. Launch pinned alongside due to vessel drifting to leeward. Inadequate fendering.	Pilot launch lands heavily on ships side with minor damage to launch belting.	(1) Pilot launch approaching from astern is caught in ship's wake and surfs under counter with damage to wheelhouse structure and hull plating.(2) Launch lands very heavily in a solid bodily contact rupturing hull integrity and harming crew. Water ingress leads to loss of stability and capsize with persons in the water and potential for fatalities (3) When pinned alongside launch and ship movement seriously damages launch causing loss of hull integrity, fenders ripped off.	0	6	1	5	3	7	6	7	5.16	**2015**: The average number of days a year when the significant wave height exceeds 3 m is 56 (a wave study by CentrePort). In addition, strong wind speeds are common from both the north and south. This hazard should be taken into account bearing in mind the above incident contributors for this hazard. Ref. 247 - 11 June 2012 pilot boat Spirit of Wellington in contact with tanker TOREA. CentrePort investigating possibility of a larger Pilot launch in 2016 and cancelling arrangements to deploy Spirit of Wellington as backup. **2005**: Contact damage is an everyday fact of life with pilot launches going alongside moving vessels in a seaway. A similar incident occurred in another NZ port resulting in damage to the pilot vessel but watertight bulkheads prevented foundering of the vessel. Previous Wellington pilot vessels in service have sustained wheelhouse damage through being caught under the flare. Hazard may also apply to official passengers such as MAF personnel boarding special ships - transfer is always on basis of safety briefing and utmost safety but risk still applies.

Rank	Hazard Ref.	Affected Areas	Accident Category	Hazard Title	Hazard Detail	Affected Vessel Types	Affected Stakeholders	Possible Causes	Consequence Descriptions		Risk By Consequence Category								Risk Overall	Remarks
									Most Likely (ML)	Worst Credible (WC)	ML				WC					
											Environment	People	Property	Stakeholders	Environment	People	Property	Stakeholders		
3	46	Main Harbour, Lambton Harbour	Contact Berthing	Contact Berthing, Pilot Exempt Vessel (RoRo Ferry).	Ferry berthing without tug assistance in adverse weather in heavy contact with berth or adjacent vessel.	Pilot Exempt	CentrePort , National Maritime Regulator, Passengers, Seafarers, Vessel Owners, Wellington Regional Council	Adverse Visibility e.g. Fog/Mist/ or Heavy Rain Squall, Adverse Wind (Force and Direction) , Anchors Not Cleared, Communications Failure (Equipment), Equipment Age, Equipment Failure (Propulsion or Steering), Equipment Quality, Excessive Speed (with Respect to Sea Conditions), Failure of Maintenance Systems , Failure to comply with Harbour Regulations, Failure to Monitor Position or Vessels Progress Onboard, Failure to Use Vessel's Nav Aids , Human Error Control/Operational, Human Error Judgement, Human Fatigue (Working Hours), Inadequate Communication/Misinterpretation or Miscommunication , Inattention to Local Weather Forecast, Information Transfer Failure, Interaction - Ship to Ship , Lack of Local Knowledge/Experience , Limitations of Crew Onboard Training, Loss of Electrical Power (Blackout), Loss of Situational Awareness (At Night/Restricted Visibility in Heavy Weather), Manning Levels, Miscalculated Manoeuvres , Missed Main Engine Start , Misuse of Drugs or Alcohol , Not Adjusting to Safety Margins for Adverse Weather , Problems with Vessel/Beacon Hill Liaison During Transit , Quality and Qualifications of Onboard Crew , Sub-optimal BRM Environment Onboard the Vessel, Tug Assistance Not Immediately Available , Tug Operational Failure , Tug Unable to Assist due to Severe Weather Conditions Vessel attempting to berth in an adverse wind at a finger berth terminal or at Aotea Quay without tug, or with only limited assistance. Adverse weather (gale SWly condition) for both finger berths and RFT. PEC Master misjudgement. Poor bridge BRM or use of anchors. Bow thruster lacks capacity and is unable to hold bow up in the prevailing conditions. Lack of set limiting wind criteria for berthing at key wharves adversely affected by windage. Master not familiar or practiced with tug assistance. Training limitations for severe weather approaches by PEC.	Contact with wharf causes a noticeable set-in of plating in with superficial damage to wharf structure.	Vessel punctures shell plating in heavy landing on wharf or other berthed vessel. Water ingress threatening loss of stability if damaged below waterline. Berth damaged and put out of use. Berth blocked or linkspan out of service. Delay to shipping movements while wreckage is cleared or berth repaired.	0	0	5	5	3	5	7	7	5.05	**2015:** Vessels are required to report defects or deficiencies which may impact on maneuverability. Wind information on RFT is now available. New Ferry of 186m now berthing in inner harbour. Now regular ordering and use of a tug for berthing in strong winds. Ferry operators are using simulators for training. **2005:** This was applicable to a single screw roro ferry that operated to Lyttelton with occasional berthing damage. However, since the departure of this vessel, records of occasional berthing contacts involving PEC RoRo vessels have continued.Lambton Harbour is used as the example however rail ferries at RFT have also suffered holed plating and during adverse weather events have damaged smaller vessels berthed nearby. Potential for fatality exists if persons on board the berthed vessel are unable to evacuate the vessel or area of contact in time. Vessels are not required to report defects affecting unassisted berthing ability. There is no set weather criterion for compulsory use of tug assistance or similarly guidance for Beacon Hill. Pilot exempt masters would probably benefit from simulator training in tug use and modelling of various conditions/situations which they may encounter. Owners need to recognise that a single screw vessel is not optimal for maneuvering required. Provision of wind speed information at the berth in addition or instead of wind speed at Beacon Hill may benefit ship handlers. A larger vessel will arrive to use the Interisland terminal. Less room available because of the larger hull form. Damage could increase from increased momentum. Setting of agreed limiting wind criteria is recommended.

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											Environment	People	Property	Stakeholders	Environment	People	Property	Stakeholders		
4	20	Main Harbour	Collision	RoRo Ferry and large vessel in Conflict (Within Harbour Waters)	Inbound passenger ferry in developing collision situation with outbound container or large vessel (excluding Tankers)	Passenger Vessel	Beacon Hill Monitoring Station, CentrePort , National Maritime Regulator, Passengers, Seafarers, Vessel Owners, Wellington Regional Council	Adverse Visibility e.g. Fog/Mist/ or Heavy Rain Squall, Adverse Wind (Force and Direction) , Berth Departure or Arrival Message to Beacon Hill not Transmitted or Acknowledged , Communications Failure (Equipment), Disregard and/or Misinterpretation of Collision Regulations , Equipment Age, Equipment Failure (Propulsion or Steering), Equipment Quality, Failure to comply with Harbour Regulations, Failure to Monitor Position or Vessels Progress Onboard, Failure to Provide Call to Beacon Hill Prior to Arrival or Departure , Failure to Use Vessel's Nav Aids , Human Error Control/Operational, Human Error Judgement, Human Fatigue (Working Hours), Inadequate Communication/Misinterpretation or Miscommunication , Information Transfer Failure, Interaction - Ship to Ship , Lack of Local Knowledge/Experience , Lack of Support/Monitoring by Beacon Hill, Limitations of Crew Onboard Training, Loss of Situational Awareness (At Night/Restricted Visibility in Heavy Weather), Manning Levels, Miscalculated Manoeuvres , Misuse of Drugs or Alcohol , Not Adjusting to Safety Margins for Adverse Weather , Not Following Pilotage Procedures, Not Following Rules and/or Bylaws and/or SOP, Not Monitoring Port Operating VHF Channels , Not Sounding/Incorrect Sounding of Required Sound Signals , Problems with Vessel/Beacon Hill Liaison During Transit , Quality and Qualifications of Onboard Crew , Sub-optimal BRM Environment Onboard the Vessel, Traffic Density, Vessel Departs from the Wellington Harbour Recommended Route Navigation lights blended in with background shore lights. Courses set by both vessels to pass too close to each other reducing margins for any error. Inadequate pilot/master/bridge team exchange.	Close quarters situation but collision averted.	Large vessel and passenger ferry in collision with punctured shell plating to both vessels requiring return to berth and repair. Potential for wide angle of blow (if tanker departing from either discharge terminal), but finer angle most likely. In the case of passenger ferry, potential for serious injury to passengers/crew, or fatality. Potential for fire.	0	0	0	6	5	5	6	6	5.01	**2005**: This scenario applies to all large vessels too. Possible for tankers departing Seaview or Evans Bay to conflict with inbound ferries/other vessels on recommended tracks. The situation is normally resolved through VHF communication and outbound ship under pilotage communicating with Beacon Hill once it clears VHF Ch.13. A ferry carrying >1000 passengers and a tanker in a collision is the worst case scenario and all efforts should be taken to keeping passing distances as wide as possible. Given the dangers a tanker provides there are no procedures to provide for a moving clearance zone (for example) around a tanker.

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											Environment	People	Property	Stakeholders	Environment	People	Property	Stakeholders		
5	28	Main Harbour	Collision	RoRo Ferry and Tanker in conflict within harbour.	Inbound or outbound RoRo ferry in developing close quarters/collision situation with tanker having departed Evans Bay or Seaview.	Passenger Vessel	Beacon Hill Monitoring Station, CentrePort , Passengers, Seafarers	Adverse Visibility e.g. Fog/Mist/ or Heavy Rain Squall, Adverse Wind (Force and Direction) , Berth Departure or Arrival Message to Beacon Hill not Transmitted or Acknowledged , Communications Failure (Equipment), Disregard and/or Misinterpretation of Collision Regulations , Equipment Age, Equipment Failure (Propulsion or Steering), Equipment Quality, Excessive Speed (with Respect to Sea Conditions), Failure of Maintenance Systems , Failure to comply with Harbour Regulations, Failure to Monitor Position or Vessels Progress Onboard, Failure to Provide Call to Beacon Hill Prior to Arrival or Departure , Failure to Use Vessel's Nav Aids , Human Error Control/Operational, Human Error Judgement, Human Fatigue (Working Hours), Inadequate Communication/Misinterpretation or Miscommunication , Inattention to Local Weather Forecast, Information Transfer Failure, Interaction - Ship to Ship , Lack of Local Knowledge/Experience , Lack of Support/Monitoring by Beacon Hill, Limitations of Crew Onboard Training, Loss of Electrical Power (Blackout), Loss of Situational Awareness (At Night/Restricted Visibility in Heavy Weather), Malicious Action by Third Party, Manning Levels, Miscalculated Manoeuvres , Missed Main Engine Start , Misuse of Drugs or Alcohol , Not Adjusting to Safety Margins for Adverse Weather , Not Following Pilotage Procedures, Not Following Rules and/or Bylaws and/or SOP, Not Monitoring Port Operating VHF Channels , Not Sounding/Incorrect Sounding of Required Sound Signals , Quality and Qualifications of Onboard Crew , Standing-in too Close to Navigational Hazards, Sub-optimal BRM Environment Onboard the Vessel, Traffic Density, Unmarked Navigational Hazard , Vessel and Beacon Hill Liaison Failure Prior to Movement Commencement , Vessel Departs from the Wellington Harbour Recommended Route , Violation of VTS Recommendations , Wind Over Tide Conditions - Harbour Entrance Steep Swells Beacon Hill operator busy passing traffic information and misses monitoring a developing situation. Pilot does not ask for situational advice from Beacon Hill or Beacon Hill does not ensure vessels are informed about movements. Direct vessel to vessel agreement is misunderstood or standoff occurs (Beacon Hill not aware). Ferry bridge team not aware of outward tracks from Seaview. Ferry or tanker not monitoring other radar's targets. Ferry, as giving way vessel alters to port across bow of tanker in contravention of Rules. Outward tanker not seen against background lighting. OOW monitors vessel's position using only ECDIS. Pilot not managing RoRo Ferry as give way vessel alters course across bow of Tanker in contravention of Rules.	Close quarters situation but collision averted.	Vessel and passenger ferry in collision with punctured shell plating to both vessels requiring return to berth and repair. High potential for injuries or even fatality to passengers/crew of ferry. Collision is most likely to be bow to bow or glancing blow.	0	0	0	6	5	5	5	6	4.88	**2015**: It is unlikely for a ferry to develop a conflict in the Seaview or Evans bay area. Incident recorded ref 12 - during transit from Evans bay to Seaview tanker terminal. It worth mentioning that the nautical chart does not show the recommended tracks for Evans Bay and Seaview and their connection between. However, from the pilot trips, the tanker vessel has adequately prepared a pilotage passage plan. There was an incident in the Main Harbour area associated with this hazard, where a passing conflict between a Tanker and a Ferry developed. This hazard reflects piloted tankers after departing Evans Bay and exiting into the main harbour, where they crate a give way situation for outbound vessels (ferries). A tanker exiting Evans Bay will turn to starboard to depart Wellington, but would present a slow vessel in relation to a ferry movement leaving Lampton harbour. Thus some human factors "pressure" exists for the Ferry to overtake or cross in front of Evans Bay before the tanker makes its turn. A series of events related to poor BRM or a ferry/tanker needing to communicate to clarify or agree passing arrangements (or not following passage plan procedures or harbour recommended tracks). Beacon Hill Signal Station acts as a LPS service and does not offer support to sequence traffic . It assistance is important to avoid these situations nad this Hazard could thus be Isolated. Recommended tracks exist in the respective nautical charts and bylaws. **2005**: Possible for tankers departing from Seaview or Evans Bay to conflict with inbound vessels or ferries using the recognised tracks. Any conflict situation is normally resolved through VHF communication and outbound ship under pilotage communicating with Beacon Hill once it clears VHF Ch.13. A ferry carrying >1000 passengers and a tanker in a collision is the worst case scenario and all efforts should be taken to keeping passing distances as wide as possible. Given the dangers a tanker provides there are no procedures to provide for a moving clearance zone (for example) around a tanker or to impose controls for vessels passing tankers. There is a particular risk at night when background shore lighting may make it difficult for vessels to detect one another visually.

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											Environment	People	Property	Stakeholders	Environment	People	Property	Stakeholders		
6	12	Entrance, Main Harbour, Lambton Harbour, Evans Bay	Grounding	Small Passenger Vessel Grounding	Harbour passenger vessel in grounding situation on passage or near berth.	Harbour Ferry	Beacon Hill Monitoring Station, National Maritime Regulator, Passengers, Police Maritime Unit, Seafarers	Adverse Visibility e.g. Fog/Mist/ or Heavy Rain Squall, Adverse Wind (Force and Direction) , Equipment Failure (Propulsion or Steering), Equipment Quality, Excessive Speed (with Respect to Sea Conditions), Failure to comply with Harbour Regulations, Failure to Monitor Position or Vessels Progress Onboard, Failure to Use Vessel's Nav Aids , Human Error Control/Operational, Human Error Judgement, Human Fatigue (Working Hours), Inadequate Communication/Misinterpretation or Miscommunication , Inattention to Local Weather Forecast, Lack of Support/Monitoring by Beacon Hill, Limitations of Crew Onboard Training, Loss of Electrical Power (Blackout), Loss of Situational Awareness (At Night/Restricted Visibility in Heavy Weather), Misuse of Drugs or Alcohol , Not Adjusting to Safety Margins for Adverse Weather , Not Following Rules and/or Bylaws and/or SOP, Quality and Qualifications of Onboard Crew , Standing-in too Close to Navigational HazardsPropulsive failure on lee shore in approach to berth during adverse conditions, insufficient time to anchor or it drags. Navigating at speed in close proximity (i.e Within 20m) to shore to save passage time or close inshore for lee in strong Northerly. Poor positional awareness in restricted visibility or by night, radar not used effectively to monitor position. Insufficient depth of water at infrequently used berths at low water, particularly in conjunction with high pressure system or swell. Debris on seafloor reduces usually acceptable UKC on approach or at berth. Depth sounder not used or operational. Lack of recent hydrographic data for berths in use or proposed for use. Launchmaster misjudges approach to berth and makes leeway into shallows on swinging. Line parts or bitts pull from deck while ferry is using engine power to stay close alongside, crew unable to reach engine control in time to prevent grounding.	Vessel's keel touches seafloor off Petone beach during slow speed harbour cruise. Able to back off without damage.Alternatively catamaran harbour ferry runs over isolated rock within the 200m line from shore. Moderate damage to one hull and rudder, light damage to other. One minor passenger injury (bruise) and vessel remains afloat and able to navigate. Vessel requires removal from water fro repairs and out of service for up to one month.	Harbour ferry or other passenger vessel surges heavily on lines during adverse Southerly conditions at exposed wharf. Line or lines part with persons falling from gangway into water, potential for major injuries or fatality. Ferry grounds on beach with damage to hull and propellers/rudders, out of service for up to 30 days to repair.Alternatively, Harbour ferry strikes underwater obstruction (rock) and opens one hull in all compartments. Ferry remains afloat, but requires evacuation. One or more Passengers enter water. Hypothermia. Close nature of response recovers all without loss of life.	1	5	5	5	2	4	4	6	4.77	Petone Wharf may be used in the future for ferry or other passenger services and has been the site of groundings leading to shaft damage and water ingress in the past. Sounding information is dated. Grounding hazard applies to any small passenger or charter service but the harbour ferry provides the most frequent service.This scenario may had occurred in April 2017.
7	83	Lambton Harbour	Collision	Rowing Skiff and Swimmer Collision	Rowing Skiff and Swimmer in collision in the Lambton Harbour area. Both in recommended lanes for the activity.	Rowing Skiff	Recreational Users, Wellington Regional Council	Adverse Visibility e.g. Fog/Mist/ or Heavy Rain Squall, Adverse Wind (Force and Direction) , Disregard and/or Misinterpretation of Collision Regulations , Failure to Monitor Position or Vessels Progress Onboard, Human Error Control/Operational, Human Error Judgement, Misuse of Drugs or Alcohol , Not Following Rules and/or Bylaws and/or SOPSkiff in practice exercise does not see swimmer in water (rowers facing rear of skiff).Recommended swimming and rowing areas cross over near Point Jerningham.	Rowing skiff in very near miss. Swimmer hit by oar. Safety boat in rapid attendance.	Rowing skiff in collision with swimmer. Swimmer struck by prow of skiff in head. Swimmer unconscious in water. No safety boat nearby.	0	6	0	6	0	7	0	6	4.76	2016 Risk raised by Wellington Rowing Club members during consultation meeting. Incident reported of near miss event in 2015.

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8	78	Seaview	Contact Berthing	Tanker Contact Berthing - Seaview Jetty	Tanker in contact berthing situation at Seaview Wharf	Tanker	CentrePort , Seafarers, Vessel Owners, Wellington Regional Council	Adverse Visibility e.g. Fog/Mist/ or Heavy Rain Squall, Adverse Wind (Force and Direction) , Anchors Not Cleared, Communications Failure (Equipment), Equipment Age, Equipment Failure (Propulsion or Steering), Equipment Quality, Excessive Speed (with Respect to Sea Conditions), Failure of Maintenance Systems , Failure to comply with Harbour Regulations, Failure to Comply with Terminal Procedures , Failure to Monitor Position or Vessels Progress Onboard, Failure to Use Vessel's Nav Aids , Human Error Control/Operational, Human Error Judgement, Human Fatigue (Working Hours), Inadequate Communication/Misinterpretation or Miscommunication , Inattention to Local Weather Forecast, Ineffective Master/Pilot Exchange (MPX), Information Transfer Failure, Lack of Local Knowledge/Experience , Lack of Support/Monitoring by Beacon Hill, Limitations of Crew Onboard Training, Loss of Electrical Power (Blackout), Loss of Situational Awareness (At Night/Restricted Visibility in Heavy Weather), Manning Levels, Miscalculated Manoeuvres , Missed Main Engine Start , Misuse of Drugs or Alcohol , Not Adjusting to Safety Margins for Adverse Weather , Not Following Pilotage Procedures, Not Following Rules and/or Bylaws and/or SOP, PPU Operating with Fault Condition , Quality and Qualifications of Onboard Crew , Sub-optimal BRM Environment Onboard the Vessel, Tug Assistance Not Immediately Available , Tug Operational Failure , Tug Unable to Assist due to Severe Weather Conditions , Violation of VTS Recommendations Lack of shore-based reference marks for Pilot to judge approach angle and speed. Pilot misjudges stopping distance required or manoeuvring characteristics of vessel. Blackout on tanker combined with tug operational failure, line failure or insufficient bollard pull for wind load. Poor exchange of information between pilot and master or key bridge personnel (including poor level of spoken English ability in foreign crew). Late connection of Tug or Tugs not connected at optimum position. Lack of accurate closing information from lines crew.	Berthing contact with minor damage to hull plating but some repair required to wharf fendering or structure.	Severe damage to tanker hull and wharf structure in heavy contact. Hull damaged and product spilt (possibility of ignition). Mooring rope subsequently parts with mooring crew in vicinity. Tanker delayed for repairs to frames and plating. Port and region affected by delay to tanker operations while survey and repairs to berth completed.	0	0	5	2	5	4	6	5	4.61	**2005**: Pilots report that Seaview wharf lacks shore-based reference marks making it difficult to estimate approach rates, particularly by night. Seaview is also particularly exposed during strong southerly winds. Working conditions are made more difficult for tugs by the rougher seas likely to be encountered in comparison to other tanker berths where fetch is more limited. **2015**: In recognition of the constraints only unlimited pilots berth tanker at Seaview and two tugs are used (65t BP).

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9	1	Approaches, Entrance	Grounding	Large vessel Grounding in Harbour Entrance/ Approach	Inbound large vessel (> 500GT) in grounding situation in adverse southerly conditions	All Vessels	Beacon Hill Monitoring Station, CentrePort , National Maritime Regulator, Police Maritime Unit, Seafarers, Vessel Owners, Wellington Regional Council	Adverse Visibility e.g. Fog/Mist/ or Heavy Rain Squall, Adverse Wind (Force and Direction) , Anchors Not Cleared, Communications Failure (Equipment), Equipment Age, Equipment Failure (Propulsion or Steering), Equipment Quality, Excessive Speed (with Respect to Sea Conditions), Failure of Maintenance Systems , Failure to comply with Harbour Regulations, Failure to Monitor Position or Vessels Progress Onboard, Failure to Use Vessel's Nav Aids , Human Error Control/Operational, Human Error Judgement, Human Fatigue (Working Hours), Inadequate Communication/Misinterpretation or Miscommunication , Inattention to Local Weather Forecast, Ineffective Master/Pilot Exchange (MPX), Information Transfer Failure, Interaction with Barretts Reef , Lack of Local Knowledge/Experience , Lack of Support/Monitoring by Beacon Hill, Limitations of Crew Onboard Training, Loss of Electrical Power (Blackout), Loss of Situational Awareness (At Night/Restricted Visibility in Heavy Weather), Malicious Action by Third Party, Manning Levels, Miscalculated Manoeuvres , Missed Main Engine Start , Misuse of Drugs or Alcohol , Not Adjusting to Safety Margins for Adverse Weather , Not Following Pilotage Procedures, Not Following Rules and/or Bylaws and/or SOP, Not Monitoring Port Operating VHF Channels , PPU Operating with Fault Condition , Problems with Vessel/Beacon Hill Liaison During Transit , Quality and Qualifications of Onboard Crew , Standing-in too Close to Navigational Hazards, Sub-optimal BRM Environment Onboard the Vessel, Tug Assistance Not Immediately Available , Tug Operational Failure , Tug Unable to Assist due to Severe Weather Conditions , Unmarked Navigational Hazard , Vessel Departs from the Wellington Harbour Recommended Route , Violation of VTS Recommendations , Wind Over Tide Conditions - Harbour Entrance Steep Swells Late pilot boarding and lack of sea room to join leads. Navigational error including incorrect scale of chart in use. Vessel being led in fails to follow pilot's instructions. Pilot does not follow procedures relating to leading in. Lack of set environmental limiting criteria for transit of entrance (with exception of under keel clearance). Delay caused by tug crews having to be called in or working on another vessel. Bollard pull of the tug is too low for prevailing conditions.	Near grounding averted.	Large vessel suffers blackout while awaiting pilot at position Bravo in fresh SW and drags anchor to ground in Fitzroy Bay. Major salvage operation to refloat, potential loss of bunkers to sea.	0	0	0	5	6	5	6	6	4.57	**2015:** Adverse weather and poor visibility conditions at the approaches and entrance are likely to affect the safe passage of a vessel. Whilst waiting for a pilot at the time of ferry and piloted vessel movements in the Approaches, the sea room available is limited. In addition the new harbour tugs are unlikely to be able to provide any assistance except in sheltered waters. In the case of high swell and strong southerly, pilots can request the master of the vessel to approach pilot station 'D'. This requires an effective team collaboration by the pilot, the vessel and Beacon Hill. For such a case, it may be a solution for a second pilot to be placed at Beacon Hill, who can advise and lead the vessel to 'D' in a safe manner. At this stage, Harbour Communication Officers do not have the proper training to provide navigational guidance and advice. Port SOPs describe situation when a transit has to be deferred (daylight) and when pilots are available it is more likely to go to a previous port to board a ship. Operational guidance also require Beacon Hill to advise ships to stay at least 3m South of Pilot station Alpha while waiting for pilot instructions. **2005:** This scenario could apply to any vessel approaching Wellington to pick up a pilot. In gale force S winds pilots are likely to lead vessels in by the pilot vessel and board in the channel or at the inner boarding area 'Delta'. The signal station is set up to provide port information and communication service to shipping and does not provide a VTS function. Signal station staff are required by SOP's to warn any vessel observed standing into danger but are not equipped or trained to provide navigational advice to vessels. Communication problems with ship's crews who do not have English as first language could minimise effectiveness of any directions given. Tug assistance may take up to two hours to reach a disabled vessel and may not have sufficient bollard pull or be equipped with suitable towing gear in severe sea conditions to tow a dead ship with high windage off a lee shore. In adverse Southerly weather, safe pilot transfer may not be possible outside. Vessels may be led in or instructed by the pilot from a position inside the harbour entrance. Beacon Hill has limited access to actual entrance or channel environmental data at night or in poor visibility and relies on experience supported by visual observations and again supported by the offshore wave rider buoy - conditions at 131m asl do not necessary reflect sea level conditions.

