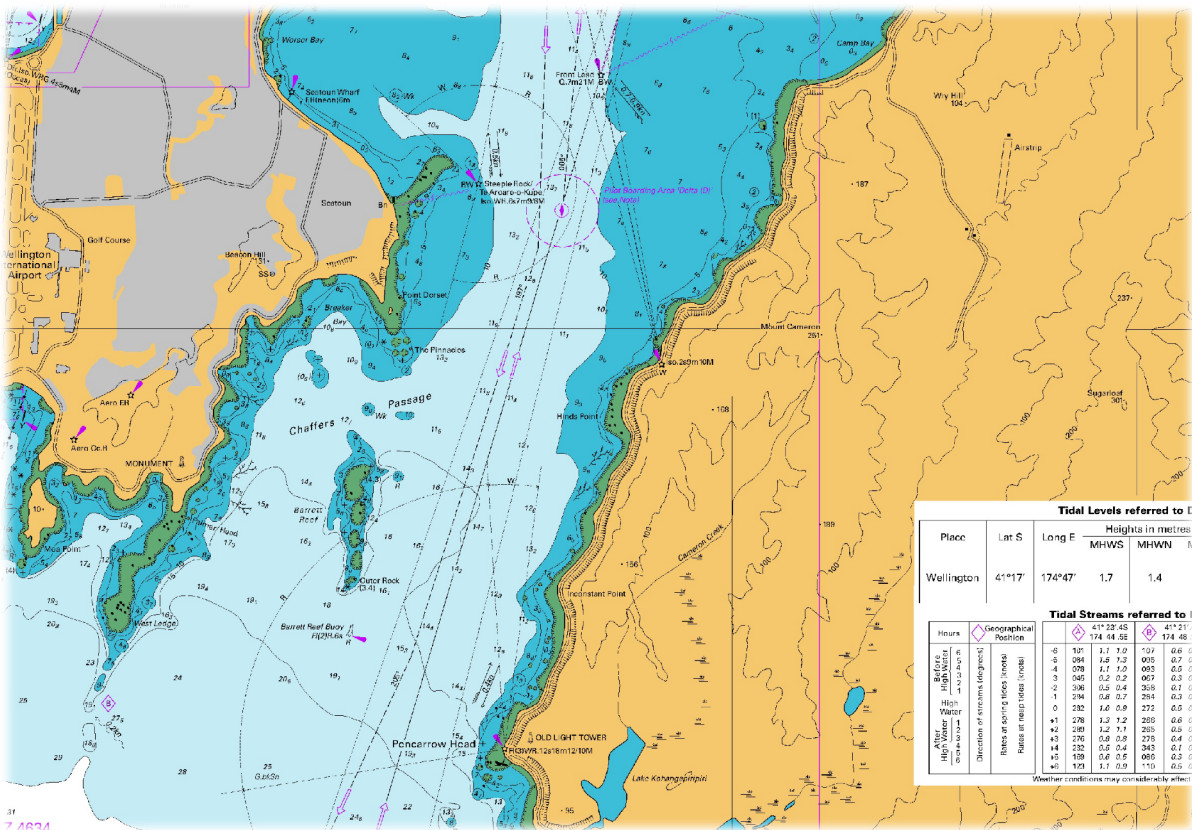


Review of Navigation Safety in Wellington Harbour Entrance Channel and Approaches



By South Maritime Solutions for Greater Wellington Regional Council and CentrePort Limited

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1. Executive Summary

South Maritime Solutions (SouthMS) have found that the various systems and standard operating procedures used in managing navigation safety in the Wellington Harbour Entrance Channel (the Entrance Channel) and its approaches are mature, having evolved over many decades. They are generally fit for purpose, but as is often the case, changes made over time in one part of the system can conflict with or adversely affect other parts. This review has not identified anything that is fundamentally wrong or non-compliant.

The purpose of the recommendations in this report is more to reset and align the various parts in the system with contemporary good industry practice and to reduce the navigation safety risk in the Entrance Channel to as low as reasonably practicable (ALARP).

Some of the recommendations can, if accepted, be implemented in the short term – others will take longer. Our overarching advice is that for those that are accepted by Greater Wellington Regional Council (GWRC) and CentrePort, the actions are included in their respective Safety Plans that form part of their Port and Harbour Marine Safety Code safety management systems. In this way, the recommendations can be prioritised and tracked as time and budget permit.

The key recommendations for improving navigation safety are those aimed at reducing the risk of high-consequence events such as collisions and groundings in and around the Entrance Channel. These include:

- Reviewing the recommended tracks (and thus the pilotage plans) throughout the harbour to be consistent with contemporary good industry practice
- Reviewing the aids to navigation (AtoNs) in and around the Entrance Channel to assist ships to maintain the existing and/or new recommended tracks
- Establishing a controlled navigation zone within the Entrance Channel to minimise the risk of large ships colliding in the channel
- Moving the pilot boarding areas at the entrance to the harbour to reduce the risk of collision between pilot-exempt ferries and ships boarding and disembarking a pilot
- Establishing better communication protocols between piloted and pilot-exempt ships to improve situational awareness across the harbour.

2. Preamble

SouthMS has been appointed by the GWRC Harbourmaster and the CentrePort Marine Operations Manager to provide an independent review of threats to navigation safety in the Entrance Channel, including the pilot boarding grounds and the approaches from seaward and the inner harbour. The review is to consider standard operating procedures and risk controls used to manage those threats. The outcome is to produce a report that defines, explains and evaluates identified threats, and recommends changes to ensure the risks are being reasonably managed and that standard operating procedures meet good industry practice. The standard operating procedures and recommended risk control options must pass the tests of reasonableness, practicality and effectiveness in ensuring the sustainable safe navigation of ships throughout the Entrance Channel and approaches.

The report includes qualitative discussion on cost versus benefit studies of recommendations, but it does not include a detailed cost-benefit-analysis. The review considers safety on the waterways for all user groups including Cook Strait ferries, international shipping, cruise ships, coastal shipping, small commercial operators, iwi, recreational boat owners and marine sports associations. Aside from navigation safety, iwi have a particular interest in the management of these natural resources, the upholding of customary practices and ensuring that the mauri of the environment is protected or enhanced.

It is important that the outcomes of this review and the decisions made gain the 'social licence' of the local community and various stakeholders (i.e. it has the ongoing approval, or social or ongoing acceptance, of the general community).

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2.1 Scope

The geographic scope of this assessment covers the Entrance Channel and its inner and outer approaches.

The report acknowledges Wellington Harbour's significance as part of the National Transportation Route. It is the primary shipping route into and out of Wellington for the Cook Strait ferries and it provides the State Highway One link between the North and South Islands.

To this end, the study considers future developments in Cook Strait/Raukawa Moana ferry services, and how the future development of ferry terminals could impact on the inner approaches to the Entrance Channel.

2.2 Navigation Safety

The concept of 'navigation safety' is defined in the New Zealand Port and Harbour Marine Safety Code as the safe movement and navigation of ships. It includes matters such as collision prevention, the management of waterways and their use by ships, AtoNs, communication and the use of navigation tools and equipment.

This report views navigation safety risk through the lens of the GWRC Harbourmaster and the current sole port operator, CentrePort. It takes into account the Harbourmaster's powers to control or influence the control of navigation safety risks within Wellington Harbour. For example, the Harbourmaster has powers to control the implementation and maintenance of AtoNs within Wellington Harbour, but has only a limited ability to influence the implementation, effective use and maintenance of onboard navigation aids. Consequently, the control of navigation safety risks relies in part on the skills of the Harbourmaster to influence persons and organisations over which they have little or no powers of control.

2.3 Risk Criteria

The authors have used the GWRC *Wellington Harbour Navigational Risk Assessment 2018* document¹ as the risk criteria for the analysis and evaluation of navigation safety risk. This approach ensures consistency with existing GWRC risk management processes.

This report is not a full review of the Wellington Harbour Risk Assessment, but in order to consider the aspects of navigation safety in the Entrance Channel a review of certain elements of the current risk assessment has been necessary. This review involved an extensive literature review, which included a review of applicable codes and standards, and consultation with 29 individuals or stakeholder groups. The focus was placed on the common marine risks listed in Table 1 of *the Port and Harbour Marine Safety Code's Key Principles for Marine Safety Risk Management Guidelines*². This table lists common marine risks and events as:

1. Collision
2. Grounding
3. Contact
4. Loss of stability
5. Fire and explosion
6. Oil spill
7. Weather event
8. Mooring breakouts.

The Code's risk guidelines have identified these areas as requiring consideration. As this report is limited to a review of safety in the Entrance Channel only, the main focus has been on collision, grounding and, to a lesser extent, contact and weather event. The stakeholder consultation was then used to identify any emerging, evolving or previously unidentified risks, and then assess the robustness of existing controls and identify any potential new, reasonably practicable controls that may be available.

¹ Marico Marine, Greater Wellington Regional Council, Wellington Harbour Navigational Risk Assessment, Issue 4, 31 August 2018.

² Port & Harbour Marine Safety Code New Zealand, Key Principles for Marine Safety Risk Management, downloaded from the Maritime New Zealand website, August 2021.

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2.4 Consultation with Iwi

Under the Local Government Act 2002, GWRC must, when making a significant decision about land or a body of water, take into account the relationship of Māori and their culture and traditions with their ancestral land, water, sites, wāhi tapu, valued flora and fauna and other taonga. During the preparation of this report, representatives of the Port Nicholson Block Settlement Trust and Ngāti Toa were consulted and were generally supportive of the process followed.

2.5 Wider Consultation

In preparing this review of navigation safety we have engaged with many stakeholders. CentrePort and GWRC identified these stakeholders and provided contacts and introductions for them. The stakeholder groups consulted with are given in Table 1.

Table 1 Stakeholder list

Group	Description
CentrePort	Current Marine Operations Manager Recently retired Marine Operations Manager Pilots Tug Masters Pilot Launch Skippers
Greater Wellington Regional Council	Harbourmaster Deputy Harbourmaster Recently retired Harbourmaster Local Port Services (Beacon Hill) operators
Maritime Regulator	Maritime New Zealand elected to not be consulted, preferring to be consulted over the draft report
Cook Strait Ferry Operator Interislander	Masters Marine Operations Management Inter-island Resilience Connection (IREX) management Picton to Wellington sailing
StraitNZ Bluebridge Ltd	Masters Marine operations management Wellington to Picton sailing
Other pilot-exempt operators	Holcim Cement Swires Shipping NIWA
Smaller commercial operators	East by West Ferries Police Maritime Unit
Iwi	Ngati Toa Te Ati Awa (Port Nicholson Block Settlement Trust)
Recreational boating associations	Recreational Fisher Association Windsurfer and kite board community
Recreational boat and fishing Clubs	Royal Port Nicholson Yacht Club Lowry Bay Yacht Club Evans Bay Yacht and Motor Boat Club Worsler Bay Boating Club
Commercial fishers	Two key resident commercial fishers

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3. Context

3.1 Description of Wellington Harbour

The term 'Wellington Harbour' is defined by an Order in Council, dated 17 January 1985 and amended 1 April 1985, *New Zealand Gazette* 14 January 1985, page 524 (Schedule 1 of the [current] Bylaws):

All that area of sea and tidal waters the outer limits being the arc of a circle running from the landward boundary of the foreshore just north of Baring Head and thence to the landward boundary of the foreshore south-west of Owhiro Bay, such an arc being an arc of a circle of 3.85 nautical miles radius and having its centre at a point on the outer rock in the Harbour of Wellington, such point being in position 41° 20.96' S, 174° 50.1' E based on WGS 84.

The inner limits being a straight line across the Hutt River at the seaward side of the Hutt Estuary road bridge and a straight line across the Waiwhetu Stream at the seaward side of Port Road. The above limits are more particularly shown on the plan marked MD 16306 and deposited in the Office of the Ministry of Transport at Wellington.

Broadly, the Entrance Channel extends in a north-south direction from Pencarrow Head in the south (the Cook Strait) to between Ward/Mākaro Island and Point Gordon to the north (inner harbour).

Barrett Reef is a prominent rocky outcrop within the seaward, southern end of the Entrance Channel. It is about five cables³ long and one cable wide and runs in a north-south direction. Barrett Reef comprises a number of rocks visible above the sea surface at high water, becoming more prominent as the tide level falls. Waves from the south break heavily over the reef.

The main shipping channel passes to the east of Barrett Reef. There is a smaller secondary channel, Chaffers Passage, that passes to the west of Barrett Reef. The width of Chaffers Passage ranges from two to three cables. There are no dedicated AtoNs for vessels transiting Chaffers Passage and there is a wreck located in its northern entrance that makes for a controlling depth of 9.6 metres. Consequently, Chaffers Passage is not suitable for shipping. Its use is limited to small commercial and recreational craft seeking shelter when entering the harbour during strong northerly winds or to keep clear of the main shipping channel. It is not suitable for use in a strong southerly weather pattern when a heavy swell is present.

The southern approach to Barrett Reef is indicated by Barrett Reef Buoy, which has a red light that flashes twice every 6 seconds (Fl(2)R.6s). The navigable channel for large ships is considered to be the areas with a water depth of 10 metres or more at Chart Datum, which is approximately the lowest astronomical tide. The navigable channel is about 1 nautical mile wide adjacent to Barrett Reef and then gradually narrows to about four cables wide off Steeple Rock, and then down to as little as three cables off Falcon Shoal. North of Falcon Shoal the navigable channel widens into the inner harbour.

The depth of water in the main shipping channel shoals from about 14 metres in the vicinity of Barrett Reef to about 11 metres in the vicinity of the Front Lead and Steeple Rock (see Figure 1). This natural shoaling causes wind and swell waves from the south to rise and steepen, in much the same way they do across a Bar Harbour. For this reason, the Wellington Harbour Entrance Channel is often referred to as a Bar Harbour.

³ One cable is 0.1 of a nautical mile (185.2 metres).

