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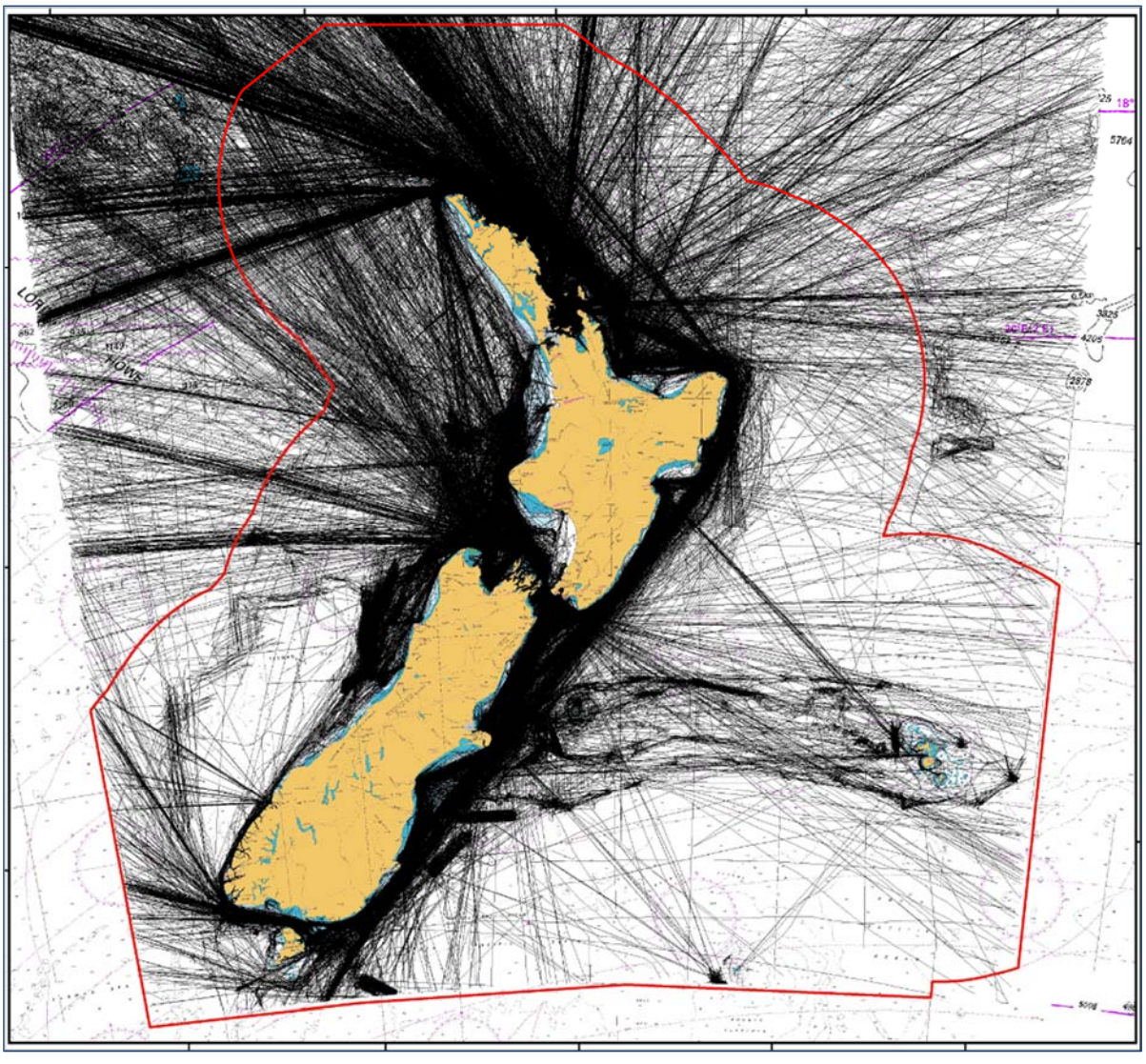
NEW ZEALAND HYDROGRAPHIC RISK ASSESSMENT - SYNOPSIS



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MARICO MARINE NEW ZEALAND LTD

LAND INFORMATION NEW ZEALAND

NEW ZEALAND HYDROGRAPHIC RISK ASSESSMENT - SYNOPSIS

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Note : The views expressed in this publication are those of the authors and do not necessarily reflect those of the New Zealand Government.

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1 INTRODUCTION

This report records a Hydrographic Risk Assessment for the sea area comprising most of the New Zealand Exclusive Economic Zone (EEZ), and was carried out by Marico Marine at the request of Land Information New Zealand (LINZ). It is important therefore to note that the views expressed in this publication do not necessarily reflect those of the New Zealand Government.

The report is in four parts: Part 1 - a National Overview (15NZ326-A); Part 2 -the North Island (15NZ326-B), Part 3 - the South Island (15NZ326-C). Part 4 is this Synopsis (15NZ326-D). The other documents of this series provide greater detail, including nomenclature, to allow the LINZ hydrographic service to develop a useful and long term work plan out of the analysis work.

1.1 PROJECT SCOPE

The geographical scope comprises the development of a Hydrographic Risk Assessment for the New Zealand waters within the EEZ, excluding the Sub-Antarctic islands (south of 48°S latitude) and the Kermadec Island shelf. The project work scope included the development of a charting benefit model to identify where areas of heightened hydrographic risk can be improved through charting re-organisation, updating, or hydrographic survey upgrades.

1.2 METHODOLOGY SUMMARY

This Hydrographic Risk Assessment uses a risk based methodology developed by LINZ for Hydrography, which has been formally recognised by the International Hydrographic Organisation (IHO). The study delivers prioritisation by risk and charting benefit, assisting LINZ to logically plan future hydrographic surveys and charting improvements throughout the EEZ. Hydrographic risk is defined as a combination of Traffic, Likelihood Criteria and Consequence Criteria. Essentially, this is a form of risk analysis that prioritises consequence. Realistic impacts from a shipping accident of each vessel type are calculated using criteria set in a large risk matrix, affecting one or more layers of spatial data in a GIS system. Impacts may be pollution related; ecological damage; loss of amenity; loss of coastal economy, or culturally adverse. The risk assessment uses a large pool of real data from the routes taken by different ship types transiting the NZ EEZ. Geographic Information System (GIS) spatial techniques link the data-based evidence from ship track records and their proximity to coastal features of interest, as well as the standards of nautical charting in the seas through which the tracks are passing. In total there are 39 layers of geographic information in the GIS data set, each forming an individual layer of risk calculations by georeferenced cell. The hydrographic risk model uses a form of Risk Terrain Modelling, which is accurate to the shipping traffic. The approach can

readily be used for other forms of risk review, e.g. oil spill risk, where the accuracy of this approach can make improvements to existing technology.

Charting Benefit is a separate calculation module that takes account of the hydrographic risk result and the margin available to make charting improvements in an area. There is further information below.

1.3 DATA SOURCES AND QUALITY

The risk approach is dependent on the quality of the input datasets. A full 12 months record of shipping traffic using New Zealand waters was used as a core input into the Hydrographic Risk Assessment, with AIS transponders fitted to all internationally trading vessels ("SOLAS" vessels) and many domestic vessels, July 2014–June 2015 used. The timescale being representative of recent economic activity, as well as seasonal variations. The Ministry for Primary Industries (MPI) supplied data sets of fishing vessel locations for the study year (VMS data), showing activity overall.

Traffic was broken down into ship types as transmitted by, some recreational craft and most domestic vessels carrying passengers for commercial gain (i.e. entered into SSM or MOSS). AIS data tracks do not represent all vessels, which typically comprise smaller coastal vessels; smaller fishing vessels; tugs; workboats and recreational vessels. Domestic passenger vessels, not accounted for by AIS were incorporated into the risk model with their routes plotted manually, with data such as passenger volume per annum attached.

Terrestrially recorded AIS traffic record was supplied by Marico Marine from their national recording database. For areas where no terrestrial coverage was available, Satellite recorded AIS (S-AIS) data was procured from the exactEarth AIS service, after quality of alternatives was assessed. ExactEarth data provided improved frequency of data update, coverage of recreational craft, as well as superior recording of time in relation to a vessel's position. Additional data was supplied by LINZ from the NZ Government AIS database, which provided some infill. Terrestrial and satellite datasets were merged, and where necessary corrected, to produce a single continuous traffic database.

1.3.1 DATA GATHERING NATIONALLY

A key component of the risk assessment was the gathering of information and local data to support the identification of risk areas and provide local input to practically assist with the priority for future hydrographic surveys. Harbour Masters, Council representatives, Port Company Operators, Passenger vessel operators and other key stakeholders were interviewed in each region during data gathering visits. Statistics of vessel movements, vessel types and sizes were compiled from data supplied by port companies, Harbour Masters, Regional Councils or Territorial Authorities, local

vessel operators and other key stakeholders. Further information was obtained from cruise vessel operators and agents about cruise calls. Other database records for cargo volumes (FIGS) and data publically available from the internet were also accessed.

Details of the fleet of coastal domestic vessels and schedules, were obtained from local vessel operators or skippers, and on line information. Wherever possible, locally sourced data was used to validate internet sourced data and vice versa.

Where GIS shapefiles of sensitive sites and other data sets were available from stakeholders, including Councils' Tier 2 Marine Oil Spill Plans, these were uploaded directly into the GIS risk model. Where unavailable, the georeferenced data sets were created by Marico. Shapefiles of Marine Reserves were supplied by the Department of Conservation (DOC). Georeferenced data sets were provided by most regional councils, for which Authors are grateful.