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10	70	Approaches, Entrance, Main Harbour, Lambton Harbour	Fire/Explosion	Fire on RoRo Ferry Within Harbour Limits	RoRo ferry has shipboard fire while transiting the approaches or entrance.	Pilot Exempt	Police Maritime Unit, Vessel Owners, Beacon Hill Monitoring Station, Seafarers	Adverse Wind (Force and Direction) , Equipment Age, Equipment Quality, Failure to Notify Hazardous Cargo, Human Error Control/Operational, Human Error Judgement, Human Fatigue (Working Hours), Limitations of Crew Onboard Training, Manning Levels, Misuse of Drugs or Alcohol , Quality and Qualifications of Onboard Crew , Wind Over Tide Conditions - Harbour Entrance Steep Swells Shipboard fire through maintenance failure/onboard procedures. Possible fire subsequent to grounding or collision. Dangerous Goods spill through cargo shift (inadequate lashing in adverse weather or for other heel experienced during transit). Inadequate separation in stowage of DG's . Incorrect identification or non-disclosure of DG's prior to loading. Ignition of fuels carried in vehicles. Reefer container fire.	Minor accommodation or galley fire controlled immediately with no external assistance necessary.	Fire on ferry involving DG's (possibly undeclared) during summer with full passenger complement. Vehicle deck isolated water curtain. Fumes given off may cause passenger injury. Possibility of inbound ferry making for Port of Refuge in Wellington with fire unable to be extinguished with onboard resources. Gas/fumes generated.	0	3	0	3	4	7	7	7	4.57	Emergency Response Plan for fire onboard a passenger vessel needs to incorporate the planned introduction of ferries carrying up to 1600 passengers and any increases in cruise liner trade. Circumstances other than fire may require the evacuation of a vessel, such as vapour release from spilled DG's. Fire on vessel with the same Worst Credible outcome is a possibility, but probably of lower relative risk given the number of vessels visiting the port and lack of DG's carried as cargo. If an exposed RoRo Ferry is in adverse wind conditions fire may escalate rapidly.
11	64	Approaches, Entrance	Personal Injury	Personal Injury, Pilot Operations, Outer Boarding Areas	Personal injury to launch crew during pilot transfer in the designated pilot boarding areas (Alpha, Beta or Charlie).	Pilot Boat	CentrePort , Seafarers	Adverse Visibility e.g. Fog/Mist/ or Heavy Rain Squall, Adverse Wind (Force and Direction) , Communications Failure (Equipment), Equipment Failure (Propulsion or Steering), Equipment Quality, Excessive Speed (with Respect to Sea Conditions), Failure to Monitor Position or Vessels Progress Onboard, Human Error Control/Operational, Human Error Judgement, Human Fatigue (Working Hours), Inadequate Communication/Misinterpretation or Miscommunication , Inattention to Local Weather Forecast, Ineffective Master/Pilot Exchange (MPX), Information Transfer Failure, Interaction - Ship to Pilot Vessel , Lack of Local Knowledge/Experience , Lack of Support/Monitoring by Beacon Hill, Limitations of Crew Onboard Training, Loss of Situational Awareness (At Night/Restricted Visibility in Heavy Weather), Miscalculated Manoeuvres , Misuse of Drugs or Alcohol , Not Adjusting to Safety Margins for Adverse Weather , Not Following Pilotage Procedures, Sub-optimal BRM Environment Onboard the Vessel, Wind Over Tide Conditions - Harbour Entrance Steep Swells Misjudgement in darkness during close approach or floodlighting failure. Coxswain does not appreciate effects of cross swell or wake/wash from own approach or passing vessel. Inexperienced L/Master. Best lee not made or speed inappropriate for conditions. Ship does not achieve the requested heading or alters speed/course substantially during approach. Sea-sickness or fatigue impairs judgment of launchmaster. L/master misjudges approach to the vessel and misjudges interaction effects between vessels causing heavy landing which knocks crew person off his feet. Pilot not secured during transfer to foredeck from cabin. Pilot proceeds to the foredeck too early and sea comes aboard washing pilot (or AB) off his feet. Disconnects safety tether too early and does not maintain a handgrip when on foredeck. Tether parts. Launch comes away from ship's side through adverse sea conditions or misjudgement. Launch is too short for sea and swell conditions and poor fendering. Manropes not provided or not used.	Pilot misjudges timing and stumbles on foredeck resulting in minor injury (strain/sprain), having disconnected from the tether. On disembarking, trips and falls or is knocked off his feet but is retained onboard.	Pilot or AB crew member falls into water or is washed against pilot boat accommodation during transfer operation with potential for severe injury (unconsciousness, back injury, crushing, laceration and fractures) or fatality. Launchmaster unable to manoeuvre launch for a pickup with only one person on board. Potential for pilot launch hull damage if hull contact occurs with vessel being worked by pilotage operation.	0	6	1	6	0	6	3	5	4.52	**2015**: CentrePort places a high emphasis on training. 2015: CentrePort intends reviewing back up backup pilot launch arrangements and investigating launch design with a longer waterline length and displacement of rough sea boarding. Since the 2005 risk assessment, more pilot boarding and departures are occurring at or close to the general area of the pilot boarding grounds. Backup pilot boat is lightweight and makes boarding more hazardous in adverse sea conditions.**2005**: Historically safety record has been good. Lighter displacement pilot launches are in use, which provide a less stable platform than those previously in service but techniques are used to pin launch alongside during transfers. Launch crews are trained to adopt best lee during transfers and be responsible for safety. All launch staff wear LSA during transfers. SOPs and critical task analysis are in place for this task.

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											Environment	People	Property	Stakeholders	Environment	People	Property	Stakeholders		
12	79	Main Harbour, Lambton Harbour, Evans Bay, Seaview	Equipment Failure	Personnel Injury during Life Boat Deployment	A deployment of a Life Boat or service tender from a commercial vessel (Cruise, Cargo or RoRo service) in the harbour suffers problems with its launching and recovery equipment.	All Vessels	Beacon Hill Monitoring Station, National Maritime Regulator, Seafarers, Vessel Owners, Wellington Regional Council	Adverse Visibility e.g. Fog/Mist/ or Heavy Rain Squall, Adverse Wind (Force and Direction) , Communications Failure (Equipment), Equipment Age, Equipment Failure (Propulsion or Steering), Equipment Quality, Failure of Maintenance Systems , Failure to comply with Harbour Regulations, Human Error Control/Operational, Human Error Judgement, Human Fatigue (Working Hours), Inattention to Local Weather Forecast, Not Following Rules and/or Bylaws and/or SOP, Wind Over Tide Conditions - Harbour Entrance Steep Swells David launching and or recovery gear fails. On load release equipment fails and releases.	During deployment of the lifeboat/work boat the on load release gear deploys before the boat is safely in the water. Operator installed used safety arrestors and boat hangs from these and is recovered. Alternately a lifting component fails and the lifeboat drops into n injury occurs and damage to the equipment	A lifting component fails or on-load release equipment operates and the lifeboat drops into the water, possibly contacting the deck first. The lifeboat is lost.Loss of life of one or more occupants.	0	5	3	0	0	6	5	6	4.47	There has been an incident rate of 1 in 18 months in Wellington Harbour.The boat must have a radio, set on channel 14 and crew must wear life jackets.
13	81	Seaview	Mooring Breakout	Mooring Breakout (Seaview Jetty)	A vessel (Tanker) alongside at Seaview Wharf experiences high winds and ovecomes the capability of mooring equipment deployed. Tanker at Seaview Jetty.	Tanker	CentrePort , National Maritime Regulator, Seafarers, Vessel Owners, Wellington Regional Council	Adverse Wind (Force and Direction) , Equipment Age, Equipment Failure (Propulsion or Steering), Equipment Quality, Failure of Maintenance Systems , Failure to Comply with Terminal Procedures , Human Error Control/Operational, Human Error Judgement, Inattention to Local Weather Forecast, Limitations of Crew Onboard Training, Quality and Qualifications of Onboard Crew , Tug Assistance Not Immediately Available Wind loading exceeds breaking strain of lines in use or lines being used are not equally set up or of same composition therefore different BS apply. One line parts loading up others. Not enough lines for the conditions. Not using enough bights to increase parts. Poor condition of lines. Moorings not tended on vessel (poor deck watch or and insufficient crew on board). Bollard Failure as SWL is exceeded - Bollards catapulted from jetty (personnel hazard). Lines poorly set, e.g., vertical line leads exceeding best practice. Not enough lines out for expected conditions. Lines parting at the leads due to chafing from ship movements.	65 BP Tugs push vessel alongside wharf while extra lines or storm lines rigged (this ML event has occurred in the past two years). Berth operator (SGS) stops discharge and disconnects flexible cargo hose. Potential for injury to crew responding to mooring failures and/or workers disconnecting cargo discharge hose.	Easterly wind (unexpected) parts lines of a tanker vessel and vessel drifts off berth. Gangways damaged or fall from wharf edge or high-level landing platform with potential for fatality(ies). Bollards are damaged and variously removed from jetty as the SWL and ultimate load exceeded. Loss of use of the wharf until repairs complete. Potential for escalation to grounding event if tugs cannot be deployed in time.	3	5	0	3	4	2	5	5	4.43	**2015**: There are two 65 BP tugs available for Seaview, a significant increase in towage capacity arriving in service since the 2005 risk assessment. However, these may take up to 90 minutes to arrive at the wharf. The easterly wind conditions that cause high windage problems on tankers discharging at Seaview are uncommon, but they are predictable and the CentrePort marine department has response plans, including placing a tug on station on a precautionary basis. SOPs can also avoid berthing a tanker in an Easterly.Seaview jetty is a strategic asset for fuel delivery to Wellington and the lower North Island.Tanker size has increased, with 60,000 tonnes displacement vessels now in service.A recent mooring assessment evaluated the wharf's mooring arrangement using the Optimoor software. Based on the conclusions, Seaview wharf (built in 70's) is likely that will not satisfy full requirements of current codes on an individual basis, but the mooring system overall does satisfy the requirements.The most likely scenario has occurred in the past two years.

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14	76	Approaches, Entrance	Grounding	Deep Draught Vessel Grounding (<9m draught)	Deep draught vessel (e.g. Tanker, Log vessel or Large Cruise Vessel) in potential grounding situation while transiting harbour entrance. Deep Draught defined as over 9 metres	SOLAS Vessels (Foreign)	CentrePort , Vessel Owners, Wellington Regional Council , Seafarers, Passengers	Adverse Wind (Force and Direction) , Communications Failure (Equipment), Equipment Failure (Propulsion or Steering), Equipment Quality, Excessive Speed (with Respect to Sea Conditions), Failure to comply with Harbour Regulations, Failure to Monitor Position or Vessels Progress Onboard, Failure to Use Vessel's Nav Aids , Human Error Control/Operational, Human Error Judgement, Human Fatigue (Working Hours), Inadequate Communication/Misinterpretation or Miscommunication , Inattention to Local Weather Forecast, Ineffective Master/Pilot Exchange (MPX), Information Transfer Failure, Interaction with Barretts Reef , Lack of Local Knowledge/Experience , Lack of Support/Monitoring by Beacon Hill, Limitations of Crew Onboard Training, Loss of Electrical Power (Blackout), Loss of Situational Awareness (At Night/Restricted Visibility in Heavy Weather), Miscalculated Manoeuvres , Misuse of Drugs or Alcohol , Not Adjusting to Safety Margins for Adverse Weather , Not Following Pilotage Procedures, Not Following Rules and/or Bylaws and/or SOP, PPU Operating with Fault Condition , Problems with Vessel/Beacon Hill Liaison During Transit , Quality and Qualifications of Onboard Crew , Standing-in too Close to Navigational Hazards, Sub-optimal BRM Environment Onboard the Vessel, Traffic Density, Violation of VTS Recommendations , Wind Over Tide Conditions - Harbour Entrance Steep Swells Swell at entrance reduces under keel clearance of an already deep vessel. Unknown hydrodynamic behaviour of vessel. Vessel speed too high for available depth of water or manoeuvre to avoid other vessel / craft leads to loss of under keel clearance through heel. Incorrect draught calculation or declaration prior to transit. Pilot error in calculating under keel clearance for time of transit. A GPS offset shows vessel correctly in channel on transit monitoring systems (AIS) and ECDIS, with vessel's actual position heading into danger.	Glancing grounding resulting in scrape with minor damage, slight plating indentation (Bounce Grounding).Alternatively, large Cruise liner touches bottom with Azipod. Reduced manoeuvring and propulsion capability.	Tanker has engine difficulties in the Narrows in adverse southerly conditions and grounds on reef or rocky shore. Hull ranges and works in heavy swell with loss of hull integrity and product spill.Alternatively serious damage to cruise vessel propulsion system results in loss of cruise schedule and very significant commercial loss. Passengers repatriated.	0	0	4	5	5	3	5	5	4.42	**2015 RA Review**: The harbour entrance channel was surveyed by LINZ and CentrePort, 2008 and 2014 respectively. See NZ 463 chart.The entrance channel depth is beginning to limit the vessel sizes that can be handled at Wellington. Tanker traffic using the port has increased in size since 2005 risk assessment, but not draft. Cruise vessel numbers have grown very significantly, with visits by the world's largest (4000 person capacity) commonplace. Only a very small number of cruise ships have a draft over 9m, but pilots are becoming aware of the effects of pitching increasing draft in a long vessel. It is described in the procedures.

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15	18	Approaches	Collision	RoRo Ferry and Large Vessel Conflict, Harbour Approaches	Passenger ferry and large vessel in developing collision situation. Collision potential with finer angle of approach (Harbour Approaches). Other vessel large SOLAS, such as Tanker, Container Vessel, Bulk Carrier, etc.	Passenger Vessel	Beacon Hill Monitoring Station, CentrePort, Passengers, Seafarers, Vessel Owners, Wellington Regional Council	Adverse Visibility e.g. Fog/Mist/ or Heavy Rain Squall, Adverse Wind (Force and Direction) , Communications Failure (Equipment), Disregard and/or Misinterpretation of Collision Regulations , Equipment Failure (Propulsion or Steering), Excessive Speed (with Respect to Sea Conditions), Failure of Maintenance Systems , Failure to comply with Harbour Regulations, Failure to Monitor Position or Vessels Progress Onboard, Failure to Use Vessel's Nav Aids , Human Error Control/Operational, Human Error Judgement, Human Fatigue (Working Hours), Inadequate Communication/Misinterpretation or Miscommunication , Ineffective Master/Pilot Exchange (MPX), Information Transfer Failure, Interaction - Ship to Ship , Lack of Local Knowledge/Experience , Lack of Support/Monitoring by Beacon Hill, Limitations of Crew Onboard Training, Loss of Electrical Power (Blackout), Loss of Situational Awareness (At Night/Restricted Visibility in Heavy Weather), Manning Levels, Miscalculated Manoeuvres , Not Following Pilotage Procedures, Not Following Rules and/or Bylaws and/or SOP, Not Monitoring Port Operating VHF Channels , Not Sounding/Incorrect Sounding of Required Sound Signals , Problems with Vessel/Beacon Hill Liaison During Transit , Quality and Qualifications of Onboard Crew , Sub-optimal BRM Environment Onboard the Vessel, Traffic Density, Vessel Departs from the Wellington Harbour Recommended Route , Violation of VTS Recommendations , Wind Over Tide Conditions - Harbour Entrance Steep Swells Passing "agreements" made directly between vessel bridge team and Pilot, then pilot distracted (by, e.g. the vessel boarding operation). Vessels not plotting to determine a rate of closure and relative bearing changes. Third party interference with planned movements and multiple vessel convergence to leads causing last minute course alterations. System reliance on a pilot to manage the traffic situation.	Developing close quarters situation at entrance but collision averted.	Collision with a fine angle of blow as vessels come together and suffer from interaction in the area of Barrats Reef. Hull damage and personnel injury. Potential for pollution through spilled bunkers if stored in wing tanks. Potential for the hazard scenario escalating to a grounding at the Harbour Entrance.	0	0	0	4	7	6	6	6	4.35	**2015**: Situation as for 2015 remains the same based on the remarks above. The conflict occurs during pilot boarding at the approaches and also during the disembarkation of the pilot while the outbound vessel navigates south of the pilot station creating occasional a conflict with an inbound ferry on the leads. In 2015 Pilots can be boarding further offshore in order to comply with good practice, but may sometimes use radio to line an inbound vessel up with the leads and board accordingly. There have been incident reports of a tanker committed inbound being in conflict with a RoRo ferry that was also approaching the port and had reported its intentions, but this occurred at the same time the pilot was boarding. In 2015, pilots have revised SOPs relating to leading vessels (revisions occur every 7-8 months). This hazard is linked to Hazard number 20 (ID).**2005**: This hazard covers all large vessel types. Pilot disembarks regularly in the channel or area of Front Lead (in southerly weather), vessel transits entrance traffic without pilot on board (although the pilot will escort from the pilot vsl) or shore based navigational support. Ferries approaching from the west are reported to regularly 'cut the corner' at the entrance or seek to make alternate starboard to starboard approach to save time. Vessels using pilot boarding station Alpha maneuvering to pick up the pilot are likely to regain leads in the same area where an inbound ferry would join the leads. Pilots report that temporary loss of spatial awareness can occur between boarding a vessel and making their way to the bridge if Master is maneuvering the vessel, but awareness is regained quickly.
16	67	Approaches, Entrance, Main Harbour, Lambton Harbour, Evans	Fire/Explosion	Fire On Small Passenger Vessel	Fire on board a harbour ferry or passenger-carrying charter vessel.	Passenger Vessel	Passengers, Seafarers	Equipment Age, Equipment Quality, Failure of Maintenance Systems , Human Error Control/Operational, Human Error JudgementEngine room or galley fire through poor maintenance or operational failure (e.g. fractured fuel line sprays diesel mist or onto hot engine parts). Build-up of combustible materials/spilled oil or fuel near ignition source. Lack of detection system in engine or other unmanned space. Electrical failure e.g. burnt wiring in any part of vessel. BBQ used on deck tips over with vessel motion. Gas build-up in bilges through faulty LPG connections or storage of cylinder below decks.	Source of potential fire e.g. electrical fault in bridge wiring or fractured diesel line in engine room detected by crew at early stage, minor fire quickly controlled.	Fire in unmanned engine room not detected early on and space not serviced by CO2 or similar system. Wooden or composite hull vessel requires evacuation with potential for up to 100 persons in the water, potential for fatalities.	0	3	3	3	2	7	6	6	4.31	**2005**: Several fires or incidents which could have led to fire have occurred on various small passenger vessels. To date these fires have either been averted or controlled with any evacuation of passengers safely carried out by emergency services vessels and craft in the immediate vicinity. Some passenger vessels are only required to carry Carley floats (rafts) or lifejackets, rather than inflatable liferafts. Persons would have to enter the water and hold onto lifelines around the raft and await rescue which may be up to half an hour away. Fatalities are likely to occur through hypothermia and drowning.

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17	21	Approaches, Entrance, Main Harbour	Collision	RoRo Ferry and RoRo Ferry in Conflict	Two Passenger RoRo ferries in developing collision situation during an overtaking or passing manoeuver near alter-course waypoints.	Passenger Vessel	Beacon Hill Monitoring Station, Passengers, Seafarers, Vessel Owners, Wellington Regional Council	Adverse Visibility e.g. Fog/Mist/ or Heavy Rain Squall, Berth Departure or Arrival Message to Beacon Hill not Transmitted or Acknowledged , Communications Failure (Equipment), Disregard and/or Misinterpretation of Collision Regulations , Equipment Failure (Propulsion or Steering), Equipment Quality, Excessive Speed (with Respect to Sea Conditions), Failure to comply with Harbour Regulations, Failure to Monitor Position or Vessels Progress Onboard, Failure to Provide Call to Beacon Hill Prior to Arrival or Departure , Failure to Use Vessel's Nav Aids , Human Error Control/Operational, Human Error Judgement, Human Fatigue (Working Hours), Inadequate Communication/Misinterpretation or Miscommunication , Information Transfer Failure, Interaction - Ship to Ship , Lack of Local Knowledge/Experience , Lack of Support/Monitoring by Beacon Hill, Loss of Electrical Power (Blackout), Loss of Situational Awareness (At Night/Restricted Visibility in Heavy Weather), Miscalculated Manoeuvres , Misuse of Drugs or Alcohol , Not Adjusting to Safety Margins for Adverse Weather , Not Following Pilotage Procedures, Not Following Rules and/or Bylaws and/or SOP, Not Monitoring Port Operating VHF Channels , Not Sounding/Incorrect Sounding of Required Sound Signals , Problems with Vessel/Beacon Hill Liaison During Transit , Sub-optimal BRM Environment Onboard the Vessel, Traffic Density, Vessel Departs from the Wellington Harbour Recommended Route , Violation of VTS Recommendations Miscalculation by ferry masters (both). VHF communications between vessels leads to confusion or lack of communication leaves one vessel in doubt as to intention of other. AIS or ECDIS operational failure. Passage plans not standardized between operators. Convergence of smaller craft near alter course points. Interference by small craft at last minute. Beacon Hill not monitoring tracks (AIS) through policy or training/qualification. Poor route monitoring and no efficiently appreciating or managing speed and CPA. RoRo ferry schedules provide common departure timings (commercial pressure).	Developing close quarters situation, which is resolved by ship to ship VHF communication.	Overtaking ferry attempts to cross ahead of other vessel resulting in interaction and fine angle of blow collision. Potential for injuries to passengers/crew on impact and damage to hulls requiring vessels to be withdrawn from service for several weeks to repair.	0	0	0	3	5	7	7	7	4.3	**2015**: Latest version of the nautical charts depict the recommended tracks for Wellington Harbour. Occasionally, ferries 'cut the corner' on the lead line and conflicts can develop in the harbour approaches; some ferries are capable of higher speeds than others. The evidence is that this is mostly resolved Ferry to Ferry by VHF, but the commercial reality of competition rivalry is present. **2005**:Ferries are reported to regularly depart from the recommended track to save passage time in the past, although this practice appears to be declining. Some may cross Falcon Shoal. Close quarters situations between ferries have occurred in the harbour approaches and inner harbour areas. Beacon Hill currently only provides a passive communications role within the limitations of equipment and training provided to staff - for example, station operators have only been required to have a general knowledge of the recommended tracks for vessels transiting the harbour. Most inbound vessels shaping for a berth from Point Halswell cross the track of outbound accelerating ferries and this requires a departure from the rules but is something that is agreed between the respective vessels.

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18	9	Approaches, Entrance, Main Harbour	Grounding	Harbour Craft (MOSS registered) Grounding	Charter Craft or Harbour ferry (MOSS) in grounding situation eg. Chaffers Passage or Somes Island.	Commercial Vessel	Beacon Hill Monitoring Station, Fishing Interests, National Maritime Regulator, Police Maritime Unit, Seafarers, Vessel Owners	Adverse Visibility e.g. Fog/Mist/ or Heavy Rain Squall, Adverse Wind (Force and Direction) , Communications Failure (Equipment), Disregard and/or Misinterpretation of Collision Regulations , Equipment Age, Equipment Failure (Propulsion or Steering), Equipment Quality, Excessive Speed (with Respect to Sea Conditions), Failure to comply with Harbour Regulations, Failure to Use Vessel's Nav Aids , Human Error Control/Operational, Human Error Judgement, Inattention to Local Weather Forecast, Information Transfer Failure, Lack of Local Knowledge/Experience , Lack of Support/Monitoring by Beacon Hill, Limitations of Crew Onboard Training, Loss of Electrical Power (Blackout), Loss of Situational Awareness (At Night/Restricted Visibility in Heavy Weather), Misuse of Drugs or Alcohol , Not Adjusting to Safety Margins for Adverse Weather , Not Following Rules and/or Bylaws and/or SOP, Standing-in too Close to Navigational Hazards, Traffic Density, Unmarked Navigational Hazard , Wind Over Tide Conditions - Harbour Entrance Steep Swells Vessel operated by non-certificated launch master. Mechanical or steering failure. Not monitoring radio VHF Ch.14. Inattention to course keeping. Reliance on autopilot. Rock-hopping rather than staying in clear water. Radar not being used or set up incorrectly. Not using sounder or nav aids such as plotter. Skipper distracted.	Vessel suffers glancing grounding, pumps cope with water ingress.	Vessel inbound in deteriorating southerly conditions runs over submerged rock and floods engine room. Vessel drifts into area of breaking seas with capsize and persons in the water, potential for multiple fatalities.	0	4	4	0	2	7	4	6	4.27	**2015**: No Incident has been recorded during the period 2009-2014. Only a near miss grounding is recorded for the vessel Kaharoa, 5th of September, 2005 at Chaffers Passage. No AtoNs exist at Chaffers Passage as its transit is suitable for local knowledge use only. *Remarks from the MNZ summary report*: Whilst undertaking hydrographic survey work in Chaffer's Passage, the port side of the transducer pods came into contact with a rock in the above position. **2005**: Vessels without a valid survey certificate or qualified skipper are reportedly offered for charter in the Wellington area. There are no AtoN for vessels using Chaffers Passage.

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19	15	Entrance	Collision	RoRo Ferry and Large or Deep Draught Vessel Collision	Ferry and deep draught ship in developing collision situation between the Pinnacles and Falcon Shoals.	Passenger Vessel	Beacon Hill Monitoring Station, CentrePort , Passengers, Seafarers	Adverse Visibility e.g. Fog/Mist/ or Heavy Rain Squall, Adverse Wind (Force and Direction) , Communications Failure (Equipment), Disregard and/or Misinterpretation of Collision Regulations , Equipment Age, Equipment Failure (Propulsion or Steering), Equipment Quality, Excessive Speed (with Respect to Sea Conditions), Failure of Maintenance Systems , Failure to comply with Harbour Regulations, Failure to Monitor Position or Vessels Progress Onboard, Failure to Provide Call to Beacon Hill Prior to Arrival or Departure , Failure to Use Vessel's Nav Aids , Human Error Control/Operational, Human Error Judgement, Human Fatigue (Working Hours), Inadequate Communication/Misinterpretation or Miscommunication , Inattention to Local Weather Forecast, Ineffective Master/Pilot Exchange (MPX), Information Transfer Failure, Interaction - Ship to Ship , Lack of Local Knowledge/Experience , Lack of Support/Monitoring by Beacon Hill, Limitations of Crew Onboard Training, Loss of Electrical Power (Blackout), Loss of Situational Awareness (At Night/Restricted Visibility in Heavy Weather), Malicious Action by Third Party, Manning Levels, Miscalculated Manoeuvres , Misuse of Drugs or Alcohol , Not Adjusting to Safety Margins for Adverse Weather , Not Following Pilotage Procedures, Not Following Rules and/or Bylaws and/or SOP, Not Monitoring Port Operating VHF Channels , Not Sounding/Incorrect Sounding of Required Sound Signals , PPU Operating with Fault Condition , Problems with Vessel/Beacon Hill Liaison During Transit , Quality and Qualifications of Onboard Crew , Sub-optimal BRM Environment Onboard the Vessel, Traffic Density, Vessel Departs from the Wellington Harbour Recommended Route , Violation of VTS Recommendations , Wind Over Tide Conditions - Harbour Entrance Steep Swells Miscalculated overt Deep draught bulk carrier navigating at extreme limit of channel to maximize CPA with other vessel. Pilot misjudges manoeuvrability of heavy vessel. Insufficient trained personnel on either bridge to provide continuity of the watch if it becomes necessary to take manual control of the helm. Pilot does not request priority for Deep Draught Vessel to possess deep channel (movement priority). Nav lights not clearly discernible. Third party interference with planned movements and multiple vessel convergence to leads causing last minute course alterations.	Close quarters situation but collision averted.	Ferry and bulk carrier in fine angle collision near Steeple Light in poor visibility. Potential for multiple injuries on impact. Punctured shell plating leads to flooding. Low possibility of pollution.	0	0	0	4	4	5	5	6	4.27	**2015**: This hazard could include all types of vessels given the fact that the size of vessels has significantly increased compare with the 2005 risk assessment. As the affected area is the Entrance where there is a limited sea-room for maneuverability, recorded incidents are only located in the Approaches. The number of movements for deep draught vessels has slightly decreased from 73 in 2005 to 61 in 2014. The constrained by draught signal can be shown to avoid any conflict with the outbound or inbound ferry. Follow-up discussion with CentrePort for its use. Check SOP for deep draught. **2005**: This hazard covers overtaking situation and head on passing situation. Some ferry masters routinely move to the East of the leads inward bound to give deeper draft vessels more room through this area, however the practice is not uniformly followed between different masters and is not necessarily a requirement of ferry passage plans. Outward ferries move to west of channel. The Pilot has the option of requesting all traffic remain clear of channel while the deep draft vessel is in transit. Proximity of the 10 metres depth contour may restrict available sea room for deep draught outbound vessels in transit through this area. Constrained by Draught signals are not routinely shown by vessels transiting the harbour with small UKC.