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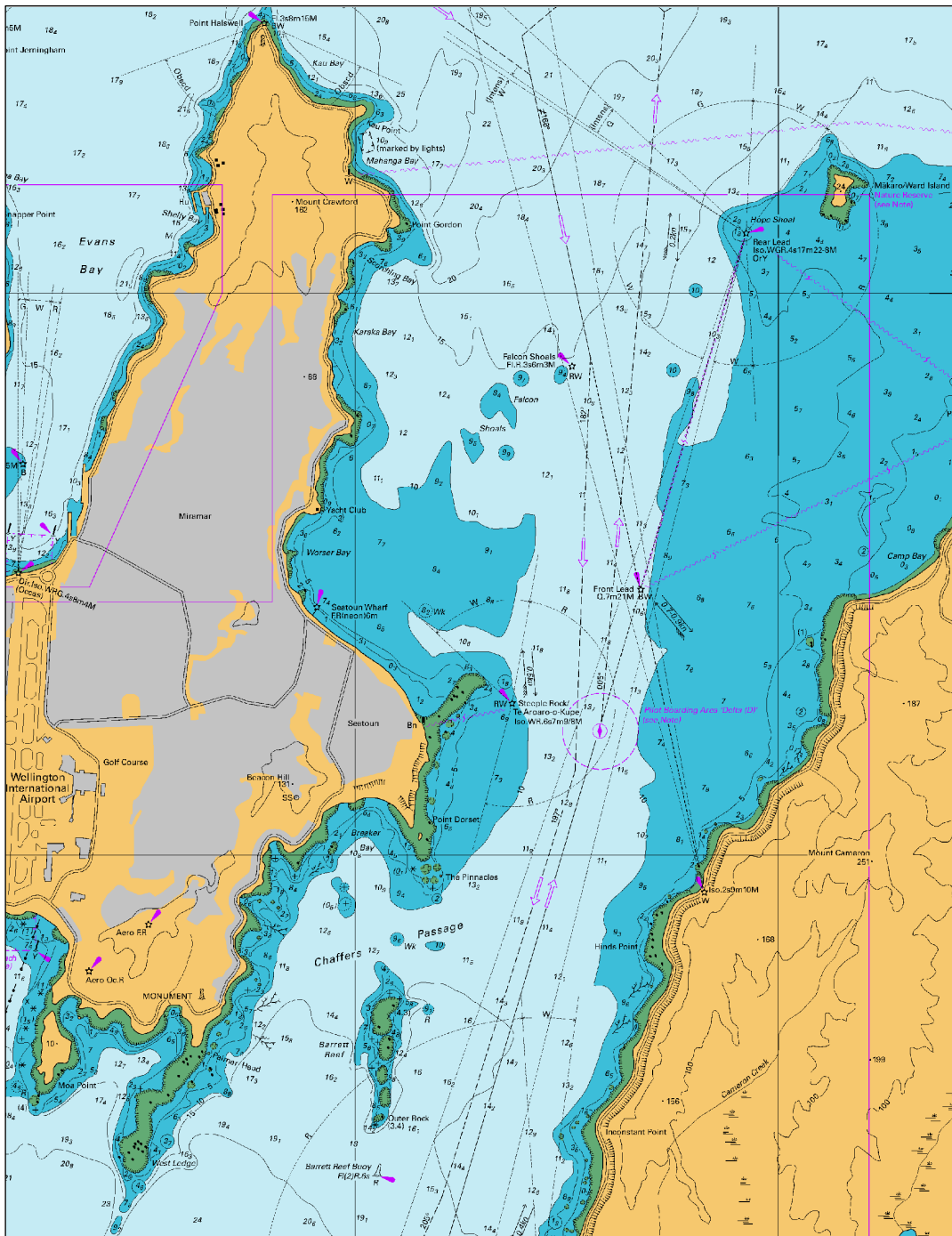


Figure 1
Wellington Harbour Entrance Channel

Most of the main navigable shipping channel has been deemed⁴ a narrow channel in accordance with Maritime Rule Part 22.9 – Narrow Channels.⁵ The narrow channel encompasses the area of the main navigable channel from the adjacent Pencarrow Head in the south to adjacent to the rear leading light beacon to the north (see Figure 2).

⁴ Wellington Navigation and Safety Bylaws – Section 6.1.7.

⁵ Maritime Rule Part 22 – Collision Prevention, Section 22.9 – Narrow Channels.

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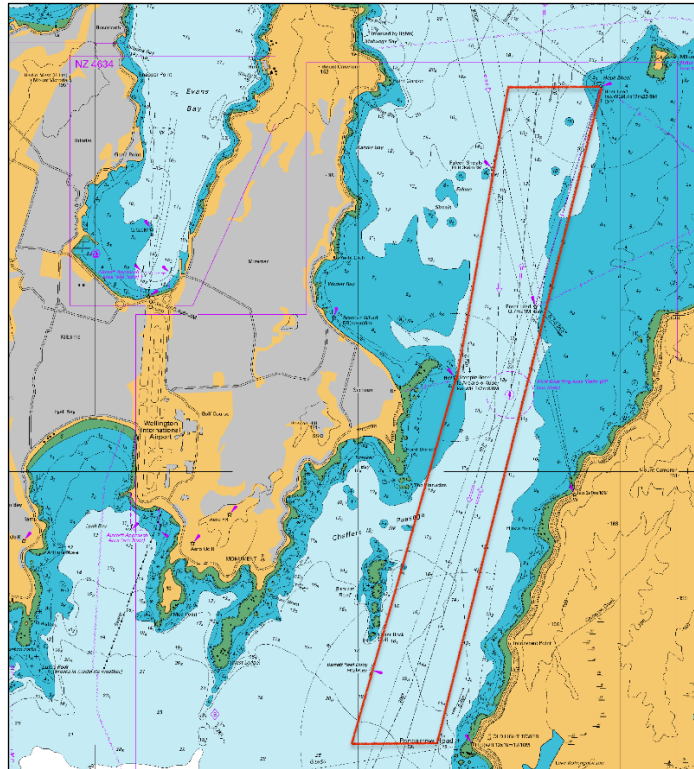


Figure 2

Wellington Harbour Entrance Channel – deemed a narrow channel

3.2 Admiralty Sailing Directions – New Zealand Pilot

The following is an excerpt from the New Zealand Pilot:⁶

From the East keep at least 5 nautical miles off Cape Palliser / Matakitaikiakupe and 4 nautical miles off Turakirae Head before proceeding to the designated pilot boarding station. Vessels are to keep well clear of the wave rider buoy (1 nautical mile west of Baring Head / O – rua-pouanu) and Arabella Rock (0.6 nautical miles northwest of Baring Head / O – rua-pouanu).

From the West pass midway between The Brothers and Fishermans Rock, thence at least 4 nautical miles off Cape Terawhiti, thence at least 4 nautical miles off Karori Rock. When abeam Sinclair Head / Te Rimurapa, vessels requiring a pilot should proceed directly to the designated pilot boarding area. Vessels not requiring a pilot may adjust course to join the leads no closer than 2 nautical miles off the entrance (or greater in southerly weather). Such vessels should beware of departing vessels.

Departing vessels — all departing vessels should note that:

1. Vessels in-bound for pilotage are likely to be under instructions from a local pilot and will be approaching the designated boarding areas of either ALPHA, BRAVO or CHARLIE (or the supplementary bad weather boarding area of DELTA)
2. Numerous ferries and other vessels exempt from pilotage are likely to be approaching from the west to a position on the leads not less than 2 nautical miles south of the entrance
3. Vessels heading east are initially to head southward on the approximate line of the leads but avoiding conflict with vessels manoeuvring to pick up their pilot. Such vessels should maintain this course until clear

⁶ Admiralty Sailing Directions NP51 – New Zealand Pilot (19th Edition), 2015.

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of harbour limits and in a position to intersect the coastal course line between Baring Head / O – ruapouanu and Cape Palliser / Matakitaikiakupe.

Weather effect on tide

Barometric pressure:

Tide predictions are computed for a standard barometric pressure of 1013 hectopascals (hPa) or millibars. A difference of 1 hPa from the average can cause a difference in tide height of one centimetre. A low barometer will allow the sea level to rise and a high barometer will tend to depress it. This phenomenon is often described as the 'inverted barometer effect'. The water level does not, however, adjust itself immediately to a change of pressure; it responds to the average change over a considerable area. Changes in sea level due to barometric pressure alone seldom exceed 30 centimetres, but as such circumstances are usually associated with adverse weather conditions the actual change in sea level is often much greater.

Wind:

The effect of the wind on sea level, and therefore on tidal heights and times, is variable and depends largely on the topography of the area. In general, it can be said that the wind will raise the level of the sea in the direction towards which it is blowing, an effect often called 'wind set-up'. A strong wind blowing onshore will pile up the water and cause the sea level to be higher than predicted, while winds blowing off the land will have the reverse effect.

Storm surges:

The combination of wind set-up and the inverted barometer effect associated with storms can create a pronounced increase in sea level, which is often called a storm surge. A long surface wave travelling with the storm depression can further exaggerate this sea level increase. A negative storm surge is the opposite effect, generally associated with high pressure systems and offshore winds, and can create unusually shallow water. This effect is detrimental to very large vessels that may be navigating with small under-keel clearances (UKCs).

Tidal streams in Cook Strait:

The tidal streams in and around Cook Strait are unreliable and mariners are warned to exercise every precaution when navigating in the vicinity. The streams often run in one direction for 8 to 10 hours, but cases have been reported of them going for 18 hours or more. When the streams have been running in one direction for an extended period it has been found that the opposite stream is much weaker or, on some occasions, hardly noticeable. The maximum rates shown on the chart, which are normally attained during spring tide conditions, are also liable to be encountered at any other time. In the vicinity of Karori Rock and Cape Terawhiti rates of up to 7 knots are frequently experienced, but as a rule do not last for more than about 1 hour. Small vessels are warned to keep well clear of tide rips as they could lose steerage way and may, in extreme cases, capsize.

Cautionary notes, charts and tide predictions

It is increasingly common for mariners to navigate in shallow water with a bare minimum depth below the keel (UKC). This minimum depth below the keel is usually assessed from the charted depths and predicted tide levels. Given this, mariners should note the following:

(a) Due to the technical limitations of hydrographic surveys and the uncertainties in tidal reductions for surveys, nautical charts can seldom be absolutely reliable in their representation of depth. Other limitations of hydrographic surveys are discussed at length in the Admiralty publication *The Mariner's Handbook* (NP100).

(b) The mariner should be aware that any chart, regardless of age of survey, may not show all seabed obstructions or shoal depths.

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(c) Depths can change quickly in areas where the seabed is highly dynamic. These critical areas are surveyed more frequently but significant changes can occur in between surveys. In all cases the mariner should contact the local authority for the latest survey and depth information.

(d) Tidal levels, and therefore the least depth over seabed obstructions, are affected by meteorological conditions, i.e. barometric pressure, wind, swell, and both positive and negative storm surges. These are described in the Tidal Section, New Zealand Nautical Almanac (NZ 204) and in the Admiralty Tide Tables (NP204). As a result, actual tide levels may vary appreciably from predicted values.

(e) Where an expected least depth or an under-keel clearance is determined using only tidal predictions and charted depths the uncertainty in the survey and tidal predictions may be compounded and the risk of contact with the seabed or grounding increases.

3.3 Shipping Movements

For the year ending June 2020, there were 1,175 piloted ship movements for 582 ship calls,⁷ down from 1,381 in the previous year.⁸ Breakdown by ship type is shown Table 2.

Table 2: Number of piloted ship calls by type

Ship type	Number of ship calls
Container ship	156
Passenger cruise ship	112
Bulk/log ships	109
Tank ships	71
Other ships	134

In the current 2020/21 year, passenger ship activity has ceased due to the Covid pandemic. Ship visits by other type will have been affected to some degree by the global pandemic situation. For the purposes of this review, we have assumed a future return to pre-Covid levels of foreign shipping.

There were 5,844 Cook Strait ferry arrivals and departures in the year ending June 2020, which was down from 6,296 in the previous year. This decrease in ferry movements is largely due to a decrease in the number of return trips as a result of Covid.

In total, that amounts to 7,008 transits of the Entrance Channel by large ships in the year ending June 2020. About 16% of transits were made with a harbour pilot on board and about 84% under the command of a pilot-exempt master.⁹ CentrePort tugs were used to assist with 2,191 tasks.¹⁰

⁷ Some pilot movements were shifting ships within the harbour.

⁸ Partly because of Covid restrictions imposed in March 2020 onwards.

⁹ Includes a number of transits by cement and NIWA vessels under the command of pilot-exempt masters.

¹⁰ Two tugs would usually be tasked for large ship movements.

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4. Discussion and Recommendations

4.1 Port Passage Plans

Recommendations:

- 1 That the Navigation Bylaws require CentrePort and operators of pilot-exempt ships to submit to the Harbourmaster their standard pilotage plan for entering and departing Wellington Harbour, which must meet contemporary accepted good industry practice.
- 2 Any port passage plans submitted for approval should use a consistent format and follow any recommended tracks by default.

Port practices have evolved over time. Ships have increased in size, which has reduced the margins for error, resulting in an increase in inherent risk. Various methods have been adopted to manage this increased risk: shipping channels have been made wider and deeper; advances in technology have been developed to make navigation more precise; ships have been fitted with better manoeuvring aids; and tugs have been increased in numbers and capability.

The requirement for ships to plan their passage from berth-to-berth has been accepted good practice for many decades. The portion of the voyage from pilotage limits to berth has become known as the standard port passage plan. Contemporary good practice is that a standard port passage plan is developed by the pilotage provider(s) and contains wider content about navigation and facilities within the harbour. The port passage plan is then modified on a case-by-case basis to account for the circumstances of the day (for example, wind, weather and tide) and the characteristics of the ship to be piloted (for example: size, manoeuvrability, draft and stability). This modified version then becomes the agreed pilotage plan and is communicated by the pilot to the ship's bridge team via the master pilot exchange (MPX).

Operators of pilot-exempt ships, such as the Cook Strait ferries, are expected to adopt this same regime. The requirement to do so stems from international good practice and New Zealand's domestic Maritime Rule Part 90 – Pilotage. Also, the New Zealand Maritime Pilots Association (NZMPA) is finalising its first edition of their *Good Practice Guide to Pilotage Planning*,¹¹ which will further develop accepted good practices for piloted and pilot-exempt ships.

While the wider content of the port passage plan is subject to more frequent change as the context changes, the routes in and out of the port would rarely change for a harbour like Wellington where the depths and topography of the channel do not vary significantly over time.