The satellite derived (S-AIS) data was augmented prior to use in the GIS modelling process. This was necessary because of data accuracy limitations: the S-AIS data is recorded at intervals when the satellite passes over the study area. The time period for the S-AIS updates around the NZ coast was around 2-4 hours, resulting in intermittent data records outside the range of terrestrial reception; in some cases a vessel could pass a location in which it berthed without positional record. Vessel tracks were enhanced with ship visit records taken from regional ports to ensure the accuracy of the risk assessment. From data gathering work, traffic analysis was updated for all vessels, including traffic frequency, density, type and size.

1.4 DATA CATALOGUE - DATA GATHERING

A purpose-built database was developed by Marico to catalogue and store all the data gathered, to ensure provenance and maintain data sensitivity classification. The database is enabled with a 'Confidential' function so that stored passenger numbers and other information that is commercially sensitive is protected from general access.

1.5 HYDROGRAPHIC RISK CRITERIA

In order to compare risk levels, a risk matrix with 39 different 'layers' of criteria were used. The risk matrix is the reference point for the calculations that occur in each cell of the GIS system. The risk matrix is presented as an Annex to the main reports.

The presence of hydrographic risk is dependent on traffic and the potential for loss of life, pollution and coastal impacts (the severity of which is related to vessel volume, type and size). Clearly, without vessel traffic, there can be no hydrographic risk. Risk potential is increased by Likelihood Criteria

such as ocean conditions; navigational complexity, distance of traffic from a coastline with high currents, Aids to Navigation (AtoNs) and navigational hazards. The level of risk is realised by Consequence Criteria such as environmental impact, cultural importance, and economic importance. Risk Criteria are thus logically categorised in Traffic, Likelihood and Consequence.

1.5.1 VESSEL RISK IMPACTS

Vessel traffic is a significant input factor into any assessment of marine risk. The vessel traffic risk by ship type took account of vessel type, as well as size (gross tonnage). Passenger vessel risk for domestic vessels was related to the passenger route volume, with SOLAS vessels. Using Event Trees to lay out the most likely and worst credible consequences of an accident for different ship types, a risk factor can be derived by vessel type and size.

Risk Criteria of relevance to vessels included the potential for loss of life, potential for oil outflow or other adverse effect on the environment, such as loss of utility; vessel damage and salvage complexity; and economic impacts of a vessel incident such as loss of tourism, damage to culturally sensitive areas, or other economic activity.

1.6 CHARTING BENEFIT MODEL

The Charting Benefit is a separate model, run after the risk assessment output has completed. The benefit module complements the hydrographic risk module in that it measures the ability of the hydrographic system to reduce risk by a charting upgrade (either a charting reorganisation or improved sea floor coverage through a survey update). The purpose of the charting benefit model is the identification of positive benefit areas that that would be available from charting improvements. The charting benefit is not driven by cost alone, it is driven by the available scope of achievable charting upgrade in relation to the charting risk present in any given area.

Charting Benefit needed to be defined during the work. It has been defined as a combination of three factors: chart accuracy, chart quality and charting extents (chart quality is defined as a combination of survey age and Zone of Confidence (ZOC)). Charting benefits are based on hydrographic survey and charting data supplied by LINZ, which was up to date to the end of the 2015 financial year. Programmed work was added to the existing portfolio if it was known to complete by July 2016.

1.7 VESSEL TRAFFIC ANALYSIS

Marine traffic through New Zealand waters was analysed regionally, taking account of Regional Council boundaries. Within each Region, the approaches and harbours of the major NZ ports were analysed. This allowed the ensuing Hydrographic Risk Assessment to flow by region.

1.8 VESSEL TRAFFIC OVERVIEW

The national result shows the overview. Traffic in the Hauraki Gulf and the approaches to Auckland (Waitemata Harbour) showed high relative density in the year of the traffic data record. A medium level of traffic density extends along the trade routes connecting Auckland to the ports further south. A high traffic density is also present in Wellington Harbour and its approaches as well as the Cook Strait passenger and vehicle ferry services into Marlborough Sounds. The approaches to Tauranga as well as the coastline around East Cape also show a medium level of traffic density, with density concentration close to port approaches. East Cape provides this result where traffic transits come together due to topography; traffic can also transit close to the coast around East Cape. There has been a recent collision with a fishing vessel in this area during darkness.

In the South Island, Marlborough Sounds and the Stewart Island link across Foveaux Strait show the same level of density (medium).

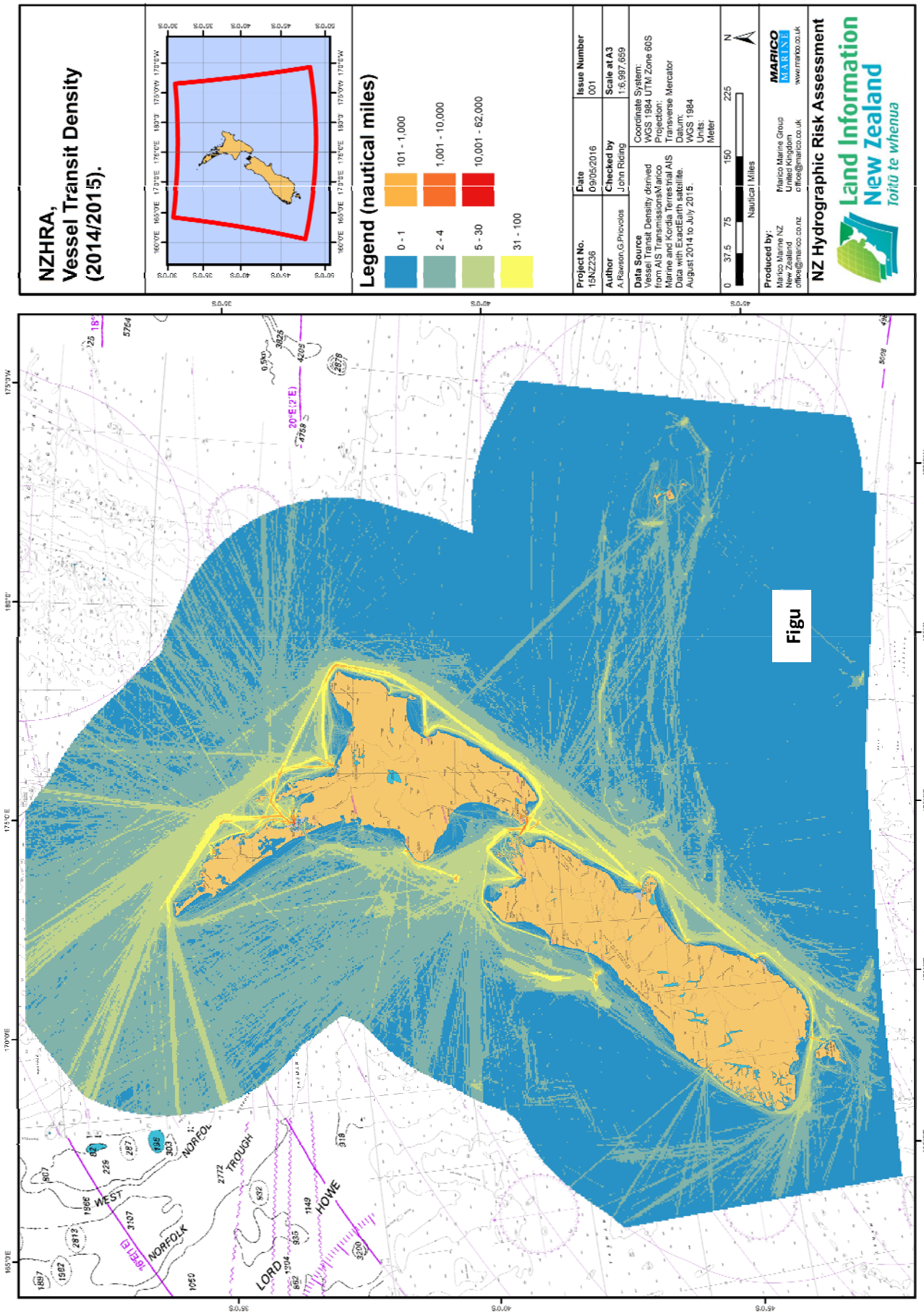
It should be noted that high traffic density does not necessarily translate into high levels of hydrographic risk.

A plot of traffic density for New Zealand waters is shown in Figure 1, over the page.

1.9 COASTAL TRAFFIC ANALYSIS

1.9.1 CARGO VESSELS

The General Cargo traffic record for 2014-15 includes container vessels, various types of dry bulk carriers, refrigerated vessels and traditional general cargo ships ('tween-deckers'). General cargo vessels are found throughout New Zealand waters and represent the majority of transiting traffic. They can range significantly in size (both length and Registered Gross Tonnage). These vessels frequent the east coast of New Zealand, with calls to all the main ports.


NZHRA,
Vessel Transit Density
(2014/2015).
Legend (nautical miles)
0 - 1
101 - 1,000
2 - 4
1,001 - 10,000
5 - 30
10,001 - 62,000
31 - 100
Project No.
15NZ236
Date
09/05/2016
Issue Number
001
Author
A.Rawson,G.Provolos
Checked by
John Riding
Scale at A3
1:6,997,659
Data Source
Vessel Transit Density derived from AIS TransmissionsMarico Marine and Kordia Terrestrial AIS Data with ExactEarth satellite. August 2014 to July 2015
Coordinate System:
WGS 1984 UTM Zone 60S
Projection:
Transverse Mercator
Datum:
WGS 1984
Units:
Meter
0 37.5 75 150 225
Nautical Miles
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NZ Hydrographic Risk Assessment
Land Information New Zealand
Toitū te whenua
Figu
NORFOLK TROUGH
WEST NORFOLK RIDGE
LORD HOWE
Figure Reference: 15NZ23_NZHRA_Density_v3_20160504

1.9.2 CRUISE VESSELS

The NZ cruise ship market has expanded significantly in recent years. This is set to continue. However, this is not only an anticipated increase in the number of vessels using NZ waters, it is also a dramatic increase in the size of vessels. Both traffic volume and size are taken account of in the hydrographic risk assessment.