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20	59	Approaches, Entrance, Main Harbour, Lambton Harbour, Evans Bay, Seaview	Foundering	Leisure Craft Foundering	Leisure craft founders in the harbour or approaches .	Leisure Craft	Beacon Hill Monitoring Station, Police Maritime Unit, Recreational Users, Seafarers	Adverse Wind (Force and Direction) , Communications Failure (Equipment), Equipment Age, Equipment Failure (Propulsion or Steering), Equipment Quality, Excessive Speed (with Respect to Sea Conditions), Failure of Maintenance Systems , Failure to comply with Harbour Regulations, Failure to Monitor Position or Vessels Progress Onboard, Human Error Control/Operational, Human Error Judgement, Inattention to Local Weather Forecast, Lack of Local Knowledge/Experience , Limitations of Crew Onboard Training, Loss of Situational Awareness (At Night/Restricted Visibility in Heavy Weather), Miscalculated Manoeuvres , Misuse of Drugs or Alcohol , Not Adjusting to Safety Margins for Adverse Weather , Not Following Rules and/or Bylaws and/or SOP, Quality and Qualifications of Onboard Crew , Standing-in too Close to Navigational Hazards, Tug Assistance Not Immediately Available , Wind Over Tide Conditions - Harbour Entrance Steep Swells Craft unsuited to sea conditions encountered.	Leisure craft capsized in choppy seas but occupants swim short distance to shore or rescued by police launch or coastguard vessel on patrol.	Small craft multiple occupants capsizes of Pencarrow coastline or other areas. Potential for fatality through hypothermia or drowning.	0	0	0	5	0	6	2	6	4.2	**2005**Small leisure craft are prone to getting caught out in deteriorating conditions and suffer mechanical failure or have insufficient power to make headway against wind and sea. A number of fatalities have occurred in the harbour and at the entrance off the South Coast where there has been disregard or inattention to changes in weather. Most of these events have occurred in Lowry Bay to the Harbour entrance (East Coast).**2015**An incident occurred during 2014 that involved the foundering of a boat due to weather conditions. Supported evidence from Harbour Ranger - incident not recorded in HAZMAN incident database.
21	14	Main Harbour	Grounding	Dragging Anchor - Main Harbour Area	Vessel Drags anchor in Harbour	All Vessels	Beacon Hill Monitoring Station, CentrePort , Seafarers, Wellington Regional Council	Adverse Wind (Force and Direction) , Equipment Quality, Failure to Monitor Position or Vessels Progress Onboard, Human Error Control/Operational, Human Error Judgement, Inattention to Local Weather Forecast, Lack of Support/Monitoring by Beacon Hill, Not Following Rules and/or Bylaws and/or SOP, Quality and Qualifications of Onboard Crew , Tug Assistance Not Immediately Available Vessel fails to monitor position at anchor or shift in wind direction or deteriorating conditions. Not plotting position and engines not on short notice and readily available. Vessel anchored in inappropriate position given forecast or not anchored with enough cable. Vessel not anchored correctly with anchor cable laid out in proper manner. Vessel with two cables out not monitoring weather conditions, fouled hawse in wind change. Anchored positional change is not immediately noticed by Beacon Hill.	Vessel dragging anchor detected by Beacon Hill or reported by other vessels or member of the public overlooking harbour, grounding averted.	Vessel dragging is undetected immediately and involves a Tanker. Vessel grounds beam on to shoreline in strong gale. Potential for puncture of double bottom and bunker spill. Vessel remains aground for up to one and a half hours as tugs respond. Difficulty in releasing vessel. Damage to propeller/rudder, dry dock required.	0	0	0	4	7	2	6	6	4.19	**2015**: A dry cargo vessel has been recorded in 2014 dragging anchor in high winds located in the main harbour - ref 29. In case AIS is not functional, Beacon Hill is not able to monitor the Main Harbour Area as there is no available radar coverage in the anchorage area. It is unlikely that a vessel does not have on AIS. Pilot SOPs required Pilot to ensure ship is left safely anchored and Beacon Hill told to monitor ship's position. **2005**: Applies to a vessel anchored at any position within the harbour. The scenario of anchor dragging has occurred in the Harbour. Radar coverage by Beacon Hill of anchorages and inner harbour could provide for monitoring of anchored vessels and provide early warning of vessels dragging anchor. Existing low BP tugs may not be able to pull a larger vessel into deeper water until abatement in weather or wind shift. Other shipping movements may be delayed while tugs are involved with refloating the grounded vessel. There is no docking or repair facility in the port for rudder/propeller damage and local tugs lack bollard pull and range to tow a large vessel to nearest drydock (possibly Australia). Vessels with two anchors out have been caught with a wind change and suffered fouled cables, remaining cast until tugs are available to assist.

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											Environment	People	Property	Stakeholders	Environment	People	Property	Stakeholders		
22	23	Main Harbour	Collision	Harbour Ferry in Conflict with Larger Vessel	Harbour ferry in developing collision situation with a larger ferry or other larger vessel transiting harbour.	Harbour Ferry	Beacon Hill Monitoring Station, Passengers, Seafarers	Adverse Visibility e.g. Fog/Mist/ or Heavy Rain Squall, Adverse Wind (Force and Direction) , Berth Departure or Arrival Message to Beacon Hill not Transmitted or Acknowledged , Communications Failure (Equipment), Disregard and/or Misinterpretation of Collision Regulations , Equipment Failure (Propulsion or Steering), Excessive Speed (with Respect to Sea Conditions), Failure to comply with Harbour Regulations, Failure to Monitor Position or Vessels Progress Onboard, Failure to Provide Call to Beacon Hill Prior to Arrival or Departure , Failure to Use Vessel's Nav Aids , Human Error Control/Operational, Human Error Judgement, Human Fatigue (Working Hours), Inadequate Communication/Misinterpretation or Miscommunication , Inattention to Local Weather Forecast, Interaction - Ship to Ship , Lack of Local Knowledge/Experience , Lack of Support/Monitoring by Beacon Hill, Limitations of Crew Onboard Training, Loss of Electrical Power (Blackout), Loss of Situational Awareness (At Night/Restricted Visibility in Heavy Weather), Miscalculated Manoeuvres , Misuse of Drugs or Alcohol , Not Adjusting to Safety Margins for Adverse Weather , Not Following Rules and/or Bylaws and/or SOP, Not Monitoring Port Operating VHF Channels , Problems with Vessel/Beacon Hill Liaison During Transit , Quality and Qualifications of Onboard Crew , Sub-optimal BRM Environment Onboard the Vessel, Traffic Density, Unmarked Navigational Hazard , Vessel and Beacon Hill Liaison Failure Prior to Movement Commencement Poor lookout on either vessel. Misjudgement of CPA by either vessel, lack of systematic plotting. Propulsive failure on harbour ferry while crossing track of other vessel. Lack of, late or misunderstood communication by VHF between vessels to arrange passing/crossing or resolution of conflict situation. Larger vessel navigating off usual track. Harbour ferry increasing risk by attempting to or by passing too close. Late interference by other vessels in planned manoeuvres. Loss of situational awareness in Fog or during hours of darkness.	Close quarters situation but collision averted. Near miss incident reports raised made.	Harbour ferry takes inappropriate avoiding action and is in collision with large vessel (RoRo ferry or other), sustaining severe damage. Potential for multiple fatalities and small diesel spill.	0	0	0	4	2	7	5	6	4.14	**2005**: The harbour ferry crosses the inward and outward tracks and may have up to approximately 90 passengers per trip. An additional larger ferry is planned for the harbour service which will at least double passenger capacity. Historically the ferry safety record is good with few close quarters situations with larger vessels reported. **2015**: A close quarters event for this hazard is the encounter between a Harbour Ferry and a Ferry. Such an example is the incident between Cobar Cat and Santa Regina in 2014. An additional one has been recorded between Santa Regina and City Cat. The particular hazard could be updated where necessary for a Harbour Ferry in Conflict with another Ferry. This is due to the high traffic movements for both Harbour Ferries and Cook Strait Ferries in contrast with other types of vessels within the Main Harbour of Wellington.

Rank	Hazard Ref.	Affected Areas	Accident Category	Hazard Title	Hazard Detail	Affected Vessel Types	Affected Stakeholders	Possible Causes	Consequence Descriptions		Risk By Consequence Category								Risk Overall	Remarks
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											Environment	People	Property	Stakeholders	Environment	People	Property	Stakeholders		
23	34	Lambton Harbour	Collision	Rowing skiff and vessel in conflict	Rowing skiff in potential collision situation with power-driven vessel in Lambton Harbour	Rowing Skiff	Recreational Users, Seafarers	Adverse Visibility e.g. Fog/Mist/ or Heavy Rain Squall, Adverse Wind (Force and Direction) , Communications Failure (Equipment), Disregard and/or Misinterpretation of Collision Regulations , Excessive Speed (with Respect to Sea Conditions), Failure to comply with Harbour Regulations, Human Error Control/Operational, Human Error Judgement, Inadequate Communication/Misinterpretation or Miscommunication , Limitations of Crew Onboard Training, Misuse of Drugs or Alcohol , Not Following Rules and/or Bylaws and/or SOP, Traffic DensityPoor lookout on craft or vessel (Skiff rowers without Cox and facing backwards). Bow-up trim of power driven craft obscures rowing skiff or other low-profile craft from view. Lack of general boating knowledge or experience. Consumption of alcohol or drugs impairs judgment of leisure craft operator. Inattention to skipper's responsibilities. Small vessel not seen in glare off water. Not showing lights as required by Collision Rules at night.	Close quarters situation but collision averted. Water taken onboard skiff is bailed out. Harbour Master receives complaint.	Rowing skiff and large leisure craft driven at high speed in collision. Potential for capsize of skiff and fatality.	0	0	0	4	0	7	3	7	4.11	**2015**: An incident that matches this particular hazard is a close quarter situation between a Rowing Skiff and a Ferry at Lambton Harbour. In this case, the rowing skiffs were obstructing the berthing operations of the Ferry (Ref. 26). Such a conflict is likely to occur with other types of vessels that berth at Lambton Harbour, including but not limited to Naval and Harbour Ferry Vessels. **2005**: Organized rowing events including dragon-boat racing are generally well managed by the harbour authority and organisers and conflicts with commercial shipping are not likely. Rowing clubs are safety conscious and generally have a safety boat in attendance with rowers, although individuals may exercise without safety craft support. Rowers also practice in the northern area of the harbour, however few conflict situations are reported in this area which generally has a lower level of leisure and commercial activity (although a water-ski club is active in the same general area). Activity occurs at any time between dawn and dusk and sometimes at night.
24	57	Approaches, Entrance	Foundering	Fishing Vessel Foundering	Fishing vessel founders at harbour entrance in adverse southerly conditions.	Fishing vessel	Fishing Interests, Seafarers	Adverse Visibility e.g. Fog/Mist/ or Heavy Rain Squall, Adverse Wind (Force and Direction) , Communications Failure (Equipment), Equipment Failure (Propulsion or Steering), Equipment Quality, Failure to comply with Harbour Regulations, Failure to Monitor Position or Vessels Progress Onboard, Human Error Control/Operational, Human Error Judgement, Human Fatigue (Working Hours), Inadequate Communication/Misinterpretation or Miscommunication , Inattention to Local Weather Forecast, Lack of Local Knowledge/Experience , Lack of Support/Monitoring by Beacon Hill, Limitations of Crew Onboard Training, Loss of Electrical Power (Blackout), Loss of Situational Awareness (At Night/Restricted Visibility in Heavy Weather), Miscalculated Manoeuvres , Misuse of Drugs or Alcohol , Not Adjusting to Safety Margins for Adverse Weather , Not Following Rules and/or Bylaws and/or SOP, Not Monitoring Port Operating VHF Channels , Quality and Qualifications of Onboard Crew , Wind Over Tide Conditions - Harbour Entrance Steep Swells Inadequate stability or freeboard for prevailing conditions including free surface effect of water ingress, ice or cargo shift. Vessel overladen. Hull structural integrity inadequate for stress imposed by sea state. Vessel not monitoring Ch.14 or responding to calls from Beacon Hill. Inexperienced person on the helm or reliance on autopilot. Ebbing tide and seas at Pencarrow particularly steep, overwhelming the vessel. No appreciation of entrance conditions before transiting the area.	Fishing vessel suffers water ingress through unsecured hatch. Vessel makes the harbour with residual stability.	Foundering at the entrance results in loss of vessel. Multiple fatalities possible. Diesel spill.	0	3	0	0	2	7	6	6	4.1	**2015**: Fishing vessels often catch large catches especially in hoki season and catch may be fluid. Hazard also applies to other weather conditions but there is higher risk in southerly conditions. There is no wave rider at the entrance.

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25	53	Lambton Harbour	Mooring Breakout	Mooring Breakout - Finger Berth	Vessel or ferry breaks lines or is unable to berth at no.3 berth, due to strong offshore southwesterly or broad northwesterly wind.	Vessel greater than 500GT	CentrePort , Seafarers, Wellington Regional Council	Adverse Wind (Force and Direction) , Equipment Age, Equipment Failure (Propulsion or Steering), Equipment Quality, Failure of Maintenance Systems , Human Error Control/Operational, Inattention to Local Weather Forecast, Tug Unable to Assist due to Severe Weather Conditions Vessel unable to hold position within central Wellington finger berth with high wind gust loads broad on vessel's bow or quarter. Not enough mooring lines. Limited capacity in thruster. Mooring lines at too acute vertical angle. Not using bights. Lines too light for loads. Winches render or brakes do not hold. Bollard failure.	Additional lines run, vessel lays off the berth, thrusters operated and vessel remains secure. Possibility of bollard failure. Tug called to assist hold on during turnaround.	Lines gradually all part before vessel can be controlled or anchors dropped. Bow or stern swings across basin at about 40° angle and contacts adjacent berth or moored vessel causing damage to either berth or both vessels. Possible fatality to personnel on wharf if bollard fails or from parting lines.	0	0	3	3	3	7	3	6	4.09	**2015:** CentrePort recognises the problem with berthing large ferries on the No.3 side and has developed terminals on to No.2 lee side of finger berths.**2005**: The No.3 side of a finger berth is difficult in a gale southwesterly or northwesterly, especially with gusty winds. The wind can be about 30 degrees off the berth.
26	82	Main Harbour, Lambton Harbour	Mooring Failure	RoRo Ferry in mooring failure	Ferry alongside in adverse weather conditions suffers mooring failure	Passenger Vessel	Beacon Hill Monitoring Station, CentrePort , Passengers, Seafarers	Adverse Wind (Force and Direction) , Equipment Age, Equipment Failure (Propulsion or Steering), Equipment Quality, Failure of Maintenance Systems , Human Error Control/Operational, Human Error Judgement, Inattention to Local Weather Forecast, Tug Assistance Not Immediately Available , Tug Unable to Assist due to Severe Weather Conditions Automatic mooring system overcome during heavy squall at Interislander ferry terminal. Limited mooring lines in use and overcome by conditions at either ferry terminal. Loss of control during berthing or departing. Ferry unable to use anchors. Tugs unable to arrive in time needed to prevent a berthing contact incident.	Tugs on call at short notice assist vessel to berth at wharf.	Ferry grounded in the inner harbour. Alternatively escalation to a significant berthing contact incident, involving damage to other vessels or wharves in inner harbour. Possibility of passenger injuries, but enough time to advise passengers if on board. Potential for fuel release.	0	3	3	3	2	4	4	6	4.09	**2015:** A representative incident occurred, June 2013 (mooring failure) at the Interislander Terminal.
27	69	Main Harbour, Evans Bay, Seaview	Fire/Explosion	Fire -Tanker operations	Fire on tanker alongside or at anchor.	Tanker	CentrePort , Seafarers	Equipment Age, Equipment Quality, Failure to comply with Harbour Regulations, Failure to Comply with Terminal Procedures , Human Error Control/Operational, Human Error Judgement, Limitations of Crew Onboard Training, Misuse of Drugs or Alcohol , Not Following Rules and/or Bylaws and/or SOP, Quality and Qualifications of Onboard Crew Vapour cloud formation on tanker or wharf deck through hold or hose string/manifold leak, or during product sampling. Source of ignition provided by personnel not following SOP's i.e. use of non-intrinsically safe electrical equipment, smoking out of designated areas or inappropriate clothing/footwear provides static build up. Inadequate precautions to prevent build-up of static electricity during discharge operations. Emergency shut-down delayed when required through poor state of equipment or lack of training/ procedural awareness of involved personnel. Shipboard fire i.e. accommodation, engine room, pump room, not immediately detected and contained.	Minor spill without source of ignition, fire averted.	Fire on tanker not immediately contained or extinguished. Limited firefighting response from terminal, delay in arrival of Fire Service appliances sufficient for fire to take control. Tug not immediately available to assist firefighting and move tanker from wharf. Explosion with multiple fatalities and possible source of fire to bush / residences in vicinity of terminal. Tanker sunk at wharf and loss of port trade.	2	0	0	4	5	5	5	5	4.08	Tug response to provide firefighting assistance or to tow tanker from berth may be up to 1 1/4 hrs away from Seaview Wharf, probably 30-45 minutes from other tanker berths. The latest tug new build, Tiaki, does have fixed firefighting capability. Some further limited firefighting capability is provided at terminals with reliance on local fire brigades to assist, if available without delay. Wharf structures other than Seaview which has a foam drenching, are not protected with foam or water systems and may suffer loss of structural integrity in a major fire, reducing accessibility of fire appliances and personnel to the scene. Adverse wind may rapidly escalate the severity of fire.

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28	54	Main Harbour, Lambton Harbour	Mooring Breakout	Mooring Breakout (Main Terminals)	A vessel with high windage breaks mooring lines in high offshore winds (other than a vessel berthed at a finger berth).	Passenger Vessel	CentrePort , Passengers, Seafarers	Adverse Wind (Force and Direction) , Equipment Age, Equipment Quality, Failure of Maintenance Systems , Human Error Control/Operational, Inattention to Local Weather Forecast, Limitations of Crew Onboard Training, Manning Levels, Not Adjusting to Safety Margins for Adverse Weather , Quality and Qualifications of Onboard Crew , Tug Assistance Not Immediately Available , Tug Unable to Assist due to Severe Weather Conditions Vessel unaware of impending adverse weather which may arrive quickly on approach of a southerly front. Wind loading exceeds breaking strain of lines in use or lines being used are not equally set up or of same composition therefore different BS apply. One line parts loading up others. Tension winches not set on the brake. Not enough lines for the conditions. Not using bights to increase parts. Lines poorly set as bollards have been removed for RoRo ramp access. Inshore bollard not used or blocked by equipment at TCW1. Poor condition of lines. Moorings not tended on vessel (poor deck watch and insufficient crew on board). Interaction of large vessel passing close by causes ranging and excessive loading on lines. Tugs lacking capacity to take load off moorings or unavailable to assist due to commitments to other shipping. Bollard Failure. High vertical leads of lines exceeding best practice. Not enough path out. Lines parting at the leads due to check from ship movements.	Tugs push vessel alongside wharf while extra lines or storm lines rigged.	(1) Involves a container vessel berthed at TCW1, which parts lines in southwesterly gale and drifts off berth. Box stack or ship's shoulder or quarter fouls crane. Potential to damage crane leg, making crane unusable. Crane likely to collapse. Potential for multiple fatalities if persons are in vicinity. Vessel could break out at same time spreader is down slot causing crane/s to collapse. Vessel drifting off berth makes contact with other ship berthed at TCW 2 which also parts lines in the extra loading. Potential for this vessel to foul cranes also. Two vessels now adrift requiring tug assistance to get back alongside and storm lines rigged. Both cranes lost. Severe financial and service impact on port trade.(2) Cruise liner or ferry parts mooring lines and drifts off berth. Gangways damaged or fall from wharf edge or high-level landing platform with potential for fatality(ies). Vessel damages berth in process.(3) High Windage Vessel such as a PCC parts line and breaks, having an impact on other vessels.	0	3	3	3	2	5	7	5	4.06	**2015**: The new cruise terminal at Aotea quay has new mooring pads for additional lines that provide more safety for high windage cruise vessels and tug capacity has been increased. The windage profile has increased substantially since 2005 with 200m PCCs now the normal and cruise ships now up to 350 in length. RFT No.3 has additional bollards fitted to create inshore mooring points.**2005**: This scenario is targeted at high windage vessel such as a container vessel, cruise liner or rail ferry berthed at Aotea Quay, TCW, QW, OPT or the ferry terminal Dock Wharf. Risk occurs particularly in S-SW gales. Often cranes are unable to be long travelled to amidships position when ceasing for wind therefore they are very vulnerable to ship contact when a ship parts mooring lines. TCW1 is more exposed berth in SW gales but all TCW/AQ berths can be affected in very strong SW or broad NW (or rarely - Wly) winds. There is potential for grounding of the adrift vessel/s if attempts to anchor are unsuccessful due to inability of crew to use anchors or anchor drags when let go (engines perhaps not available to assist) and pilot/tug assistance not immediately available, or collision with other vessels transiting the area, particularly at night. In severe wind events where wind loads are >100 tonnes, tugs lack sufficient BP to hold some vessels alongside, for example car carriers, larger container vessels and passenger vessels with high windage. Tugs often have to push for many hours at a time to ease mooring loads. In scenario, vessel drifting off berth could make contact with another ship creating a worst case scenario and loss of more than one crane.

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29	84	Approaches, Entrance, Main Harbour	Fire/Explosion	Fire on a Cruise Vessel	Fire on a cruise vessel within harbour limits or alongside. Fire either in in passenger service area or in engine or ancillary equipment rooms.	Passenger Vessel	Beacon Hill Monitoring Station, CentrePort , National Maritime Regulator, Passengers, Police Maritime Unit, Seafarers, Vessel Owners, Wellington Regional Council	Equipment Age, Equipment Quality, Failure of Maintenance Systems , Human Error Control/Operational, Human Error Judgement, Malicious Action by Third PartyLeaking fuel or lubricating oil.Problems in high voltage equipment.Laundry and laundry storage spaces.Smoking in crew relaxing areas.Passenger smoking or malpractice.	A range of small fires in passenger service areas, store rooms, propulsion and auxiliary spaces, detected by crew at early stage, minor fire quickly controlled.	Fire in propulsion system limits maneuverability. Engineroom suppression system fails to operate properly and high-voltage electrical generation lost for propulsion. Tugs, already on standby, attend vessel. Vessel requires evacuation with potential for up to 5000 passengers needing evacuation. Passenger injury and op to one fatality.	0	0	4	4	3	5	6	5	3.99	2015: During 2013, a fire broke out on DAWN PRINCESS when in offshore waters. Crew successfully addressed the emergency and extinguished the fire without any injuries.Very large cruise vessels routinely visit Wellington and their crews are trained and drill for emergencies, including fire. Cruise vessels have a growing use of diesel electric propulsion with very high voltage propulsor motors. Fire on a large vessel within harbour waters or alongside requires wider port response for crowd management and emergency services response.There are a number of recorded events where passenger vessel "hi Fog" systems have been found defective.

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30	65	Approaches, Entrance	Personal Injury	Personal Injury, Pilot Operations at Inner Boarding	Personal injury to pilot during more sheltered boarding, including Delta	Pilot Boat	CentrePort , Seafarers	Adverse Visibility e.g. Fog/Mist/ or Heavy Rain Squall, Adverse Wind (Force and Direction) , Communications Failure (Equipment), Equipment Age, Equipment Failure (Propulsion or Steering), Equipment Quality, Failure to Monitor Position or Vessels Progress Onboard, Human Error Control/Operational, Human Error Judgement, Human Fatigue (Working Hours), Inadequate Communication/Misinterpretation or Miscommunication , Inattention to Local Weather Forecast, Ineffective Master/Pilot Exchange (MPX), Interaction - Ship to Pilot Vessel , Limitations of Crew Onboard Training, Miscalculated Manoeuvres , Misuse of Drugs or Alcohol , Not Following Pilotage Procedures, Not Following Rules and/or Bylaws and/or SOP, Wind Over Tide Conditions - Harbour Entrance Steep Swells Ladder incorrectly rigged. Misjudged approach or loss of situational awareness in poor visibility/night or weather/sea conditions, aided by radar or floodlighting failure. L/Master does not appreciate effects of cross swell or wake/wash from own approach or passing vessel and comes off vessel. Inexperienced L/Master. Best lee not made or speed inappropriate for conditions and ship does not achieve the requested heading (through getting into irons or misjudgement of helm and engine speed required to affect turn) or alters speed/course substantially during the launches approach. Steering or propulsive failure on launch. L/Master misjudges effects of interaction between vessels causing heavy landing which knocks pilot off his feet. Pilot misjudges timing of transfer to/from launch in adverse sea conditions. Pilot not secured during transfer to foredeck or the tether parts. Pilot disconnects too early and does not maintain a handgrip when on foredeck. Pilot launch comes away from ships side through adverse sea conditions or launch master misjudgement. Pilot ladder parts through becoming caught under launch belting during rise and fall of launch (ladder may be in poor condition). Ladder parts due to the lack of maintenance. Difficult transition to gangway when using a combined system. Launch too short for sea and swell conditions. Manropes not provided or not used.	Pilot misjudges transfer from launch to or from ladder resulting in minor injury (strain/sprain). Pilot trips and falls overboard or is knocked off his feet and falls overboard.	Pilot falls into water or back onto launch during transfer operation with potential for severe injury (unconsciousness, back injury, crushing, laceration and fractures) or fatality.	0	6	0	0	0	6	0	4	3.98	**2015**: CentrePort intends severing relationship with coastguard to provide backup launch. CentrePort also intends getting a new launch with a longer waterline length. Note: It is pilot's choice whether to use manropes or not. **2005**: Pilots are required to conform to STCW-95 medical requirements for seafarers. Historically Wellington pilots safety record has been good. Lighter displacement pilot launches are in use which provide a less stable platform than those previously in service but techniques are used to pin launch alongside during transfers. Pilots are trained to adopt best lee during transfers and personally arrange this rather than leave it to other party. Pilots wear LSA at all times in transfer. Hazard may also apply to official passengers such as MAF personnel boarding special ships - transfer is always on basis of prior safety briefing and utmost safety but risk still applies.