In our opinion, there is little need for the Wellington Regional Navigation and Safety Bylaws 2021 (Navigation Bylaws) to be tightly prescriptive in the description of how ships enter and depart the harbour, particularly when the matter is adequately controlled by the contemporary international and domestic rules and regulations and accepted good practice codes described above. For clarity, we are not recommending that the Harbourmaster relinquish all control over safe pilotage procedures and practices in the harbour. We are recommending that the requirement remains for port passage plans to be approved by the Harbourmaster to ensure that all passage plans are similar, if not the same, and they are consistent with accepted good industry practice.

¹¹ *Good Practice Guide To Pilotage Planning – Guide To The Process of Producing Fit-For Purpose Passage Plans for Pilotage Operations* (1st Edition), Publication PPG-1 October 2020.

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4.2 Recommended Tracks

Recommendation:

- 3 There are inconsistencies in the various methods used to publish the recommended tracks and in the various directions to mariners about the way the recommended tracks 'shall' be followed. Also, the reasons for the Navigation Bylaws being so prescriptive on pilotage routes have been superseded by contemporary best industry practice piloting and passage planning procedures.

It is therefore recommended that either:

- the recommended tracks be removed from the Navigation Bylaws, or
- if the recommended tracks are retained in the Navigation Bylaws, then any anomalies in the way they are published and referred to will need to be rectified and the intent of the recommended tracks be fully and clearly explained for the benefit of all harbour users.

Promulgation of recommended tracks

Compulsory pilotage for Wellington Harbour was introduced in 1952. In 1975, a set of 'tracks' were developed for vessels to use when transiting the Entrance Channel to and from the various berths that lie within the harbour. These tracks were said to be guidelines and evolved into becoming the passage plan used by Wellington Harbour pilots.

The Navigation Bylaws include these tracks and refer to them as 'recommended tracks'. The Bylaws make it mandatory for certain vessels to follow these tracks except in certain circumstances.

In about 2014, the recommended tracks were published on the official Wellington Harbour Chart (NZ4633 Wellington Harbour), referring to them as 'recommended tracks'. The chart includes the notation '*All vessels of 18 metres or more shall follow the recommended tracks and directions as detailed in Schedule 6 of the Wellington Regional Navigation and Safety Bylaws*'. However, this notation is inconsistent with the wording in the Navigation Bylaws, and not all the recommended tracks published in the Bylaws are included on the Wellington Harbour Chart.¹² This is expanded on below.

Schedule 6 of the current Navigation Bylaws is titled 'Recommended Tracks' and is split into Part A and Part B. Part A is a diagram showing recommended tracks through the Entrance Channel and then on to '*Tracks to Main Wharves, including Ferry Berths*'. Part B is a diagram showing the same recommended tracks through the Entrance Channel and then on to '*Tracks to all CentrePort Wharves*' (see Figure 3). Schedule 6 also contains a list of all 'Wellington Pilotage Waypoints', which correspond to the recommended tracks described within the Navigation Bylaws.

The notation on the chart does not delineate between those recommended tracks contained in Part A or Part B of Schedule 6; it simply refers to 'recommended tracks' in Schedule 6.

However, the 18-metre rule only refers to tracks shown in Part A. Section 6.1 of the Navigation Bylaws describes '*Directions for Transiting Wellington Harbour Entrance*'. Paragraph 6.1.4 requires all vessels over 18 metres in length to follow only the tracks shown in Part A of Schedule 6¹³ (those tracks to the main wharves and ferry berths).

¹² The tracks to wharves in Evans Bay are not depicted and neither are the final tracks to and from the main wharf and ferry berths.

¹³ Wellington Regional Navigation and Safety Bylaws 2003, Section 6.1 – Directions for Transiting Wellington Harbour Entrance, Paragraph 6.1.4.

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Section 6.2 of the Navigation Bylaw describes '*General Directions for Navigating in Wellington Harbour*'. Paragraph 6.2.6 states '*Any vessel required to follow the recommended tracks shall, in a prudent and seaman-like manner, unless for reasons of safety of navigation or pressure of weather, follow the recommended tracks as shown in Schedule 6*'. As mentioned above, Schedule 6 covers both Part A and Part B. This generic reference to 'recommended tracks' in Paragraph 6.2.6 and the specificity of Paragraph 6.1.4 that refers to only Part A of the schedule creates some uncertainty.

The uncertainty is exacerbated by Paragraph 6.2.7,¹⁴ which affords vessels that are under pilot instruction permission to deviate from the recommended tracks for reasons '*other than*' '*reasons of safety of navigation or pressure of weather*'. We found no logical reason for making this allowance. Pilot-exempt ships and piloted vessels are interacting in the same area with the same goal – to transit in and around the harbour safely and without incident.

The recommended tracks are essentially the tracks exercised in the port passage plan developed by CentrePort pilots. Pilot-exempt vessel operators have broadly adopted the same recommended tracks into their respective passage plans. There is little discretion otherwise available. In the past one issue with promulgating the recommended tracks on the chart is that once on there it was a difficult and timely process to change them. We understand that today the process is not so difficult. It has in the past also been a difficult and timely process to make changes to the recommended tracks in the Navigation Bylaws. The Bylaws are generally reviewed once every 5 years, although the current thinking is that parts of them could be reviewed more often if required.

Nevertheless, there seems little advantage in having them published in two statutory documents when one would do, the risk being that differences can evolve over time as is the current case. Not all the recommended tracks are published on the Wellington Harbour Chart. For example, Schedule 6 of the Navigation Bylaws shows a recommended track west of Falcon Shoal, yet this track is not published on the chart. This is causing some conflict with other harbour users. We discuss this in the following sections. The Navigation Bylaws also show recommended tracks for vessels entering and departing Evans Bay, which are not published on the nautical chart and are not always followed by pilots. We suggest that from the time a tanker enters Evans Bay the pilotage plan has morphed into a manoeuvring plan.

This risk can be eliminated by the removal of the recommended tracks from the Navigation Bylaws, which could simply include the requirement to follow the recommended tracks published on the chart. Should that option be adopted, the recommended tracks currently published on the chart should be reviewed and amended as necessary to be compatible with other changes adopted as a result of this report. The Harbourmaster would need to retain the right to veto any proposed changes to the recommended tracks published on the chart.

For these reasons, and those discussed in the following sections, we are recommending that the recommended tracks be removed from the Navigation Bylaws. If they are to remain then these anomalies will need to be rectified and the intent of the recommended tracks fully and clearly explained for the benefit of all harbour users.

¹⁴ Wellington Regional Navigation and Safety Bylaws 2003, Section 6.2 – General Directions for Navigating in Wellington Harbour, Paragraph 6.2.7.

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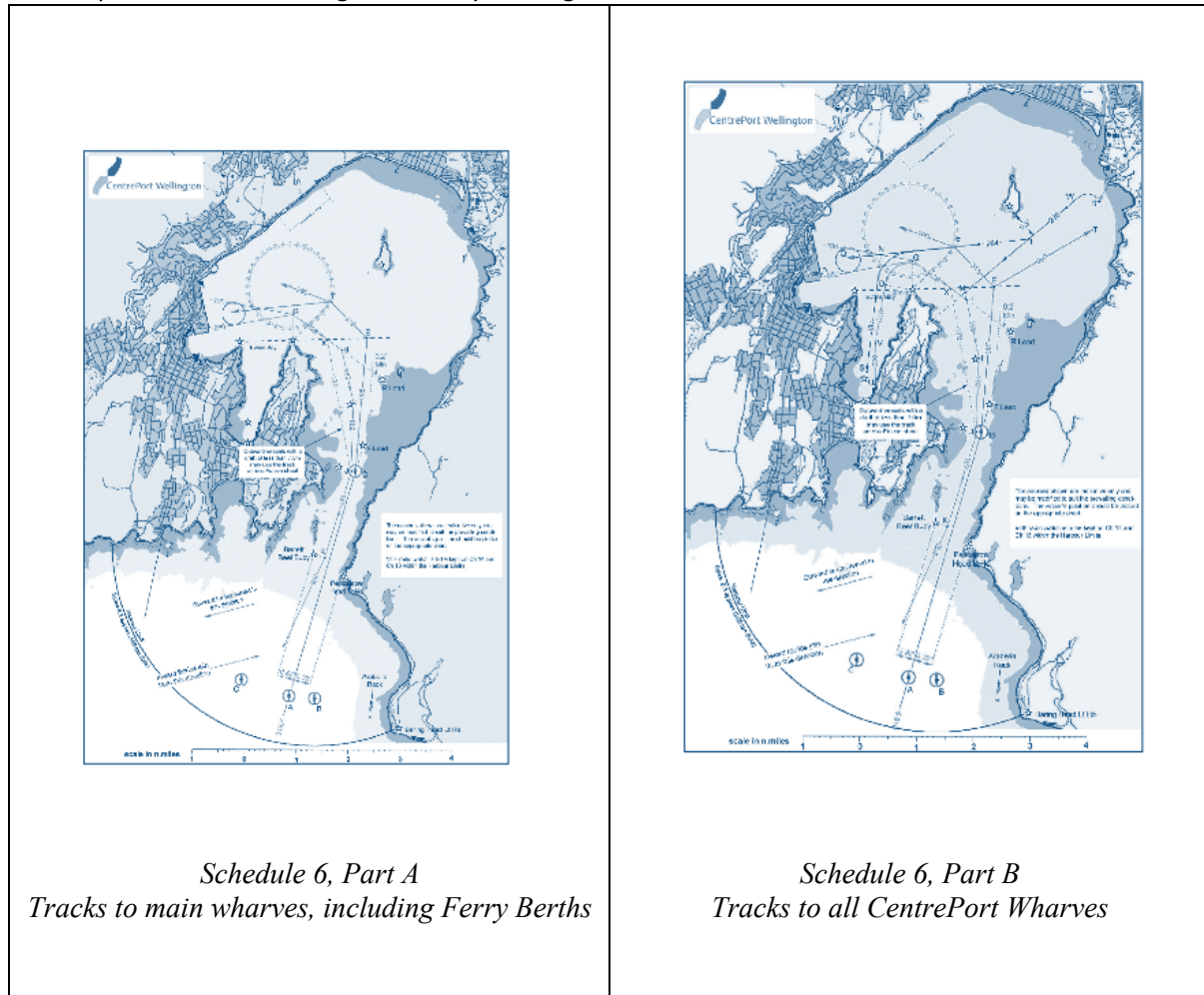


Figure 3
Diagrams from Schedule 6 to Navigation Bylaws

Are the recommended tracks fit for purpose in the current and emerging context?

Recommendations:

- 4 That the recommended tracks be reviewed and amended as appropriate to correspond with any other actions arising from this report.
- 5 That regardless of what other actions are adopted, the recommended tracks be reviewed to alleviate or remove unnecessary doglegs and facilitate the controlled turn method instead of an abrupt waypoint-to-waypoint method.

There was a consensus among stakeholders that the various recommended tracks from the Entrance Channel to the different wharves and berths inside the harbour have worked well over the years. However, in discussions with stakeholders some, if not most, pilots are routinely following a route different from the recommended tracks when tracking from Seaview Wharf and merging with traffic transiting to and from the main wharves.

Also, it is unclear where the recommended tracks begin for an inward bound vessel. The recommended track is superimposed on the extended line of the main leading lights, which extends out past the pilot boarding grounds (on both the chart and Schedule 6 to the Navigation Bylaws). The Bylaws require inbound ships to join the line of main leading lights at least 2 nautical miles south of Barrett Reef Buoy. We therefore assume that it is at this point that the recommended tracks begin. Otherwise, if the

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recommended tracks started further south (e.g. at the harbour limit), then technically ships that join only 2 nautical miles out could be construed as not following the recommended tracks from the harbour limit. The issue is exacerbated by Schedule 6 to the Navigation Bylaws by the inclusion of arrows depicting the **direction** (emphasis added) from which inward and outward ferries join and depart respectively, neither of which aligns with the recommended tracks. This instruction appears to undermine the permitted activity of a ferry joining the line of the leads from further than 2 nautical miles south of Barrett Reef Buoy, and from a different direction.

Further, opinions varied as to whether the recommended tracks through the Entrance Channel worked, or were effective in reducing to ALARP the risk of ships grounding or colliding. Currently, the inbound and outbound tracks are not reciprocal. The inbound tracks follow closely the main sets of leading lights and transits broadly depicting the centre of the navigable channel, whereas the outbound tracks are offset to starboard of the main leads and transits.

There were two main reasons given by those in favour of retaining the current recommended tracks:

- They are familiar with these tracks and they have worked well for many years with few issues
- They felt uncomfortable with the concept of inbound and outbound ships following the same tracks (on a collision course).

And yet, not many pilots and masters were comfortable passing an opposing ship in the narrows off Steeple Rock and Falcon Shoal without deviating off the recommended tracks to achieve a more comfortable passing distance.

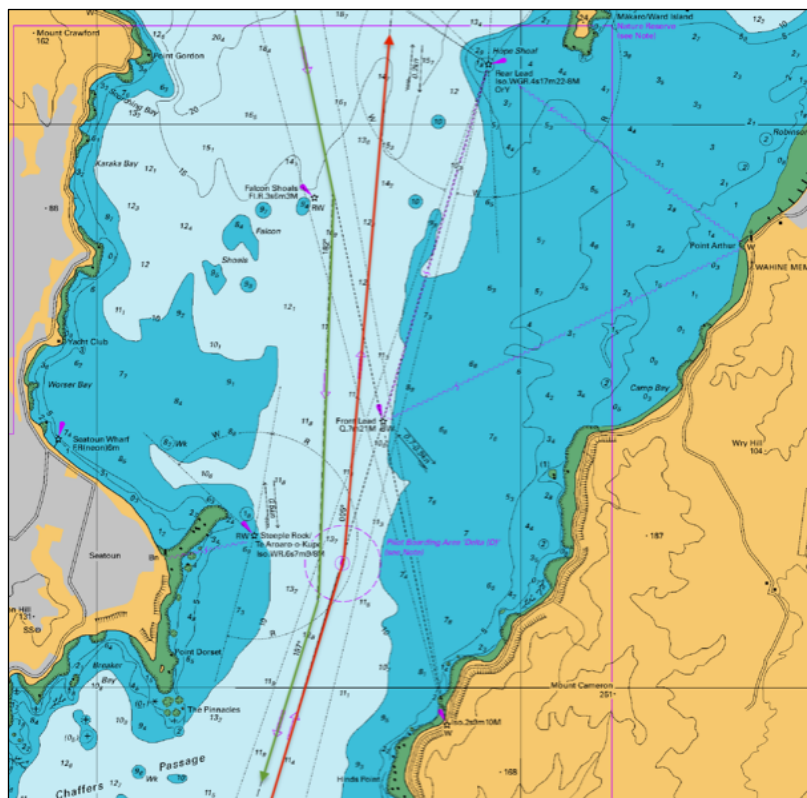


Figure 4

Extract from Chart NZ4633 showing inward tracks highlighted in red and outward tracks in green

Figure 4 shows the recommended tracks for the Entrance Channel published on Chart NZ4633. The inbound bound tracks have been highlighted in red and the outbound tracks in green. The tracks converge to a minimum distance between them of 75 metres just south of Steeple Rock, and then open slightly to 120 metres off Barrett Reef Buoy to the south and to 280 metres off Falcon Shoal to the north.