The risk criteria takes all cruise vessel "stops" into account, both where they berth and where they anchor or drift using tenders. This is because there may be a need to review the density of hydrographic survey sea floor coverage if cruise vessels regularly anchor or work tenders to land passengers ashore, so it affects both the hydrographic risk profile and charting benefit output. Note that both the track and the cruise vessel stop plots show an increasing importance of Fiordland as a cruise destination and Milford Sound as an international arrival or departure port.

1.9.3 TANKER VESSELS

Overall, tanker traffic is a significant sector of the NZ marine traffic profile. Apart from the west coast of the South Island, there are records of tanker transits throughout all NZ waters. Much of this trade is also international, with some large vessel transits making NZ calls and then passing South of New Zealand to visit Victorian, NSW and Tasmanian ports of Australia. There is also evidence of tankers passing through NZ waters as a waypoint to other destinations (i.e. without NZ port calls).

A code for tankers promulgates recommended tanker routes in the NZ Nautical Almanac, Annual Notices to Mariners 10 (ANTM 10), with a recommended minimum distance of 5 nm off the coast, any charted danger or outlying islands, until a position where alteration is required to make port. This Hydrographic Risk Assessment provides clear evidence that these recommendations have not been followed in a number of instances. It is recognised that the likelihood of adherence to these routes have been strengthened in the ANTM 10.

1.9.4 FISHING VESSELS

There is considerable fishing activity in NZ waters, which differs by location dependent on the fishery in season. Fishing activity is both inshore with smaller vessels, and offshore mostly with larger and some 'factory' vessels.

1.9.5 DOMESTIC COASTAL VESSELS

Like international marine traffic, the level of domestic coastal traffic is also key to the Hydrographic Risk Assessment, especially those with passenger services. In some of its population centres, New

Zealand is developing mature passenger traffic routes, with significant passenger volumes. Most of these are high speed craft designs, or, as in the case of the Cook Strait, traditional passenger and freight RoRo ferries. Accurate passenger data (people per annum per route) was obtained during data gathering, which was used as an input into the risk assessment.

In terms of orders of magnitude, Auckland passenger volumes dominate the record. The volume of passengers experiencing a Milford Sound cruise per annum is (using the same order of magnitude yardstick) still lower than that of the Cook Strait ferry service, but it is in that same data category.

1.9.6 RECREATIONAL CRAFT

Recreational craft use in New Zealand is significant, with the country being recorded as having one of the highest boat ownership rates per head of population in the world. The record presented in the report is for larger recreational craft as well as some so called “mega yachts”, all of which are carrying AIS transponders. The craft represented show recreational craft usage extends throughout NZ coastal waters. There are also a significant number of international voyages undertaken by recreational craft. On a national basis, the highest concentration of recreational craft use is along the north-eastern coast of North Island.

1.9.7 ANCHORAGE LOCATIONS

NZ anchorage locations for the 2014-15 period have been detected from the AIS data record, where vessels have become stationary for a set test period, as well as having declared (via AIS) of an anchoring event. The reason for this analysis is to allow a comparison within the risk assessment to establish locations where commercial vessels are anchoring in relation to those anchorage areas designated by the charting.

In accordance with IHO standards, LINZ would normally require improved sea floor coverage or even record information provided about sea bed type (holding) for a designated anchorage area. Examples where sea floor coverage information could be improved include Gisborne, Wellington and Taranaki.

Areas that appear to be important for vessel anchoring outside of designated anchorages include Bream Bay, Taranaki; the outer Queen Charlotte Sound, D’Urville Island, Cloudy Bay, Lyttelton Approaches, Bluff Approaches and parts of Fiordland.

2 NATIONAL RESULTS

2.1 HYDROGRAPHIC RISK RESULTS – NEW ZEALAND

There are a number of NZ locations where the NZ hydrographic risk profile is heightened. This may be due to a high level of traffic overall (or vessel types with greater loss of life or polluting potential), or due to a location where either environmentally or culturally important sites are present (close to transiting traffic). However, heightened risk in the hydrographic sense does not necessarily mean there is a need for charting upgrades, it may just be heightened risk. If charting is at its most appropriate standard for the heightened risk area and sea floor coverage is good, then only a low charting benefit will be available. In other words, heightened risk will be present in areas for a number of reasons, but if charting is already to a good and modern standard, then charting makes the lowest contribution possible to the risk profile.

An assessment of the benefits available from charting upgrades are needed for the development of a LINZ work programme for charting updates.

The overall Hydrographic Risk result is shown below in **Figure 2**. Blue is low hydrographic risk, Red is heightened hydrographic risk.