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31	41	Main Harbour	Contact Navigation	Contact with vessels at anchor, in Harbour	A vessel makes contact with a vessel either at the explosives anchorage or in the inner anchorage.	Vessel greater than 500GT	Seafarers, Vessel Owners	Adverse Visibility e.g. Fog/Mist/ or Heavy Rain Squall, Adverse Wind (Force and Direction) , Berth Departure or Arrival Message to Beacon Hill not Transmitted or Acknowledged , Communications Failure (Equipment), Failure to comply with Harbour Regulations, Failure to Monitor Position or Vessels Progress Onboard, Failure to Provide Call to Beacon Hill Prior to Arrival or Departure , Failure to Use Vessel's Nav Aids , Human Error Control/Operational, Human Error Judgement, Human Fatigue (Working Hours), Inadequate Communication/Misinterpretation or Miscommunication , Information Transfer Failure, Lack of Local Knowledge/Experience , Lack of Support/Monitoring by Beacon Hill, Limitations of Crew Onboard Training, Loss of Situational Awareness (At Night/Restricted Visibility in Heavy Weather), Malicious Action by Third Party, Misuse of Drugs or Alcohol , Not Following Rules and/or Bylaws and/or SOP, Not Monitoring Port Operating VHF Channels , Problems with Vessel/Beacon Hill Liaison During Transit , Sub-optimal BRM Environment Onboard the Vessel, Vessel and Beacon Hill Liaison Failure Prior to Movement Commencement , Vessel Departs from the Wellington Harbour Recommended Route Inattention to track setting and course keeping. Setting a course too close to anchored vessel. Failure to appreciate effect of wind and leeway when passing. Beacon Hill not monitoring inner harbour or had not given advice of anchored vessel. Vessel had anchored without informing Beacon Hill. Ship anchored lights not seen against city lights. Ship has dragged so was not in position given or expected. Poor visibility from wheelhouse (i.e. positioning of fishing equipment obscures line of sight). Not using radar or radar incorrectly set up. No remote monitoring. Vessel anchored to obstruct approach to Lambton Harbour or Aotea Quay by larger vessel, including a departure from these areas. Vessel anchored at charted Explosives anchorage obstructs vessel making approach to RFT or Aotea Quay. Sun glare distracts lookout.	Close quarters situation but safe passing achieved.	(1) Vessel in region of Quarantine Anchorage struck by departing or arriving vessel causing damage to both vessels. Both vessels require considerable repair work(2) Vessel anchored at Explosives Anchorage contacted by ferry or vessel over-running 315° track at speed with severe damage to both vessel including loss of product, fire and explosion. Severe injuries to personnel.	0	0	0	2	4	6	7	6	3.96	Risk is comparatively low as not many vessels anchor but when they anchor either close in or when a tanker is at the explosives anchorage the risk as described is obvious. Pilots comment on risk of a vessel over-running the 315° track. Beacon can monitor all vessels providing they have AIS. Harbour recommended routes have advisory status; a transiting vessel can deviate from the route to increase the passing distance from anchored vessels.
32	43	Evans Bay	Contact Berthing	Tanker Contact Berthing	Tanker in contact berthing at Burnham Wharf.	Tanker	CentrePort , Seafarers	Wind limiting criteria exceeded for manoeuvre. Berthing downwind when head to wind should have been chosen. Blackout on tanker combined with tug operational failure, line failure or insufficient bollard pull for wind load. Pilot or tug master error including communications failure between pilot and tug master. Poor exchange of information between pilot and master or key bridge personnel (including poor level of spoken English ability in foreign crew) giving a sub-optimal BRM environment. Pilot inexperienced for conditions and ship type and not following standard practice. Pilot underestimates vessel displacement when calculating stopping distances. Misjudged approach speed or angle, missed engine start when required. Late connection of tugs or tugs not connected at optimum position. Anchors not prepared for use or used incorrectly. Misjudged turning point or speed of approach. Pilot loses situational awareness on approach due to lack of shore based references at night time or reduced visibility. Lack of accurate closing information from lines crew. Cognitive stress and fatigue. Not using PPU for approach.	Contact with superficial damage to fendering and hull.	Severe damage to tanker hull and wharf structure in heavy contact. Hull damaged and product spilt. Possible parting of a mooring line in vicinity of berthing crew. Tanker delayed for repairs to frames and plating. Port and region affected by delay to tanker operations while survey and repairs to berth completed.	0	0	3	0	6	4	6	6	3.96	The quality of closing information given by line crews to pilots is reported to be of variable quality and non-standard. Most, but not all tankers trading to Wellington are double hulled. A Safety Audit carried out on tanker berths in the port (1999) identified that fendering was least developed on Burnham wharf, requiring 'particular attention to approach angle and speed while mooring, in order to avoid structural damage to wharf or hull of tanker'. Special weather and other limiting parameters are established in CentrePorts pilotage procedures for tanker operations in Evans Bay.

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33	17	Approaches, Entrance, Main Harbour	Collision	RoRo Ferry / Large Vessel and Fishing Vessel Conflict.	Ferry or large vessel and fishing vessel in developing collision situation on approach to or within harbour.	Passenger Vessel	Passengers, Seafarers, Vessel Owners	Adverse Visibility e.g. Fog/Mist/ or Heavy Rain Squall, Adverse Wind (Force and Direction) , Berth Departure or Arrival Message to Beacon Hill not Transmitted or Acknowledged , Communications Failure (Equipment), Disregard and/or Misinterpretation of Collision Regulations , Equipment Failure (Propulsion or Steering), Excessive Speed (with Respect to Sea Conditions), Failure to comply with Harbour Regulations, Failure to Monitor Position or Vessels Progress Onboard, Failure to Provide Call to Beacon Hill Prior to Arrival or Departure , Failure to Use Vessel's Nav Aids , Human Error Control/Operational, Human Error Judgement, Human Fatigue (Working Hours), Inadequate Communication/Misinterpretation or Miscommunication , Inattention to Local Weather Forecast, Information Transfer Failure, Lack of Local Knowledge/Experience , Lack of Support/Monitoring by Beacon Hill, Limitations of Crew Onboard Training, Loss of Electrical Power (Blackout), Loss of Situational Awareness (At Night/Restricted Visibility in Heavy Weather), Malicious Action by Third Party, Manning Levels, Miscalculated Manoeuvres , Misuse of Drugs or Alcohol , Not Adjusting to Safety Margins for Adverse Weather , Not Following Pilotage Procedures, Not Following Rules and/or Bylaws and/or SOP, Not Monitoring Port Operating VHF Channels , Not Sounding/Incorrect Sounding of Required Sound Signals , Problems with Vessel/Beacon Hill Liaison During Transit , Quality and Qualifications of Onboard Crew , Sub-optimal BRM Environment Onboard the Vessel, Traffic Density, Vessel Departs from the Wellington Harbour Recommended Route , Violation of VTS Recommendations , Wind Over Tide Conditions - Harbour Entrance Steep Swells Fishing vessel not monitoring Ch.14. Vessels not plotting to determine rate of closure and relative bearing change. Either vessel not using all nav aids (ECDIS or AIS) effectively so unsure of limits of navigable water when taking evasive action. Inattention to course keeping by fishing vessel and reliance on autopilot. Fishing vessel not aware of larger vessel overtaking and manoeuvres in front of ferry at last moment. Nav lights not clearly discernible. Fishing Vessel is engaged in fishing activities at the harbour entrance or approaches.	Close quarters situation but collision averted.	Fishing vessel run down by other vessel and capsizes with potential for multiple fatalities and loss of marine diesel to sea.	0	0	0	3	4	6	5	5	3.89	**2015**: Recommended Tracks have been inserted into the Navigation and Safety Bylaws and nautical charts. Great surveillance from Beacon Hill PIS. Now AIS coverage. Applies to other large vessels as well. Smaller vessels commonly navigate between the outbound track and shore to save passage time and avoid outbound traffic. Outbound vessels are reported to navigate inside the recommended track to save passage time especially when crossing Falcon Shoal or occasionally to avoid anchored vessels off Kau Bay. In fine weather small vessels also fish at night.**2005**: Both ferries and fishing vessels are reported to disregard the recommended tracks for entering/leaving the harbour - this may increase the probability of conflict situations. Visiting fishing vessels may be unaware of the local routing system on their first entry.

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											Environment	People	Property	Stakeholders	Environment	People	Property	Stakeholders		
34	11	Evans Bay	Grounding	Tanker Grounding Harbour (Evans Bay)	Tanker with high freeboard in grounding situation in Evans Bay.	Tanker	Seafarers, National Maritime Regulator, CentrePort , Beacon Hill Monitoring Station, Police Maritime Unit, Wellington Regional Council , Vessel Owners	Adverse Visibility e.g. Fog/Mist/ or Heavy Rain Squall, Adverse Wind (Force and Direction) , Anchors Not Cleared, Equipment Age, Equipment Failure (Propulsion or Steering), Equipment Quality, Failure to comply with Harbour Regulations, Failure to Comply with Terminal Procedures , Failure to Monitor Position or Vessels Progress Onboard, Human Error Control/Operational, Human Error Judgement, Inattention to Local Weather Forecast, Ineffective Master/Pilot Exchange (MPX), Lack of Local Knowledge/Experience , Lack of Support/Monitoring by Beacon Hill, Limitations of Crew Onboard Training, Manning Levels, Miscalculated Manoeuvres , Not Adjusting to Safety Margins for Adverse Weather , Not Following Rules and/or Bylaws and/or SOP, PPU Operating with Fault Condition , Quality and Qualifications of Onboard Crew , Sub-optimal BRM Environment Onboard the Vessel, Tug Assistance Not Immediately Available , Tug Operational Failure , Tug Unable to Assist due to Severe Weather Conditions Pilot or tug master error. Line parting or insufficient bollard pull available for the wind load. Pilot inexperienced for conditions and ship type. Misjudged approach at night or in restricted visibility or shore based nav aids required for manoeuvre inoperative contributing to loss of situational awareness. Anchors not prepared for use or used incorrectly. Misjudged (late) turning point and vessel drifts to leeward during turn in a northerly and lands on end of Miramar wharf. Other craft interfere with planned movement at last minute.	Grounding by stern in soft sea floor by Shoal Pile light, vessel relocated by tugs and continues manoeuvre to berth with no significant damage.	(1) Forward tug failure in rising Northerly winds, tanker drifts to head of bay to ground by stern on rocky shore before anchors hold with fractured shell plating and damage to stern gear, loss of shaft lubricating oil. Potential for loss of bunkers/hull failure if tanker grounds.(2) Vessel takes a sheer to starboard in strong NWly conditions and vessel runs onto western shore or shoal before control is regained with resultant effects as described above.	0	0	0	3	6	2	6	6	3.84	**2015**: Human Error Control/Operational by pilot - A misjudged turning point towards the shoal of the tanker vessel can create a grounding situation. Miramar has a wind anemometer fitted. **2005**: There is no wind measuring instrumentation giving real-time wind speeds at Burnham Wharf to make it possible to accurately measure increase of wind speed while the vessel in is transit from AQ or Seaview to Evans Bay. Pilots use wind speed measured at Beacon Hill, the ships own anemometer (if in working order) and local knowledge of wind acceleration in the bay to judge when wind speed is likely to exceed set operating criteria. Operation of the sector light should be confirmed before entering the bay if the light is required as a reference for the intended swinging direction. Tug masters also report that it is not uncommon for ships crews to have difficulty passing a heaving line or securing the towline onboard in an efficient manner due to the wind, thus delaying effective use of the tug. Major oil spill in strong N conditions may close airport with product on runway from wind-blown spray. Resultant could also be a contact at Miramar. Possibility of affecting operations at the airport.

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35	48	Main Harbour	Contact Berthing	Contact with Container Crane	Vessel at container berth in contact with container crane	Vessel greater than 500GT	CentrePort , Seafarers	Adverse Wind (Force and Direction) , Berth Departure or Arrival Message to Beacon Hill not Transmitted or Acknowledged , Communications Failure (Equipment), Equipment Failure (Propulsion or Steering), Failure of Maintenance Systems , Failure to comply with Harbour Regulations, Failure to Comply with Terminal Procedures , Human Error Control/Operational, Human Error Judgement, Human Fatigue (Working Hours), Inadequate Communication/Misinterpretation or Miscommunication , Inattention to Local Weather Forecast, Information Transfer Failure, Lack of Support/Monitoring by Beacon Hill, Limitations of Crew Onboard Training, Loss of Electrical Power (Blackout), Not Adjusting to Safety Margins for Adverse Weather , Not Following Rules and/or Bylaws and/or SOP, Tug Assistance Not Immediately Available , Tug Unable to Assist due to Severe Weather Conditions , Vessel and Beacon Hill Liaison Failure Prior to Movement Commencement Cranes not amidships or clear of the berth. Strong onshore winds coupled with high air draft or deep draft. With a strong wind off the wharf on bow or quarter the ship comes off the berth at an angle during singling up and touches crane leg. Tugs not positioned to hold vessel on during singling up in offshore wind scenario. Crew singling up before Pilot is on board and tugs are in position to assist. Winch failure at one end during singling up or letting go in strong offshore winds and ships cants one end onto wharf with tugs incapable of regaining control. Tug operational failure or towline breakage during departure. Pressure from Stevedores or Agent to move vessel regardless of safety issues. Sub-optimal BRM environment. Tug let go too early and one end drops back onto wharf. Only one tug available or sailing with only one tug and thruster and then thruster fails. Not following SOP covering permission from Marine Manager to sail with cranes over vessel. Not following plan derived from risk assessment undertaken before starting the task.	Cranes missed but minor damage to plating of hull and wharf fendering system.	Crane/s toppled. Serious damage to hull plating and wharf. Potential for fatality to personnel on ship under crane or linesmen. Remaining container cranes unable to be traversed passed damage, berth out of action for considerable time.	0	0	3	0	2	6	7	7	3.82	**2015**: Sometimes cranes cannot be long travelled due to wind exceeding limits and a vessel may need to be sailed. A conventional or other ship may be berthed adjacent and there is stevedore opposition to stopping that vessel to temporarily move cranes. Normal procedure allows a vessel to sail with the permission of the Marine Manager providing the cranes are amidships (at a position of least risk) and completion of a risk assessment. Marine Manager will look at risk factors involved before providing permission. Cranes positioned at either end of the vessel are high risk.

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36	47	Main Harbour, Lambton Harbour	Contact Berthing	Vessel in Contact Berthing - Aotea Quay	Large vessel such cruise vessel, car carrier, container or general cargo ship in contact berthing with wharf or container cranes in restricted visibility, strong onshore winds, berthing in very strong wind conditions.	Vessel greater than 500GT	Seafarers, Vessel Owners	Adverse Visibility e.g. Fog/Mist/ or Heavy Rain Squall, Adverse Wind (Force and Direction) , Anchors Not Cleared, Berth Departure or Arrival Message to Beacon Hill not Transmitted or Acknowledged , Communications Failure (Equipment), Equipment Failure (Propulsion or Steering), Equipment Quality, Failure to Monitor Position or Vessels Progress Onboard, Failure to Provide Call to Beacon Hill Prior to Arrival or Departure , Failure to Use Vessel's Nav Aids , Human Error Control/Operational, Human Error Judgement, Human Fatigue (Working Hours), Inadequate Communication/Misinterpretation or Miscommunication , Inattention to Local Weather Forecast, Ineffective Master/Pilot Exchange (MPX), Information Transfer Failure, Lack of Local Knowledge/Experience , Lack of Support/Monitoring by Beacon Hill, Loss of Electrical Power (Blackout), Loss of Situational Awareness (At Night/Restricted Visibility in Heavy Weather), Miscalculated Manoeuvres , Missed Main Engine Start , Misuse of Drugs or Alcohol , Not Adjusting to Safety Margins for Adverse Weather , Not Following Rules and/or Bylaws and/or SOP, PPU Operating with Fault Condition , Sub-optimal BRM Environment Onboard the Vessel, Tug Assistance Not Immediately Available , Tug Operational Failure , Tug Unable to Assist due to Severe Weather Conditions Misjudged speed or angle in cross wind approach. Misjudged approach plan and ship does not turn down wind due to wind pressure and tugs or thruster unable to control vessel. Low power - displacement to windage ratio, downwind approach too fast. Blackout on ship at critical time, wind loading on ships hull too high for bollard pull of available tugs to check momentum. Tugs incapable of regaining control. Tug operational failure or towline breakage. Not using anchor/s. In a stern board, pilot misjudges due to steep angle of approach, with stern tug unable to lift off, engine fails to fire ahead and lack of clear visibility aft, and no closing information from lines crews, makes heavy contact with the vessel's quarter. Misjudges roundup point or vessel refuses to put bow into the wind when berthing head to wind. Container cranes not clear of berth. Thruster failure when berthing. Pilot inexperience for ship type. Attempting to berth in adverse weather with minimum berthing clearances.	Minor damage to plating of hull and wharf fendering system.	Serious damage to hull plating and wharf. Wharf piles damaged and container cranes unable to be traversed past damage, berth out of action for considerable time with associated loss of port trade. Potential for breach of fuel line.	0	0	4	0	4	4	5	5	3.79	This applies to other vessels required to berth downwind or in adverse conditions. NZ car trade generally attracts lower quality PCC displaced from main world routes, thus they may be not so well equipped. Ship's own bow thrust (where this unit is fitted) is not usually sufficient. An average sized PCC of 200m with a draft of 7m has a beam windage area of approx 4000m2. With a 28 knot beam wind the pressure due to a beam wind is 60 tonnes, at 40 knots it is 122 tonnes. PCCs are getting bigger with vessels now up to 200m loa, greatly increasing windage and wind forces over quoted examples. Most PCCs must berth starboard side to due to hull/ramp configuration with the result that downwind berthing for these vessel types becomes common. Downwind berthing may also be necessary for other ship types to fit with stevedores' requirements (i.e. for container crane to fit over high box stack at HW) or siting of operational gangway on one side only. Ships are required to berth at least 30m from a tanker but berth clearances between other vessels may be 20m or less. If fuel pipeline (presently protected under the quay) along Aotea Quay is damaged, there is potential for a significant spill.

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37	24	Approaches, Entrance, Main Harbour, Lambton Harbour	Collision	Large Vessel or RoRo Ferry and Naval Vessel in Conflict	Ferry or other larger vessel in developing collision situation with naval vessel (especially on rounding Kau Point).	All Vessels	Beacon Hill Monitoring Station, Seafarers	Adverse Visibility e.g. Fog/Mist/ or Heavy Rain Squall, Adverse Wind (Force and Direction) , Berth Departure or Arrival Message to Beacon Hill not Transmitted or Acknowledged , Communications Failure (Equipment), Equipment Failure (Propulsion or Steering), Equipment Quality, Excessive Speed (with Respect to Sea Conditions), Failure to comply with Harbour Regulations, Failure to Monitor Position or Vessels Progress Onboard, Failure to Provide Call to Beacon Hill Prior to Arrival or Departure , Failure to Use Vessel's Nav Aids , Human Error Control/Operational, Human Error Judgement, Inadequate Communication/Misinterpretation or Miscommunication , Information Transfer Failure, Interaction - Ship to Ship , Lack of Local Knowledge/Experience , Lack of Support/Monitoring by Beacon Hill, Loss of Situational Awareness (At Night/Restricted Visibility in Heavy Weather), Miscalculated Manoeuvres , Not Adjusting to Safety Margins for Adverse Weather , Not Following Pilotage Procedures, Not Monitoring Port Operating VHF Channels , Problems with Vessel/Beacon Hill Liaison During Transit , Vessel Departs from the Wellington Harbour Recommended Route , Violation of VTS Recommendations Naval vessels are not subject to pilotage. Beacon Hill unable to monitor all harbour areas and pass positive movement information to vessels, unless they have AIS. Misunderstood intentions by both vessel. Not plotting other vessel to determine if close quarters situation is pending. Naval vessel not monitoring Ch.14. Speed inappropriate given a conflict situation may arise. Naval Vessel has AIS switched off.	Close quarters situation but collision averted.	Collision between ferry and naval vessel. Naval vessel's shell plating punctured and water ingress. Possible loss of stability and potential for capsize with military personnel in water. Loss of bunkers to sea (kerosene or gas oil).	0	0	0	3	3	5	5	6	3.77	**2015**: No incident has been recorded. Vessels are asked to switch on AIS within the harbour. **2005**: Naval vessels are not subject to pilotage and may be transiting the harbour or exercising in areas where other shipping normally navigate. Most foreign navy ships however always request a pilot but are not obligated to do so unless using two tugs for berthing in which case a pilot may board in the inner harbour only. Communications difficulties may arise with vessels of foreign navies where vessels seek to communicate through VHF with either Beacon Hill or another vessel.
38	33	Lambton Harbour	Collision	Small Commercial Vessel /RoRo Ferry in Conflict	Small commercial , fishing or passenger vessel in collision situation with ferry or other large vessel sailing or approachin g the berth.	Recreational Craft	Vessel Owners, Seafarers	Adverse Visibility e.g. Fog/Mist/ or Heavy Rain Squall, Adverse Wind (Force and Direction) , Communications Failure (Equipment), Disregard and/or Misinterpretation of Collision Regulations , Equipment Quality, Excessive Speed (with Respect to Sea Conditions), Failure to comply with Harbour Regulations, Failure to Monitor Position or Vessels Progress Onboard, Failure to Use Vessel's Nav Aids , Human Error Control/Operational, Human Error Judgement, Inadequate Communication/Misinterpretation or Miscommunication , Information Transfer Failure, Lack of Support/Monitoring by Beacon Hill, Limitations of Crew Onboard Training, Not Adjusting to Safety Margins for Adverse Weather , Not Following Rules and/or Bylaws and/or SOP, Not Monitoring Port Operating VHF Channels , Problems with Vessel/Beacon Hill Liaison During Transit , Quality and Qualifications of Onboard Crew , Sub-optimal BRM Environment Onboard the Vessel, Violation of VTS Recommendations Poor lookout by small commercial vessel. Incomplete or late traffic reporting procedure followed by vessel intending to sail or upon sailing. Beacon Hill unable to provide positive traffic information through inability to monitor all harbour areas, unless they have AIS. Larger vessel not monitoring radar or distracted through arrival or departure process. Not showing lights as required by Collision Rules at night.	Close quarters situation but collision averted.	Harbour ferry runs into side of berthing ferry by night in adverse weather. Both forepeaks holed and flooded. Potential for multiple serious injury or fatalities to passengers and crew.	0	0	0	3	2	6	4	6	3.74	**2015**: Due to the high traffic movements for both a Harbour Ferry and a RoRo Ferry compared to other vessel types, the likelihood for a close quarter situation remains but due to the low incident records the ML frequency is unchanged. **2005**: Some staff at Beacon Hill are reported to provide a less detailed traffic report to small commercial vessels (in some cases this may be because the vessel operator has indicated to Beacon Hill that they do not require a traffic report), indicating a need for consistent operating procedures to be applied. Conflict may also occur between smaller commercial vessels through inadequate information flow between relevant parties. Worst credible event was narrowly averted in the last 10 years.

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39	3	Approaches, Entrance, Main Harbour	Grounding	Small Fishing Vessel Grounding, Approaches	Inshore fishing vessel in grounding situation in harbour approaches (including Island Bay and Chaffers Passage)	Fishing vessel	Seafarers	Adverse Visibility e.g. Fog/Mist/ or Heavy Rain Squall, Adverse Wind (Force and Direction) , Communications Failure (Equipment), Equipment Age, Equipment Failure (Propulsion or Steering), Equipment Quality, Excessive Speed (with Respect to Sea Conditions), Failure to comply with Harbour Regulations, Failure to Use Vessel's Nav Aids , Human Error Control/Operational, Human Error Judgement, Human Fatigue (Working Hours), Inadequate Communication/Misinterpretation or Miscommunication , Inattention to Local Weather Forecast, Lack of Local Knowledge/Experience , Lack of Support/Monitoring by Beacon Hill, Limitations of Crew Onboard Training, Loss of Electrical Power (Blackout), Loss of Situational Awareness (At Night/Restricted Visibility in Heavy Weather), Misuse of Drugs or Alcohol , Not Adjusting to Safety Margins for Adverse Weather , Not Following Rules and/or Bylaws and/or SOP, Not Monitoring Port Operating VHF Channels , Quality and Qualifications of Onboard Crew , Standing-in too Close to Navigational Hazards, Traffic Density, Unmarked Navigational Hazard , Violation of VTS Recommendations Reliance on autopilot. Using Chaffers Passage without local knowledge.	Fishing vessel in glancing grounding on submerged rock in entrance to Island Bay or in Chaffers Passage. Bilge pumps cope with water ingress, vessel makes mooring safely and temporary repairs effected.	Fishing vessel attempting to enter Island Bay or Chaffers Passage by night grounds heavily on submerged rock with rapid water ingress leading to capsize. Persons in the water with potential for fatalities and small diesel spill to sea.	0	3	0	0	2	6	4	6	3.74	2005: Small commercial vessel groundings could also be considered within this hazard. There are relatively few small commercial vessels operating out of Wellington and most are local vessels with good knowledge of the harbour and approaches. Non-local vessels may use Wellington for shelter or visit during Hoki season. Fishing charter vessels also operate around the South Coast. Small vessels use Chaffers Passage. Leisure craft and charter vessel activity may increase around and in Island Bay with the sinking of HMNZS Wellington as a dive attraction, AtoN in this area may need to be reviewed.2015: Small fishing vessel has been washed ashore in Island Bay after mooring failed. Needs re-scoring update
40	50	Main Harbour	Contact Berthing	Container Vessel Heels Abruptly Alongside	Low freeboard container vessel gets caught under berth fenders as tide rises at TCW1. Vessel suddenly comes free, causing sudden rolling of vessel. List resulting if loading had continued on one side whilst vessel trapped. Damage to container crane/s likely.	Container Vessel	CentrePort	Adverse Wind (Force and Direction) , Equipment Quality, Human Error Control/Operational, Human Error Judgement, Inadequate Communication/Misinterpretation or Miscommunication , Limitations of Crew Onboard Training, Not Following Rules and/or Bylaws and/or SOP, Quality and Qualifications of Onboard Crew Not tending moorings or watching tide. Planners consider stevedores requirements only and do not consider freeboard and fender fouling aspects when choosing a berthed position. Ship is using an automatic heeling system without considering that main deck lip may be catching under fenders against tight moorings preventing the vessel coming back upright, pumping system continues to transfer ballast until ballasted weights force vessel to come quickly clear. Low initial GM and takes excessive heel during cargo operations. Poor cargo planning on ship or shoreside. Incorrect shipboard action taken to correct angle of loll.	Crane and container is clear of ship and is not caught. Gangway at risk of dropping into the water.	(1) Crane is just being positioned in the slot on inboard or outboard side with a 40' box on the spreader. Relative motion of the vessel compared to the slung box in the abrupt heel causes box to swing relative to the slot and crushes hatchman with potential of a fatality.(2) Lifting box from bottom of an outboard slot when change of heel takes place, box is caught and lifting wire parts. Falling components seriously injure stevedores working on deck below. Potential to pull crane over.(3) During change in heel unlashed boxes fall overside and ship touches crane.	0	3	0	0	0	6	6	6	3.68	**2015**: There are currently no low freeboard ships calling at the port. **2005**: A relatively rare event but has happened recently. The potential is real when using a small laden container vessel berthed on the horizontal rubber fenders at TCW 1. It can only happen at this berth as TCW2 is fendered with wooden vertical fendering. TCW1 was built for Generation 1 container ships and bigger and not small low freeboard vessels. Modern ships are fitted with an auto heel system designed to keep ship within certain heel tolerances during cargo work and complacency in their reliability and use may cause ship's crews not to consider the aspect of the ship being temporarily fouled on a shore side obstruction. Consequences of a worst case situation have high commercial risk to the port. More rapid cargo operations possible with higher-rate cranes planned for port reduces time available for cargo planners to take action to keep vessel within stability limits.