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Ships with an excess of 25 metres beam frequently transit the Entrance Channel with a combined closing speed of up to 40 knots. Two ships at a 25-metre beam passing off Steeple Rock, and on the recommended tracks, would pass with a 50-metre closest point of approach (CPA), which leaves little margin for human error or mechanical failure. The credible consequences of a ship collision or grounding in this area would be high.

Using the risk concept of reasonable practicability, it is recognised that absolute safety cannot be guaranteed in some circumstances, which permits the duty holder a defence for choosing not to adopt certain risk reduction measures. However, for high-consequence events, if more can be done for very little effort then the failure to do so will probably be considered negligent in the legal aftermath of an incident. The likelihood of ships colliding or grounding in the Entrance Channel would also be high if ships were to routinely pass in this area while maintaining the recommended tracks. We are recommending that GWRC and CentrePort take all reasonable measures to reduce this risk.

Most of the pilot exemption certificate (PEC) masters and pilots consulted expressed concern at passing another ship in this area with such small margins, and some even expressed concern at passing large ships elsewhere in the channel between Steeple Rock and Barrett Reef Buoy. Some were also uncomfortable passing ships in the area off Falcon Shoal, particularly as outbound and inbound ships approaching it can be on a collision course leading up to a course alteration by the outbound ship off Falcon Shoal Beacon. Pilots and masters generally alleviate the perceived risk by either adjusting speed to avoid passing in the narrows or deviating to starboard to increase the passing distance.

There is sufficient sea room to alleviate, if not remove, the doglegs that currently exist around the Falcon Shoal and Steeple Rock area, particularly if the concept of a controlled navigation zone and marginally offset inbound and outbound tracks were to be adopted. Also, the waypoint-to-waypoint style of the recommended tracks is no longer consistent with modern passage planning, which allows for controlled turns to 'ease' onto the next course. We discuss these concepts in the following sections.

There were some pilots and masters who had no issue with passing ships this close in these areas. These are possibly mariners who have a greater appetite for risk, or who do not fully appreciate the consequences if it goes wrong, or they have been doing it for so long the risk has become normalised. In our view, the act of ships passing on parallel course with such small margins for error is an unnecessary risk with potentially catastrophic consequences. The current situation created by the recommended tracks is unlikely to achieve the desired social licence.

This discussion invites two questions:

1. Why are the outbound tracks offset so far to starboard of the inbound tracks that follow the main leading lights and transits? and
2. Do the recommended tracks enhance navigation safety if most mariners are routinely deviating from them to avoid collisions?

Some answers are discussed in the following sections.

Narrow channels

The Entrance Channel is deemed to be a narrow channel under Maritime Rule Part 22 – Collision Prevention, Paragraph 22.9 – Narrow Channels. Paragraph 22.9(1) states that, 'A vessel proceeding along a narrow channel or fairway must keep as near to the outer limit of the channel or fairway which lies on its starboard side as is safe and practicable'.

What constitutes safe and practicable will be determined by many factors including: the size and manoeuvrability of the vessel; its draught in relationship to the available depth of water; what navigational hazards lie near the extremities of the channel; and the weather. It is more likely to be safe and practicable for a small shallow-draught vessel to transit the starboard side or even outside of the navigable channel. Arguably, the safest and most practicable place for a large deeper-draught vessel would be near the centre of the channel as far away from navigation hazards as possible, affording it

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more opportunity to recover from an adverse event or if they are required to manoeuvre for collision avoidance.

The recommended tracks for an outbound vessel already place the vessel to starboard of the main navigable channel, closer to navigation hazards on that side, and leave less room to recover from an adverse situation. If it is accepted that the safest water for a large ship is the deep water in the centre of a narrow channel, and it would appear this has been accepted for inbound vessels, then it could be said that the outbound recommended tracks adversely affect navigation safety, rather than enhance it. That said, there are sections of the channel where the outbound tracks leave more sea room to starboard than the inbound tracks do.

Having the outbound tracks so far to starboard has already been identified as a factor in a fatal collision between an outbound container vessel and an inbound commercial fishing vessel near Barrett Reef in 1996.¹⁵ Although there were many other factors that contributed to the collision, the fact that the outbound container ship was following the recommended tracks on the starboard side of the channel before the event unfolded was a factor.

There is as much justification for outbound ships to utilise the centre of the channel and the associated leading lights and transits as there is for inbound ships. Ships meeting on reciprocal courses is not unusual in most places in the world. It is a situation that is usually resolved with good communication and simple adherence to the collision regulations. When two vessels meet each other head on, each goes to starboard and avoids the other, and this is consistent with the narrow channel rule.

However, there is an argument for having inbound and outbound tracks marginally offset to starboard rather than directly reciprocal. Ships will inevitably deviate left or right of the recommended track as they are influenced by weather, current, tide and the variances of human performance. If two ships on reciprocal tracks were to both deviate marginally to port of the track, each ship would be showing the other a green sidelight, and thereby forcing a decision about whether a port or starboard passing would be more appropriate under the circumstances. If the standard routes are designed to separate the two ships slightly to starboard of centre, the chances are better that each ship will present a more favourable aspect. Each ship would see a red sidelight as they approach, even if they have to move over a little off their route to increase their closest point of approach.

Whether there is sufficient sea room for this to occur safely in the narrow sections of the Entrance Channel is another discussion, which we address in the following section.

4.3 Controlled Navigation Zones

Recommendation:

- | | |
|---|---|
| 6 | The Harbourmaster and CentrePort investigate the feasibility of introducing a controlled navigation zone for the narrow sections of the Wellington Harbour Entrance Channel off Steeple Rock and Falcon Shoal to allow only one vessel of a certain type or parameter to occupy the controlled navigation zone at any time. |
|---|---|

The width of the navigable channel between the 10-metre depth contours either side is between three and four cables (550 to 740 metres) in the Steeple Rock and Falcon Shoal areas. For the most part, smaller-to-average size ships¹⁶ (excluding deep-draught ships or those constrained by their draught)¹⁷ passing in

¹⁵ TAIC Report 96-214, *Collision Between Container Vessel Sydney Express and the Fishing Trawler Maria Luisa, Wellington Heads, 29 December 1996.*

¹⁶ Typically coastal cargo traders of under 10,000 gross registered tonnes.

¹⁷ Rule 22 Collision Prevention – means a power-driven vessel severely restricted in its ability to deviate from the course it is following due to its draught in relation to the available depth and width of water.

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this area could be achieved with some degree of safety, provided the bridge teams are communicating their intentions well.

For larger¹⁸ and sometimes less manoeuvrable vessels, including deep-draught vessels, passing in this area could be considered high risk. This has been acknowledged by many pilots and PEC holders and many simply take action to avoid passing in the area. Others, however, appear equally happy to pass in the area and some without feeling the need to communicate with the other ship.

There is no formal system for managing the navigation of, and communication between, ships transiting these narrows. Instead, these aspects are managed on an *ad hoc* basis, depending on the master and pilot preference at the time. With the trend of an increasing size of Cook Strait ferries and foreign ships we recommend that the concept of a controlled navigation zone be investigated for managing traffic through this area. It could be similar to what has worked adequately for Tory Channel for many years (managed by the masters), or it could be 'managed' (not directed) using Beacon Hill Signal Station (Beacon Hill).

The length of any such controlled navigation zone could vary, depending on the size and type of ships and weather conditions. The length of any such controlled navigation zone may be able to be shortened with some reconfiguration of the channel off Falcon Shoal, which is discussed in the following section. Such a controlled navigation zone need not be as restrictive as the one in Tory Channel. For example, it may be safe to allow ships travelling in the same direction to occupy the zone at the same time, but not allow overtaking.

Should this option be implemented, the recommended tracks within the zone could be adjusted to form a single bi-directional track that aligns with the AtoNs and the deepest water. The recommended tracks leading into and out of a controlled navigation zone could be optimised to give a marginal offset to starboard, while providing maximum opportunity to recover from an adverse event.

We note that currently departing ships are receiving information about other shipping movements when they give a 10-minute call to Beacon Hill. Arriving ships typically receive this information about 30 minutes before entering harbour limits. For a controlled navigation zone to work effectively, Beacon Hill, pilots and PEC masters will need to receive this information much earlier to avoid bottlenecks at either end of such a zone. Systems would need to be established to facilitate earlier access to planned and actual shipping movements in the Entrance Channel.

4.4 Falcon Shoal

Recommendation:

- 7 That one or more of the following options be taken:
 - 7.1 Prohibit ships of over 500 gross registered tonnage (GRT) from transiting west of Falcon Shoal, with a goal of separating large shipping from frequent recreational boating and fishing activity in this area, or
 - 7.2 If outbound ships will be permitted to pass west of Falcon Shoal to achieve greater separation from inbound vessels, then this should be socialised with other harbour users and the recommended track west of Falcon Shoal should be published on the chart, or
 - 7.3 Investigate the feasibility of moving Falcon Shoal Beacon westward and dredging the eastern edge of the shoal to increase the width of the navigable channel in this area. If this option is adopted, then Option 7.1 could be adopted instead of Option 7.2.

Stakeholders have reported relatively few issues with the interaction between recreational craft and large ships, except in the Falcon Shoal area. Both the inbound and outbound recommended tracks (on

¹⁸ Ships typically over 10,000 gross registered tonnes.

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the chart) pass east of Falcon Shoal. West of Falcon Shoal is a popular area for small yacht racing and recreational fishing (see Figure 5).

Historically, outbound ships have used the track west of Falcon Shoal, usually to achieve better separation from an inbound ship. With the increase in the size and draught of Cook Strait ferries, this deviation west of Falcon Shoal has become a less popular option due to the shallower water over the shoal. Nevertheless, both the *Bluebridge* and *The Interislander* have a current outbound passage plan for transiting west of Falcon Shoal, and at least one of the ships routinely uses this passage even when there is no inbound traffic. The time saved by using this passage can be measured in seconds rather than minutes, but the risk of collision with small craft increases significantly.

Stakeholders report several near misses between recreational craft and ships transiting west of Falcon Shoal.

Also, in our opinion, ships that routinely transit west of Falcon Shoal may not be complying with Paragraph 6.2.6 of the Navigation Bylaws, which states they may only deviate from the recommended tracks 'for reasons of navigation safety or pressure of weather'. As mentioned, the route is published in the Navigation Bylaws, but not on the chart. The issue is not free from doubt. We recommend considering the option of prohibiting ships from transiting west of Falcon Shoal Beacon unless it is in exceptional circumstances.



Figure 5
Extract of Chart NZ 4633 showing Falcon Shoal area

As mentioned, however, there is limited room for ships to pass within the navigable channel west of Falcon Shoal Beacon. In fact, this is the narrowest part of the Entrance Channel and involves outbound ships potentially encountering an inbound ship while altering course adjacent to the beacon. If it were feasible to move Falcon Shoal Beacon further west and dredge the edge of the shoal to widen the navigable channel, this would reduce the risk of ships colliding in the area and reduce the need for them to transit west of the beacon. We recommend that this option is explored and the cost versus benefits evaluated with those of an alternate option, which is to include the area off Falcon Shoal in any controlled navigation zone. A combination of both options should also be reviewed.

4.5 Pilot Boarding

Recommendations:

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- 8 Consider moving pilot boarding areas Alpha, Bravo and Charlie south to the harbour and pilotage limits to reduce the potential for conflict between pilot-exempt vessels entering the harbour and those vessels embarking a pilot.
- 9 Review whether there is the need for three pilot boarding areas in such close proximity to the harbour approaches, and if they are all to remain, label them in a more logical way.
- 10 Amend the restrictive wording in the Navigation Bylaws that requires inbound vessels to join the main leads at least 2 nautical miles south of Barrett Reef Buoy, to allow vessels to deviate from this requirement to reduce the risk of collision with vessels manoeuvring to embark a pilot.
- 11 Mandate through the most appropriate means the requirement for pilots and PEC holders to routinely communicate with other ships well in advance of a close-quarters situation developing between their ship and another navigating within or outside in the approaches to Wellington Harbour. This includes ships that a pilot is about to embark or disembark from.

There are four designated pilot boarding areas depicted on the chart. They are marked by the standard chart symbol for a pilot station. Three (pilot stations Alpha, Bravo and Charlie) are located near the entrance about 0.8 nautical miles inside of the harbour and pilotage limits. The fourth (pilot station Delta) is located on the line of the main leading lights adjacent to Steeple Rock.

Alpha, Bravo and Charlie pilot boarding areas are used variously by the pilots, depending on vessel traffic and weather conditions. In the main Bravo, to the east of the line of leading lights, is used in easterly or fresh southerly wind conditions, or when required to separate outbound traffic or inbound traffic approaching from the west. Alpha, on the line of the leading lights, is used in light wind conditions. Charlie, west of the line of the leading lights, is used in northerly and southerly wind conditions but is the most used pilot station for northerly conditions, which is the prevailing wind (see Figure 6).