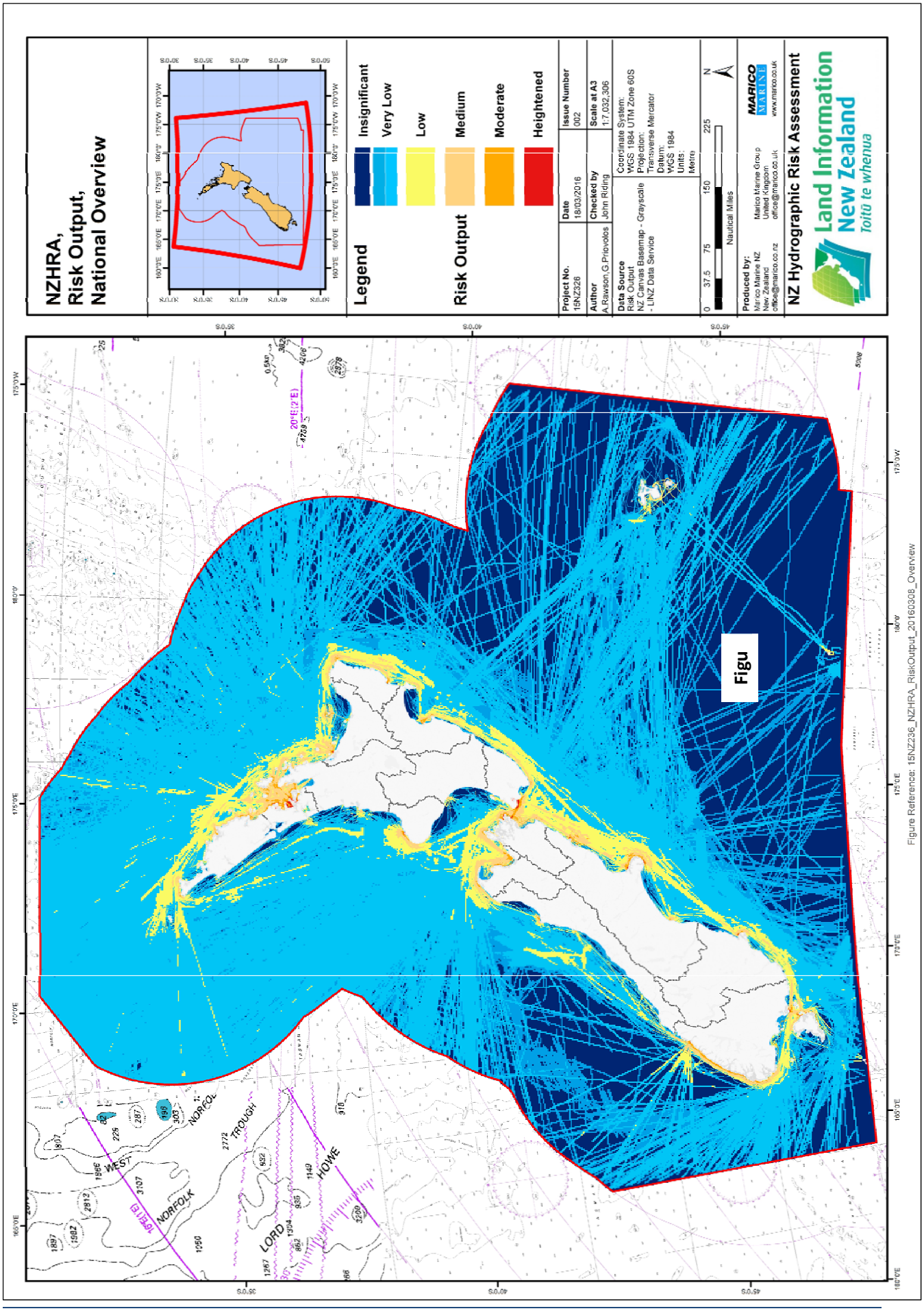


Figure Reference: 15NZ236_NZHRA_RiskOutput_20160308_Overview

2.2 CHARTING BENEFIT RESULTS – NEW ZEALAND

2.2.1 NORTH ISLAND

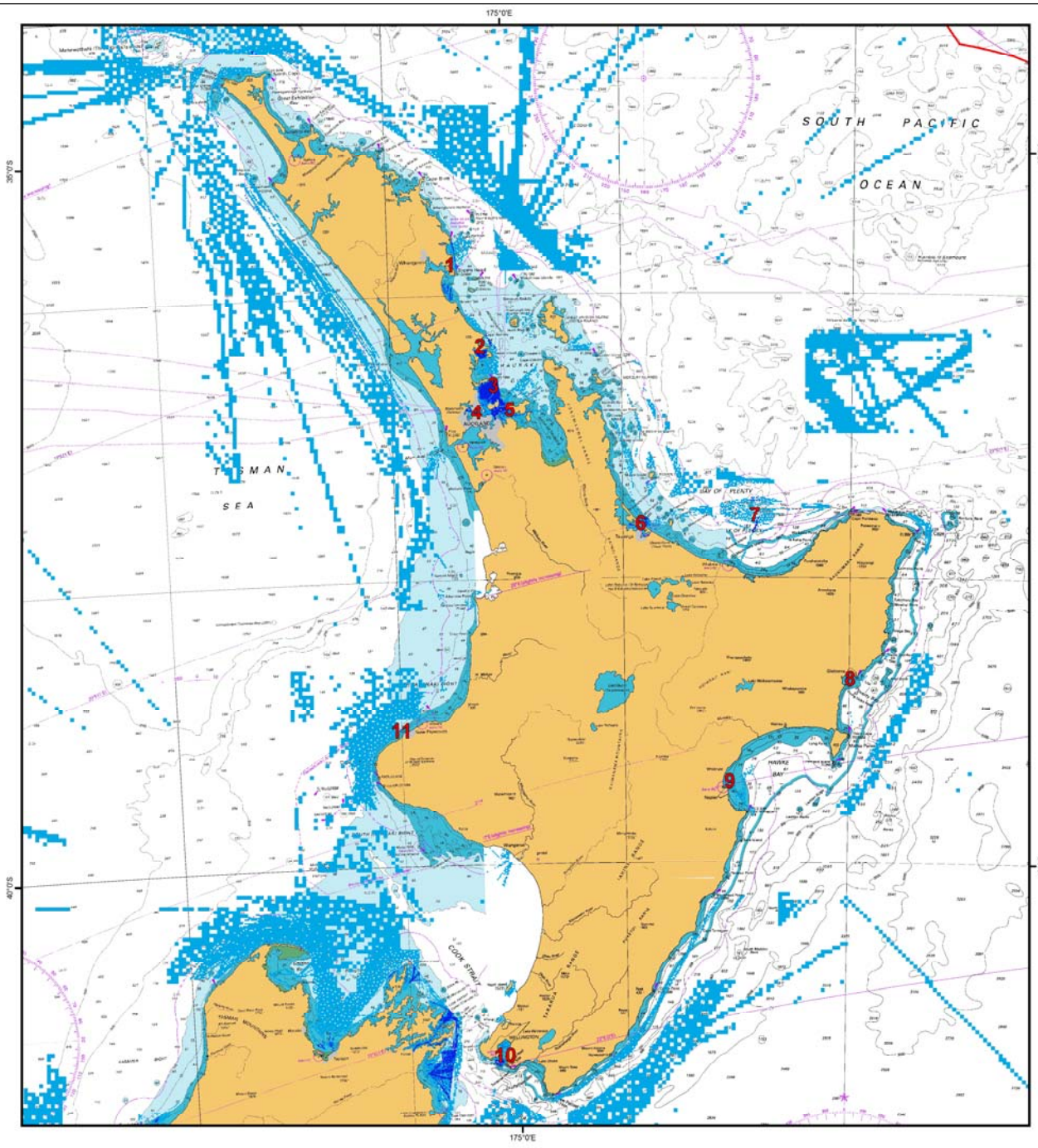
The following table identifies, at an overview, important areas in the North Island where the comparative charting benefit is positive with an associated elevated risk level. It is a high level risk and benefit summary, which must be interpreted with care and is not in any order of priority.

NEW ZEALAND NORTH ISLAND Identified Areas for Charting Improvements				
Region		Area	Comparative Benefit Level	Comparative Risk Level
1	Northland	Whangarei Harbour	Positive	Moderate
2	Auckland	Kawau Bay	Positive	Heightened
3	Auckland	Auckland - Inner Hauraki Gulf	Positive	Heightened
4	Auckland	Auckland - West Harbour	Positive	Heightened
5	Auckland	Auckland – Tamaki Strait	Positive	Heightened
6	Bay of Plenty	Tauranga Approaches & Centre Harbour	Positive	Heightened
7	Bay of Plenty	White Island	Positive	Moderate
8	Gisborne	Gisborne Approaches	Positive	Heightened
9	Hawke's Bay	Napier Approaches	Positive	Heightened
10	Wellington	Wellington Harbour & Approaches	Positive	Heightened
11	Taranaki	Taranaki Harbour & Approaches	Positive	Heightened

Table 1 : North Island Key Hydrographic Risk Summary Result

The Charting Benefit result is shown in **Figure 3** for the North Island. The darker blue shows areas of positive benefit. The plot is at an overview level and presents results for moderate and positive benefit areas only. The benefit results are further detailed in the main reports, on a Regional Council jurisdictional basis.

Risk Plots with the same Important Areas identified are presented at **Annex A**



Important Areas			
1	Whangarei	7	White Island
2	Kawau Bay	8	Gisborne Approaches
3	Auckland Inner Hauraki Gulf	9	Napier Approaches
4	Auckland West Harbour	10	Wellington Harbour and Approaches
5	Auckland Tamaki Strait	11	Taranaki Harbour
6	Tauranga Approaches and Centre Harbour		

Legend

Charting Benefit Output

Moderate

Positive

0 10 20 40 60
Nautical Miles

Scale at A3
1:2,802,916

NZ Hydrographic Risk Assessment

North Island
Important Areas for Charting Improvements - Charting Benefit Output Results

Land Information New Zealand
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Figure Reference: 15NZ236_NZHRA_NorthIsland_20160421_ComparativeResults_Benefit

Figure 3 : NZ National Charting Benefit

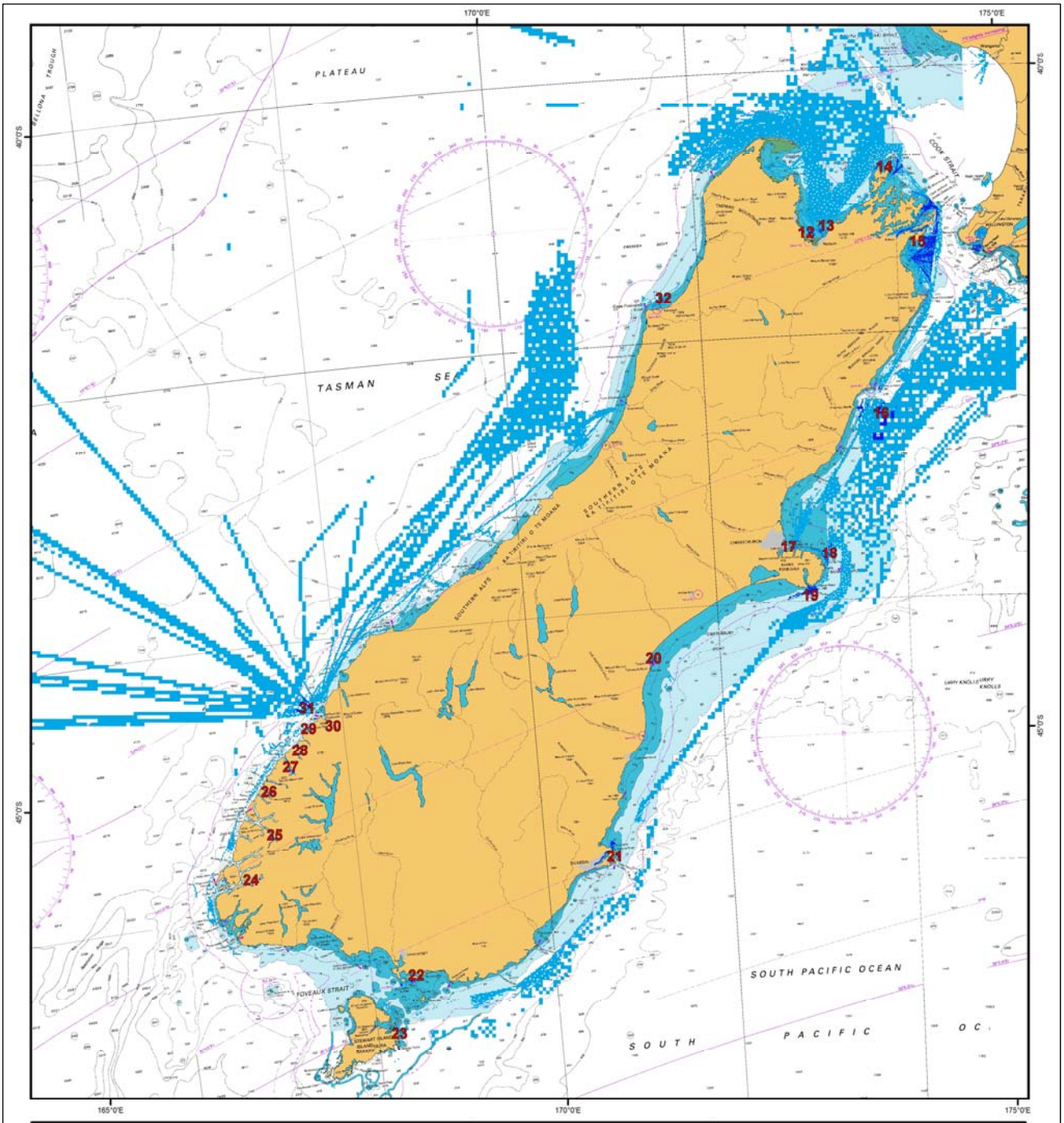
2.2.2 SOUTH ISLAND

Table 2 references important areas in the South Island where the comparative charting benefit is positive with associated elevated risk. It is a high level risk and benefit summary, which must be interpreted with care and is not in any order of priority.