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41	58	Approaches, Entrance	Foundering	Pilot Vessel Foundering	Pilot vessel in potential capsize situation in heavy seas at the harbour entrance.	Pilot Boat	CentrePort , Seafarers	Adverse Visibility e.g. Fog/Mist/ or Heavy Rain Squall, Adverse Wind (Force and Direction) , Equipment Failure (Propulsion or Steering), Excessive Speed (with Respect to Sea Conditions), Failure to comply with Harbour Regulations, Failure to Monitor Position or Vessels Progress Onboard, Human Error Control/Operational, Human Error Judgement, Human Fatigue (Working Hours), Inadequate Communication/Misinterpretation or Miscommunication , Inattention to Local Weather Forecast, Ineffective Master/Pilot Exchange (MPX), Lack of Support/Monitoring by Beacon Hill, Loss of Electrical Power (Blackout), Misuse of Drugs or Alcohol , Not Adjusting to Safety Margins for Adverse Weather , Not Following Pilotage Procedures, Not Following Rules and/or Bylaws and/or SOP, Not Monitoring Port Operating VHF Channels , PPU Operating with Fault Condition , Violation of VTS Recommendations , Wind Over Tide Conditions - Harbour Entrance Steep Swells Pilot vessel exceeding operational envelope. Pilot vessel required to attempt transfer of pilot from beyond harbour entrance in unsuitable conditions. Pilot vessel attempts to lead other vessel in from outside the harbour entrance during adverse sea conditions. inexperience of launchmaster and inattention to course keeping. Using autopilot in inappropriate conditions. Division of command of pilot launch between pilot and launchmaster. Misjudged assessment of sea conditions by pilot and/or launchmaster (particularly at night). Loss of inflatable pontoon from RHIB hull (structural failure). Deflation of compartment(s) through heavy landing on ship's hull during transfer reduces stability of launch for inward transit. Not appreciating more severe conditions at entrance when tide is against the wind. Launch too short for conditions.	Launch broaches in heavy following sea but is recovered by actions of launchmaster.	Launch is broached in heavy following sea and subsequently capsized by successive seas with persons in water and potential for fatalities. Vessel may end for end and breakup.	0	3	0	0	0	6	6	6	3.68	**2005**: Equally applies to all small vessels required to transit entrance in very marginal conditions i.e. Police and Coastguard. Standard safe practice regarding the leading in of vessels provides for the launch to stay to the north of the extreme sea conditions to offer a lead in to a vessel. The pilot vessels in use are designed for offshore work, are well found and twin engined, but is too short, with experienced crews. The safety record is historically good and a training programme in place for crews. The entrance section of the channel is notoriously bad for steep sea condition when outgoing tide is against southerly wind. Conditions moderate further out when clear of direct tide stream and when tide changes. **2015**: CentrePort intents severing relationship with coastguard to supply a backup launch and CentrePort intends getting a new launch with a longer waterline length.

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42	16	Approaches, Entrance, Main Harbour	Collision	RoRo Ferry and Leisure Craft Conflict	Ferry and leisure craft in developing collision situation.	Passenger Vessel	Passengers, Recreational Users, Seafarers	Communications Failure (Equipment), Disregard and/or Misinterpretation of Collision Regulations , Equipment Failure (Propulsion or Steering), Excessive Speed (with Respect to Sea Conditions), Failure to comply with Harbour Regulations, Failure to Use Vessel's Nav Aids , Human Error Control/Operational, Human Error Judgement, Human Fatigue (Working Hours), Inadequate Communication/Misinterpretation or Miscommunication , Information Transfer Failure, Lack of Local Knowledge/Experience , Lack of Support/Monitoring by Beacon Hill, Limitations of Crew Onboard Training, Loss of Situational Awareness (At Night/Restricted Visibility in Heavy Weather), Miscalculated Manoeuvres , Misuse of Drugs or Alcohol , Not Following Rules and/or Bylaws and/or SOP, Sub-optimal BRM Environment Onboard the Vessel, Traffic DensityLack of general maritime knowledge of leisure craft operator. Sea-sickness or fatigue impairs judgment of leisure craft operator. Leisure vessel impedes passage of ferry. Not using radar or radar set up incorrectly. Not plotting or taking relative bearings. Poor lookout and disregard of Collision Prevention Rules and relevant bylaws. Inability to rapidly provide manual control of the helm. Nav lights not shown or clearly discernible. Ferry speed inappropriate given impending situation. Third party interference with planned movements and multiple vessel convergence to leads causing last minute course alterations.	Close quarters situation but collision averted.	Leisure craft run down by larger vessel with potential for multiple fatalities. Ferry takes evasive action and grounds in shoal water causing hull damage.	0	0	0	4	0	7	2	5	3.68	**2015**: A related incident is a Ferry and a Recreational Fishing Vessel collision encounter - some the incidents are not reported. The near miss took place in the approaches where a boat was anchored and fishing in a busy pilotage area. An additional close quarter took place between a RoRo and a Fishing vessel in the approaches. It is taken account due to its similarity with the Hazard. **2005**: Most leisure users are likely to be unaware of the recommended routes used by shipping transiting the harbour or they do not understand manoeuvring constraints of larger vessels. Many do not monitor Ch.14. This information could be useful to leisure users in assessing risk of collision with larger vessels but could also lead to faulty assumptions when vessels do not follow recommended tracks for whatever reason. Vessels not subject to pilotage, such as naval and smaller foreign fishing vessels may not have an awareness of the routing system in use or choose to deviate without informing Beacon Hill, presenting a heightened collision hazard for all harbour users.
43	77	Approaches, Entrance, Main Harbour, Lambton Harbour, Evans Bay, Seaview	Collision	Leisure Craft and Small Commercial Vessel Conflict	Leisure craft and small commercial vessel in developing collision situation in any harbour area.	Leisure Craft	Seafarers, Recreational Users	Adverse Visibility e.g. Fog/Mist/ or Heavy Rain Squall, Communications Failure (Equipment), Disregard and/or Misinterpretation of Collision Regulations , Equipment Failure (Propulsion or Steering), Equipment Quality, Excessive Speed (with Respect to Sea Conditions), Failure to comply with Harbour Regulations, Failure to Monitor Position or Vessels Progress Onboard, Failure to Use Vessel's Nav Aids , Human Error Control/Operational, Human Error Judgement, Inadequate Communication/Misinterpretation or Miscommunication , Information Transfer Failure, Lack of Support/Monitoring by Beacon Hill, Limitations of Crew Onboard Training, Loss of Situational Awareness (At Night/Restricted Visibility in Heavy Weather), Miscalculated Manoeuvres , Misuse of Drugs or Alcohol , Not Following Rules and/or Bylaws and/or SOP, Not Monitoring Port Operating VHF Channels , Not Sounding/Incorrect Sounding of Required Sound Signals , Standing-in too Close to Navigational Hazards, Traffic DensityPoor lookout by either vessel or craft. Not using radar or craft poor radar target with no efficient radar reflector. Vessel and craft not visible to each other in rain or reduced visibility or flying spray. Vessel / craft navigating at speed inappropriate for the conditions including proximity to shore, point or headland or in area of relatively high traffic density. Nav lights not shown by craft / vessel or difficult to detect against shore lights or backscatter from own lights. Lack of maritime knowledge or experience of craft operator. Craft operating around commercial wharf area. Commercial vessel not following recommended route for transiting harbour.	Close quarters situation but collision averted.	Lightly constructed harbour passenger vessel (ferry or charter) in collision at speed with medium sized launch or yacht. Potential for injuries on impact and craft sinks with persons in the water and fatalities.	0	0	0	0	3	8	6	7	3.66	'Small Commercial Vessel' includes various passenger type, local and visiting survey, tug, cable protection and miscellaneous vessels as well as harbour craft ie. harbour tugs and pilot vessels. Collisions have occurred in the past between small commercial vessels and leisure craft in the harbour within the past 10 years, to date without fatality or serious injury. Probability of the Worst Credible outcome is likely to be highest during special events where there is a high density of leisure craft and commercial spectator vessels operating on the harbour, particularly during night events. Navigation lights from vessels or craft of any size may be particularly difficult to detect from a vessel/craft approaching from the eastern harbour areas, against the background shore lights. The harbour ferry routinely transits this route by night, where proper use of radar is critical in the early detection of leisure craft. Small commercial vessels may also be encountered by leisure craft at pinch points such as Kau Point if the larger vessel is not following the recommended route.

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											Environment	People	Property	Stakeholders	Environment	People	Property	Stakeholders		
44	2	Approaches, Entrance	Grounding	Foreign flagged FV less than 500GT Grounding, approaches	Foreign flagged fishing vessel of less than 500GT in grounding situation in the harbour approaches .	Fishing vessel	Fishing Interests, Seafarers	Adverse Visibility e.g. Fog/Mist/ or Heavy Rain Squall, Adverse Wind (Force and Direction) , Anchors Not Cleared, Communications Failure (Equipment), Equipment Failure (Propulsion or Steering), Equipment Quality, Failure to comply with Harbour Regulations, Failure to Monitor Position or Vessels Progress Onboard, Failure to Use Vessel's Nav Aids , Human Error Control/Operational, Human Error Judgement, Human Fatigue (Working Hours), Inadequate Communication/Misinterpretation or Miscommunication , Inattention to Local Weather Forecast, Interaction with Barretts Reef , Lack of Local Knowledge/Experience , Lack of Support/Monitoring by Beacon Hill, Limitations of Crew Onboard Training, Loss of Electrical Power (Blackout), Loss of Situational Awareness (At Night/Restricted Visibility in Heavy Weather), Miscalculated Manoeuvres , Misuse of Drugs or Alcohol , Not Adjusting to Safety Margins for Adverse Weather , Not Following Rules and/or Bylaws and/or SOP, Not Monitoring Port Operating VHF Channels , Quality and Qualifications of Onboard Crew , Standing-in too Close to Navigational Hazards, Sub-optimal BRM Environment Onboard the Vessel, Traffic Density, Violation of VTS Recommendations , Wind Over Tide Conditions - Harbour Entrance Steep Swells Vessel of less than 500GT not subject to pilotage. Navigational error with lack of appropriate scaled information. Not communicating with harbour control. Communicating on Agents channel only in foreign language. Anchors until daylight but anchor does not hold. Reliance on autopilot. Not using a plotter or radar on appropriate scales. Not in receipt of or using port information. Small vessel interference with planned movement and multiple vessel convergence on leads.	Near grounding averted.	Vessel proceeds into Lyall Bay (or adjacent bays) through navigational error and trying to find main leads and grounds with water ingress and capsize, potential for fatalities and loss of bunkers to sea.	0	0	0	2	4	6	5	5	3.6	**2015**: Foreign Flag FV are now calling only very infrequently at the port. **2005**: Foreign flagged fishing vessels have grounded or narrowly avoided grounding through navigational error in Owhiro Bay and Lyall Bay as well as inner harbour areas. They may lack appropriate charts and the ability to communicate effectively in English with other vessels or signal station. Part 90 does not provide for pilotage for such vessels despite these vessels not being able to communicate with other port users.

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											Environment	People	Property	Stakeholders	Environment	People	Property	Stakeholders		
45	6	Approaches, Entrance	Grounding	Tug and tow grounding, Entrance	Tug under 500GT with large tow and no local assistance grounds tow during transit (inwards or outwards).	Tug & Tow	Seafarers, Beacon Hill Monitoring Station, CentrePort , Vessel Owners, Wellington Regional Council , National Maritime Regulator	Adverse Visibility e.g. Fog/Mist/ or Heavy Rain Squall, Adverse Wind (Force and Direction) , Communications Failure (Equipment), Equipment Age, Equipment Failure (Propulsion or Steering), Equipment Quality, Failure of Maintenance Systems , Failure to comply with Harbour Regulations, Failure to Monitor Position or Vessels Progress Onboard, Failure to Provide Call to Beacon Hill Prior to Arrival or Departure , Failure to Use Vessel's Nav Aids , Human Error Control/Operational, Human Error Judgement, Human Fatigue (Working Hours), Inadequate Communication/Misinterpretation or Miscommunication , Inattention to Local Weather Forecast, Lack of Local Knowledge/Experience , Lack of Support/Monitoring by Beacon Hill, Limitations of Crew Onboard Training, Loss of Electrical Power (Blackout), Loss of Situational Awareness (At Night/Restricted Visibility in Heavy Weather), Manning Levels, Miscalculated Manoeuvres , Misuse of Drugs or Alcohol , Not Adjusting to Safety Margins for Adverse Weather , Not Following Rules and/or Bylaws and/or SOP, Not Monitoring Port Operating VHF Channels , Quality and Qualifications of Onboard Crew , Standing-in too Close to Navigational Hazards, Sub-optimal BRM Environment Onboard the Vessel, Traffic Density, Tug Assistance Not Immediately Available , Unmarked Navigational Hazard , Vessel Departs from the Wellington Harbour Recommended Route , Wind Over Tide Conditions - Harbour Entrance Steep Swells Towing vessel of less than 500GT not subject to pilotage (regardless of tow size or combined size of tow). While attempting to keep clear of ferry traffic misjudges limits of safe water. Navigational error from not using appropriately scaled information. Not communicating with harbour control. Tow too long or short tow parts. Tow not manned and unable to use anchors. Local tugs unable to connect up. Remains in the offing to wait favourable conditions but is set ashore. Propulsive or steering failure on lee shore. Reliance on autopilot. Not using a plotter or radar on appropriate scales. Not in receipt of or using port navigational information. Pressure to complete task (from tow contract). Interference by third party and convergence by other vessels on leads.	Near grounding averted.	Tow yaws, catches wind beam on or on quarter, line parts during tug efforts to regain control and drives ashore. Tug fouls propeller in urgency to pick up emergency towline and is unable to assist further. Minor pollution from towed vessel's ruptured tanks.	0	2	0	0	4	6	4	6	3.53	**2015**: No incident has been recorded. Human Error Judgement and Control are contributors for such a type of hazard. Advisory Circular to Part 90 dated April 2011 described the application of Part 90. Pilotage may be required. **2005**: Pilotage requirements for described units are not covered by Part 90 and Bylaws do not cover a situation to encompass total size of tug and tow (but ref to Marlborough Bylaws which also considers the towed vessel's GT) in assessing pilotage needs. Tug may only be 250GT and therefore exempt but may be towing a large unit i.e. a ship with a tow length of up to 300m. Small vessel skippers are not subject to any requirement to obtain or use locally derived port information but they may be in charge of a very large unit.
46	85		Contact navigation	Jack-Up Rig Operations - Contact by Vessel	Jack-Up rig in Harbour Drilling Operations is in contact with a vessel following harbour recommended routeing.	Harbour Ferry	Beacon Hill Monitoring Station; CentrePort; National Maritime Regulator; Vessel Owners; Wellington Regional Council ;	Human Error: Disregard and/or Misinterpretation of Collision Regulations ; Failure to Use Vessel's Nav Aids ; Human Error Judgement; Inadequate Communication/Misinterpretation or Miscommunication ; Inattention to Local Weather Forecast; Limitations of Crew Onboard Training; Loss of Situational Awareness (At Night/Restricted Visibility in Heavy Weather); Miscalculated Manoeuvres ; Not Following Pilotage Procedures; Not Monitoring Port Operating VHF Channels ; Sub-optimal BRM Environment Onboard the Vessel Traffic Management: Failure to Provide Call to Beacon Hill Prior to Arrival or Departure; Problems with Vessel/Beacon Hill Liaison During Transit ; Vessel and Beacon Hill Liaison Failure Prior to Movement Commencement ; Vessel Departs from the Wellington Harbour Recommended Route Violation: Failure to comply with Harbour Regulations; Violation of VTS Recommendations. Jack-Up Rig going on and off station during winter periods of adverse weather, or moving to a new drilling location. Re position followed by a period of fog. Large vessels moving. Craft, commercial or recreational, not fitted with electronic navigation equipment or onboard display of AIS targets. Lack of attention by craft skipper.	Close quarters with harbour ferry, which sees rig at the last minute and make a sudden alteration of course. Passenger thrown of balance and minor injury.	Jack-up rig setting up to drill in new location in combination with a period of reduced visibility is struck with a glancing blow by a cross harbour ferry, or a recreational craft. Extensive damage and potential for fatality.	1	2	1	2	2	4	3	3	**3.47**	Jack-Up Rig drilling the Wellington Aquifer in 2017 to determine its extents. Jack-up rig drilling in a number of locations between Kau Bay and Somes Island, including in the "lanes" that represent the harbour recommended routes. Beacon Hill has radar coverage into the area, but not into the inner harbour. Large vessels moving in the area have AIS reception and would see the rig location. A recreational craft is less likely to be out in times of fog, but scenario is more likely to involve a smaller vessel.

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47	71	Main Harbour, Lambton Harbour, Evans Bay	Seismic Event	Seismic Event - Tsunami	Tsunami from locally generated event affects harbour with insufficient time for promulgation of warning to users. Seiching effect also possible.	All Vessels	Beacon Hill Monitoring Station, CentrePort, Police Maritime Unit, Seafarers, Wellington Regional Council	Local earthquake immediately generates seiche response in harbour waters. Distant significant earthquake generates tsunami which enters harbour some 45 minutes to hours after event. Underwater landslide offshore generates large waves which enter harbour shortly after event.	Insignificant effect from a distant event and shipping not adversely affected.	Local event causes seiching in harbour. Berthed ships part moorings and container vessels working cargo have potential to damage cranes in surge. Product spill from tanker discharging. Grounding of ships in transit (unlikely). Small craft washed ashore and broken up.RoRo ferry alongside suffers movement which may damage RoRo ramp.	0	0	0	0	6	7	7	7	3.43	**2017**: The Wellington Harbour Entrance provides a natural throttle to waterflow and the harbour itself is a large volume of water. An earthquake with faults slipping within the harbour itself (1850 earthquake) may provide the most immediate and more significant Tsunami event. Damage to RoRo ramps could be significant and affect key infrastructure - Raising of ramps after working cargo may be a reasonable risk management measure as the area goes through a period of increased seizmic action.**2015**: Key personnel and Harbour Master Dept receive text warning directly from Emergency Management Centre. This can activate responses. **2005**: Wellington may be affected by either locally generated tsunami type waves, for which there may be little time available to notify shipping, For those generated by distant events, such as in the Pacific or Indian Ocean (causing waves which refract off the Antarctic ice shelf), a national warning system is in place to receive early warning of approaching tsunami. CentrePort has an Incident Action Plan covering tsunami. Section 11 of the NZ Nautical Almanac contains information on the procedure in the event of earthquake. Although a distant earthquake event may not cause tsunami of damaging magnitude to reach NZ, long waves may still affect predicted tide times and heights to a degree which may be significant for the transit of deep draught vessels through Wellington and other harbours. Does the NZ warning system warn of any size tsunami approaching the coast to enable movement planning to take possible effects of even small amplitude but long waves into consideration? For example recent Indonesian event.

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48	45	Main Harbour	Contact Berthing	Vessel Contact with Tanker or Cruise Liner at Aotea Quay	A vessel manoeuvring in the vicinity of a Tanker working cargo (discharging or backloading gas oil), or a vessel bunkering, contacts or interacts with the vessel alongside. This includes the same event involving a large cruise liner at Aotea Quay.	Vessel greater than 500GT	Passengers, Seafarers	Adverse Wind (Force and Direction) , Anchors Not Cleared, Berth Departure or Arrival Message to Beacon Hill not Transmitted or Acknowledged , Communications Failure (Equipment), Equipment Failure (Propulsion or Steering), Equipment Quality, Excessive Speed (with Respect to Sea Conditions), Failure to comply with Harbour Regulations, Failure to Monitor Position or Vessels Progress Onboard, Failure to Provide Call to Beacon Hill Prior to Arrival or Departure , Failure to Use Vessel's Nav Aids , Human Error Control/Operational, Human Error Judgement, Human Fatigue (Working Hours), Inadequate Communication/Misinterpretation or Miscommunication , Inattention to Local Weather Forecast, Ineffective Master/Pilot Exchange (MPX), Interaction - Ship to Ship , Lack of Local Knowledge/Experience , Lack of Support/Monitoring by Beacon Hill, Limitations of Crew Onboard Training, Loss of Situational Awareness (At Night/Restricted Visibility in Heavy Weather), Miscalculated Manoeuvres , Not Adjusting to Safety Margins for Adverse Weather , Not Following Rules and/or Bylaws and/or SOP, Problems with Vessel/Beacon Hill Liaison During Transit , Sub-optimal BRM Environment Onboard the Vessel, Tug Assistance Not Immediately Available , Tug Operational Failure , Tug Unable to Assist due to Severe Weather Conditions , Vessel and Beacon Hill Liaison Failure Prior to Movement Commencement Berthing in a southerly. Vessel passing adjacent berth loses control in strong wind conditions. Tug BP not sufficient to regain control. Anchors not used. Misjudged approach line with track set too close to berthed vessel. Interaction effects. Poor berth planning or movement timing. Tug line parts at load lifting off. Ferry overruns approach to RFT and strikes berthed vessel. Miscalculation in berthing marks provided.	Close quarters situation but control regained and safe passing achieved.	Surge from manoeuvring vessel causes ranging of other vessel, with potential to part a discharge (if a tanker) or bunkering hose. Potential for a gangway alongside to move off edge of quay. Potential for major injuries or even a fatality. Alternatively a contact event with ship's side causes the same effects. Loss of hull integrity possible. Ship or tug crew injured by tug line if this parts.	0	0	0	3	4	4	4	6	3.42	**2015**: Pilots are trained to recognise this risk and manoeuvre the ship accordingly. More likely to occur when Master with a PEC is manoeuvring their vessel. PC holders are more likely to be using either the Ferry terminal or the cement berth. **2005**: Ships are required to berth at least 30m from a tanker but berth clearance for other vessels may be 20m or less. Cruise vessels may be up to 280m LOA and >32m beam so are big structures in their own right. Although this hazard describes contact with a cruise liner or tanker it also applies to any large vessel berthing at TCW or AQ between vessels or adjacent to another ship. Wash from ferries departing RFT 1 has been reported as a cause of cement carriers ranging alongside while discharging cargo with potential for parting of discharge hoses.

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49	8	Entrance, Main Harbour, Lambton Harbour, Seaview	Personal Injury	Personal Injury to Swimmer - Cross Harbour Ferry Terminals	Persons swimming near Days Bays Wharf or Wellington terminal while ferry is approaching or sailing, with potential personal injury to swimmer.	Harbour Ferry	Recreational Users, Seafarers	Adverse Visibility e.g. Fog/Mist/ or Heavy Rain Squall, Adverse Wind (Force and Direction) , Human Error Judgement, Lack of Local Knowledge/Experience , Limitations of Crew Onboard Training, Malicious Action by Third Party, Misuse of Drugs or Alcohol , Not Following Rules and/or Bylaws and/or SOPSwimmers difficult to see from ferry in sunglare, choppy conditions or poor visibility on approach. Swimmers unaware of ferry approach or departure, no sound signal from ferry. Ferry exceeds 5 knots within 200 metres of structure or shoreline. Ferry operates propulsion without confirming area clear of swimmers. Persons swim between hulls of catamaran ferry while alongside, ferry crew unable to detect presence. Persons disregard warning signs on wharf or signage vandalised or otherwise missing / obscured. Persons deliberately obstruct ferry (protest).	Swimmers in water near ferry berth detected by crew, ferry delayed while swimmers clear area required for berthing or departing.	Swimmer is caught on the propeller of the harbour ferry. lone swimmer under the jetty structure remains and is swept against structure by water flow from propellers.Worst case : Swimmer is run down with fatality.	0	0	0	6	0	4	0	4	3.4	**2015**Days Bay is a highly popular swimming beach during summer with the wharf in common use as a diving platform. In summer, it presents an ongoing problem. Police action has been undertaken in the past to prevent persons deliberately diving into the water as the ferry approaches or departs. Signage warns swimmers of the danger presented by ferry operations. Swimmers also occur in a line between Eastbourne and Days Bay Wharf with people training for competitive events. The problem has also been raised in 2016 by the ferry operator as affecting berthing at the Wellington Ferry terminal, Queens Wharf, with some swimmers reluctant to leave. End of School year through summer is affected. The cross harbour ferry route traffic has grown with both more frequent service and greater passenger capacity, assisted by transport policy. Terminals at Wellington, Seatoun, Seaview (Days bay) Hazard is rising in importance at the time of the 2016 Wellington Harbour Risk revision.The Harbour Rangers together with Wellington Council and Days Bays have meetings during 2016 to discuss further mitigation measures.
50	26	Approaches, Entrance, Main Harbour, Lambton Harbour, Evans Bay, Seaview	Collision	Leisure Craft and Vessel in Conflict	Leisure craft and large ship in developing collision situation (over 500GT).	Leisure Craft	Recreational Users, Seafarers	Adverse Visibility e.g. Fog/Mist/ or Heavy Rain Squall, Adverse Wind (Force and Direction) , Communications Failure (Equipment), Disregard and/or Misinterpretation of Collision Regulations , Equipment Quality, Excessive Speed (with Respect to Sea Conditions), Failure to comply with Harbour Regulations, Failure to Monitor Position or Vessels Progress Onboard, Failure to Use Vessel's Nav Aids , Human Error Control/Operational, Human Error Judgement, Lack of Local Knowledge/Experience , Lack of Support/Monitoring by Beacon Hill, Limitations of Crew Onboard Training, Miscalculated Manoeuvres , Misuse of Drugs or Alcohol , Not Following Rules and/or Bylaws and/or SOP, Quality and Qualifications of Onboard Crew , Sub-optimal BRM Environment Onboard the Vessel, Traffic DensityLaunch fails to detect approaching large ship by night against background shore lights. Smaller craft not showing nav lights or working lights obscure nav lights. Poor lookout on craft or vessel. Radar incorrectly set up or not being monitored. Launch is a poor radar target. Laden vessel has an extensive obscured area ahead caused by deck cargo or cranes. Insufficient trained personnel on vessels bridge for harbour transit, continuity of watch broken in order to take manual control of helm. Leisure craft impedes passage of larger vessel by disregard of 500GT rule. Leisure craft lacks appreciation of manoeuvring area required by larger vessel and lacks appreciation of harbour tracks and limitations caused by deep draught. Convergence of small craft around a course alteration point.	Close quarters situation but collision averted.	Launch run down by ship with potential for fatality. Ship runs aground correcting from taking last minute evasive action.	0	0	0	0	3	8	3	7	3.39	**2015**: No incident has been recorded. Due to the profile change for both vessel movements and size, this hazard is a candidate for review. **2005**: Leisure users are presently unlikely to be aware of recommended tracks used by shipping unless they belong to a harbour boating or yacht club (track information has been sent to all local clubs).