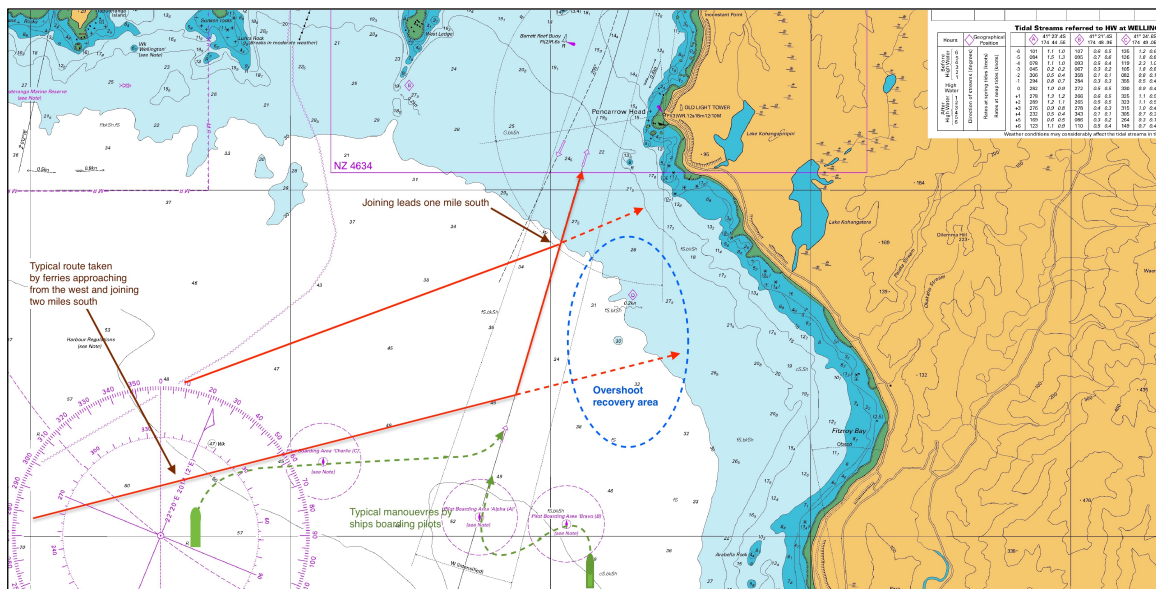


Figure 6

Extract from Chart NZ4633 showing potential conflict between vessels near the pilot boarding grounds

Some time before the establishment of the four pilot boarding areas, a Harbourmaster's directive was issued to require ships approaching from the west and intending to use the leading line to be established on the leading line at least 2 nautical miles south of Barrett Reef Buoy. This directive was aimed at creating a natural separation between ships arriving from the west and those departing the harbour to the west.

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This instruction was mainly directed at pilot-exempt ships (the Cook Strait Ferries) that could enter the harbour without needing to board a pilot.

A consequential benefit of the 2 nautical mile rule is that in the event of a ferry overshooting the leading line due to distraction or otherwise, the ship has more sea room to recover the leading line before grounding in shoal water. A ship joining 1.5 nautical miles south of the buoy would have about 1 nautical mile before grounding in the shoal water ahead (3 minutes at 20 knots). A ship overshooting when joining 1 nautical mile south of the buoy, as shown in Figure 6, has about half (0.5) a nautical mile before grounding in the shoal water ahead (1.5 minutes at 20 knots).

For the reasons given above, the joining 2 nautical mile south rule is a good one and should be retained.

However, the typical track for ferries approaching from the west passes close to or through the Charlie boarding area, which creates a natural area of conflict. While the channelling of ships into harbours inherently creates close-quarter situations and risk of collision, it is important that procedures for managing harbour traffic mitigate the risk as far as is reasonably practicable.

The problem arises from the combined effect of the Navigation Bylaw that prohibits ships from joining the leads closer than 2 nautical miles and the subsequent placement of the pilot boarding areas in the same area. The two actions are coercing ships to occupy the same space unnecessarily. While it is true that Cook Strait ferries can join the leads from further south, they will still need to transit through the pilot boarding areas at some point, so this does not resolve the issue.

Collisions around pilot boarding areas are not uncommon around the world. A typical piloted ship will have a bridge team comprising a master, duty officer and helmsman. For the pilot transfer, the duty officer will usually be sent down to check the ladder and escort the pilot to or from the bridge. This means on nearly every ship, during the 5 to 10 minutes when the ship is manoeuvring to board or disembark the pilot, the master will be on the bridge alone with the helmsman. The risk of the master becoming overloaded or losing situational awareness is higher than at any other time in the pilotage. Routeing ferries through the same area unnecessarily increases the risk of collision.

For the most part, incidents are not occurring during good weather. The approaching ferries are not under the additional pressure of managing their course and speed in response to adverse sea conditions, and the task of pilots directing and boarding their ships is not as intense. However, during adverse southerly conditions ferry masters may like to vary their approach to the harbour to increase passenger comfort and prevent damage to vehicular freight. The pilot's task of directing and boarding a ship requires their full attention because it is more difficult and therefore risky.

Planning ahead and good communication is key. From our discussions with the various stakeholders, broadly speaking, those masters and pilots who routinely plan well ahead and communicate well with other ships unsurprisingly tend to have less concern about the natural conflict in the pilot boarding areas and tend to be involved in fewer incidents.

We also question the need for three pilot boarding areas, particularly if they are all moved southward to the harbour limit. Anecdotal evidence suggests that arriving ships can be confused by a direction to proceed to a particular pilot boarding area. It is not until they zoom in on the Electronic Chart Display and Information System (ECDIS) that the delineation between them becomes clear. Even then, the three boarding areas seem to be in no particular order, left to right versus right to left. Alpha is on the leads, Bravo is to the east and Charlie is to the west.

We suggest three options to consider for resolving the issue:

- 1 The first is to move the pilot boarding areas south to the harbour and pilotage limit. This could extend the pilotage task some 0.8 nautical miles seaward, but the benefits in reducing the risk of collision will likely outweigh this disadvantage. Also, pilots may still direct ships closer in if there is no conflicting traffic.
- 2 The second is to allow PEC masters more discretion to deviate from the requirement to join the leads at least 2 nautical miles out to reduce the risk of collision, but only for that reason and no other. Currently the Navigation Bylaws allow this for '*pressures of weather*', but not

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for collision prevention. Obviously, a master has the overriding authority to act in the interests of good seamanship and safety. However, many PEC masters expressed a reluctance to deviate from the instructions for entering the harbour and the instruction to follow the recommended tracks due to the way they have been worded. If the pilot boarding areas are moved further south, the need for ferries to deviate from the recommended tracks should reduce.

- 3 The third is to foster a culture of planning ahead, so there is a requirement that could be imposed for those with the conduct of each ship to communicate their intention to each other, rather than adopting the dangerous practice of making assumptions on what will happen next. This will require a coordinated approach involving CentrePort and the various pilot-exempt ship operators, possibly with the need to mandate the practice through Navigation Bylaws. This option should be considered regardless of Options 1 and 2.

We are recommending that one or a combination of these three options be adopted.

4.6 Pilot Area Delta and Pilotage by Leading

Recommendation:

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|--|
| <p>12 Consider removing pilot boarding area Delta from chart NZ4633.</p> |
|--|

Pilot station Delta has been created to allow for the practice of 'pilotage by leading' if a pilot is unable to embark or disembark due to pressures of weather. Pilotage by leading is currently not being routinely practised in the port, although CentrePort has retained a current procedure to follow should it be required.

Stakeholder feedback suggests that pilotage by leading will not take place for inbound vessels, except for emergency situations such as a medical emergency. The risks are considered too high, and we would agree. There is a global concern over falling standards of seafarers world-wide. While the pilot may be able to brief a master and talk the ship in, the pilot will have limited ability to assess the competence and culture of the bridge team remotely. Even if it was decided to lead a vessel in, the Delta pilot boarding area holds little significance. The pilot will choose at what point he or she will board regardless of the Delta boarding area. The same applies to where a pilot may choose to disembark before 'leading' the ship out to the pilotage limit.

A case in point was the entry of the fishing vessel *Viking Bay*, which due to the high Covid risk on board was deemed too risky for a pilot to board. A risk assessment was conducted involving the appropriate authorities and the vessel was led to the berth by the pilot.

There is another potential issue with the Delta pilot boarding area. Maritime Rule Part 90 – 90.24(6) does not require a ship to carry a pilot '*... when a ship is transiting between the parameter of the pilotage area and the designated pilot boarding station or anchorage within that pilotage area with the prior approval of the pilot*'.

The footnote to this paragraph further explains that:

... such approvals must only be given in accordance with the pilotage provider's SOPs and may not be appropriate in all pilotage areas or circumstances. Where adopted, such arrangements must be agreed between the pilotage provider and the harbourmaster. Approvals may be relayed to a ship by an appropriately qualified person, other than a pilot, who is designated to do so in accordance with those SOPs.

The circumstance described above is different from pilotage by leading. Technically, with the existence of the Delta pilot boarding area published on the chart, a pilot, or Beacon Hill on the pilot's behalf, could authorise a ship to transit to this area without being led. The caveat is that this decision must be made in accordance with CentrePort's standard operating procedures, which must be

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agreed by the Harbourmaster. CenterPort has wisely chosen to use its Procedure 4.50 – (Leading in During Adverse Weather or Unable to Board) to manage this situation.

However, there is the potential that this situation is inadvertently confused with pilotage by leading, or a simple communication error between Beacon Hill and an inbound vessel resulting in that vessel proceeding up the channel without being led by a pilot. The risk is small for pilot boarding areas Alpha, Bravo and Charlie, as these areas are only just inside the pilotage limits. For pilot boarding area Delta, however, a ship could inadvertently navigate arguably the most difficult portion of the pilotage without a pilot on board and without being led.

The Delta pilot boarding area therefore appears to hold little significance. A pilot can choose anywhere along the port pilotage plan to embark or disembark a vessel, depending on the circumstances. Because the pilotage by leading procedure is currently used regardless of whether the vessel is navigating within the harbour under Maritime Rule Part 90.24(6) – Approval to Navigate to a Pilot Boarding Area or Maritime Rule Part 90.23(b) – Pilotage by Leading we are recommending that the Delta pilot boarding area be removed from the chart to avoid any doubt.

4.7 Application of Collision Prevention Rules Near Narrow Channels

Recommendation:

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|----|--|
| 13 | Conduct a workshop involving experienced pilots, PEC holders and experts in maritime law to work through the various collision prevention scenarios that are typically encountered in and around the Wellington Harbour Entrance Channel, with a view to developing guidance for inclusion in pilotage training and standard operating procedures. |
|----|--|

There has been much interest in the recent judgment of the United Kingdom Supreme Court in the case involving the collision between the container ship *Ever Smart* and the Very Large Crude Carrier (VLCC) *Alexandra 1* off the port of Jebel Ali on 11 February 2015. We refer to this case as there are some learnings that are of relevance to the Entrance Channel.

In brief, the *Ever Smart* was outbound from Jebel Ali and had been navigating along the [narrow] channel. She had exited the narrow channel when the collision occurred. At collision, her speed over the ground was 12.4 knots. *Alexandra 1* was inbound to Jebel Ali, but had not entered the channel as she was waiting in the pilot boarding area to pick up a pilot. She was moving over the ground very slowly, approaching the channel but with a varying course. At collision, her speed over the ground was 2.4 knots. Although it was night-time, there was good enough visibility for the vessels to have seen each other from about 23 minutes before the collision. For the whole of that period, the two vessels were approaching each other on a steady bearing.

The similarities with the Wellington situation are obvious, as ships are entering and exiting a narrow channel near the area where some are manoeuvring to embark or disembark a pilot. The judgment distinguishes between when a crossing rule (give way to starboard) becomes displaced by the narrow channel rule. The normal head-on or crossing rules would apply to a ship that is manoeuvring variously (regarding course and speed) on approach to a pilot station or manoeuvring to embark a pilot (sometimes on a pilot's advice). That is, the narrow channel rules would not yet apply to this vessel.

On the other hand, the crossing rule might be displaced by the narrow channel rule when a ship is approaching Wellington with the intention of navigating along the narrow channel, either having embarked a pilot or they are not required to embark one. That is, '*when the approaching vessel is shaping up to enter the channel, adjusting her course so as to reach the entrance on her starboard side of it, on her final approach*'.

In our opinion, the judgment has the effect in some circumstances of extending the limits of the narrow channel beyond those published for the purposes of collision avoidance. In the Wellington context, the judgment covers the situation when a ship is outbound from the channel and another

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is manoeuvring to pick up a pilot. The judgment does not cover the scenario of an arriving ship conflicting with a ship manoeuvring to embark or disembark a pilot. Mariners would be forgiven for thinking that the normal head-on and crossing rules would apply in that case, but the judgment casts some doubt if one ship is said to be '*shaping its course for its final approach to the narrow channel*' and the other is not.

The other and perhaps more common scenario is an outgoing ship in the narrow channel when a ferry approaching from the west is '*shaping up on its final approach for the entrance to the narrow channel*'. Applying the crossing rule, the outgoing ship is the give-way vessel, yet it may not be able to adjust its course to starboard while still in the channel, and once out of the channel it may have limited time and room to take action that is early and substantial enough to avoid a collision. This scenario is exactly why the Navigation Bylaws mandate ships intending to enter the narrow channel to do so from at least 2 nautical miles south of Barrett Reef Buoy.

The judgment tends to reinforce the Navigation Bylaw rule, which is that ships approaching the narrow channel should do so in a manner consistent with the narrow channel rule (taking the starboard side) when there is opposing traffic. If it is accepted that the narrow channel can include the approaches to it, then ships should be allowing sufficient sea room by taking the starboard side of the channel further south when there is opposing outbound traffic. If, however, there is no outbound opposing ship then it may be preferable to join the leads further in, rather than risk collision with another ship manoeuvring to pick up a pilot. However, as mentioned in Section 4.5, this should not be so far north that there is insufficient room to recover from an overshoot of the leading line without significant risk of a grounding.

It will be more complex when there are inbound and outbound ships, as well as ships manoeuvring to embark or disembark a pilot. Recommendations 8 through 11 made in earlier sections should help alleviate the risk in these situations.

However, it is important that pilots and PEC holders fully understand the complexities of the collision prevention rules in and around the approaches to harbours. Working on the theory that prevention is more desirable than learning from a judgment following a serious collision, we are recommending that the various scenarios are workshopped with the inclusion of experts in maritime law, and the results included in training and standard operating procedures.

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4.8 Wellington Harbour Radio (Beacon Hill Signal Station)

Recommendations:

- 14 Extend the harbour camera system available to Beacon Hill Signal Station to include coverage of the inner harbour, including Evans Bay.
- 15 Extend the radar coverage for Beacon Hill to cover the inner harbour as well.
- 16 Develop a system to audit the performance of Beacon Hill to ensure adherence to agreed performance standards and standing operating procedures.
- 17 Review the pilotage by leading procedure and the Beacon Hill communication procedures to ensure Maritime Rule – Part 90 is being adhered to, and that there is a clear distinction between information being passed to a ship and an instruction from the pilot.
- 18 Undertake an analysis to consider the cost versus the benefits of relocating Wellington Harbour Radio from Beacon Hill to a more central location. The costs of implementing Recommendations 14 and 15 should also be considered.
- 19 If Wellington Harbour Radio remains located at Beacon Hill, consider replacing the tinted windows in the Beacon Hill Signal Station with retractable sunshades.