NEW ZEALAND SOUTH ISLAND Identified Areas for Charting Improvements				
Region		Area	Comparative Benefit Level	Comparative Risk Level
12	Tasman Bay	Rabbit Island	Positive	Moderate
13	Nelson	Nelson Approaches	Positive	Heightened
14	Marlborough	D'Urville Island	Positive	Moderate
15	Marlborough	Marlborough Sounds	Positive	Heightened
16	Canterbury	Kaikoura	Positive	Heightened
17	Canterbury	Lyttelton Harbour	Positive	Heightened
18	Canterbury	Banks Peninsula	Positive	Moderate
19	Canterbury	Akaroa Approaches	Positive	Heightened
20	Canterbury	Timaru Harbour & Approaches	Positive	Heightened
21	Otago	Otago Harbour & Approaches	Positive	Heightened
22	Southland	Bluff Harbour Approaches	Positive	Heightened
23	Southland	Stewart Island	Positive	Heightened
24	Southland	Dusky Sound	Positive	Heightened
25	Southland	Doubtful Sound	Positive	Heightened
26	Southland	Caswell, Charles and Nancy Sounds	Positive	Heightened
27	Southland	George Sound	Positive	Heightened
28	Southland	Bligh Sound	Positive	Heightened
29	Southland	Poison Bay	Positive	Heightened
30	Southland	Milford Sound – Fresh Water Basin/ Sandfly Point	Positive	Heightened
31	Southland	Milford Sound Approaches	Positive	Heightened
32	West Coast	Westport Approaches	Positive	Heightened

Tab

The Charting Benefit result is shown in **Figure 4** for the North Island. The darker blue shows areas of positive benefit. The plot is at an overview level and presents results for moderate and positive benefit areas only. The benefit results are further detailed in the main reports, on a Regional Council jurisdictional basis. Risk Plots with the same Important Areas identified against the risk result are presented at **Annex A**



Important Areas			
12	Tasman - Rabbit Island	23	Stewart Island - East Coast
13	Nelson	24	Dusky Sound
14	D' Urville Island	25	Doubtful Sound
15	Marlborough Sounds	26	Caswell, Charles, and Nancy Sounds
16	Kaikoura	27	George Sound
17	Lyttelton Harbour	28	Bligh Sound
18	Banks Peninsula	29	Poison Bay
19	Akaroa Approaches	30	Milford Sound - Fresh Water Basin/Sandfly Point
20	Timaru Harbour and Approaches	31	Milford Sound Approaches
21	Otago Harbour and Approaches	32	Westport Approaches
22	Bluff Approaches		

Legend

Charting Benefit Output

Moderate

Positive

0 10 20 40 60
Nautical Miles

Scale at A3
1:2,976,198

NZ Hydrographic Risk Assessment

South Island
Important Areas for Charting Improvements - Charting Benefit Output Results

Land Information New Zealand
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Reference: 15NZ236_NZHRA_SouthIsland_20160421_ComparativeResults_Benefit

Figu

3 HYDROGRAPHIC RISK RESULTS – IMPORTANT AREA SUMMARIES

This section summarises reasons for each Important Area, where there is heightened risk and positive benefit combination.

3.1 NORTH ISLAND

3.1.1 AREA 1 : WHANGAREI HARBOUR

Traffic through the Heads at Whangarei is dominated by tankers heading to the refinery at Marsden Point. Although the Whangarei charts have been recently updated and the charting quality ZOC is good, this positive benefit is mainly due to the charting scale: Marsden Point is currently charted at 1:18,000 but there is no berthing chart for Northport or the refinery berths. Similarly, Portland Bulk Loading Wharf, where bulk cement is loaded into a dedicated vessel, is charted at 1:18,000 scale with no berthing chart available. Berthing charts for these three commercial wharves would ensure a complete ENC navigational folio.

The charted anchorage area north-east of the leads was surveyed in 2004 However, there is another more commonly used charted anchorage area south of the leads and in the middle of Bream Bay, (south of the area marked 'Foul Ground'). This was partly surveyed in 2000-04 and partly in 1962. A single data point, describing sea floor quality nearby, is described as 'Rock', which could be interpreted to mean poor holding. These, combined with the Coastal chart scale (i.e. not Approach) of these anchorage areas, explain the charting benefit result.

3.1.2 AREA 2 : KAWAU BAY

This charting benefit result is due to inadequate charting scale for this harbour area: a harbour scale chart is missing from this area. Contributing to the result is the age of the source data, from 1975, for this high-use area by large numbers of craft both commercial and recreational. There is a passenger ferry crossing to Kawau Island, a marina, yacht club, water taxi and busy charter boat operations, all out of Sandspit and contributing to traffic density, as well as this being arguably the most popular recreational boating, diving and fishing and sheltered anchorage area in the Auckland region. Kawau Bay is a Restricted Area for vessels greater than 500 GT or more than 40m LOA.

3.1.3 AREA 3 : AUCKLAND – INNER HAURAKI GULF

The positive benefit here is partly due to the charting scale on the inner Hauraki Gulf (Approaches to Auckland), with its chart scale of 1:100,000 being more suitable for a Coastal chart than Approach.

This area has heavy commercial vessel use, domestic ferry traffic routes, high charter vessel traffic, as well as particularly high recreational use. In addition, the presence of a ZOC C charting standard (in parts) and heightened risk contribute to the charting benefit. Heightened risk arises from source data dating from 1970, in parts of the shipping approaches to the port. The extents of the Auckland Harbour limits are significant and in order to meet the IHO recommendations for charting coverage for Harbour Waters, the analysis concluded that charting in the area will need review by LINZ.

3.1.4 AREA 4 : AUCKLAND – WEST HARBOUR

The west harbour area of Auckland has high domestic passenger ferry traffic routes, which combines with old survey data in a few places from 1967-87 and the West Park Marina/ferry berth at Hobsonville survey charted as dating from 1987. There is no Berthing scale chart for West Park Marina or Beach Haven Wharf areas. The ZOC C charting standard, contributes to the charting benefit in this area.

3.1.5 AREA 5 : AUCKLAND – TAMAKI STRAIT

Auckland's Tamaki Strait and approaches, from Rangitoto to Waiheke Island, show a positive benefit. This is mainly due to survey age, for almost the whole area (1968-69), combined with high domestic passenger and recreational traffic routes. The passenger services via Waiheke to Coromandel and to the smaller islands south-east of Waiheke, contribute to a positive charting benefit result, along the south coast of Waiheke Island.

The approaches to the busy Half Moon Bay Marina were surveyed in 2007, but show a benefit due to the high traffic volume. This includes passenger and vehicular ferries to multiple destinations.

Pine Harbour, with its marina and busy passenger terminal in Tamaki Strait, is charted at Approach chart scale of 1:40,000 scale, and combines with survey dates of 1968-69. This explains the positive charting benefit result in the south-east part of Tamaki Strait.

3.1.6 AREA 6 : TAURANGA APPROACHES AND CENTRE HARBOUR

Although survey age of the commercial port is less than 5 years, extensive areas of the outer approaches to Tauranga and many of the designated ship anchorages are charted as being surveyed in 1960, which when combined with busy commercial traffic of New Zealand's largest export port, provides a charting benefit to the Approaches to Tauranga.

The Port of Tauranga chart NZ5412 is at 1:10,000 scale, outside the recommended Berthing chart scale, which has resulted in a positive charting benefit in the main Tauranga shipping channels.

Most of the centre harbour is ZOC B. However, the areas near Omokoroa and part of the Western Channel, are ZOC U. This, combined with limited charting extents, deliver a charting benefit. This area is charted at 1:40,000 Approach scale, where a Harbour scale may be more appropriate. There is a passenger/vehicular ferry route in this area. The charting extents for the main part of Tauranga Harbour as far west as Omokoroa Point could usefully be reviewed.

Survey data south of Town Reach in the outer Waimapu Estuary are charted at 1:40,000 with data from 1957 according to chart NZ5412, but 1961-2003 according to chart NZ5411. The scale and the survey dates provide a charting benefit result.

3.1.7 AREA 7 : WHITE ISLAND

The busy tourist excursion route from Whakatane to White Island was last surveyed in 1965, as was the Tauranga-East Cape SOLAS vessel route past the Volkner Rocks. The cruise vessel anchorage on the southeast side of White Island does not have any sea floor type data, giving no indication of quality of anchor holding. When combined with a ZOC C charting standard, the result is a comparative charting benefit for traffic routes near White Island.

3.1.8 AREA 8 : GISBORNE APPROACHES

A narrow approach route into Poverty Bay was last surveyed in 1986 however extensive areas outside this path date back to 1953 surveys. Large numbers of cargo vessels anchor in Poverty Bay, awaiting a berth or cargo. The anchoring location was last surveyed in 1953.

A small area south-west of Tuaheni Point is showing a positive benefit within pilotage limits, with a survey data from 1953.

3.1.9 AREA 9 : NAPIER APPROACHES

The most frequently used approach routes into and out of Napier have been surveyed within the last 12 years (2004). However, areas commonly used by cargo vessels to approach the port and anchor, were surveyed in 1980. Data on sea floor type is limited. There are several areas marked 'un-surveyed' around Cape Kidnappers and Clifton coastline, in the Approaches to Napier. This is chart NZ561; large areas of this chart were last surveyed in 1954.

3.1.10 AREA 10 : WELLINGTON HARBOUR AND APPROACHES

The heavy traffic density of all types, particularly the Cook Strait passenger ferries, combine with a site of high economic importance, navigational complexity and marine reserves to contribute to the

heightened risk output in the Approaches and Harbour areas. The scale of the Approach chart at 1:100,000 further heightens the risk.

All vessel types were observed to anchor in Wellington Harbour, including Tankers, with the main portion of the harbour last surveyed in 2007, giving a heightened risk output in the harbour.

The main factors contributing to the charting benefit in the Wellington Approaches are the scale of the approach chart, which is at Coastal scale, combined with the heavy passenger traffic and parts of the busy Approaches that were last surveyed in 1985, with the critical approach channel by Barrett Reef last surveyed in 1976-1977.