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51	31	Seaview, Evans Bay, Lambton Harbour, Main Harbour	Collision	Leisure Craft in Conflict	Leisure craft in conflict with each other in high leisure use area. Can involve powered and sail.	Leisure Craft	Beacon Hill Monitoring Station, Police Maritime Unit, Recreational Users, Wellington Regional Council , CentrePort , National Maritime Regulator, Seafarers	Adverse Visibility e.g. Fog/Mist/ or Heavy Rain Squall, Adverse Wind (Force and Direction) , Disregard and/or Misinterpretation of Collision Regulations , Equipment Quality, Excessive Speed (with Respect to Sea Conditions), Failure to comply with Harbour Regulations, Failure to Monitor Position or Vessels Progress Onboard, Failure to Use Vessel's Nav Aids , Human Error Control/Operational, Human Error Judgement, Inadequate Communication/Misinterpretation or Miscommunication , Limitations of Crew Onboard Training, Miscalculated Manoeuvres , Misuse of Drugs or Alcohol , Not Following Rules and/or Bylaws and/or SOP, Quality and Qualifications of Onboard Crew , Traffic DensityPoor lookout. Multi-use of area by variety of craft. By-law disregarded including excessive speed in close proximity to other vessels, structures or the shore and operation of high speed leisure craft by person under 15 years of age without supervision. Not showing lights as required by Collision Prevention Rules at night. Low powered nav lights obscured by background lighting.	Close quarters situation with powered craft and yacht, but collision averted.	Two power driven craft in high speed collision with potential for serious injury on impact. Possible loss of one craft.	0	0	0	0	3	7	6	7	3.38	**2015**: An incident that reflects this type of hazard is a Sailing Vessel and Sailing Vessel conflict during a racing event within the Harbour limits. Due to the high number of racing events (on a weekly basis) there are reported incidents that reflect a leisure craft conflict. Focus could be given on the importance and the number of race competitions for Wellington Harbour, incident ref. 25, 562, 677.**2005**: The mix of leisure craft includes PWCs, small pleasure launches, row boats and small power craft. Concentrations of leisure craft are highest in Oriental, Evans and Kau Bay, but leisure activity occurs throughout the harbour. Education and enforcement is carried out by water-borne patrols by Harbour Rangers and Wharf Police. Honorary Enforcement Officers (Launch wardens) are also in use. 200 metre / 5 knot buoys, signage and other markers are in place (Reserved Area and Water - ski access lanes) in several harbour areas.
52	7	Approaches, Entrance	Grounding	Grounding - High Windage Vessel - Approaches	Light draught or high windage vessel is overwhelmed by conditions just after leaving port (and within port limits).	All Vessels	Wellington Regional Council , Beacon Hill Monitoring Station, CentrePort , Seafarers	Adverse Visibility e.g. Fog/Mist/ or Heavy Rain Squall, Adverse Wind (Force and Direction) , Equipment Quality, Human Error Judgement, Inadequate Communication/Misinterpretation or Miscommunication , Inattention to Local Weather Forecast, Ineffective Master/Pilot Exchange (MPX), Lack of Local Knowledge/Experience , Limitations of Crew Onboard Training, Miscalculated Manoeuvres , Not Adjusting to Safety Margins for Adverse Weather , Quality and Qualifications of Onboard Crew , Wind Over Tide Conditions - Harbour Entrance Steep Swells Underpowered light vessel is unable to clear the port after being led clear by the pilot. Vessel is underpowered for the conditions and propeller is not gripping water due to excessive pitching or poor trim. Tide is adverse. Gale to storm force winds with high seas and swell. Master has refused to accept advice from pilot to remain in port until weather abates or tide changes.	Vessel remains hove to but making no or little headway until weather abates and vessel gradually makes an offing.	Vessel is hove to but conditions prevent vessel making headway and vessel actually loses ground. On top of a swell the wind blows the vessel about. Master selects course for harbour entrance but has difficulty keeping course and is unable to make entrance. Vessel refuses to maintain course and goes aground near entrance. Hull punctured in many places with loss of bunkers and possible fatalities during grounding situation.	0	0	0	0	6	7	7	6	3.36	**2015**: No incident has been recorded. There is a distinction to be made available for the Harbour Master system without Directions supporting pilot. Pilots are very aware of this situation and will delay the departure of such vessel until conditions improve. Directions are provided when necessary with the cooperation both of Harbour Master and CentrePort. **2005**: This scenario is infrequent but has happened during winter gales with light draft and underpowered vessels unable to make a sufficient offing. Vessel becomes uncontrollable or master elects to attempt to turn vessel about and return for shelter but loses control. Vessels have got into difficulty, and have been spun around. Ferries have aborted off the entrance and returned. Environmental information at entrance is of relevance. Car carriers of 200m in length are programmed to visit the port from end of 2005. Pilot advice may not be accepted by Harbour Master.

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53	49	Main Harbour, Lambton Harbour	Contact Berthing	Small Harbour Ferry in Contact Berthing	Harbour ferry in contact berthing situation at any berth.	Harbour Ferry	Vessel Owners, Passengers, Seafarers	Adverse Visibility e.g. Fog/Mist/ or Heavy Rain Squall, Adverse Wind (Force and Direction) , Excessive Speed (with Respect to Sea Conditions), Failure to Use Vessel's Nav Aids , Human Error Control/Operational, Human Error Judgement, Human Fatigue (Working Hours), Inattention to Local Weather Forecast, Limitations of Crew Onboard Training, Loss of Situational Awareness (At Night/Restricted Visibility in Heavy Weather), Miscalculated Manoeuvres , Quality and Qualifications of Onboard Crew Adverse weather, mechanical malfunction at critical time. Rate of approach to berth is too fast. Skipper tired or fatigued or stressed by bad weather and task in hand. Sun glare affects vision.	Heavy landing but no damage	Ferry in heavy contact with wharf resulting in significant damage to hull and injuries to passengers and crew. Ferry out of service until repairs made.	0	0	3	0	0	6	3	6	3.32	**2015**: A harbour ferry still experiences situations with contact berthing. One incident occurred at Seatoun wharf in adverse weather conditions. **2005**: Injuries to passengers through berthing contact have occurred within the past 15 years and damage has occurred to a ferry hull more recently, resulting in loss of service for several days (hull puncture above the water line). Expansion of the ferry service is planned with another vessel expected to commence a service in 2005, potentially doubling the number of passengers carried. At Queens Wharf the ferry berths at a wharf with a low deck. Passengers waiting on this deck may be involved in a heavy contact if the ferry mounts the wharf, particularly at high water.
54	51	Main Harbour	Contact Berthing	Tanker Contact Berthing - Aotea Quay	Tanker in contact berthing at Aotea Quay.	Tanker	CentrePort , Seafarers	Adverse Visibility e.g. Fog/Mist/ or Heavy Rain Squall, Adverse Wind (Force and Direction) , Anchors Not Cleared, Equipment Failure (Propulsion or Steering), Excessive Speed (with Respect to Sea Conditions), Failure to comply with Harbour Regulations, Failure to Monitor Position or Vessels Progress Onboard, Failure to Use Vessel's Nav Aids , Human Error Control/Operational, Human Error Judgement, Human Fatigue (Working Hours), Inadequate Communication/Misinterpretation or Miscommunication , Inattention to Local Weather Forecast, Ineffective Master/Pilot Exchange (MPX), Lack of Local Knowledge/Experience , Lack of Support/Monitoring by Beacon Hill, Limitations of Crew Onboard Training, Loss of Electrical Power (Blackout), Loss of Situational Awareness (At Night/Restricted Visibility in Heavy Weather), Miscalculated Manoeuvres , Missed Main Engine Start , Not Adjusting to Safety Margins for Adverse Weather , Not Following Rules and/or Bylaws and/or SOP, Quality and Qualifications of Onboard Crew , Sub-optimal BRM Environment Onboard the Vessel, Tug Assistance Not Immediately Available , Tug Operational Failure , Tug Unable to Assist due to Severe Weather Conditions Wind limiting criteria exceeded for manoeuvre. Berthing downwind when head to wind should have been chosen. Blackout on tanker combined with tug operational failure, line failure or insufficient bollard pull for wind load. Pilot or tug master error including communications failure between pilot and tug master. Poor exchange of information between pilot and master or key bridge personnel (including poor level of spoken English ability in foreign crew). Pilot inexperienced for conditions and ship type and not following standard practice. Pilot underestimates vessel displacement when calculating stopping distances. Misjudged approach speed or angle. Late connection of tugs or tugs not connected at optimum position. Anchors not prepared for use or used incorrectly. Misjudged turning point or speed of approach. Lack of accurate closing information from lines crew.	Contact with superficial damage to fendering and hull.	Severe damage to tanker hull and wharf structure in heavy contact. Hull damaged and product spilt. Possible parting of a mooring line in vicinity of berthing crew. Tanker delayed for repairs to frames and plating. Port and region affected by delay to tanker operations while survey and repairs to berth completed.	0	0	0	0	6	6	7	6	3.3	**2015**: Only experienced pilots are allocated to tanker (two 65t BP tugs used).**2005**: The quality of closing information given by line crews to pilots is reported to be of variable quality and non-standard. Most, but not all tankers trading to Wellington are double hulled.

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55	66	Main Harbour	Personal Injury	Personal injury to civil engineering workers	Passing ship wash causes personnel working on port structures, or construction divers to be affected.	All Vessels	CentrePort, Seafarers	Excessive Speed (with Respect to Sea Conditions), Human Error Judgement, Human Fatigue (Working Hours), Inadequate Communication/Misinterpretation or Miscommunication , Information Transfer Failure, Lack of Support/Monitoring by Beacon Hill, Limitations of Crew Onboard Training, Not Following Rules and/or Bylaws and/or SOP, Problems with Vessel/Beacon Hill Liaison During Transit , Quality and Qualifications of Onboard Crew , Sub-optimal BRM Environment Onboard the Vessel. Vessel unaware of personnel on a punt, boat or divers working in vicinity. Engineering or diving staff did not give information to Beacon Hill. Beacon Hill did not pass on information. Rate of approach to berth is too fast. Master tired or fatigued or stressed by bad weather and task in hand. Attention distracted by bad weather. Divers not exhibiting 'A' flag.	Construction stage, punt or boat knocked about in wash. Or near miss between vessel and divers.	Wash does serious damage to stage, boat and personnel are knocked into the water with potential for serious injury.	0	3	0	0	0	6	0	4	3.22	**2015**: Procedures are in place which mitigates this risk by CentrePort. **2005**: The risk as described is always there and is mitigated by constant use of same skilled contractors but contractors less familiar with the port environment and various diving companies also frequent the port environment.
56	68	Main Harbour, Lambton Harbour, Evans Bay	Fire/Explosion	Fire - Vessel Alongside	Fire aboard vessel alongside wharf carrying out maintenance involving hot work	All Vessels	CentrePort, National Maritime Regulator, Police Maritime Unit, Seafarers, Wellington Regional Council	Equipment Quality, Human Error Control/Operational, Human Error Judgement, Inadequate Communication/Misinterpretation or Miscommunication , Information Transfer Failure, Not Following Rules and/or Bylaws and/or SOP, Quality and Qualifications of Onboard Crew Failure to comply with conditions of or obtain hot work permit.	Fire quickly extinguished with no significant damage or injury.	Major fire with potential for fatalities and severe damage to vessel. Salvage operation required with suspension of wharf use.	0	0	0	0	4	7	6	6	3.2	It is estimated that between 500-600 Hot Work Permits are issued by the Harbours Department annually. Fires have occurred in the past, with virtually all thought to have been caused by failure to comply with permit conditions.
57	42	Main Harbour	Contact Berthing	Contact with Vessel Berthed at Container Berth	Container ship with all gear swung outboard and crane/s over vessel, contacted by vessel manoeuvring in vicinity.	Vessel greater than 500GT	CentrePort, Seafarers	Adverse Visibility e.g. Fog/Mist/ or Heavy Rain Squall, Adverse Wind (Force and Direction) , Anchors Not Cleared, Equipment Failure (Propulsion or Steering), Failure of Maintenance Systems , Human Error Control/Operational, Human Error Judgement, Human Fatigue (Working Hours), Inadequate Communication/Misinterpretation or Miscommunication , Ineffective Master/Pilot Exchange (MPX), Information Transfer Failure, Interaction - Ship to Ship , Limitations of Crew Onboard Training, Loss of Electrical Power (Blackout), Miscalculated Manoeuvres , Not Following Rules and/or Bylaws and/or SOP, PPU Operating with Fault Condition , Sub-optimal BRM Environment Onboard the Vessel, Tug Operational Failure Vessel berthing or sailing in close proximity to vessels alongside loses control in strong wind conditions. Tug BP not sufficient to regain control. Anchors not used. Misjudged approach line with track set too close to berthed vessel. Interaction effects. Distraction by bad weather environment. Poor berth planning. Ship or tug has malfunction at critical time. Tug line parts at load lifting off. Error made in calculating or placing bridge mark, Crew not giving correct clearing information. Pilot unable to see either end. Not using PPU to assist approach.	Close quarters situation but control regained and safe passing achieved.	Interaction pulls vessel off berth and gangway falls with stevedores on it at the time, potential for major injuries and fatalities. Ship's side struck with loss of hull integrity and spaces flooded. Possibility of oil spillage due to damaged container. Ship or tug crew injured by tug line. Ship movement causes ship to strike container leg which collapses crane over ship with major damage and fatalities amongst crew and stevedores.	0	0	0	0	2	6	7	6	3.08	Ships berth as close as 20m from each other and gap between adjacent ships may only be ship length plus 40m or less in total. Pilot would normally make a steeper approach head to wind in such tight circumstances but sometimes stevedore's requirements require other options to be made. Cranes further obstruct passing area (Container crane boom end is approx 38m from wharf face and ship's cranes may extend 30m from the ship's side). In Port Chalmers container cranes are required to be boomed up temporarily when a ship manoeuvres past.

Rank	Hazard Ref.	Affected Areas	Accident Category	Hazard Title	Hazard Detail	Affected Vessel Types	Affected Stakeholders	Possible Causes	Consequence Descriptions		Risk By Consequence Category								Risk Overall	Remarks
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											Environment	People	Property	Stakeholders	Environment	People	Property	Stakeholders		
58	39	Approaches, Entrance, Main	Contact Navigation	Leisure Craft Contact Navigation	Leisure craft in contact with floating debris.	Leisure Craft	Recreational Users, Seafarers	Adverse Visibility e.g. Fog/Mist/ or Heavy Rain Squall, Human Error Control/Operational, Human Error Judgement, Quality and Qualifications of Onboard Crew Poor lookout. Debris difficult to detect particularly by night or in restricted visibility.	Glancing contact with debris, superficial damage to craft hull.	Heavy contact at speed with large log, hull punctured with rapid water ingress. Craft sinks with persons in the water and potential for injury or fatality.	0	0	0	0	0	7	3	7	3	Large logs are frequently washed into the harbour through the Hutt River following high rainfall events. Logs are occasionally lost off Aotea Quay during log-ship loading. This hazard may occur in other parts of the harbour.2014 RA update: This type of hazard could be extended to a port company vessel. An incident has been reported of a pilot boat contact with a log.
59	63	Main Harbour, Lambton Harbour, Evans Bay, Seaview	Personal Injury	Lines Crew Injury	Lines crew injured due to a mooring line accident.	All Vessels	CentrePort, Seafarers	Adverse Wind (Force and Direction) , Equipment Age, Equipment Quality, Failure to Comply with Terminal Procedures , Human Error Judgement, Human Fatigue (Working Hours), Inadequate Communication/Misinterpretation or Miscommunication , Information Transfer Failure, Loss of Situational Awareness (At Night/Restricted Visibility in Heavy Weather), Misuse of Drugs or Alcohol , Quality and Qualifications of Onboard Crew , Sub-optimal BRM Environment Onboard the Vessel, Tug Assistance Not Immediately Available , Tug Operational Failure , Tug Unable to Assist due to Severe Weather Conditions Strain exceeds BS on mooring line during manoeuvre and line parts. Personnel in whiplash area. Berthing in strong wind conditions causes intermittent loads. Not using trained linesmen under supervision. Ship movement caused by another ship or wind gusts during singling up or arrival. Linesmen stand on wrong side of slack line or is a bight.Fingers or hand caught in eye of line when strain comes on. Getting hands caught on wire snags. Pilot/Master not following standard procedures or best practice. Mooring or sailing plan limited discussed with lines team. Tug not used correctly to ease strain on moorings. Lines caught on stringer or fender. Ship being maneuvered by exempt Master unfamiliar with working tug. Working area not checked. Attempting to lift line without support causing strains. A tug line parting under strain may also impact directly (line hits wharf personnel) or indirectly (ship goes out of control) on wharf personnel. Open service plate causes a linesman to trip and cause harm or fall over the wharf edge.	Line/s part but without harming anyone.	Serious injury or fatality to personnel when line parts. Badly injured lines crew person thrown or pulled into water.	0	1	0	0	0	7	3	5	2.94	**2015**: CentrePort places a high emphasis on training and safety in mooring operations. Every person in a lines team has to have undertaken theory and practical training which emphasises the safety rules involved with handling mooring lines. Linesmen wear LSA on all lines operations and supervision is at each end in radio communication with ship's bridge. Once per year there is an injury of some form with mooring.**2005**: CentrePort has training process for lines crew which highlights safety risks. Following a fatality involving a broken tug line, when an exempt master was overloaded during a manoeuvre, a pilot is always employed when using two tugs. One staff member was on long sick leave as a result of falling into an open service access at the wharf side. Lines crew have been pulled into the water on at least one occasion.

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											Environment	People	Property	Stakeholders	Environment	People	Property	Stakeholders		
60	37	Entrance, Main Harbour, Evans Bay	Collision	Vessel in conflict Windsurfer and or Craft	Windsurfer and other vessel or craft in developing collision situation in Wellington Harbour	Windsurfer	Recreational Users, Seafarers	Adverse Visibility e.g. Fog/Mist/ or Heavy Rain Squall, Adverse Wind (Force and Direction) , Human Error Judgement, Lack of Local Knowledge/Experience , Not Following Rules and/or Bylaws and/or SOPPoor lookout, made more difficult by spray. High relative speed of approach in crossing situation. Heavy concentration of windsurfers from both directions. Windsurfer falls off in path of leisure craft or vessel. Leisure craft operator or windsurfer lacks general maritime knowledge and is inattentive. Sunglare impedes lookout.	Close quarters situation through manoeuvrability of windsurfer, collision averted.	Power driven craft runs down windsurfer in water (falls in front of power craft) with potential for fatality.	0	0	0	0	0	7	0	7	2.78	2005: In fresh Northerly conditions Evans Bay is a popular windsurfing area, particularly between Shelly Bay and Snapper Point. Other leisure users need to be especially vigilant navigating through this area as windsurfers approach at high speed from both sides. Conflicts between commercial movements such as tankers and windsurfers are also possible although of lower probability given the low frequency of tanker movements through Evans Bay. Ferry masters and pilots have reported potential for collision between larger vessels and windsurfers sailing between Seatoun and the eastern harbour coast. Windsurfers used to be hired from Seatoun beach - this has now ceased and limitations would be placed on any commercial operator by the Harbour Master's department. 2015: No reported incidents during 2009 - 2014. Likewise with recreational activities (kayaks and sailing vessels), windsurfers might obstruct a large vessel in transit. This is important due to the increasing traffic movements compared to 2005 for this type of hazard.
61	25	Approaches, Entrance, Main Harbour, Evans Bay	Collision	Leisure Craft and Kayak in Conflict	Power driven leisure craft and kayaker in developing collision other than Lambton Harbour.	Leisure Craft	Recreational Users, Seafarers	Adverse Visibility e.g. Fog/Mist/ or Heavy Rain Squall, Adverse Wind (Force and Direction) , Human Error Control/Operational, Human Error Judgement, Lack of Local Knowledge/Experience , Loss of Situational Awareness (At Night/Restricted Visibility in Heavy Weather), Not Following Rules and/or Bylaws and/or SOP, Quality and Qualifications of Onboard Crew **2005**: Power driven vessel navigating at speed within 200 meters of shore, bylaw disregard. Poor lookout on power driven vessel, particularly if excessively trimmed by stern. Kayaks difficult to detect in reflected sunlight or choppy conditions.**2015**: Loss of situational awareness	Close quarters situation but collision averted.	Power driven vessel navigating at speed close to shore runs down two-seater kayak with potential for fatality.	0	0	0	0	0	7	0	7	2.78	**2015**: A similar incident is reported for a close quarter situation between a water ski and rowing skiff. The underlying cause is the loss of situational awareness. Both skipper and water-ski users should follow the Harbour's bylaws. Otherwise, an injury to happen is likely high. The event occured during a racing event(water ski sport event). No available recreational vessel incident rates. **2005**: Kayaks also need to be aware of the requirements of existence of water ski lanes and areas reserved for PWC's and avoid crossing these areas while in use. Kayakers may not be aware of the low-visibility of their craft to other vessels. Kayaks may be encountered in any part of the harbour but particularly close to shore in Oriental and Evans Bay, the eastern bays and around Somes Island. Conflict between other craft and kayaks is also covered specifically in Hazard 32, 'Kayak and other vessel conflict, Lambton Harbour'.

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											Environment	People	Property	Stakeholders	Environment	People	Property	Stakeholders		
62	35	Entrance, Main Harbour, Lambton Harbour, Evans Bay, Seaview	Collision	Leisure Craft and Water-ski in Conflict	Leisure craft and water-skier or Personal Water Craft in developing collision situation, i.e. Evans Bay, or Days Bay or Kau Bay, near or in the water-ski lane.	Leisure Craft	Recreational Users, Seafarers	Adverse Visibility e.g. Fog/Mist/ or Heavy Rain Squall, Human Error Judgement, Lack of Local Knowledge/Experience , Loss of Situational Awareness (At Night/Restricted Visibility in Heavy Weather), Misuse of Drugs or Alcohol , Not Following Rules and/or Bylaws and/or SOP, Quality and Qualifications of Onboard Crew Conflict in usage of limited area. Disregard of Bylaw relating to conduct in access lanes. Lack of boating knowledge by either craft operator. Poor lookout including failure of craft towing water-skier to carry required observer. Consumption of alcohol impairs judgment. Sun glare impedes vision.	Close quarters situation but collision averted.	Power driven vessel crosses water-ski access lane and is in collision with water-ski vessel or skier with fatality.	0	0	0	0	0	7	0	7	2.78	Kau Bay is a popular area is summer and is one of the sites for a water-ski access lane in the harbour. Lack of general boating knowledge is a significant factor in this scenario where a leisure vessel operator may be unaware of the significance of water-ski lane markings onshore and bylaws regulating their use. The same applies to Reserved Areas used by PWC's
63	32	Lambton Harbour	Collision	Kayak and other vessel in Conflict	Kayak in collision with vessel sailing from a commercial wharf area.	Kayak	Recreational Users, Seafarers	Adverse Visibility e.g. Fog/Mist/ or Heavy Rain Squall, Not Following Rules and/or Bylaws and/or SOPKayak paddling around and under wharves not visible to vessel crew. Kayak paddling in prohibited area, kayaker not aware of this area or lacks general maritime knowledge. Poor safety briefing given to hired kayak. Kayak not seen in glare off water.	Member of crew notices kayak around wharf area and departure delayed until clear.	Kayak directly in path of ferry coming out of berth and is run down with likely fatality.	0	0	0	0	0	7	0	7	2.78	**2015**: Need to assess the present kayaking activity. Similar to Hazard No. 16.**2005**: The Harbours Department regularly audits the safety briefing given to kayak hirers to ensure that necessary safety information is given. There is less control of independent kayakers where general lack of maritime knowledge amongst leisure users is an issue. Kayaking activity is rapidly increasing in NZ.
64	10	Main Harbour	Grounding	Grounding High Windage Vessel	Light draught or high windage vessel is unable to safely manoeuvre.	All Vessels	Beacon Hill Monitoring Station, CentrePort , Seafarers	Adverse Visibility e.g. Fog/Mist/ or Heavy Rain Squall, Adverse Wind (Force and Direction) , Human Error Control/Operational, Human Error Judgement, Inattention to Local Weather Forecast, Not Adjusting to Safety Margins for Adverse Weather Underpowered vessel with light draft, wind broad on the bow and pivot point further aft, draft particularly light forward, refuses to put bow further into the wind during gale southerly conditions to take a new course during outward passage. Harbour revs may only be available and vessel is underpowered for the conditions. Pilot requests sea revs but they are unavailable at short notice. In gale NWly conditions when outward bound, wind pressure on vessel's quarter prevents vessel from coming onto new course.	Pilot assesses problem early and holds vessel in a safe part of the harbour pending a reduction in wind strength or a changed angle of approach to new course.	Vessel refuses to alter course and goes aground at full speed whilst bridge team attempting to maintain control. Hull punctured with loss of bunkers likely.	0	0	0	0	6	2	6	6	2.74	**2015**: No Incident has been recorded. The ML scenario remains the same. This likely following a situation while in port. Procedures now in place to warn pilot of engine maintenance. It is unlikely the pilot would sail a ship in such a situation. **2005**: This scenario is infrequent but has happened with a light draft log vessel type refusing to come onto the leads and after finally starting to turn went right through the wind to put wind on other bow. Pilot recommended to master that it would be desirable to remain in port pending weather abatement but master insisted pilot sail the vessel. This situation now addressed in new port Standard Terms of doing business which provide for a pilot not to sail a ship in a similar situation. High airdraft vessel such as PCCs will have so much wind pressure on their quarter and can only be manoeuvred by taking a round turn out of the vessel in the direction of lesser pressure.

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											Environment	People	Property	Stakeholders	Environment	People	Property	Stakeholders		
65	36	Main Harbour, Lambton Harbour	Collision	Leisure Craft and Waka in Conflict	Waka and leisure craft in developing collision situation.	Leisure Craft	Seafarers, Recreational Users	Adverse Visibility e.g. Fog/Mist/ or Heavy Rain Squall, Adverse Wind (Force and Direction) , Human Error Judgement, Inattention to Local Weather Forecast, Lack of Local Knowledge/Experience , Limitations of Crew Onboard Training, Misuse of Drugs or Alcohol , Not Following Rules and/or Bylaws and/or SOPPoor lookout on leisure craft which is travelling at an excessive speed and disregarding Bylaws or Maritime Rule 91. Lack of maritime knowledge by leisure vessel operator. Sunglare impedes vision.	Close quarters situation but collision averted.	Runabout navigating at speed runs over Waka with potential for multiple fatalities on impact and persons in water.	0	0	0	0	0	7	2	6	2.71	**2016**Safety awareness and continuous interaction with Hoe Tonga Pacific Waka Awa Association. **2005**Attendant safety boats may be used to alert other craft to presence of wakas. Wakas may be operating without safety boats in attendance. General education level of leisure user is an issue, particularly the availability of high power-displacement ratio of many power driven leisure craft.
66	73	Main Harbour, Lambton Harbour, Evans Bay, Seaview	Collision	Small Commercial and Recreational Craft Conflict	Small harbour ferry or other commercial vessel in potential collision situation with leisure craft in approaches to Days Bay wharf.	Small Commercial	Beacon Hill Monitoring Station, CentrePort , Recreational Users, Seafarers, Vessel Owners, Wellington Regional Council	Adverse Wind (Force and Direction) , Disregard and/or Misinterpretation of Collision Regulations , Equipment Failure (Propulsion or Steering), Failure to comply with Harbour Regulations, Human Error Control/Operational, Human Error Judgement, Human Fatigue (Working Hours), Inadequate Communication/Misinterpretation or Miscommunication , Limitations of Crew Onboard Training, Malicious Action by Third Party, Misuse of Drugs or Alcohol , Not Following Rules and/or Bylaws and/or SOP, Quality and Qualifications of Onboard Crew , Traffic DensityCraft difficult to see from ferry in sunglare, choppy conditions or poor visibility on approach. Craft unaware of ferry approach or departure, poor look out. Ferry exceeds 5 knots within 200 metres of structure or shoreline. Ferry manoeuvres off wharf while craft crossing stern or alongside. Kayak or small craft enter between hulls of catamaran ferry while alongside, ferry crew unable to detect presence prior to operating propulsion. Persons disregard warning signs on wharf or signage vandalised or otherwise missing / obscured. Inadequate safety briefing given to persons hiring small craft. Fatigue on the part of the launchmaster.	Near miss between ferry and craft but collision averted.	Small craft crossing southern end of the wharf is run down by departing ferry with fatality.	0	0	0	0	0	7	0	7	2.69	**2015**: The Main Harbour risk area has been separated from Seaview. The pilot boat has been in a near miss position with a small boat (No nav lights). This hazard could be further updated for port company vessels.**2005**: Rowing boats and kayaks are hired during summer months and launched from the beach adjacent to the wharf. Days Bay beach and nearby bays are popular areas for a range of aquatic activity, particularly kayaking. Generally few problems are reported but potential for Worst Credible outcome exists if the ferry accelerates away from wharf on departure and is unable to stop on meeting a small craft emerging from under or around the end of the wharf.
67	38	Entrance	Contact Navigation	Fishing Vessel Contact Navigation	Fishing vessel in contact with navigational beacon	Fishing vessel	CentrePort , Fishing Interests, Seafarers, Wellington Regional Council	Adverse Visibility e.g. Fog/Mist/ or Heavy Rain Squall, Equipment Age, Failure to Monitor Position or Vessels Progress Onboard, Failure to Use Vessel's Nav Aids , Human Error Control/Operational, Human Error Judgement, Human Fatigue (Working Hours), Lack of Local Knowledge/Experience , Lack of Support/Monitoring by Beacon Hill, Loss of Situational Awareness (At Night/Restricted Visibility in Heavy Weather), Misuse of Drugs or Alcohol , Not Following Rules and/or Bylaws and/or SOP, Standing-in too Close to Navigational Hazards. Poor lookout. Inattention to track setting and course keeping. Failure to appreciate effect of wind and tidal stream. Steering or mechanical failure. Poor visibility from wheelhouse (positioning of fishing equipment obscures line of sight). Not using radar or radar incorrectly set up.	Vessel sights structure at close range and contact averted with near miss.	Wooden hulled inshore trawler contacts Steeple Rock beacon at speed causing rapid water ingress to hull. Potential for fatality from the contact event. Possible loss of marine diesel to sea. Beacon structure requires repair and light temporarily inoperative.	0	0	0	0	4	6	4	4	2.68	Fishing vessels have struck Steeple Light and Front Lead (there was one relatively serious event resulting in a large hole above the waterline). To date no vessels have sunk as a result. Vessels navigating in this area are under radar observation from Beacon Hill and operating procedures require these vessels to be acquired and plotted by ARPA while in radar sight. Signal station operators are tasked with observing the safe transit of vessels within sight and particularly radar sight. Procedure is set for the alerting of a vessel observed standing into danger. However, some situations are more clearly apparent than others - as vessels routinely pass close to navigational marks such as Steeple Beacon, it is difficult for signal operators to detect with any certainty whether a vessel will contact the structure or pass it closely. A small alteration of course by the vessel concerned at a late stage may either result in a contact or averted contact. Operators are less likely to intervene in these cases but have done so in the past where no ambiguity has existed, for example in the case of a foreign fishing vessel shaping to pass to the East of Ward Island.