Wellington Harbour Radio is located and operated from the Beacon Hill Signal Station high on the hill above Seatoun overlooking the Wellington Harbour Entrance Channel. Operators are afforded expansive views of the Entrance Channel from a direction overlooking Falcon Shoal to the north and the entire approaches to it to the south.

Beacon Hill has been designated as a Local Port Service (LPS). An LPS may be established when, in the opinion of the contracting state,¹⁹ the volume of traffic or the degree of risk does not justify exercising their rights under the International Convention on Safety of Life at Sea 74/78 (SOLAS) to establish Vessel Traffic Services (VTS).²⁰

The IALA guidelines state that:

... where a Contracting Government is of the opinion that the navigational complexity, volume of traffic or the degree of risk does not justify exercising their rights to establish VTS under provisions of SOLAS, there may be a need for information to be exchanged between ship and shore to ensure efficient handling of shipping and in-port processes. In such circumstances, it is particularly important that mariners are left in no doubt that they are communicating with local port services and not with a VTS.

The guidelines further note that:

Personnel providing such local port services should restrict communications to the provision of basic factual information and avoid opinion, advice or instruction that might be provided through a VTS by personnel who have undertaken specialist VTS training.

We are of the opinion that an LPS is the appropriate service for Wellington Harbour, and that this is adequately acknowledged and documented in the various Beacon Hill manuals and standard operating procedures.

¹⁹ States that have contracted to SOLAS through IMO – in this case administered by New Zealand’s Maritime regulator, Maritime New Zealand.

²⁰ IALA Guideline G1142 – The Provision of Local Port Services Other Than VTS (1st Edition), December 2018.

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Some stakeholders commented that there have been occasions, albeit rare, when Beacon Hill operators may have exceeded their jurisdiction and given navigation instruction. However, of those operators spoken with there was a good understanding of their role. We note that recently all Beacon Hill operators have undergone a 1-week refresher training that has reinforced this understanding.

We have alluded to the possibility of establishing a controlled navigation zone for the narrow sections of the Entrance Channel, which could either be self-administered by the pilots and PEC masters or administered/controlled by Beacon Hill. In our opinion, Beacon Hill could administer such a scheme within its status as an LPS. However, there would be a need to develop standard operating procedures and provide Beacon Hill operators with training in advance.

Beacon Hill has recently been upgraded with the construction of a new purpose-built signal station, and it has been equipped with modern navigation, communication and monitoring equipment in line with its purpose.

The radar coverage does not cover the inner harbour. In our opinion, it would enhance navigation safety if camera coverage was provided and radar coverage was extended to cover all major areas of Wellington Harbour. This would be particularly useful when managing an event in the harbour, and would help operators maintain situational awareness during times of poor visibility when the signal station can be enveloped in fog or cloud, as happens from time-to-time.

The 'cab' of the signal station is fitted with floor-to-ceiling, angled, permanently tinted glass windows. Operators report that during darkness the tinting can adversely affect the visibility of lights in the channel, particularly those of small vessels. Some of the various AtoNs around the harbour are also reportedly difficult to see. We recommend that in due course the windows be replaced with clear glass and that suitable retractable sun filters be installed to help control temperature and glare.

Beacon Hill is manned 24 hours, 7 days a week by a single operator. The staff are made up of a mix of permanent and part-time operators. The usual risks associated with single-person night operations will need to be carefully managed, but we saw no evidence that they were not. However, given the importance of Beacon Hill's function, we are also recommending that a system of audits and assessments be developed to ensure standards are maintained at an acceptable level. These could take the form of actual assessments or audits of communication recordings, or a combination of both.

Having Beacon Hill located where it is has obvious benefits, as operators can visually observe activity in the Entrance Channel most of the time. However, due to its height above sea level, the signal station can become enveloped in fog or low cloud, at which times they lose that benefit.

As alluded to above, there are some challenges regarding single-person staffing at a remote location. Advances in technology allow the same or a similar service to be provided at a more central location (e.g. within the Harbourmaster or CentrePort offices). While there may be some down sides to such a move, there would be considerable opportunity to improve efficiency. The risks associated with a remote signal station appear to be adequately managed for now. However, the potential benefits might warrant moving the operation to a more central location. We are recommending that a cost-benefit exercise be undertaken to establish whether the costs of relocating the signal station are outweighed by the benefits. If a controlled navigation zone in the Entrance Channel is established, then Beacon Hill's role in that scheme should be considered as part of that analysis.

Communication

We have alluded to the benefits of good communication between pilots, PEC masters and masters of ships manoeuvring to embark or disembark a pilot. Good communication is critical to reducing the risk of collision in the harbour and its approaches, particularly in the vicinity of the pilot boarding areas. This communication begins when the pilot is transiting to the pilot boarding area on the pilot boat. According to some stakeholders, there is an area in the harbour where very high frequency

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(VHF) transmission between the pilot and a ship waiting to embark the pilot near the pilot boarding ground is affected by the topography of the harbour.²¹

On occasion, it appears a pilot passes instructions to the ship via the Beacon Hill operator. While this may be considered to be an efficient use of Beacon Hill, some care will be required as this begins to cross the boundaries of pilotage by leading and the status of Beacon Hill as an LPS only. Care will be needed to ensure the receiving ship understands the status of the message (i.e. differentiates between an instruction from the pilot via Beacon Hill as opposed to an instruction directly from Beacon Hill).

One remedy is to address the VHF transmission issue between the inner and outer harbour by using a repeater station or some other equally effective means. Also, we recommend a review of the pilotage by leading standard operating procedure and the applicable Beacon Hill procedures to ensure they are in line with the legal requirements set out in Maritime Rule Part 90.

Most pilots spoken to said they consider they have taken over communications with the ship when the pilot boat is in the Entrance Channel, and they have the subject ship in sight or can communicate directly with it. As Beacon Hill will invariably have been passing information to the inbound ship, it would be good practice for there to be a formal 'handover' of communications from Beacon Hill to the pilot, or vice versa.

4.9 Over 18-Metre Vessels

Recommendation:

- 20 The requirement for small vessels to keep clear of large vessels within Wellington Harbour are adequately covered by the over/under 500 GRT rule and the narrow channel rule for vessels under 20 metres. We recommend reviewing the requirement for vessels over 18 metres to follow the recommended tracks.

It is not clear historically why 18 metres was chosen as the length for vessels required to follow the recommended tracks. It was possibly an attempt to reduce the risk of collision between smaller commercial vessels and recreational craft. However, as mentioned the requirement is applicable only to vessels over 18 metres that transit the Entrance Channel, then to and from the main wharves and ferry berths. They are not required to keep to the recommended tracks elsewhere in Wellington Harbour.

The Entrance Channel is a designated narrow channel. The collision prevention rules require vessels under 20 metres in length to not impede the passage of ships that can safely navigate only within the narrow channel. The Navigation Bylaws, however, require vessels of 18 metres in length or more to follow the same recommended tracks that ships must follow. This has the effect of compelling smaller vessels along the same tracks that large ships can only follow, whereas most smaller vessels can safely navigate outside of the narrow channel, where they are less likely to impede the passage of large ships.

There were at the time of writing several smaller craft that were caught by the 18-metre rule requirement:

- The Police Launch
- The new East-by-West passenger ferry
- The CentrePort tugs

²¹ VHF transmission is line-of-sight. The surrounding hills stand between the pilot boat transiting the inner harbour and a ship in the approaches to the harbour.

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- The pilot launch.

In our opinion, the requirement for smaller craft to keep out of the way of larger craft is adequately covered by the 500 GRT rule and the narrow channel rule.

The 18-metre rule arguably increases the risk of a collision between ships and small commercial vessels, so we recommend that it be reviewed for effectiveness and practicality.

4.10 Reporting of Operational Defects

Recommendation:

- 21 Include the definition of reportable defects as worded in Maritime Rule Part 90 – Pilotage in the Navigation Bylaws and in the pre-arrival information for ships.

Accidents due to failure of critical manoeuvring systems is a current and evolving risk in most ports. It has been acknowledged by the maritime industry (including the IMO) that there has been a disturbing global decline in the competency of navigation and engineering crews. This means not only a decline in ship maintenance and repair, but also in the standard of crew resource management in reacting to a mechanical failure. For example, failure to communicate an emerging problem has been a factor in all three major groundings at the Port of Tauranga in recent years. There have been several historical incidents involving system failures with Cook Strait ferries, and in more recent times a propulsion failure involving a foreign-registered passenger cruise ship.

Although there has been an attempt at a global level to reverse this trend, there is unlikely to be a significant improvement in the short term. Port companies will need to factor this into their own thinking when designing their safety management systems. State regulators will also need to factor this into their regulatory and compliance monitoring regime.

A ship arriving or departing port involves the transition of a several systems between deep sea and port mode. For example:

- Changing of fuel systems
- Changing generator configuration and capacity
- Changing from deep sea to port manoeuvring systems (the main engine(s) may not have been operated astern for several weeks)
- Bringing online manoeuvring systems such as bow and stern thrusters
- Bringing online systems that have undergone major maintenance or repair at sea or in port.

These transitions have the potential to impact the functionality and reliability of a ship's propulsion or manoeuvrability. It is good practice to ensure that the changeover of steering and propulsion-related systems is completed and tested prior to commencing pilotage.

Section 6.1 of the Navigation Bylaws – Directions for Transiting Wellington Harbour Entrance state:

The master of any vessel entering Wellington Harbour must call Wellington Harbour Radio on VHF Channel 14 and report their intention to enter the harbour. They shall also inform Wellington Harbour Radio of 'the operational status of the vessel'.²²

Maritime Rule Part 90 requires that:

In addition to any other legal requirements for reporting, where a ship has defective propulsion, manoeuvring or communications equipment, or any other condition which may adversely affect its operational capability, the master must— (a) where rule 90.23 applies, report the defect to and consult with the pilot before the ship is navigated within the pilotage area 13; or (b) where rule 90.24

²² Wellington Navigation Bylaws, Paragraph 6.1.1 (c).

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applies, report the defect to and consult with the harbourmaster before navigating the ship within the pilotage area.

Further, a footnote to Maritime Rule Part 90 says:

The harbourmaster should establish protocols for the pilotage area for the reporting of defects and consultation by PEC holders in such situations. For example, reporting may be to the local harbour control service initially who will contact the harbourmaster, and reporting of defects to the port operator or pilotage provider may be stipulated as well.

The current wording and requirements for reporting ship defects at Wellington fall short of the requirements of Maritime Rule Part 90. Observations during the consultation phase of this review indicate that the reporting has become a routine, almost automatic, reporting regime between masters and Beacon Hill, with only obvious major defects such as loss of an engine being disclosed. Some masters were not familiar with the full extent of the reporting required under Maritime Rule Part 90.

Masters on foreign ships are unlikely to be familiar with the Maritime Rule Part 90 requirements. Pre-arrival information to, and declaration by, masters is a useful mechanism for ensuring the full and correct information on the operational status of ships is being received by the pilots and the Harbourmaster.

We are recommending that the process for reporting, receiving and responding to ship defects be reviewed and upgraded to be consistent with Maritime Rule Part 90.

4.11 Aids to Navigation (AtoNs)

Recommendations:

- 22 In the short term, review the configuration, location and direction of any new and existing AtoNs marking the leading lines/transits to align with any changes made resulting from this review.
- 23 In the longer term, or as part of Recommendation 24, consider installing sets of port and starboard 'side leading light beacons' parallel to the main leading lights with a view to creating a corridor from the harbour entrance to Steeple Rock, or installing alternative modern AtoNs that achieve the same effect.
- 24 In the longer term, consider the use of virtual AtoNs to mark navigation hazards where it is not feasible or practicable to install physical AtoNs, or to temporarily replace physical AtoNs that become damaged, lost or inoperable.

In the main, stakeholders were generally happy with the number and quality of the AtoNs provided around Wellington Harbour. That said, recreational users were happy based on their ability to use the main AtoNs primarily to assist vessels using the main channels and recommended tracks. Smaller vessels using these AtoNs will of course be operating in the same space as those larger vessels that follow the recommended tracks, potentially creating a conflict.

However, there are some improvements that could be considered when planning future enhancements to the network of AtoNs.

There are currently only two sets of leading transit light beacons marking the Entrance Channel. They are the main leads (017/197 degrees inbound/outbound) and the transit between the front lead and an isometric light beacon located on the shore near Hind Point, which provides a transit for outbound vessels (168 degrees) as they track southward towards Falcon Shoal Beacon. Both these transits are enhanced with an intensified white sector extending either side of the main transit line. Some stakeholders opined that the rear lead can be difficult to detect in the back scatter of lights of Lower Hutt, and one stakeholder thought the daylight visibility was poor unless the intensified daylight mode

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was switched on (referring to the colour and state of maintenance of the actual structure). These are areas that could be reviewed to improve the effectiveness of these leads.

There is an intensified white-green sector light emitting Northwest from the main rear lead at Hope Shoal. However, the narrow intensified white sector from this light does not align with the 126-degree recommended track from the main wharves and ferry berths. Pilots and PEC masters tend to align the rear lead with a light on top of the bus terminus near Point Arthur. There are no 'official' transits marking the section of the channel between Steeple Rock Light and Falcon Shoal Light, once turned onto the 182 degrees recommended track outbound or the 005 degree track inbound. For this sector of the channel, navigators are more reliant on electronic navigation aids and line of sight navigation based on single visual reference points provided by Falcon Shoal and the Front Leading Light beacons.

Pilots and PEC masters have adapted to using an array of other unofficial transits and points of definition on the shore to monitor their vessel's progress in good visibility.

The main leading lights are highly visible at night and the intensity can be increased during daylight hours on request when there is poor visibility. The intensified white sector emitting from the rear lead broadly indicates a navigable channel along the line of the main leads, albeit narrowing the further north ships transit up until Steeple Rock. The transition from intensified to non-intensified gives an indication of the lateral position in the channel, as does any lateral offset of the leading light beacons. However, these features do not provide a definitive visual measure of how far a ship is laterally displaced from the line of the leads, and thus how close to the side of the navigable channel it is without the use of electronic navigation aids.