3.1.11 AREA 11 : TARANAKI HARBOUR AND APPROACHES

The heightened risk in the approaches to Taranaki is associated with significant tanker traffic and survey age outside the harbour. In some areas this is from 1989-1990, including all designated and informal anchorages. Vessels are not permitted to anchor within Harbour Limits, unless under pilotage: the plots show numerous tankers anchored outside the harbour limits over a large area, mostly in 20-30m water depth, 2 - 6 nm north-north-east of the port.

The chart advises extreme caution when anchoring due to the poor nature of the holding ground throughout the area. There is no data on the chart in the vicinity of the anchorage relating to sea floor type.

The harbour area shows positive charting benefit, because of multiple varying dredged depths (from 2007), with no sea floor point-sounding data.

3.2 SOUTH ISLAND – RESULTS SUMMARIES

3.2.1 AREA 12 : TASMAN BAY – RABBIT ISLAND

A charting benefit is showing north of Rabbit Island (northwest of Nelson) due to domestic traffic, mostly water taxis and recreational craft transiting to the Abel Tasman National Park. Furthermore, although this area is in Tasman Region, it is also within the Nelson Harbour Limits and as such should be charted at Approach scale. Parts of this area were surveyed in 1957 and parts in 1986, which contribute to the result.

3.2.2 AREA 13 : NELSON APPROACHES

The positive benefit here is due to the ZOC C charting standard and heightened risk from the source data age. Nelson outer approaches were surveyed in 1957. These outer approaches are a converging

area for all types of vessel traffic bound for the port of Nelson, and are also where numerous cargo and tanker vessels anchored within the project year.

3.2.3 AREA 14 : D'URVILLE ISLAND

The ZOC C charting standard and the heightened risk from the age of the source data, dating from 1950, combines to produce the charting benefit. Added to this is the high volume of all types of traffic converging around this 'pinch' point. Notwithstanding these, the positive benefit here is mostly due to the charting scale, as the island is inside the Marlborough Harbour Limits and should therefore have a harbour scale chart.

3.2.4 AREA 15 : MARLBOROUGH SOUNDS AND APPROACHES

The northern entrance to Queen Charlotte Sound is used by cruise vessels for anchoring and ferrying passengers ashore. Inter-island ferries use this northern approach to Picton in adverse weather and when renewing their Pilotage Exemptions.

The positive benefit for Queen Charlotte Sound is partly due to the charting scale being an Approach scale of 1:36,000, whereas a Berthing scale may be more appropriate for some areas. Most of the Queen Charlotte Sound is charted as dating from 1942-1943, which combines with the ZOC C charting standard to give the positive benefit. Picton Wharves were last surveyed in 1978-86.

Tory Channel Entrance, which is used by a high volume of ferries on the Strait service, has chart source data from 1978. There is a high volume of passenger and vehicular traffic on this route.

The designated ship anchorage in Cloudy Bay and its approaches, along with the outer approaches to Port Underwood, are charted a Coastal scale. This is within Marlborough Harbour limits, resulting in a charting benefit result.

3.2.5 AREA 16 : KAIKOURA

The positive benefit at Kaikoura is due to the ZOC C charting standard and the heightened risk from the age of the source data, with the area around Kaikoura Peninsula last surveyed in 1998. Cruise vessels anchor near the coast in 20-30m water depth, with little sea floor type data available. Permission from the Harbour Master is required to enter this Restricted Area. The Kaikoura chart scale is 1: 30,000, not appropriate for cruise ship anchoring.

High passenger numbers from the domestic tourist operations, watching marine mammals offshore, increase the benefit result.

3.2.6 AREA 17 : LYTTELTON HARBOUR

Lyttelton Inner Harbour and close approaches were last surveyed in 1998 with the shallow upper harbour and across to the passenger ferry destination of Diamond Harbour last surveyed in 1951. The Lyttelton Harbour chart has a ZOC C charting standard. The effect of the Christchurch earthquake damage to Lyttelton Harbour has changed its traffic profile, but there are also significant development recovery plans. Most (but not all) cruise vessels call at Akaroa instead, which is popular with passengers. This should not make the results in Lyttelton Harbour incorrect as there is a record of significant numbers of cargo, tanker and fishing vessels using this harbour during the year of traffic record.

3.2.7 AREA 18 : BANKS PENINSULA

A route around the outside of Banks Peninsula was surveyed in 2012. However, numerous ship tracks show that traffic was not restricted to these routes, regularly passing closer to the land, through areas last surveyed in 1952. A chart rating of ZOC D indicates poor quality data, or data that cannot be assessed due to lack of information in this area.

Most types of vessels, especially fishing vessels, passed close inshore around Banks Peninsula. Tankers though did transit further offshore. Furthermore, this is an area of converging vessel tracks, as all South Island's east coast traffic has to pass around this protruding peninsula.

3.2.8 AREA 19 : AKAROA APPROACHES

The positive benefit at Akaroa Approaches is due to a ZOC C charting standard and heightened risk from the age of the source data, with the approaches to Akaroa surveyed in 1952. Additionally, there is no harbour scale chart for this harbour area. Akaroa Harbour is charted at 1:30,000 and needs a harbour limit that can be adopted into charting. Since the earthquake damage to Port Lyttelton, cruise ship visits to Akaroa have dramatically increased: the traffic plots recorded 75 cruise vessels calls at Akaroa during the 2014-15 season. Feedback from cruise representatives suggests this is unlikely to change. The harbour is also frequented by fishing vessels transiting in and out of the harbour close to the coast.

3.2.9 AREA 20 : TIMARU HARBOUR AND APPROACHES

The survey data for the outer approaches to Timaru dates back to 1959, resulting in positive charting benefit in the outer approaches.

Timaru Harbour itself also shows a charting benefit. This is mainly due to there being no depth data for the harbour: rather, the chart states that the harbour is dredged to several different depths which results in a ZOC U unassessed quality of bathymetric data. A survey date of 2000-04 for the harbour and inner approaches, provides Timaru with positive charting benefit result.

3.2.10 AREA 21 : OTAGO HARBOUR AND APPROACHES

Otago Harbour's approaches were last surveyed in 1986-87 and the main channel through the harbour is charted as being surveyed in 2001-02. Advice from the Harbour Master is that the harbour channel is actually surveyed annually and maintained to 7.3m.

In areas like Otago Harbour where the chart is marked with the maintained depth, the individual channel sounding depths are not published, as channel depths are maintained to a published depth by the port company or regional council. The Chart Benefit model will show a high benefit on the basis of it being a harbour channel with no point-sounding data, so the benefit module erroneously shows a maximum benefit. Anomalies like this are highlighted for LINZ review.

3.2.11 AREA 22 : BLUFF APPROACHES

This positive benefit is due to inadequate charting scale for Bluff harbour approach area: an approach scale chart could be considered for this area that is currently charted at 1:100,000 scale, more appropriate for general navigation. Contributing to the result is the age of some of the source data, from 1984.

3.2.12 AREA 23 : STEWART ISLAND – EAST COAST

In the 2014-2015 data period, approximately 20 cargo vessels anchored in the shelter of Stewart Island's north-east coast. These were outside the Pilotage Limit for Stewart Island and in a designated ship anchorage at Murray Beach. Charted survey was in 1981 with no sea floor type data. A moderate hydrographic risk is present in this location. These waters are all charted at 1:100,000 or Coastal scale, which is not recommended for vessel anchoring.

A total of 15 cruise ships anchored north of Ulva Island in Paterson Inlet, inside pilotage limits. These passed through a Marine Reserve, resulting in heightened risk in parts of Paterson Inlet.

The charting benefit for Stewart Island arises predominantly from charting age, which dates from 1981 around the designated anchorages off Murray Beach, to 1951 for areas north of Chew Tobacco Point. Chew Tobacco Point has occasional cruise vessels visits, which anchor, but it is mostly used by fishing vessels. The ZOC C charting standard contributes to benefit result.

3.2.13 AREA 24 : DUSKY SOUND

Most of the Sounds are gazetted as having Harbour/Pilotage Limits and according to IHO recommendations would be charted at harbour charting scales of 1:8,001 – 25,000.

The positive charting benefit for the inlet east of Five Fingers Peninsula is due to survey data 1994-95, combined with the presence of a Marine Reserve. This provides a heightened risk result. Although there is only one passenger cruise ship track recorded, there is significant domestic passenger traffic going deep into Facile Harbour and Earshell Cove. Domestic passenger vessels also transit the narrow passage between Anchor and Petrel Islands.

Routes through the centre of Dusky Sound were surveyed in 2008. However, cruise ship tracks show traffic was not restricted to these routes. Traffic regularly transited areas last surveyed in 1994-1995. At least five cruise ship transits occurred though the narrow (200 metres wide) Paget Passage (2014-2015).

The passages north, south and east of Cooper Island show a charting benefit. There is significant domestic passenger traffic in the upper reaches of this Sound, including into Supper Cove. These vessel tracks run off the 1:25,000 scale Dusky Sound chart NZ7656 and onto the 1:60,000 scale chart NZ7653. This suggests review of charting extents would be beneficial.

3.2.14 AREA 25 : DOUBTFUL SOUND

A number of larger cruise vessels visited Doubtful Sound, with a few anchoring in Bradshaw Sound. However, most vessels circumnavigated Secretary Island through Thompson Sound. A 91m cruise vessel transiting three times through the Marine Reserve's. This is narrow, less than 100 metres wide, with no minimum charted depth. There is less than 20m water depth in Te Awaatu Channel (The Gut), on the south side of Secretary Island.

The positive benefit shown for Doubtful Sound is from the significant amount of domestic traffic here, combined with the age of the source data, (the approaches were last surveyed in 1998) with the afore-mentioned Te Awaatu Channel last being surveyed in 1985.