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68	29	Main Harbour, Lambton Harbour, Evans Bay	Collision	Tug in collision with vessel being assisted	Tug has contact and a collision with a vessel being assisted to berth or sail.	Tug	CentrePort , Seafarers	Adverse Visibility e.g. Fog/Mist/ or Heavy Rain Squall, Adverse Wind (Force and Direction) , Equipment Failure (Propulsion or Steering), Failure to Monitor Position or Vessels Progress Onboard, Human Error Control/Operational, Human Error Judgement, Human Fatigue (Working Hours), Inadequate Communication/Misinterpretation or Miscommunication , Ineffective Master/Pilot Exchange (MPX), Interaction - Ship to Ship , Limitations of Crew Onboard Training, Loss of Electrical Power (Blackout), Loss of Situational Awareness (At Night/Restricted Visibility in Heavy Weather), Miscalculated Manoeuvres , Not Following Rules and/or Bylaws and/or SOP, Tug Operational Failure Higher risk at the bow position due to interaction effects, bulbous bow and ships flare. The tugmaster misjudges the speed and angle of approach when making fast at the bow. Loss of tug control systems, engine power or engine/s at the critical approach phase. Insufficient engine revs selected. The pilot or exempt master does not monitor the tug position, misjudges speed or orders engine movement or a change in heading at the critical time. Tug use plan not provided or discussed. Loss of communications. Winch does not release under emergency conditions. Tugmaster temporarily incapacitated and control lost before Tug Operator takes over. Lesser damage caused by misjudgement when making contact during a push situation. Pilot uses engines astern without communication when tug is not clear aft. Tug is overrun when pulling on the bow and swept alongside flat. Similar causes as above occur during incidents; most common is the loss of situational awareness or operational control error.	Tug has glancing blow with hull and pushed off before regaining control with nil or minimal damage.	2005: Tug caught under bow flare doing considerable damage to mast, top house and flybridge. Operating personnel suffer severe lacerations and possible fatality. Tug holed and disabled and takes water in engine room with loss of diesel in one main deep tank (up to 30 tonnes). Towline parts and ship assisted loses control and makes contact with berth or another vessel before control of ship is regained. Main deck side doors not closed and vessel downfloods on the resultant heel and sinks. Tug struck by propeller when close into stern. Tug pinned alongside when assisting ship into a finger berth, pilot misjudges and tug unable to escape causing considerable hull damage.2015: Two new tugs have been added to the CentrePort fleet. The worst credible outcome changes - present fuel tank capacity 68 tonnes.	0	0	0	0	2	6	6	4	2.65	**2015**: There is an increasing likelihood of a collision of a tug assisting a large vessel to unberth or berth. This is evident by various recorded incident occurred between a tug and various types of SOLAS Vessels from 2009 to 2014. Seaview can be added as an affected area for the associated hazard. The most notable one - Tiaki collides 0n 3 Feb 12 with the tanker Eagle Miri whilst tanker is berthed a Seaview and Tiaki putting a pilot aboard. CentrePort places high emphasis on tugmaster training and has trained on tugmaster overseas to be a qualified trainer. Additionally all tugmasters have annual competency checks by external trainer. There are also regular meetings between tugmasters and pilots.**2005**: Tugs make fast at the bow up to about 6 knots. Basic design of Voith tugs considerably reduces risks at the bow and on the towline compared with ASD type tugs as the lever between staple and propeller units is long and as units are forward they can pull the tug away from effects of bow interaction. Contact or collision risk is historically very low. In 84 tug years using Voith tugs and over 95,000 movements significant damage due a collision to the value of $60k has happened only once. Training regime for Tugmasters and Pilots covers the risks and consequences illustrated. In covering contact in a push situation new fenders provide for high compressibility and loads with less likelihood of damage to tug as a result of misjudgement during this manoeuvre.

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											Environment	People	Property	Stakeholders	Environment	People	Property	Stakeholders		
69	30	Entrance, Main Harbour, Evans Bay	Collision	Small Commercial Vessels in Conflict	Small commercial , fishing or passenger vessel in collision situation with similar vessel navigating in opposite direction.	All Vessels	Seafarers	Adverse Visibility e.g. Fog/Mist/ or Heavy Rain Squall, Adverse Wind (Force and Direction) , Berth Departure or Arrival Message to Beacon Hill not Transmitted or Acknowledged , Disregard and/or Misinterpretation of Collision Regulations , Excessive Speed (with Respect to Sea Conditions), Failure to comply with Harbour Regulations, Failure to Monitor Position or Vessels Progress Onboard, Failure to Provide Call to Beacon Hill Prior to Arrival or Departure , Failure to Use Vessel's Nav Aids , Human Error Judgement, Human Fatigue (Working Hours), Inadequate Communication/Misinterpretation or Miscommunication , Lack of Local Knowledge/Experience , Lack of Support/Monitoring by Beacon Hill, Limitations of Crew Onboard Training, Miscalculated Manoeuvres , Misuse of Drugs or Alcohol , Not Following Rules and/or Bylaws and/or SOP, Not Monitoring Port Operating VHF Channels , Quality and Qualifications of Onboard Crew , Sub-optimal BRM Environment Onboard the Vessel, Traffic Density; Poor lookout by both vessels. Not using radar. Incomplete traffic reporting procedure followed by vessel intending to sail or upon sailing. Beacon Hill unable to provide positive traffic information through inability to monitor all harbour areas. Vessel's track too close to points, not providing room for other vessel to manoeuvre. Going at speed inappropriate for the conditions. Nav lights not visible or obscured against working lights. Convergence of smaller craft around course alteration points.	Close quarters situation but collision averted.	Vessels collide. Both vessels holed and flooded. Potential for serious injury and possible passenger fatality.	0	0	0	0	2	6	4	4	2.56	**2015**: An incident between two fishing vessels has been reported for this type of incident (Ref.110)**2005**: Some staff at Beacon Hill are reported to provide a less detailed traffic report to small commercial vessels. This in itself is not a cause of any collision but may indicate different procedures followed by different signal station staff and highlights performance monitoring issues. Familiarity may lead to complacency amongst frequent port users.
70	4	Approaches, Entrance	Grounding	Leisure Craft Grounding, Approaches / Entrance	Leisure craft in grounding situation along the south coast for example at Island Bay, Barrett Reef, West Ledge or Chaffers Passage.	All Vessels	Recreational Users, Police Maritime Unit, Seafarers	Adverse Visibility e.g. Fog/Mist/ or Heavy Rain Squall, Adverse Wind (Force and Direction) , Equipment Failure (Propulsion or Steering), Excessive Speed (with Respect to Sea Conditions), Failure to Use Vessel's Nav Aids , Human Error Control/Operational, Human Error Judgement, Human Fatigue (Working Hours), Inattention to Local Weather Forecast, Lack of Local Knowledge/Experience , Limitations of Crew Onboard Training, Loss of Electrical Power (Blackout), Loss of Situational Awareness (At Night/Restricted Visibility in Heavy Weather), Misuse of Drugs or Alcohol , Not Following Rules and/or Bylaws and/or SOP, Quality and Qualifications of Onboard Crew , Standing-in too Close to Navigational Hazards, Unmarked Navigational Hazard , Wind Over Tide Conditions - Harbour Entrance Steep Swells Leisure craft operating in adverse weather or poor visibility (fails to detect leads or lead lights inoperative). Weed blocks propulsion or cooling system. Other propulsive or steering failure, including propulsion or steering gear fouled on craypot line. Inattention to track keeping.	Disabled craft receives tow from other craft, Coastguard or Police launch and grounding averted.	Runabout grounds on any section of rocky coast in adverse southerly weather and sinks/is broken up with persons in water and potential fatalities.	0	0	0	0	2	6	2	6	2.52	**2015:** Waka unable to enter harbour in heavy weather and sort shelter in Island Bay. This area is poorly scaled on the navigational chart. Rudder post touched the bottom and needed repair. Weather conditions can be an underlying cause for a grounding, especially for recreational vessels which navigate without proper weather forecast information and a comprehensive passage plan. **2005**: Education of leisure craft users particularly with regard to use of weather forecasts is a national issue involving a multi-agency approach. Craypots are set within the 50 metre depth contour along the south coast and may present a fouling hazard to small craft.

Rank	Hazard Ref.	Affected Areas	Accident Category	Hazard Title	Hazard Detail	Affected Vessel Types	Affected Stakeholders	Possible Causes	Consequence Descriptions		Risk By Consequence Category								Risk Overall	Remarks
									Most Likely (ML)	Worst Credible (WC)	ML				WC					
											Environment	People	Property	Stakeholders	Environment	People	Property	Stakeholders		
71	27	Approaches, Entrance, Main Harbour, Lambton Harbour, Evans Bay	Collision	Yacht and ferry or large vessel in Conflict.	Yacht engaged in racing and ferry or large vessel in developing collision situation.	Leisure Craft	Beacon Hill Monitoring Station, CentrePort , Passengers, Recreational Users, Seafarers, Wellington Regional Council	Adverse Visibility e.g. Fog/Mist/ or Heavy Rain Squall, Adverse Wind (Force and Direction) , Disregard and/or Misinterpretation of Collision Regulations , Failure to comply with Harbour Regulations, Failure to Monitor Position or Vessels Progress Onboard, Human Error Control/Operational, Human Error Judgement, Inadequate Communication/Misinterpretation or Miscommunication , Inattention to Local Weather Forecast, Information Transfer Failure, Lack of Local Knowledge/Experience , Lack of Support/Monitoring by Beacon Hill, Limitations of Crew Onboard Training, Miscalculated Manoeuvres , Not Following Rules and/or Bylaws and/or SOP, Sub-optimal BRM Environment Onboard the Vessel, Traffic Density, Vessel Departs from the Wellington Harbour Recommended Route , Violation of VTS Recommendations Yacht race set across fairway to pass round a nav aid. Lack of liaison with harbour authority or poor management of start by race officers including decision to proceed in poor visibility. Poor lookout on yacht impedes passage of vessel of more than 500GT. Yachts unfamiliar with shipping tracks or lack appreciation for manoeuvring room required by larger vessel. Yachts taking unnecessary risks to maintain race positions. Lack of wind prevents yachts from making way to clear channels or track lines. Poor lookout or sub-optimal BRM including poor communication on a larger vessel. Bridge team lacks situational awareness. Pilot is not informed of the racing events prior to pilotage.	Close quarters situation but collision averted.	Yacht tracks in front of ferry or larger ship and is run down with potential for fatalities.	0	0	0	0	0	6	4	5	2.48	**2015**: The importance for the occurrence of this hazard is a racing event. Racing competitions/events or yacht regattas are taking place on a frequent basis (sometimes weekly especially during summer) due to a high number of yacht and sailing clubs (six in number). However, there is a similar recorded incident for this type of hazard. This occurred within the Main Harbour area. HAZMAN Assessed Risk: The frequency for a ML scenario decreases.**2005**: Organization of yacht races so as to minimize conflict with shipping has reportedly improved in recent years with liaison between the harbour authority and clubs. Conflicts still occur with the majority of reported incidents appearing to be between ferries. Clubs have been sent track information to display on notice boards and to disseminate to members. This may also involve parts of the harbour being in differing visibilities i.e. the entrance to Rear Lead may be in thick fog but the inner harbour may be clear with the limits of restricted visibility being unknown to the bridge team. Procedures should involve race setting to have turning marks clear of main nav aids and harbour tracks.
72	13	Approaches, Entrance, Main Harbour, Lambton Harbour, Evans Bay, Seaview	Grounding	Leisure Craft Grounding	Leisure craft grounds within an inner harbour area.	Leisure Craft	Passengers, Recreational Users, Seafarers	Adverse Visibility e.g. Fog/Mist/ or Heavy Rain Squall, Adverse Wind (Force and Direction) , Equipment Failure (Propulsion or Steering), Excessive Speed (with Respect to Sea Conditions), Failure to Monitor Position or Vessels Progress Onboard, Failure to Use Vessel's Nav Aids , Human Error Control/Operational, Human Error Judgement, Inattention to Local Weather Forecast, Lack of Local Knowledge/Experience , Limitations of Crew Onboard Training, Loss of Electrical Power (Blackout), Loss of Situational Awareness (At Night/Restricted Visibility in Heavy Weather), Misuse of Drugs or Alcohol , Not Following Rules and/or Bylaws and/or SOP, Quality and Qualifications of Onboard Crew , Standing-in too Close to Navigational Hazards, Unmarked Navigational Hazard Lack of local knowledge or chart work ability, rock not visible at high water. Misjudgement of safe distance off by experienced local without radar or chart plotter. Rock not marked with buoy or beacon. Alcohol or drugs impair judgement of leisure craft operator. Propulsive or steering failure, including running out of fuel and fouling fishing nets or pots.	Leisure vessel strikes rock at slow speed with damage but slow rate of water ingress, craft makes marina without assistance.	Power driven craft strikes rock at speed by night with potential for major injuries to occupants and potential for fatality on impact. Craft drifts off rock to sink or capsize.	0	0	0	0	0	6	2	6	2.36	**2015:** A launch has touched bottom near Somes Island and did take on water, requiring assistance at Seaview Marina to stay afloat. Human Error Judgement and Control are contributors to such a type of hazard. Ref. 895 - At 2230 23/6/12 The launch Wakamarie called on channel 14 to inform BH that they have hit rocks off Somes island and are taking on water. She is a 60 tonne steel hull vessel (about 70 foot) with 2 POB. Although they did not request assistance BH contacted Maritime Police and Harbour Ranger to give them a heads up. Once they made it back to their berth at Seaview Marina they found the pumps weren't keeping up with the water coming in. BH rang Maritime Police who sent the Fire Service and headed out there themselves. The Harbour Ranger picked up some pumps and oil booms and headed out. The travel lift can only lift 50 tonnes so cannot be used. **2005:** Several craft are reported to have struck the rock off the reef to the North of Somes Island, often by night. Set nets or craypots may present a fouling hazard to small craft which may subsequently ground after losing propulsion or steering.

Rank	Hazard Ref.	Affected Areas	Accident Category	Hazard Title	Hazard Detail	Affected Vessel Types	Affected Stakeholders	Possible Causes	Consequence Descriptions		Risk By Consequence Category								Risk Overall	Remarks
									Most Likely (ML)	Worst Credible (WC)	ML				WC					
											Environment	People	Property	Stakeholders	Environment	People	Property	Stakeholders		
73	56	Approaches, Evans Bay	Mooring Failure	Swing Mooring Failure - Fishing Vessel	Fishing vessel drags or parts swing mooring in adverse weather in Island Bay.	Fishing vessel	Seafarers, Fishing Interests	Adverse Wind (Force and Direction) , Equipment Age, Equipment Quality, Failure of Maintenance Systems , Not Following Rules and/or Bylaws and/or SOPPoor condition of swing mooring tackle. Poorly secured bridle on vessel. Infrequent inspection. Illegally placed mooring. Extreme weather conditions.	Fishing vessel breaks loose and grounds with rapid recovery.	Fishing vessel drags ashore in heavy Southerly gale and becomes total loss, potential for small diesel spill.	0	0	0	0	3	0	6	3	2.25	Swing Mooring failure or dragging has occurred at Island Bay in the past, which is predominantly populated with fishing vessels. Although this is specific to Island Bay, it also refers to fishing boats in the harbour generally.
74	60	Entrance, Main Harbour	Swamping	Wash Swamping & Capsize of Leisure Craft	Recreational fishing craft swamped or capsized by wash of passing large vessel.	Leisure Craft	Fishing Interests, Recreational Users, Seafarers	Disregard and/or Misinterpretation of Collision Regulations , Excessive Speed (with Respect to Sea Conditions), Failure to comply with Harbour Regulations, Failure to Monitor Position or Vessels Progress Onboard, Human Error Control/Operational, Human Error Judgement, Human Fatigue (Working Hours), Inadequate Communication/Misinterpretation or Miscommunication , Lack of Local Knowledge/Experience , Limitations of Crew Onboard Training, Loss of Situational Awareness (At Night/Restricted Visibility in Heavy Weather), Miscalculated Manoeuvres , Not Adjusting to Safety Margins for Adverse Weather , Not Following Pilotage Procedures, Not Following Rules and/or Bylaws and/or SOP, Traffic DensityInsufficient time on sighting vessel for fishers to recover anchor and bring craft onto safer heading to negotiate wash. Fishers not aware of tracks used by larger vessels. Poor lookout by fisher and unaware of larger vessels approach. Lack of local knowledge including tracks used by shipping. Larger vessel sets course to pass too close to fisher.	Recreational fishing craft rolls heavily with potential for occupants/crew to fall overboard.	Small older fibreglass or aluminium craft swamped in wash. Insufficient reserve buoyancy and craft sinks or capsizes, persons in water with potential for fatalities.	0	0	0	0	0	6	2	6	2.21	**2015**: Kau Pt to Falcon Shoal is an area commonly used by anchored recreational fishers, however they may be found anywhere in fine weather. The outbound track for shallow draft vessels crosses Falcon shoal but PEC information manual describes this course to be taken only when there is no accumulation of small craft in the area.
75	62	Main Harbour, Lambton Harbour, Evans Bay	Personal Injury	Personal Injury to Swimmer - Designated Areas	Craft or vessel in conflict with swimmer or diver close to shore in the vicinity of popular bathing areas.	All Vessels	Recreational Users, Seafarers	Adverse Visibility e.g. Fog/Mist/ or Heavy Rain Squall, Disregard and/or Misinterpretation of Collision Regulations , Human Error Judgement, Misuse of Drugs or Alcohol , Not Following Rules and/or Bylaws and/or SOP, Quality and Qualifications of Onboard Crew Craft navigating at speed within 200 metres of shore including rowing skiffs and coaching craft. Skipper unaware of Regulations or bylaws covering this situation. Charter vessel cruising close to shore, swimmer difficult to detect at dusk, by night or in reduced visibility. Swimmers proceeding beyond 200 metre buoys. Swimmers not seen in glare off water. Swimmers using areas designated as Access Lanes or Reserved Area at the same time as craft. Lane markers or signage not present in established lane or area.	Swimmer potentially hit by leisure craft (minor injury or near miss).	Swimmer run over by power driven craft with fatality.	0	0	0	0	0	6	0	4	2.13	The 200 metres zone (5 knots speed) off the Oriental Bay shoreline is well marked with buoys and swimming is gaining in popularity. Some leisure vessel users may not have any form of boating knowledge and may be unaware of the significance of these buoys. The presence of the harbour authority workboat and Harbour Rangers enhances safety and awareness of the hazards. Waterborne Wharf Police patrols also provide an education and enforcement resource. Swimmers may be encountered in other harbour areas such as Days Bay, Kau Bay and Scorching Bay and are reportedly encountered beyond the 200 metre zone occasionally. Charter vessels may navigate within 200 metres of shore at slow speed. Signage may be vandalised or defaced.
76	55	Main Harbour, Evans Bay	Mooring Failure	Swing Mooring Failure Leisure Craft	Leisure craft drags or parts swing moorings in adverse weather (Evans Bay).	Leisure Craft	Seafarers, Recreational Users	Adverse Wind (Force and Direction) , Equipment Age, Equipment Quality, Failure of Maintenance Systems , Not Following Rules and/or Bylaws and/or SOPPoor condition of swing mooring tackle. Poorly secured on craft. Infrequent inspection. Illegally placed swing mooring. Extreme weather conditions.	Owners, Coastguard or Police remove vessel to wharf or otherwise safely secure craft.	Yacht drags ashore and becomes total loss. Alternatively, owner sets off in small craft to retrieve yacht in adverse conditions.	0	0	0	0	0	0	3	6	2.07	Some owners do not appreciate wind forces created on their craft in a gale and the need to put out extra swing mooring tackle to cater for Wellington conditions generally.

Rank	Hazard Ref.	Affected Areas	Accident Category	Hazard Title	Hazard Detail	Affected Vessel Types	Affected Stakeholders	Possible Causes	Consequence Descriptions		Risk By Consequence Category								Risk Overall	Remarks
									Most Likely (ML)	Worst Credible (WC)	ML				WC					
											Environment	People	Property	Stakeholders	Environment	People	Property	Stakeholders		
77	75	Lambton Harbour, Evans Bay, Seaview	Loss of Stability (Cargo Operations)	Vessel Capsizes at Berth During Cargo Operations	Vessel takes list during cargo operations, which could be excessive, with potential for shift of cargo, possible contact with container cranes or capsize at berth.	Container Vessel	CentrePort, National Maritime Regulator, Seafarers, Vessel Owners, Wellington Regional Council	Adverse Wind (Force and Direction) , Human Error Control/Operational, Human Error Judgement, Human Fatigue (Working Hours), Limitations of Crew Onboard Training, Not Following Rules and/or Bylaws and/or SOP, Quality and Qualifications of Onboard Crew Poor cargo planning on ship or shoreside. Low initial stability of vessel. Automatic heeling tanks fail to function as expected or in manual mode and incorrectly used (or inappropriate ballasting to rectify list).	Vessel takes angle of loll at berth but capsize averted by mooring lines, stability subsequently recovered.	Vessel takes angle of loll and incorrect action taken on board to correct leads to vessel rolling quickly to opposite side. Unsecured deck cargo shifts with possible loss over the side or major injury / fatality to person in vicinity on deck.	0	0	0	0	0	5	3	5	2.02	More rapid cargo operations will be possible with higher-rate cranes planned for port in the near future. This is likely to reduce the time available for cargo planners (both on ship and ashore) to take action to keep vessel within design stability limits. Capsize at the berth has been considered a 'worst case' scenario rather than Worst Credible. The scenario also affects some double hulled Tanker designs, when a period of "lol" can occur during lightship at commencement of ballasting. However, with Tanker design an extreme outcome of vessel loss is most unlikely.
78	61	Main Harbour, Lambton Harbour	Swamping	Swamping / Capsize - Rowing Skiff or Dragon Boat	Rowing skiff or dragon boat swamped or capsizes in Lambton Harbour. Hazard relates to organised events and associated practice activities.	Rowing Skiff	Recreational Users	Adverse Wind (Force and Direction) , Excessive Speed (with Respect to Sea Conditions), Human Error Judgement, Inattention to Local Weather Forecast, Lack of Local Knowledge/Experience , Limitations of Crew Onboard Training, Not Adjusting to Safety Margins for Adverse Weather , Not Following Rules and/or Bylaws and/or SOPWind produces choppy seas in area used for training or wake from passing vessel / craft creates adverse sea condition. Passing vessels or craft exceeding speed limit for area or proximity to shore causes wash. Low freeboard, minimal stability / reserve buoyancy of laden skiff. Sheltered area of harbour not used. Poor judgement of capability of skiff and prevailing or developing conditions. Lack of safety boat / club officer to prevent rowers proceeding into unsuitable conditions or marshal skiffs into smooth water.	Water ingress occurs and craft is evacuated by safety craft.	More than one craft capsizes with persons in the water. Insufficient SAR capacity to recover all crews at once: potential for hypothermia and fatalities.	0	0	0	0	0	4	0	6	2.01	2005Skiffs generally use the sheltered area available in Lambton Harbour. Coaching boats are usually in attendance. These boats should be crewed by suitably experienced persons and carry Personal Flotation Devices for the number of rowers on the water. Coaching boats should also be of adequate design to embark persons safely or support those in the water. Sufficient coaching boats are required in attendance to provide for number of rowing skiff crew on the water at any one time.2015There are no fatalities reported up to date and no serious incidents. During training or sport events there are rescue boats present. Internal rules and procedures exist to minimize this type of hazards.
79	40	Lambton Harbour	Contact Navigation	Contact with structures in Lambton Harbour	A vessel makes contact with pile beacons off Container Terminal or Kings Wharf.	All Vessels	Beacon Hill Monitoring Station, CentrePort, Seafarers, Vessel Owners, Wellington Regional Council	Adverse Visibility e.g. Fog/Mist/ or Heavy Rain Squall, Adverse Wind (Force and Direction) , Failure to Monitor Position or Vessels Progress Onboard, Failure to Use Vessel's Nav Aids , Human Error Control/Operational, Human Error Judgement, Lack of Support/Monitoring by Beacon Hill, Limitations of Crew Onboard Training, Miscalculated Manoeuvres , Misuse of Drugs or Alcohol , Not Following Rules and/or Bylaws and/or SOP, Quality and Qualifications of Onboard Crew , Standing-in too Close to Navigational Hazards, Sub-optimal BRM Environment Onboard the Vessel, Unmarked Navigational Hazard Poor lookout. Inattention to track setting and course keeping. Setting a course too close to Terminal. Pile lights not seen against city lights. Poor visibility from wheelhouse (i.e. positioning of fishing equipment obscures line of sight). Not using radar or radar incorrectly set up. No remote monitoring. Sunglare distracts.	Contact with pile, pile damaged but not needing replacement.	Pile damaged by vessel manoeuvring into berth, requiring replacement.	0	0	0	0	0	0	3	3	1.31	Pile Beacons at Kings Wharf have been struck 3 times in 10 years (fishing and ferry related). The middle wooden pile is not lit.