It might be feasible to install sets of parallel port and starboard leading light beacons either side of the main leading lights (see Figure 7 for an example), or to adjust the configuration and characteristics of the existing leading light beacons to provide the same effect.²³ This would provide an additional visual reference either side of the main leads to better indicate how far displaced a ship is from the main leads. It would have the added benefit of providing alternate leading lights near the extremities of the navigable channel for small shallower draught vessels to use, rather than them using the main leads and risk impeding the passage of large vessels, particularly at night.

An alternative to side leads would be marking the sides of the main navigable channel with buoys. However, the extremes of sea conditions experienced in the outer channel would make this difficult and the positioning of the buoys potentially unreliable. There is an argument that the presence of additional buoys in the area provides more 'targets for vessels to hit', particularly in heavy southerly conditions.

Virtual AtoNs would provide an alternative to physical buoys without the added cost and risk and these are being increasingly used globally. The reliability has improved since the adoption of performance standards through the IMO and the International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA).

However, the use of virtual AtoNs was only intended by the IMO and IALA to be used to mark hazards that are difficult or impracticable to mark with permanent structures or buoys. An example would be marking the deep-water channel across a bar harbour that is forever changing. Another intended use was to temporarily mark a hazard where the permanent mark has been lost or damaged or is inoperable.

One disadvantage of virtual AtoNs is they are only visible to vessels that have Automatic Identification System (AIS) capability. Nevertheless, AIS has become a standard feature of SOLAS and coastal fleets and is becoming more widely used on small commercial and even recreational vessels as less sophisticated models come on the market and the cost of installation decreases.

We are recommending GWRC explore the potential use of virtual AtoNs in Wellington Harbour in accordance with IMO, IALA and Maritime New Zealand guidelines.

²³ One stakeholder referred to the leading light system used in Copenhagen.

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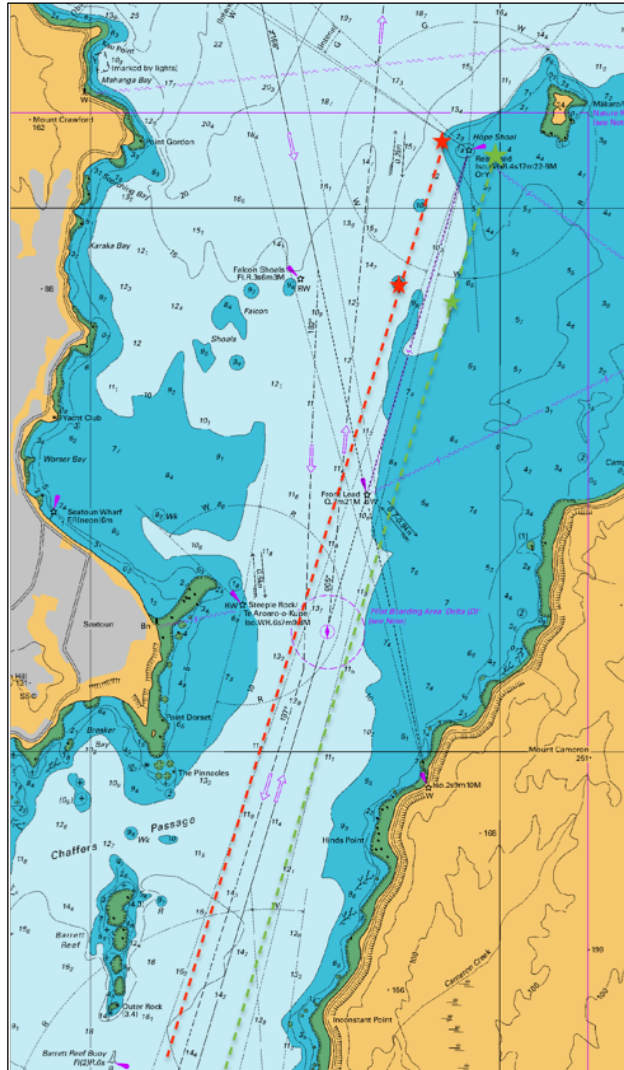


Figure 7
Extract from Chart NZ4633 showing example of side leads

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4.12 High-Density Electronic Charts (bENC)

Recommendation:

- 25 CentrePort and GWRC request Land information New Zealand (LINZ) to produce an official 6ENC that can be loaded on the ship's ECDIS.

CentrePort currently use a high-density electronic navigation chart (ENC) that is loaded on the portable pilot units (PPU). This enhanced electronic chart is updated with data from the latest hydrographic survey. The chart is referred to as a 6ENC, which means the safety depth contours are rounded to the nearest 1 metre or less. A standard 5ENC rounds up or down to the nearest 5-metre safety depth contour, which is the standard used by most hydrographic service providers such as LINZ.

6ENC charts (commonly referred to as bENCs) will provide the user with more accurate data on where the ship can go before running out of UKC, which is particularly useful when managing an incident. For example, when a ship deviates substantially from the planned track and the bridge team are assessing the best action to avert a grounding or regain the track.

A problem arises, however, when the ship's ECDIS is using a 5ENC and the pilot is using a PPU loaded with a 6ENC. The pilot and master are then not working from the same dataset and are not privy to the same information. The master using the ECDIS can receive a false impression of where the ship will start running out of UKC.

It is not uncommon for pilotage providers to request production of official 6ENC charts for their port and harbour charts, so that they can be loaded onto the ship's ECDIS.

A 6ENC would be particularly useful when piloting deep-draught vessels. These can be used to plan a deep-draught route for ships, which can be replicated on the ship's ECDIS, thus providing a back-up should either the PPU or the ECDIS fail.

We are recommending CentrePort and GWRC request that LINZ produces a 6ENC chart for the Entrance Channel and adjacent waters. The data from hydrographic surveys can be used to update the 6ENC periodically.

4.13 Tug Suitability and Capability

Recommendation:

- 26 CentrePort and GWRC use a structured Management of Change process to review future tug requirements, including the risk of having to provide towage assistance in the waters of the Wellington Harbour Entrance Channel.

The CentrePort tug fleet includes two modern Azimuth stern drive (ASD) tractor tugs, each having a 68-tonne bollard pull. ASD tractor tugs are specifically designed as berthing tugs. They are highly manoeuvrable and have sufficient combined power to assist high-sided ships such as passenger, container and car carriers to berth and unberth in a range of wind conditions typically experienced at the port. Consequently, they are not well suited to operating in high waves and they have limited escort capability due to their limited ability to tow from the stern.²⁴ Also, the tugs are not fitted with a substantial skeg, which limits their usefulness in escorting ships using the indirect pull method.²⁵

²⁴ The main towing winch is located at the bow.

²⁵ Typically used at higher ship speeds from between 5 and 10 knots where pull on the towline is generated by hydrodynamic forces on the tug skeg as the tug is driven at an angle to the ship's direction of travel.

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All tug types have strengths and weaknesses that need to be considered in the specific Wellington operating context. The current tugs are well suited to direct pulling in sheltered waters when assisting ships to manoeuvre to and from the berth.

However, from a broader perspective, pilotage and harbour limits extend out to the often rough waters of the Entrance Channel and beyond to the harbour limits.

There is a credible risk that a ship could become disabled and ground or require assistance outside of or within the outer part of the Entrance Channel. This could happen in any weather and sea state, including when sea conditions are beyond the current tug capability. This scenario represents a potentially significant risk to the port and the wider Wellington Harbour area from a ship safety, commercial and/or environmental perspective. A scenario where the Wellington tugs are unable to deploy (through choice of design) and help avert a shipping casualty in the Entrance Channel is unlikely to receive the ongoing approval, or social or ongoing acceptance, of the general community.

There is a common misconception that the only tug type capable of working effectively in the Entrance Channel would be an ocean-going salvage tug. This would be true for the worst southerly conditions typically experienced. However, adverse events can happen in any weather conditions, even in calm conditions where the current tug fleet can work effectively. This was the case recently when a passenger cruise ship became disabled in the Entrance Channel in good weather conditions.

We are recommending that when considering replacement and future tug capability, consideration be given to purchasing tugs that have better capability for working and escorting in a seaway than the existing tugs. Such tugs would not be capable of operating safely in the worst credible conditions, but at least would improve the emergency response capability in more than calm conditions. Weather criteria can be developed to limit the sea state in which current and future tugs can safely and effectively operate.

4.14 Dynamic Under-Keel Clearance (DUKC)

Recommendation:

- 27 The requirement for DUKC for ships that meet certain criteria for draught and dimensions to be included in the Navigation Bylaws or be mandated through some other mechanism.

Currently, CenterPort uses the key parameter for static UKC of 1.5 metres for the Entrance Channel, which provides a safety factor allowance for ship squat at reduced speed, ship motions and navigational allowances.

The KeelCheck software is provided as an aid²⁶ to determine the DUKC for draughts over 10 metres. Allowances for swell height and period and the effect on UKC as a ship rolls and pitches are considered on a predictive basis, rather than measured.

Although there have not been any recorded events involving a ship striking the seabed in the Entrance Channel, the dimensions of ships using the channel have increased and are predicted to increase in the future. This supports the case for more focus on DUKC for vessels over certain draught and dimensions. CentrePort has begun work on developing a DUKC system for piloted vessels and has recently commissioned a review of the current UKC parameters for the shallows around Falcon Shoal.

The intention is to provide a higher degree of accuracy for predicting and measuring DUKC in the future, and thus aim for a reduction in the risk of such an event occurring. *The Interislander Cook Strait*

²⁶ Since December 2020 the programme has not been validated.

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ferry operator is reportedly considering how to apply what CentrePort is working on for its larger new-build ferries.

Given the potential consequence of a large ship contacting the seabed in the Entrance Channel, we are recommending that DUKC be mandatory for all ships whose draught and dimensions exceed certain criteria. To capture all ships, piloted and PEC operated, it may be necessary to include requirements in the Navigation Bylaws.

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5. Recommendations

- 1 That the Navigation Bylaws require CentrePort and operators of pilot-exempt ships to submit to the Harbourmaster their standard pilotage plan for entering and departing Wellington Harbour, which must meet contemporary accepted good industry practice.
- 2 Any port passage plans submitted for approval should use a consistent format and follow any recommended tracks by default.
- 3 There are inconsistencies in the various methods used to publish the recommended tracks and in the various directions to mariners about the way the recommended tracks 'shall' be followed. Also, the reasons for the Navigation Bylaws being so prescriptive on pilotage routes have been superseded by contemporary best industry practice piloting and passage planning procedures. It is therefore recommended that either:
 - the recommended tracks be removed from the Navigation Bylaws, or
 - if the recommended tracks are retained in the Navigation Bylaws, then any anomalies in the way they are published and referred to will need to be rectified and the intent of the recommended tracks be fully and clearly explained for the benefit of all harbour users.
- 4 That the recommended tracks be reviewed and amended as appropriate to correspond with any other actions arising from this report.
- 5 That regardless of what other actions are adopted, the recommended tracks be reviewed to alleviate or remove unnecessary doglegs and facilitate the controlled turn method instead of an abrupt waypoint-to-waypoint method.
- 6 The Harbourmaster and CentrePort investigate the feasibility of introducing a controlled navigation zone for the narrow sections of the Wellington Harbour Entrance Channel off Steeples Rock and Falcon Shoal to allow only one vessel of a certain type or parameter to occupy the controlled navigation zone at any time.
- 7 That one or more of the following options be taken:
 - 7.1 Prohibit ships of over 500 gross registered tonnage (GRT) from transiting west of Falcon Shoal, with a goal of separating large shipping from frequent recreational boating and fishing activity in this area, or
 - 7.2 If outbound ships will be permitted to pass west of Falcon Shoal to achieve greater separation from inbound vessels, then this should be socialised with other harbour users and the recommended track west of Falcon Shoal should be published on the chart, or
 - 7.3 Investigate the feasibility of moving Falcon Shoal Beacon westward and dredging the eastern edge of the shoal to increase the width of the navigable channel in this area. If this option is adopted, then Option 7.1 could be adopted instead of Option 7.2.
- 8 Consider moving pilot boarding areas Alpha, Bravo and Charlie south to the harbour and pilotage limits to reduce the potential for conflict between pilot-exempt vessels entering the harbour and those vessels embarking a pilot.
- 9 Review whether there is the need for three pilot boarding areas in such close proximity to the harbour approaches, and if they are all to remain, label them in a more logical way.

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- 10 Amend the restrictive wording in the Navigation Bylaws that requires inbound vessels to join the main leads at least 2 nautical miles south of Barrett Reef Buoy, to allow vessels to deviate from this requirement to reduce the risk of collision with vessels manoeuvring to embark a pilot.
- 11 Mandate through the most appropriate means the requirement for pilots and PEC holders to routinely communicate with other ships well in advance of a close-quarters situation developing between their ship and another navigating within or outside in the approaches to Wellington Harbour. This includes ships that a pilot is about to embark or disembark from.
- 12 Consider removing pilot boarding area Delta from chart NZ4633.
- 13 Conduct a workshop involving experienced pilots, PEC holders and experts in maritime law to work through the various collision prevention scenarios that are typically encountered in and around the Wellington Harbour Entrance Channel, with a view to developing guidance for inclusion in pilotage training and standard operating procedures.
- 14 Extend the harbour camera system available to Beacon Hill Signal Station to include coverage of the inner harbour, including Evans Bay.
- 15 Extend the radar coverage for Beacon Hill to cover the inner harbour as well.
- 16 Develop a system to audit the performance of Beacon Hill to ensure adherence to agreed performance standards and standing operating procedures.
- 17 Review the pilotage by leading procedure and the Beacon Hill communication procedures to ensure Maritime Rule – Part 90 is being adhered to, and that there is a clear distinction between information being passed to a ship and an instruction from the pilot.
- 18 Undertake an analysis to consider the cost versus the benefits of relocating Wellington Harbour Radio from Beacon Hill to a more central location. The costs of implementing Recommendations 14 and 15 should also be considered.
- 19 If Wellington Harbour Radio remains located at Beacon Hill, consider replacing the tinted windows in the Beacon Hill Signal Station with retractable sunshades.
- 20 The requirement for small vessels to keep clear of large vessels within Wellington Harbour are adequately covered by the over/under 500 GRT rule and the narrow channel rule for vessels under 20 metres. We recommend reviewing the requirement for vessels over 18 metres to follow the recommended tracks.
- 21 Include the definition of reportable defects as worded in Maritime Rule Part 90 – Pilotage in the Navigation Bylaws and in the pre-arrival information for ships.
- 22 In the short term, review the configuration, location and direction of any new and existing AtoNs marking the leading lines/transits to align with any changes made resulting from this review.
- 23 In the longer term, or as part of Recommendation 24, consider installing sets of port and starboard 'side leading light beacons' parallel to the main leading lights with a view to creating a corridor from the harbour entrance to Steeple Rock, or installing alternative modern AtoNs that achieve the same effect.
- 24 In the longer term, consider the use of virtual AtoNs to mark navigation hazards where it is not feasible or practicable to install physical AtoNs, or to temporarily replace physical AtoNs that become damaged, lost or inoperable.
- 25 CentrePort and GWRC request Land information New Zealand (LINZ) to produce an official 6ENC that can be loaded on the ship's ECDIS.