However the charting benefit shown for the southeast arm near Deep Cove is due to the charting extents, with the inner reaches of Doubtful Sound being charted at 1:60,000 scale, combined with the Marine Reserve in this area.

3.2.15 AREA 26 : CASWELL, CHARLES AND NANCY SOUNDS

The positive benefit for Caswell, Charles and Nancy Sounds, is mainly due to the charting scale. The entire area in all three Sounds was last surveyed in 1997-1998 at 1:50,000 scale, a scale more suitable for approach charting than harbour charting. All three Sounds have designated Harbour/Pilotage Limits so each requires Harbour scale charting.

Charles Sound has a Marine Reserve at Friendship Head, which has increased charting benefit.

One boutique cruise ship made at least nine separate visits to Caswell Sound and five trips through Charles Sound during the season. It appears this was to anchor.

3.2.16 AREA 27 : GEORGE SOUND

The positive benefit for George Sound, Fiordland, comes from the charting scale. The entire Sound was last surveyed in 1998 to 1:50,000 scale, more suitable for approach charting. George Sound has designated Harbour/Pilotage Limits so requires a Harbour scale chart. At least one boutique cruise ship anchored multiple times in both of the arms of George Sound.

3.2.17 AREA 28 : BLIGH SOUND

Bligh Sound has a Marine Reserve, combined with traffic, providing increased risk. The Sound was last surveyed in 1998, to 1:50,000 scale, more suitable for approach charting. This Sound has designated Harbour/Pilotage Limits, so a harbour scale chart would be recommended. At least one boutique cruise ship anchored at the head of this Sound, on more than one occasion.

3.2.18 AREA 29 : POISON BAY

The positive benefit at Poison Bay, Fiordland, is due to the charting scale. The entire area was last surveyed in 1998 to 1:50,000 scale, more suitable for approach charting. Poison Bay has designated Harbour/Pilotage Limits so requires a Harbour scale chart. Cruise vessel traffic in this bay is less than in other nearby Sounds, with only two cruise ships calling into Poison Bay.

3.2.19 AREA 30 : MILFORD SOUND – FRESH WATER BASIN/SANDFLY POINT

Milford Sound shows an area of positive benefit mainly due to high passenger traffic through Fresh Water Basin. The shallow/drying areas in the south of Fresh Water Basin were surveyed in 1996 but the navigable waters were surveyed last in 2008, to ZOC A standard. Significant domestic passenger traffic is recorded as far upstream as Sandfly Point on the Arthur River. The shallow waters upstream

of the jetty and island were surveyed in 1996 and provide a positive charting benefit result. The chart insert showing Fresh Water Basin and Sandfly Point is at 1:10,000 scale.

A large portion of Milford Sound is a 16km long Marine Reserve, a popular place to view rare black corals, resulting in heightened risk. There are frequent large cruise vessel visits and high domestic passenger traffic volume.

3.2.20 AREA 31 : MILFORD SOUND APPROACHES

The outer approaches to Milford Sound were last surveyed in 1981. These offshore cells of positive charting benefit reflect the international cruise vessel routes to and from Australian cruise destinations. This area was surveyed to a ZOC C charting standard.

This is an extremely busy area for cruise ship and domestic excursion activity, and vessel traffic in this area is predicted to continue increasing.

3.2.21 AREA 32 : WESTPORT APPROACHES

Westport shows a positive benefit in the outer approaches. This is due to a ZOC C charting standard and heightened risk, arising from source data age. Although the harbour and inner approaches were charted in 2003, the outer approaches use chart source data from 1958.

4 SUMMARY HYDROGRAPHIC RISK TABLES

North Island					
Area by Region		Comparative Risk Level			Comments
		Medium	Moderate	Heightened	
					NORTHLAND REGION
1	Whangarei Harbour			✓	• Heightened Risk at the Main Harbour wharfs coupled with a positive benefit • A combination of approach and harbour charts - NZ 5214, 5219 • The chart extents and scale could benefit from reorganisation • Restricted navigational Waters • Chart Quality classified as ZOC B
					AUCKLAND REGION
2	Kawau Bay			✓	• Heightened risk at Kawau Bay extending into Matakana River and Bon Accord Harbour • High Domestic and Recreational shipping traffic within the bay • Chart extents and scale could benefit from reorganisation • Survey age greater than 30 years • Chart Quality classified as ZOC B • Vessel Restrictions both in size and length apply in the area of Kawau Bay • Restricted navigational waters • Approach chart NZ 5227
3	Auckland Inner Hauraki Gulf			✓	• Heightened risk which extents up to Tiritiri Matangi Island in the North and Rangitoto Island in the South. • High transiting shipping traffic for all vessel types • Chart extents/scale could benefit from reorganisation • Survey age greater than 30 years • Chart Quality classified ZOC B & C. • Approach Chart NZ 5321

North Island					
Area by Region		Comparative Risk Level			Comments
		Medium	Moderate	Heightened	
4	Auckland West Harbour			✓	• Heightened risk within the harbour limits of Auckland West Harbour, including the West Park Marina, Harriet Point and Beach Haven Wharf • Chart extents/scale could benefit from reorganisation • Survey age greater than 30 years • ZOC C charting standard • Restricted navigational waters • High traffic density for domestic vessels • Harbour Charts NZ 5323 and NZ 5322
5	Auckland Tamaki Strait			✓	• Heightened risk throughout Tamaki Strait, East of Auckland harbour • Survey age greater than 30 years • High traffic density for domestic vessels • Chart quality classified as ZOC C • Approach Chart NZ 5324
					TAURANGA REGION
6	Tauranga Approaches and Centre Harbour			✓	• Heightened risk at Tauranga Approaches and Centre Harbour • Ferry route between Opureora and Omokoroa Point • Chart extents and scale could benefit from reorganisation • Chart Quality classified as ZOC B • Survey age less than 5 years • Dredged Channel and Restricted Navigational Waters • Approach Charts NZ 5413 and 5411, Harbour Chart NZ 5412
					BAY OF PLENTY REGION
7	White Island		✓		• Moderate risk offshore White Island • Chart Quality classified as ZOC C • Survey age greater than 30 years • Approach Chart NZ 5423

North Island					
Area by Region		Comparative Risk Level			Comments
		Medium	Moderate	Heightened	
					GISBORNE REGION
8	Gisborne Approaches			✓	• Heightened risk at Gisborne Approaches within Harbour limits • Chart Quality classified as ZOC C • Survey age greater than 30 years • A combination of Approach and Harbour Chart NZ 5571
					NAPIER REGION
9	Napier Approaches			✓	• Heightened risk located at Napier approaches within the pilotage limits • Chart age only - Survey age greater than 30 years • Chart Quality classified as ZOC B • A combination of Harbour and Berthing Chart NZ 5612, Approach chart NZ 561
					WELLINGTON REGION
10	Wellington Harbour and Approaches			✓	• Heightened risk at Wellington Harbour and approaches • Chart age only - Survey age greater than 30 years • Chart Quality classified as ZOC B • Harbour Chart NZ 4633 and Berthing Chart NZ 4634
					TARANAKI REGION
11	Taranaki Harbour and Approaches			✓	• Heightened risk at Taranaki Harbour, approaches, and unofficial anchorages • Survey age between 10 to 20 years • Chart Quality classified as ZOC B • A combination of Harbour and Berthing chart NZ 4432

Table 3 : Summary Risk Table by Region – North Island

South Island					
Area by Region		Comparative Risk Level			Comments
		Medium	Moderate	Heightened	
					TASMAN REGION
12	Tasman – Rabbit Island			✓	• Heightened risk located north of Rabbit Island, within Nelson harbour limits • Survey Age between 10 to 20 years • Chart Extents/Scale could benefit from reorganisation • Domestic passenger traffic
					NELSON REGION
13	Nelson Approaches			✓	• Heightened risk at Nelson harbour approaches within pilotage and harbour limits • Chart Quality classified as ZOC C • Survey age greater than 30 years • Approach Chart NZ 6142
					MARLBOROUGH REGION
14	D'Urville Island		✓		• Moderate risk located west and north east of D'Urville Island • Chart Quality classified as ZOC C • Chart extents/scale could benefit from reorganisation • Survey age greater than 30 years
15	Marlborough Sounds			✓	• Heightened risk throughout Marlborough Sounds within harbour limits • Chart Quality classified as ZOC C • Chart extents/scale could benefit from reorganisation • Survey age greater than 30 years • A combination of Approach and Harbour Charts NZ 6153 and 6154
					CANTERBURY REGION
16	Kaikoura			✓	• Heightened risk offshore of Kaikoura • Domestic passenger traffic, mainly whale and dolphin watching activity. • Chart Quality classified as ZOC C • Survey age greater than 30 years • Approach Chart NZ 6212

South Island					
Area by Region		**Comparative Risk Level**			**Comments**
		Medium	**Moderate**	**Heightened**	
17	Lyttelton Harbour			✓	• Heightened risk at Lyttelton Harbour within harbour limits • Chart Quality classified as ZOC C • Chart age greater than 30 years • Approach Chart NZ 632 and Harbour Chart NZ 6321
18	Banks Peninsula		✓		• Moderate risk East of Banks Peninsula • Chart Quality classified as ZOC D – i.e. poor quality data, or data that cannot be assessed due to lack of information. • Chart age greater than 30 years • Approach Chart NZ 631
19	Akaroa Approaches			✓	• Heightened risk at Akaroa Approaches • Vessel Reporting procedures at Harbour entrance • Cruise and Domestic passenger traffic activity • Chart Quality classified as ZOC C • Chart extents/scale could benefit from reorganisation • Chart age greater than 30 years • Approach Charts NZ 632 and 6324
20	Timaru Harbour and Approaches			✓	• Heightened risk at Timaru Harbour and Approaches within harbour limits • Dredged Channel in the main harbour • Chart Quality classified as ZOC U – i.e. area is not assessed /unsurveyed charting area • Chart extents/scale unassessed • Chart age between 10 to 20 years • A combination of Approach and Berthing Chart NZ 6422
					OTAGO REGION
21	Otago Harbour and Approaches			✓	• Heightened risk at Otago Harbour and Approaches within the harbour limits • Chart Quality classified as ZOC C • Chart age between 10 to 20 years • A combination of Harbour and Berthing Chart NZ 6612