Annex C Risk Score Comparison Table (2006-2017)

Rank 2005	Rank 2017	Rank Change	Hazard Ref	Hazard Title	2005 Risk Score (Inherent)	2017 Risk Score (Residual)	Change in Risk
1	1	0	5	RoRo Ferry Grounding, Entrance	6.81	5.58	-1.23
66	2	64	19	Pilot Launch Vessel Contact During Transfer Operations	2.74	5.16	2.42
4	3	1	20	RoRo Ferry and large vessel in Conflict (Within Harbour Waters)	5.68	5.01	-0.67
5	4	1	46	Contact Berthing, Pilot Exempt Vessel (RoRo Ferry).	5.59	4.90	-0.69
15	5	10	28	RoRo Ferry and Tanker in conflict within harbour.	4.68	4.88	0.2
71	6	65	12	Small Passenger Vessel Grounding	2.65	4.77	2.12
NEW	7	NEW	83	Rowing Skiff and Swimmer Collision	NEW	4.76	NEW
26	8	18	78	Tanker Contact Berthing - Seaview Jetty	4.3	4.61	0.31
9	9	0	1	Large vessel Grounding in Harbour Entrance/ Approach	5.28	4.55	-0.73
16	10	6	70	Fire on RoRo Ferry Within Harbour Limits	4.65	4.54	-0.11
36	11	25	64	Personal Injury, Pilot Operations, Outer Boarding Areas	3.98	4.52	0.54
NEW	12	NEW	79	Personnel Injury during Life Boat Deployment	NEW	4.45	NEW
NEW	13	NEW	81	Mooring Breakout (Seaview Jetty)	NEW	4.43	NEW
14	14	0	76	Deep Draught Vessel Grounding (greater than 9m draught)	4.81	4.40	-0.41
2	15	-13	18	RoRo Ferry and Large Vessel Conflict, Harbour Approaches	5.75	4.32	-1.43
19	16	3	67	Fire On Small Passenger Vessel	4.61	4.28	-0.33
3	17	-14	21	RoRo Ferry and RoRo Ferry in Conflict	5.75	4.28	-1.47

Rank 2005	Rank 2017	Rank Change	Hazard Ref	Hazard Title	2005 Risk Score (Inherent)	2017 Risk Score (Residual)	Change in Risk
25	18	7	9	Harbour Craft (Commercial Service) Grounding	4.3	4.27	-0.03
12	19	-7	15	RoRo Ferry and Large or Deep Draught Vessel Collision	5.05	4.24	-0.81
11	20	-9	59	Leisure Craft Foundering	5.22	4.20	-1.02
41	21	20	14	Dragging Anchor - Main Harbour Area	3.84	4.19	0.35
33	22	11	23	Harbour Ferry in Conflict with Larger Vessel	4.14	4.14	0
34	23	11	34	Rowing skiff and vessel in conflict	4.09	4.11	0.02
32	24	8	57	Fishing Vessel Foundering	4.17	4.10	-0.07
23	25	-2	53	Mooring Breakout - Finger Berth	4.43	4.09	-0.34
NEW	26	NEW	82	RoRo Ferry in mooring failure	NEW	NEW	NEW
35	27	8	69	Fire -Tanker operations	4.08	4.08	0
6	28	-22	54	Mooring Breakout (Main Terminals)	5.59	4.06	-1.53
NEW	29	NEW	84	Fire on a Cruise Vessel	NEW	3.99	NEW
37	30	7	65	Personal Injury, Pilot Operations at Inner Boarding	3.98	3.98	0
38	31	7	41	Contact with vessels at anchor, in Harbour	3.96	3.96	0
39	32	7	43	Tanker Contact Berthing	3.96	3.96	0
7	33	-26	17	RoRo Ferry / Large Vessel and Fishing Vessel Conflict.	5.46	3.87	-1.59
40	34	6	11	Tanker Grounding Harbour (Evans Bay)	3.84	3.84	0
29	35	-6	48	Contact with Container Crane	4.24	3.82	-0.42
18	36	-18	47	Vessel in Contact Berthing - Aotea Quay	4.63	3.79	-0.84
42	37	5	24	Large Vessel or RoRo Ferry and Naval Vessel in Conflict	3.77	3.77	0

Rank 2005	Rank 2017	Rank Change	Hazard Ref	Hazard Title	2005 Risk Score (Inherent)	2017 Risk Score (Residual)	Change in Risk
43	38	5	33	Small Commercial Vessel /RoRo Ferry in Conflict	3.74	3.74	0
44	39	5	3	Small Fishing Vessel Grounding, Approaches	3.74	3.74	0
45	40	5	50	Container Vessel Heels Abruptly Alongside	3.68	3.68	0
46	41	5	58	Pilot Vessel Foundering	3.68	3.68	0
47	42	5	77	Leisure Craft and Small Commercial Vessel Conflict	3.66	3.66	0
20	43	-23	16	RoRo Ferry and Leisure Craft Conflict	4.56	3.66	-0.9
27	44	-17	2	Foreign flagged FV less than 500GT Grounding, approaches	4.3	3.60	-0.7
48	45	3	6	Tug and tow grounding, Entrance	3.53	3.53	0
NEW	46	NEW	85	Jack-Up Rig Operations - Contact by Vessel	NEW	3.47	NEW
57	47	10	71	Seismic Event - Tsunami	2.89	3.43	0.54
21	48	-27	45	Vessel Contact with Tanker or Cruise Liner at Aotea Quay	4.52	3.42	-1.1
64	49	15	8	Personal Injury to Swimmer - Cross Harbour Ferry Terminals	2.78	3.40	0.62
49	50	-1	26	Leisure Craft and Vessel in Conflict	3.51	3.39	-0.12
51	51	0	7	Grounding - High Windage Vessel - Approaches	3.36	3.36	0
28	52	-24	49	Small Harbour Ferry in Contact Berthing	4.29	3.32	-0.97
52	53	-1	51	Tanker Contact Berthing - Aotea Quay	3.3	3.30	0
50	54	-4	31	Leisure Craft in Conflict	3.37	3.29	-0.08
53	55	-2	66	Personal injury to civil engineering workers	3.22	3.22	0
54	56	-2	68	Fire - Vessel Alongside	3.2	3.20	0

Rank 2005	Rank 2017	Rank Change	Hazard Ref	Hazard Title	2005 Risk Score (Inherent)	2017 Risk Score (Residual)	Change in Risk
55	57	-2	42	Contact with Vessel Berthed at Container Berth	3.08	3.08	0
56	58	-2	39	Leisure Craft Contact Navigation	3.96	3.00	-0.96
13	59	-46	63	Lines Crew Injury	4.85	2.94	-1.91
60	60	0	37	Vessel in conflict with Windsurfer or similar Craft	2.78	2.78	0
58	61	-3	25	Leisure Craft and Kayak in Conflict	2.78	2.78	0
59	62	-3	35	Leisure Craft and Water-ski in Conflict	2.78	2.78	0
62	63	-1	32	Kayak and other vessel in Conflict	2.78	2.78	0
65	64	1	10	Grounding High Windage Vessel	2.74	2.74	0
67	65	2	36	Leisure Craft and Waka in Conflict	2.71	2.71	0
63	66	-3	73	Small Commercial and Recreational Craft Conflict	2.78	2.69	-0.09
69	67	2	38	Fishing Vessel Contact Navigation	2.68	2.68	0
70	68	2	29	Tug in collision with vessel being assisted	2.65	2.65	0
72	69	3	30	Small Commercial Vessels in Conflict	2.56	2.56	0
73	70	3	4	Leisure Craft Grounding, Approaches / Entrance	2.52	2.52	0
8	71	-63	27	Yacht and ferry or large vessel in Conflict.	5.29	2.47	-2.82
74	72	2	13	Leisure Craft Grounding	2.37	2.36	-0.01
75	73	2	56	Swing Mooring Failure - Fishing Vessel	2.29	2.25	-0.04
30	74	-44	60	Wash Swamping & Capsize of Leisure Craft	4.22	2.21	-2.01
68	75	-7	62	Personal Injury to Swimmer - Designated Areas	2.69	2.13	-0.56
76	76	0	55	Swing Mooring Failure Leisure Craft	2.07	2.07	0

Rank 2005	Rank 2017	Rank Change	Hazard Ref	Hazard Title	2005 Risk Score (Inherent)	2017 Risk Score (Residual)	Change in Risk
77	77	0	75	Vessel Capsizes at Berth During Cargo Operations	2.04	2.02	-0.02
24	78	-54	61	Swamping / Capsize - Rowing Skiff or Dragon Boat	4.38	2.01	-2.37
78	79	-1	40	Contact with structures in Lambton Harbour	1.31	1.31	0

Table 19 : Risk Comparison Table -2006 and 2017

NB. The comparison presented in this table is an analysis is based on risk scoring prior to delivery of the new wellington pilot vessel (see hazard 19, rank 2).

Annex D Mapped Risk Controls (Existing)

Rank	Hazard Ref.	Accident Category	Hazard Title/Areas Affected	Summary Risk Control - Harbour Regulator	Risk Control - CentrePort	Notes
1	5	Grounding	RoRo Ferry Grounding; Entrance	1 Harbour Organization 1.6 Information notes on charts 1.7 Wave rider buoy 1.9 Recommended Tracks 2.1 Wellington Weather and Wave Data Information Service 2.3 Incident communication facility 2.4 Leading light manual control 2.5 Webcam covering entrance 2.6 Beacon Hill Traffic Monitoring Service 4 Aids to Navigation 6.1 Maritime Rule MNZ 90 6.2 Exemption process 6.3 PEC Handbook 7.1 Police on-water capability and control 7.2 Other local SAR resources	CP6 CP Metconnect site	Bylaw provision in place for a ferry passage plan to join leads at a minimum of 2 miles off the entrance. Harbour Authority has access to Metconnect online weather platform. Beacon Hill monitoring (passive)
2	19	Contact Navigation	Pilot Launch Vessel Contact During Transfer Operations; Approaches, Entrance	6.3 PEC Handbook	CP2.4 Pilot allocation/movement planning CP2.5 Leading vessels to/from Area Delta CP2.6 Use of outer boarding areas CP4.2 Pilot launches	
3	46	Contact Berthing	Contact Berthing, Pilot Exempt Vessel (RoRo Ferry); Main Harbour, Lambton Harbour	1 Harbour Organization 2.1 Wellington Weather and Wave Data Information Service 2.3 Incident communication facility 2.6 Beacon Hill Traffic Monitoring Service 6.2 Exemption process 7.1 Police on-water capability and control 7.2 Other local SAR resources	CP4.1 Tugs CP4.3 Fendering CP6 CP Metconnect site	

Rank	Hazard Ref.	Accident Category	Hazard Title/Areas Affected	Summary Risk Control - Harbour Regulator	Risk Control - CentrePort	Notes
4	20	Collision	RoRo Ferry and Large Vessel in Conflict (within Harbour Waters); Main Harbour	1 Harbour Organization 1.6 Information notes on charts 1.9 Recommended Tracks 2.1 Wellington Weather and Wave Data Information Service 2.3 Incident communication facility 2.6 Beacon Hill Traffic Monitoring Service 3.4 Directions for harbour navigation 4 Aids to Navigation 6.2 Exemption process 6.3 PEC Handbook 7.1 Police on-water capability and control 7.2 Other local SAR resources	CP2.2 Pilot/Master exchange CP2.3 Recommended track compliance CP2.5 Leading vessels to/from Area Delta CP2.6 Use of outer boarding areas CP3.1 Marine Personnel experience and expertise CP3.2 Management Practice CP3.3 Interface with yacht clubs CP4.1 Tugs CP4.2 Pilot launches	
5	28	Collision	RoRo Ferry and Tanker in conflict within Harbour; Main Harbour	1 Harbour Organization 1.9 Recommended Tracks 2.1 Wellington Weather and Wave Data Information Service 2.3 Incident communication facility 2.6 Beacon Hill Traffic Monitoring Service 3.4 Directions for harbour navigation 4 Aids to Navigation 6.1 Maritime Rule MNZ 90 6.2 Exemption process 6.3 PEC Handbook 7.2 Other local SAR resources	CP2.2 Pilot/Master exchange CP2.3 Recommended track compliance CP3.1 Marine Personnel experience and expertise CP3.2 Management Practice CP4.1 Tugs	An incident has been recorded between a RoRo Ferry and a tanker vessel. Approaches to and from the oil terminals in Evans Bay and Seaview are included in the recommended tracks. These are used by the pilots and included in the pilot procedures by CentrePort.
6	83	Collision	Rowing Skiff and Swimmer Collision; Lambton Harbour	4.1 Upcoming Buoy Installation for Recommended Swimming Lanes		Rowing clubs in Wellington have taken steps forward towards solving safety issues. Buoys are to be installed in recommended swimming lanes at Wellington Harbour.

Rank	Hazard Ref.	Accident Category	Hazard Title/Areas Affected	Summary Risk Control - Harbour Regulator	Risk Control - CentrePort	Notes
7	78	Contact Berthing	Tanker Contact Berthing - Seaview Jetty; Seaview	1 Harbour Organization 2.1 Wellington Weather and Wave Data Information Service 2.3 Incident communication facility 2.6 Beacon Hill Traffic Monitoring Service	CP2.1 Limited Parameters CP2.10 CentrePort SOPs Seaview Wharf CP2.2 Pilot/Master exchange CP2.4 Pilot allocation/movement planning CP2.11 Portable Pilot Unit CP3.1 Marine Personnel experience and expertise CP3.2 Management Practice CP4.1 Tugs CP4.2 Pilot launches CP6 CP Metconnect site	Fendering conditions haven't changed at Seaview and Burnham wharf.
8	1	Grounding	Large vessel Grounding in Approaches; Approaches, Entrance	1 Harbour Organization 1.4 Hydrographical survey 1.5 Tide Gauge 1.6 Information notes on charts 1.7 Wave rider buoy 2.1 Wellington Weather and Wave Data Information Service 2.3 Incident communication facility 2.4 Leading light manual control 2.5 Webcam covering entrance 2.6 Beacon Hill Traffic Monitoring Service 3.4 Directions for harbour navigation 4 Aids to Navigation 6.1 Maritime Rule MNZ 90 7.1 Police on-water capability and control 7.2 Other local SAR resources	CP2.2 Pilot/Master exchange CP2.3 Recommended track compliance CP2.5 Leading vessels to/from Area Delta CP2.6 Use of outer boarding areas CP2.11 Pilot Portable Unit CP3.1 Marine Personnel experience and expertise CP3.2 Management Practice CP3.3 Interface with yacht clubs CP6 CP Metconnect site	During severe weather conditions, pilot embarkation becomes challenging in the approaches. CentrePort plans to purchase a new pilot boat specifically designed for the sea conditions at Wellington Harbour entrance.

Rank	Hazard Ref.	Accident Category	Hazard Title/Areas Affected	Summary Risk Control - Harbour Regulator	Risk Control - CentrePort	Notes
9	70	Fire/Explosion	Fire on RoRo Ferry Within Harbour Limits; Approaches, Entrance, Main Harbour, Lambton Harbour	1 Harbour Organization 1.8 Dangerous Goods Notification 2.3 Incident communication facility 7.1 Police on-water capability and control 7.2 Other local SAR resources		
10	64	Personal Injury	Personal Injury, Pilot Operations, Outer Boarding Areas; Approaches, Entrance		CP2.2 Pilot/Master exchange CP2.4 Pilot allocation/movement planning CP2.5 Leading vessels to/from Area Delta CP2.6 Use of outer boarding areas CP3.1 Marine Personnel experience and expertise CP4.2 Pilot launches	
7	59	Foundering	Leisure Craft Foundering; Approaches, Entrance, Main Harbour, Lambton Harbour, Evans Bay, Seaview	1.2 Education 2.3 Incident communication facility 3.9 carriage of lifejackets 7.1 Police on-water capability and control 7.2 Other local SAR resources		

Rank	Hazard Ref.	Accident Category	Hazard Title/Areas Affected	Summary Risk Control - Harbour Regulator	Risk Control - CentrePort	Notes
9	15	Collision	RoRo Ferry and Large or Deep Draught Vessel Collision; Entrance	1 Harbour Organization 1.6 Information notes on charts 1.9 Recommended Tracks 2.3 Incident communication facility 2.4 Leading light manual control 2.6 Beacon Hill Traffic Monitoring Service 3.4 Directions for harbour navigation 4 Aids to Navigation 6.1 Maritime Rule MNZ 90 6.2 Exemption process 6.3 PEC Handbook 7.1 Police on-water capability and control 7.2 Other local SAR resources	CP2.2 Pilot/Master exchange CP2.3 Recommended track compliance CP2.5 Leading vessels to/from Area Delta CP3.1 Marine Personnel experience and expertise CP3.2 Management Practice CP4.1 Tugs CP4.2 Pilot launches	
10	18	Collision	RoRo Ferry and Large Vessel Conflict, Harbour Approaches; Approaches	1 Harbour Organization 1.6 Information notes on charts 1.9 Recommended Tracks 2.1 Wellington Weather and Wave Data Information Service 2.3 Incident communication facility 2.4 Leading light manual control 2.6 Beacon Hill Traffic Monitoring Service 3.4 Directions for harbour navigation 4 Aids to Navigation 6.1 Maritime Rule MNZ 90 6.2 Exemption process 6.3 PEC Handbook 7.1 Police on-water capability and control 7.2 Other local SAR resources	CP2.2 Pilot/Master exchange CP2.3 Recommended track compliance CP2.5 Leading vessels to/from Area Delta CP2.6 Use of outer boarding areas CP3.1 Marine Personnel experience and expertise CP3.2 Management Practice CP3.3 Interface with yacht clubs CP4.1 Tugs CP4.2 Pilot launches	

Rank	Hazard Ref.	Accident Category	Hazard Title/Areas Affected	Summary Risk Control - Harbour Regulator	Risk Control - CentrePort	Notes
11	81	Mooring Breakout	Mooring Breakout (Seaview Jetty); Seaview		CP2.10 CentrePort SOPs Seaview Wharf CP2.8 Mooring guidelines CP3.1 Marine Personnel experience and expertise CP4.1 Tugs CP4.3 Fendering CP6 CP Metconnect site	A study, that has been undertaken on behalf of CentrePort in 2014, illustrated a low bollard capacity at Seaview jetty.
12	63	Personal Injury	Lines Crew Injury; Main Harbour, Lambton Harbour, Evans Bay, Seaview		CP2.1 Limited Parameters CP2.13 Windspeed Limits - Container Cranes CP2.9 Procedures for shore based operatives CP3.1 Marine Personnel experience and expertise CP3.2 Management Practice	
14	70	Fire/Explosion	Fire on RoRo Ferry Within Harbour Limits; Approaches, Entrance, Main Harbour, Lambton Harbour	1 Harbour Organization 1.8 Dangerous Goods Notification 2.3 Incident communication facility 7.1 Police on-water capability and control 7.2 Other local SAR resources		

Rank	Hazard Ref.	Accident Category	Hazard Title/Areas Affected	Summary Risk Control - Harbour Regulator	Risk Control - CentrePort	Notes
15	76	Grounding	Deep Draught Vessel Grounding; Approaches, Entrance	1 Harbour Organization 1.4 Hydrographical survey 1.5 TideGauge 1.6 Information notes on charts 1.7 Waverider buoy 2.1 Wellington Weather and Wave Data Information Service 2.3 Incident communication facility 2.4 Leading light manual control 2.5 Webcam covering entrance 2.6 Beacon Hill Traffic Monitoring Service 3.4 Directions for harbour navigation 4 Aids to Navigation 6.1 Maritime Rule MNZ 90 7.1 Police on-water capability and control 7.2 Otherlocal SAR resources	CP2.2 Pilot/Master exchange CP2.3 Recommended track compliance CP2.5 Leading vessels to/from Area Delta CP2.6 Use of outer boarding areas CP2.11 Portable Pilot Unit CP3.1 Marine Personnel experience and expertise CP3.2 Management Practice	
16	21	Collision	RoRo Ferry and RoRo Ferry in Conflict; Approaches, Entrance, Main Harbour	1 Harbour Organization 1.6 Information notes on charts 1.9 Recommended Tracks 2.1 Wellington Weather and Wave Data Information Service 2.3 Incident communication facility 2.4 Leading light manual control 2.6 Beacon Hill Traffic Monitoring Service 3.4 Directions for harbour navigation 4 Aids to Navigation 6.1 Maritime Rule MNZ 90 6.2 Exemption process 6.3 PEC Handbook 7.1 Police on-water capability and control	CP2.3 Recommended track compliance	

Rank	Hazard Ref.	Accident Category	Hazard Title/Areas Affected	Summary Risk Control - Harbour Regulator	Risk Control - CentrePort	Notes
17	64	Personal Injury	Personal Injury, Pilot Operations, Outer Boarding Areas; Approaches, Entrance		CP2.2 Pilot/Master exchange CP2.4 Pilot allocation/movement planning CP2.5 Leading vessels to/from Area Delta CP2.6 Use of outer boarding areas CP3.1 Marine Personnel experience and expertise CP4.2 Pilot launches	
18	47	Contact Berthing	Vessel in Contact Berthing - Aotea Quay; Main Harbour, Lambton Harbour	1 Harbour Organization 2.1 Wellington Weather and Wave Data Information Service 2.3 Incident communication facility 2.6 Beacon Hill Traffic Monitoring Service 6.2 Exemption process	CP2.1 Limited Parameters CP2.2 Pilot/Master exchange CP2.4 Pilot allocation/movement planning CP2.7 Berthing Planning CP3.1 Marine Personnel experience and expertise CP3.2 Management Practice CP3.3 Interface with yacht clubs CP4.1 Tugs	

Rank	Hazard Ref.	Accident Category	Hazard Title/Areas Affected	Summary Risk Control - Harbour Regulator	Risk Control - CentrePort	Notes
19	54	Mooring Breakout	Mooring Breakout (Main Terminals); Main Harbour, Lambton Harbour	1 Harbour Organization 2.1 Wellington Weather and Wave Data Information Service 2.3 Incident communication facility 2.6 Beacon Hill Traffic Monitoring Service	CP2.2 Pilot/Master exchange CP2.4 Pilot allocation/movement planning CP2.7 Berthing Planning CP2.13 Windspeed Limits - Container Cranes CP3.1 Marine Personnel experience and expertise CP3.2 Management Practice CP3.3 Interface with yacht clubs CP4.1 Tugs	
20	67	Fire/Explosion	Fire On Small Passenger Vessel; Approaches, Entrance,Main Harbour, Lambton Harbour,Evans Bay	1 Harbour Organization 1.8 Dangerous Goods Notification 2.3 Incident communication facility 7.1 Police on-water capability and control 7.2 Other local SAR resources	CP4.1 Tugs	

Rank	Hazard Ref.	Accident Category	Hazard Title/Areas Affected	Summary Risk Control - Harbour Regulator	Risk Control - CentrePort	Notes
21	17	Collision	RoRo Ferry / Large Vessel and Fishing Vessel Conflict; Approaches,Entrance, Main Harbour	1 Harbour Organization 1.6 Information notes on charts 1.9 Recommended Tracks 2.1 Wellington Weather and Wave Data Information Service 2.3 Incident communication facility 2.4 Leading light manual control 2.6 Beacon Hill Traffic Monitoring Service 3.4 Directions for harbour navigation 4 Aids to Navigation 6.1 Maritime Rule MNZ 90 6.2 Exemption process 6.3 PEC Handbook 7.1 Police on-water capability and control 7.2 Other local SAR resources	CP2.2 Pilot/Master exchange CP2.3 Recommended track compliance CP3.1 Marine Personnel experience and expertise CP3.2 Management Practice CP3.3 Interface with yacht clubs CP4.1 Tugs	
22	79	Equipment Failure	Life Boat; Main Harbour, Lambton Harbour, Evans Bay, Seaview	3.16 Lifeboat/Workboat Deployment		
23	9	Grounding	Harbour Craft (MOSS registered) Grounding; Approaches, Entrance, Main Harbour	1 Harbour Organization 2.1 Wellington Weather and Wave Data Information Service 2.3 Incident communication facility 2.5 Webcam covering entrance 2.6 Beacon Hill Traffic Monitoring Service 7.1 Police on-water capability and control 7.2 Other local SAR resources		

Rank	Hazard Ref.	Accident Category	Hazard Title/Areas Affected	Summary Risk Control - Harbour Regulator	Risk Control - CentrePort	Notes
24	23	Collision	Harbour Ferry in Conflict with Larger Vessel; Main Harbour	1 Harbour Organization 1.9 Recommended Tracks 2.1 Wellington Weather and Wave Data Information Service 2.3 Incident communication facility 2.6 Beacon Hill Traffic Monitoring Service 3.4 Directions for harbour navigation 4 Aids to Navigation 6.1 Maritime Rule MNZ 90 6.2 Exemption process 7.2 Other local SAR resources	CP2.2 Pilot/Master exchange CP2.3 Recommended track compliance CP3.1 Marine Personnel experience and expertise CP3.2 Management Practice CP4.1 Tugs	
25	8	Personal Injury	Personal Injury to Swimmer - Cross Harbour Ferry Terminals; Entrance, Main Harbour, Lambton Harbour; Seaview	5.1 Warning Signs at Harbour Ferry Wharf		
26	53	Mooring Breakout	Mooring Breakout - Finger Berth; Lambton Harbour	1 Harbour Organization 1.1 Event Promulgation 1.2 Education 2.3 Incident communication facility 3.2 Event Management 3.5 Restricted Areas 3.7 Speed restrictions 3.8 Operating Requirement 3.9 carriage of lifejackets 7.1 Police on-water capability and control 7.2 Other local SAR resources		
27	34	Collision	Rowing skiff and vessel in conflict; Lambton Harbour	1.9 Recommended Tracks 2.6 Beacon Hill Traffic Monitoring Service 4 Aids to Navigation 5. Signage, shore markings and buoys		

Rank	Hazard Ref.	Accident Category	Hazard Title/Areas Affected	Summary Risk Control - Harbour Regulator	Risk Control - CentrePort	Notes
28	48	Contact Berthing	Contact with Container Crane; Main Harbour	1 Harbour Organization 2.1 Wellington Weather and Wave Data Information Service 2.3 Incident communication facility 2.6 Beacon Hill Traffic Monitoring Service	CP2.1 Limited Parameters CP2.2 Pilot/Master exchange CP2.4 Pilot allocation/movement planning CP2.7 Berthing Planning CP3.1 Marine Personnel experience and expertise CP3.2 Management Practice CP4.1 Tugs	
29	57	Foundering	Fishing Vessel Foundering; Approaches, Entrance	2.1 Wellington Weather and Wave Data Information Service 2.6 Beacon Hill Traffic Monitoring Service		

Rank	Hazard Ref.	Accident Category	Hazard Title/Areas Affected	Summary Risk Control - Harbour Regulator	Risk Control - CentrePort	Notes
30	16	Collision	RoRo Ferry and Leisure Craft Conflict; Approaches, Entrance, Main Harbour	1 Harbour Organization 1.1 Event Promulgation 1.2 Education 1.6 Information notes on charts 1.9 Recommended Tracks 2.1 Wellington Weather and Wave Data Information Service 2.3 Incident communication facility 2.4 Leading light manual control 2.6 Beacon Hill Traffic Monitoring Service 3.1 500-tons rule Section 6.3 3.2 Event Management 3.3. Enforcement officers 3.8 Operating Requirement 4 Aids to Navigation 5. Signage, shore markings and buoys 6.1 Maritime Rule MNZ 90 6.2 Exemption process 7.1 Police on-water capability and control 7.2 Other local SAR resources		Leisure education is a primary RCM including signage at marinas and boat ramps. There is also an enforcement element with Harbour Rangers and Wharf Police on water presence

Table 20 : Existing Risk Control Mapped to Hazards