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- 26 CentrePort and GWRC use a structured Management of Change process to review future tug requirements, including the risk of having to provide towage assistance in the waters of the Wellington Harbour Entrance Channel.
- 27 The requirement for DUKC for ships that meet certain criteria for draught and dimensions to be included in the Navigation Bylaws or be mandated through some other mechanism.

6. Conclusions

The authors are grateful to the various stakeholders who freely offered their time, experiences in Wellington Harbour and expert opinion. Thus, they provided essential insights not always available from the reviews of technical documents and records.

We have found that the various systems and standard operating procedures used in managing navigation safety in the Entrance Channel and its approaches are mature, having evolved over many decades. They are generally fit for purpose, but as is often the case changes made over time in one part of the system can conflict with or adversely affect other parts. This review has not identified anything that is fundamentally wrong or non-compliant.

Nevertheless, we have made 27 recommendations to GRWRC and CentrePort. The purpose of these recommendations is more to reset and align the various parts in the system with contemporary good industry practice and to reduce the navigation safety risk in the Entrance Channel to as low as reasonably Practicable.

We have not separated these out to one party or the other, but rather leave that to the parties to work collaboratively to consider. This should not be difficult because from our observations collaboration between the parties is very good.

Some of the recommendations can, if accepted, be implemented in the short term – others will take longer. Our overarching advice is that for those that are accepted by GWRC and CentrePort, the actions be included in their respective Safety Plans that form part of their Port and Harbour Marine Safety Code safety management systems. In this way, the recommendations can be prioritised and tracked as time and budget permit.

The key recommendations for improving navigation safety are those aimed at reducing the risk of high-consequence events such as collisions and groundings in and around the Entrance Channel. These include:

- Reviewing the recommended tracks (and thus the pilotage plans) throughout the harbour to be consistent with contemporary good industry practice
- Reviewing the AtoNs in and around the Entrance Channel to assist ships to maintain the existing and/or new recommended tracks
- Establishing a controlled navigation zone within the Entrance Channel to minimise the risk of large ships colliding in the channel
- Moving the pilot boarding areas at the entrance to the harbour to reduce the risk of collision between pilot-exempt ferries and ships boarding and disembarking pilots
- Establishing better communication protocols between piloted ships and pilot-exempt ships to improve situational awareness across the harbour.

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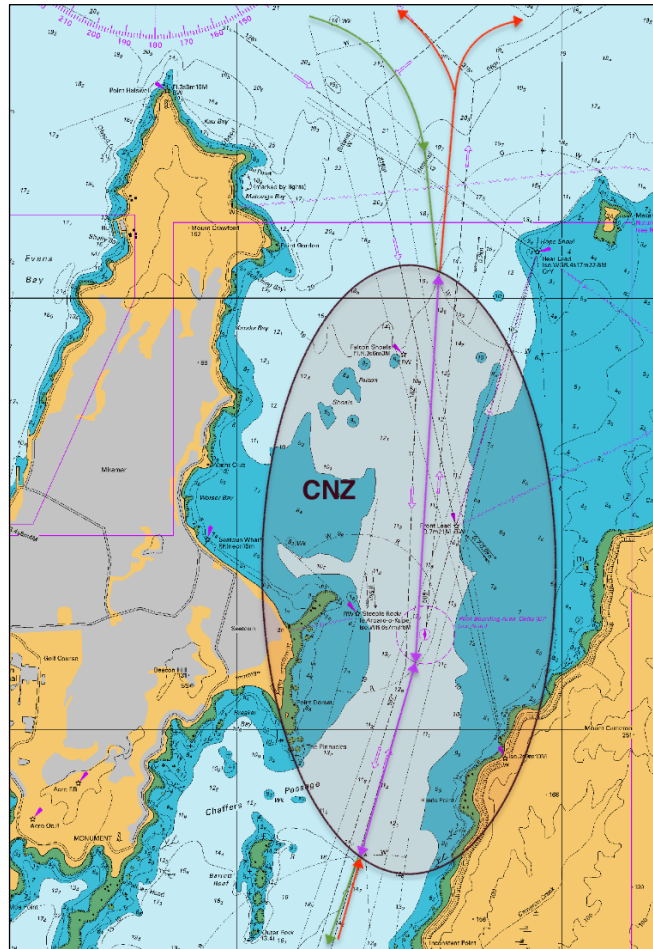


Figure 8

Annotated extract from Chart NZ4633 showing a broad concept of how a controlled navigation zone and associated recommended tracks in the Wellington Harbour Entrance Channel could look

Figure 8 shows an example only of how a controlled navigation zone and associated recommended track could look. Obviously, the detail would need to be worked through using the experts who will oversee and use the system.

7. Authors

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Tim is a Master Mariner with 22 years' experience in maritime operations and 20 years in accident investigation. His 17 years at sea included 5 years' command experience on various ship types on international trades. He has extensive shore-based leadership experience, including 5 years' marine operations management for a fleet of roll-on-roll-off-passenger (RoPax) and seasonal fast ferries. Tim gained 5 years' experience as a Maritime Accident Investigator with the New Zealand Transport Accident Investigation Commission before taking on the role of its Chief Investigator and General Manager Investigation Services, responsible for a team of 15 investigators working on maritime, aviation and rail accident investigations to international standards. He has represented New Zealand at international forums such as the IMO, the International Civil Aviation Organization (ICAO) and the Marine Accident Investigators' International Forum (MAIIF). Tim is a Chartered Master Mariner and a member of the:

- Nautical Institute (Associate Fellow)
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MIKE PERSON

Mike is a Master Mariner with more than 35 years' international experience working with some of the most respected names in the marine and offshore industries. Mike has been involved in marine safety management since 1995 when he wrote his MSc thesis on the International Safety Management (ISM) Code, scoring in the top 2% of the London School of Economics' theses for that year. Since then, he has gained significant experience in the regulation, development and practical implementation of risk and marine management systems.

Mike has headed the American Bureau of Shipping's ISM programme in Europe, Africa and the Middle East. Returning to New Zealand, he was the inaugural Regional Harbourmaster for Southland. On completing his MBA in 2006, he established his maritime consultancy and has since completed diverse projects, such as managing risk for the salvage of the severely damaged West Atlas drilling rig after the explosion of the Montara well-head platform in the Timor Sea and establishing a number of high-performance maritime management systems and emergency response plans. Mike is a:

- Fellow of the Nautical Institute
- Member of the New Zealand Company of Master Mariners
- Member of Business Mentors New Zealand.

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Appendix 1 – Abbreviations

8. Abbreviation		Meaning
AIS		Automatic Identification System
ALARP		As low as reasonably practicable
ASD		Azimuth stern drive
AtoN		Aids to navigation
CentrePort		CentrePort Wellington Limited
CPA		Closest point of approach
ECDIS		Electronic Chart Display and Information System
ENC		Electronic navigation chart
GWRC		Greater Wellington Regional Council
GRT		Gross registered tonnage
IALA		International Association of Marine Aids to Navigation and Lighthouse Authorities
IMO		International Maritime Organization
IREX		Inter-Island Resilience Connection
ISM		International Safety Management
LINZ		Land Information New Zealand
LPS		Local Port Service
Maritime NZ		Maritime New Zealand
MPX		Master pilot exchange
NZMPA		New Zealand Maritime Pilots Association
PEC		Pilot exemption certificate
PPU		Portable pilot unit
RoPax		Ro-on-roll-off passenger
SOLAS		International Convention for the Safety of Life at Sea
SouthMS		South Maritime Solutions
STCW		Standards of Training, Certification and Watchkeeping for Seafarers
STCW Convention		International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978
VHF		Very high frequency
VTS		Vessel Traffic Service

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Appendix 2 – Definitions

9. Term	Meaning
Aid to navigation (AtoN)	IALA definition – a device, system or service, external to the vessel, designed and operated to enhance the safe and efficient navigation of all vessels and/or vessel traffic.
Allision	The running of one vessel into another stationary object or vessel, as distinguished from a collision, where both vessels are usually in motion.
As low as reasonably practicable	A concept used to help determine whether the risk level associated with a particular safety issue is acceptable. Generally, it refers to a range of risk levels between intolerable and broadly acceptable, where there is some onus on the relevant organisation(s) to demonstrate that it has addressed the safety issue as much as is reasonably practical to do in the circumstances.
Assurance	Evidence that gives confidence that something will or will not happen or has/has not happened.
Collision	The act of ships or vessels striking each other. In its strict sense, collision means the impact of two vessels both moving, and is distinguished from allision, which is the striking of a moving vessel against one that is stationary.
Communication	The transmission of information necessary for the safe and effective functioning of an organisation to the appropriate recipient(s) in a clear, unambiguous and intelligible form.
Competence	A cluster of related abilities, commitments, knowledge and skills that enable a person (or organisation) to act effectively in a job or situation. Competence extends beyond the completion of statutory training. For example, the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (the STCW Convention) certificate of competence is not in itself evidence of competence.
Competence assurance	An assurance of a range of criteria including academic and vocational qualifications, demonstrable experience, technical skills, medical certification and appropriate training.
Competent person	Any person who has: (a) the relevant knowledge, experience and skills to carry out the task required; and (b) either (i) a relevant qualification evidencing the person's possession of that knowledge, experience and skills, or (ii) if the person is an employee, a certificate issued by the person's employer evidencing the person's possession of that knowledge, experience and skills.
Consequence	The outcome of an event affecting objectives. A consequence can be certain or uncertain and can have positive or negative and direct or indirect effects on objectives.
Controls	The measures put in place by an organisation to facilitate and assure the safe performance of the operational components of the system (i.e. operational personnel and equipment).
Critical risks	Risks with catastrophic consequences, typically of low probability.

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9. Term	Meaning
Enforcement	A successful and cost-effective compliance strategy will draw on a range of options for responding to non-compliance. Responses can range from encouraging and assisting an individual or business to comply where the risk presented is minor, to revoking an operating licence and bringing criminal or civil court action in cases of serious risk and deliberate non-compliance.
Escape	The process of leaving a stricken vessel in an emergency when the evacuation system has failed; it may involve entering the sea directly and is the 'last resort' method of getting personnel off a vessel.
Evacuation	The leaving of a stricken vessel and its vicinity in an emergency in a systematic manner and without directly entering the sea. Successful evacuation will result in persons being transferred to a place of safety (i.e. a safe onshore location or a safe offshore location or marine vessel with suitable facilities). Evacuation means may include helicopters, lifeboats and a Mass Evacuation System.
Fatalities	Cases that involve one or more persons dying as a result of a work-related incident or occupational illness. 'Delayed' deaths that occur after the incident are included if the deaths were a direct result of the incident.
Fire/Explosion	Fire can occur when flammable material, oxygen and sufficient ignition energy are available. Explosion depends on an atmosphere of a mixture of flammable material and oxygen. The best approach to prevent fires and explosions is to substitute or minimise the use of flammable material.
Foundering	The ship fills up with water and sinks.
Grounding	The impact of a ship on the seabed or the waterway side. In accidental cases it is commonly referred to as 'running aground'.
Hazard	Something with the potential for harm.
Incident	An occurrence, other than an accident, associated with the operation of a transport vehicle, which affects or could affect the safety of operation.
Likelihood	The degree to which something can reasonably be expected to happen.
Navigation aid	An onboard system of equipment used by navigators to assist their navigation decision-making.
Navigation safety	The safe movement and navigation of ships. It includes matters such as collision prevention, management of waterways and their use by ships, aids to navigation, communication and the use of navigation tools and equipment.
Near miss	An undesired event that, under slightly different circumstances, could have resulted in harm to people, damage to the environment, damage to property or loss of process.
Pilot-exempt masters	Ship masters who have fulfilled the requirements for obtaining a pilot exemption certificate (PEC) under Maritime Rule Part 90 – Pilotage.

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9. Term	Meaning
Place of safety	An onshore or safe offshore location or vessel where medical treatment and other facilities for the care of survivors are available.
Practicable	A condition when it is reasonable for a particular organisation to address (or have addressed) a particular safety issue. It involves considering the level of risk, the state of knowledge of the safety issue and the ways it can be addressed, the availability and suitability of ways to address the issue, and the cost of doing so.
Recovery/Rescue	The process of recovering persons following their evacuation or escape from an installation, and rescuing them near the installation and taking them to a place of safety.
Risk	The effect of uncertainty on objectives. Risk usually relates to potential events arising from risk sources, as well as their consequences and likelihood.
Risk analysis	A detailed consideration of uncertainties, risk sources, consequences, likelihood, events, scenarios, controls and their effectiveness, the purpose of the analysis, the availability and reliability of information, and the resources available. Analysis techniques can be qualitative, quantitative or a combination.
Risk assessment	The overall process of risk identification, risk analysis and risk evaluation.
Risk evaluation	A comparison of the results of risk analysis to the established risk criteria to determine where additional action is required. Decisions should take account of the wider context and the actual and perceived consequences for external and internal stakeholders.
Risk management	Coordinated activities to direct and control risk in an organisation.
Threats	External things that exist beyond the Harbourmaster's control and include anything that can affect navigation safety negatively.
Vessel Traffic Service	A marine traffic monitoring system established by harbour or port authorities, similar to air traffic control for aircraft. The International Maritime Organization (IMO) defines VTS as ' <i>a service implemented by a competent authority designed to improve the safety and efficiency of vessel traffic and protect the environment</i> '.
Worst credible scenario	The worst occurrence, regarding the severity of its consequences, that could result from a safety issue after the risk controls and management processes in place to minimise risk have been considered.