South Island					
Area by Region		Comparative Risk Level			Comments
		Medium	Moderate	Heightened	
					SOUTHLAND REGION
22	Bluff Approaches			✓	• Heightened risk at Bluff Approaches within Harbour Approaches • Chart extents/scale could benefit from reorganisation • Survey age greater than 30 years • Chart Quality classified as ZOC B • Harbour Chart NZ 6821
23	Stewart Island - East Coast			✓	• Heightened risk at Stewart Island - East Coast, south of Ulva Island and Bullers Point. • Chart Quality classified as ZOC C • Survey age greater than 30 years • Approach Chart NZ 6825
24	Dusky Sound			✓	• Heightened risk at Dusky Sound within harbour limits • Survey age between 20 to 30 years • Chart Quality classified as ZOC B • Approach Chart NZ 7653 and Harbour Chart NZ 7655 and 7656
25	Doubtful Sound			✓	• Heightened risk at Doubtful Sound • Survey age greater than 30 years • Chart Quality classified as ZOC B • Approach Chart NZ 7624
26	Caswell, Charles, and Nancy Sounds			✓	• Heightened risk at Caswell, Charles, and Nancy Sounds within harbour limits • Chart extents/scale could benefit from reorganisation • Survey age between 10 to 20 years • Chart Quality classified as ZOC A • Approach Chart NZ 7623
27	George Sound			✓	• Heightened risk at George Sound within harbour limits • Chart extents/scale could benefit from reorganisation • Survey age between 10 to 20 years • Chart Quality classified as ZOC A • Approach Chart NZ 7623

South Island					
Area by Region		Comparative Risk Level			Comments
		Medium	Moderate	Heightened	
28	Bligh Sound			✓	• Heightened risk at Bligh Sound within harbour limits • Chart extents/scale could benefit from reorganisation • Survey age between 10 to 20 years • Chart Quality classified as ZOC A • Approach Charts 7622 and 7623
29	Poison Bay			✓	• Heightened risk at Poison Bay within harbour limits • Chart extents/scale could benefit from reorganisation • Survey age between 5 to 10 years • Chart Quality classified as ZOC A • Approach Chart NZ 7622
30	Milford Sound - Fresh Water Basin/Sandfly Point			✓	• Heightened risk at Fresh Water Basin and Sandfly Point within harbour limits • High Domestic Passenger traffic activity • Chart Quality classified as ZOC A • Poor chart extents/scale • Survey age between 5 to 10 years • Harbour Chart NZ 7621
31	Milford Sound Approaches			✓	• Heightened risk at Milford Approaches, located out of the harbour limits • Chart Quality classified as ZOC C • Chart extents/scale could benefit from reorganisation • Survey age between 5 to 10 years • Approach Chart NZ 7622
					WEST COAST REGION
32	Westport Approaches			✓	• Heightened risk at Westport Approaches/Harbour Entrance out of the harbour limits • Fishing and Cargo traffic activity • Chart Quality classified as ZOC C - low • Survey age greater than 30 years • Approach chart NZ 71

Table 4 : Summary Risk Table by Region – South Island

4.1 DISCUSSION AND OBSERVATIONS

Although the project has provided some challenge to deliver a Hydrographic Risk Analysis for the whole of the New Zealand EEZ, a prioritisation of the navigable waters by hydrographic risk has been achieved. A charting benefit assessment, based on the combination of the risk result per GIS cell and the available margin of charting improvements possible in that GIS cell, had to be developed. The resulting output does provide a clear identification of areas that allows a survey and charting updating plan to be developed.

This work will result in a charting upgrade plan, covering a number of years. This is a decision of LINZ and not part of this work.

4.1.1 CHART DATA

It is practically impossible to update all of the source data used in a chart at one time. This produces some of the scattering of charting benefit result visible in the plots. In the LINZ portfolio, chart source data can, in some parts, date back to 1939. These areas currently provide limited sea floor coverage. Where charting benefit results are also positive due to other contributing factors, policy can prioritise these areas over others.

As ports expand and cater for larger vessels, small or shallow berths become redundant, while new berths are created in deeper water. A separate study could identify berths of high economic importance so that these may be prioritised for charting improvements. Charts in some harbour areas could be reviewed for relevance of existing berth coverage.

Similarly, parts of harbours that were once used by smaller coastal vessels may be unused by the larger vessels now frequenting these ports. Identifying the relevance of some harbour chart extents from a vessel usage point of view was not part of this project but could usefully contribute to charting reorganisation.

A few ZOC-U (unassessed) areas remain around the coast, as do some close inshore un-charted areas.

4.1.2 TRAFFIC ROUTES

Several areas of navigational importance stood out during the risk assessment review: the northern tip of the Coromandel Peninsula in particular showed traffic approaching as close as a mile to the reef extending out from Cape Colville. Tankers have passed around 1nm from the protected nature reserve at Cuvier Island.

There appears room for some improvements to the navigational safety management of vessels using coastal waters in areas of significant current (Colville Channel), or those of navigational complexity (for example Hole in the Wall - Mercury Islands; or Motuihe Channel, Auckland).

Cargo vessels passed as close as 1nm to East Island, at East Cape. East Island has a rock which uncovers at low tide, located approx. 0.3nm to the north-east. Vessels are relying on a chart scale overall 1:300,000 with this particular portion of it surveyed in 1986-96 at 1:75,000). A number of tankers passed inside the recommended 5nm off this 'pinch' point.

Numerous large cargo vessels and one tanker passed within 2nm of the Brothers Islands in Cook Strait, with large numbers of cargo vessels passing only a 1nm off Stephens Island.

4.1.3 CHARTING SCALES

The project has been able to identify areas, e.g. Marlborough Sounds approaches, where a Charting Reorganisation (in terms of scale and extents) will be of benefit to navigation. The priority areas are identified in the body of this Synopsis.

4.1.4 HARBOUR APPROACH AREAS

Analysis of Charting Benefit Results show a number of Harbour Approach areas of note. This is due in most cases to the scale or extent of the existing Approach charts. These are often at a scale more suitable for Coastal than Approach charting. A review of these areas by LINZ would be beneficial.

4.1.5 ANCHORAGES

There are a number of informal, anchorages in use around the NZ coast, used by large vessels. Sea floor coverage does not always meet the standard recommended by the IHO in such areas; this may need to be brought to the attention of Mariners. However, it may be useful to consider sea floor conditions in such areas, in conjunction with the local navigational safety authority.

The charting quality and/or scale of individual anchorage areas for applicable ports are identified and discussed in the relevant North Island or South Island sections of the report.

Taranaki has a large number of tankers anchoring offshore and outside of designated anchorages. The chart does advise extreme caution when anchoring due to the poor nature

of the holding ground throughout the area. There has been a case of a tanker dragging anchor and additional information about the sea floor may influence improvements.

4.1.6 CHART PLOTTERS

There is no quick or easy method of updating chart data in chart plotters. Recreational craft/ vessels and the majority of smaller commercial vessel are required only to carry charts suitable for their intended voyage. Many use plotters with outdated data.

A procedure for updating electronic charts on existing plotters would be beneficial to all mariners, but may be outside the scope of the current project.

4.1.7 CHART UPDATING

The updating of charting within harbour areas was a subject of feedback during data gathering. It is achieved periodically with a balance between cost and expediency.

Some ports have provided a charting benefit result in their maintained channels due to dated chart information, in spite of regular survey by ports. Whilst, piloted vessels do not necessarily need to rely on official nautical charts (Pilots have access to local survey results), those navigating pilot exempt (PEC) vessels do not always have similar access to the latest survey data, but rely on official nautical chart data.

Most New Zealand ports are deepening channels to facilitate access to berths by larger vessels. Entrance channels are often deeper or different to charted, because of annual maintenance or capital dredging by ports or harbour masters.

The risk assessment has a charting benefit result in these areas. It may be of use to consider policy for charting update periods in such areas.

4.1.8 HARBOUR LIMITS

Changes to Harbour responsibility in New Zealand Harbour Waters occurred following the Port Companies Act 1988. This has resulted in navigational responsibilities being delivered through Regional Council systems, who have jurisdiction both inside and outside Harbour Limits. Harbour Limits can thus been seen as of lower importance in NZ waters, but they are internationally recognised (and harbour liability case law is fundamental to such limits). Not all harbour limits appear on all of the LINZ charts and the risk assessment needed to manually add these in some cases. Accordingly this is a worthwhile area of policy review.

The change in harbour responsibilities has resulted in port companies no longer carrying out hydrographic surveys of non-commercial parts of harbours. Charted data of these areas has become outdated.

4.1.9 CATZOC

The CATZOC rating is of help to the navigator using ECDIS and it is also a key input into a Hydrographic Risk assessment. LINZ has policy to add the M-QUAL Charting Quality CATZOC rating to its charts and has done this to almost all of its coastal charting series, but not into the offshore series of charts. There is reason for this as it is deep water and sea floor coverage only needs to be limited. It is worthwhile LINZ considering extending the ZOC assessment into the NZ EEZ, apart from planning charts, so that the LINZ international charts are given a rating reflecting their sea floor coverage and quality overall. This will also assist in a future review of the GIS based risk model.

Annex A Important Areas by Risk Result

1 IMPORTANT AREA RESULTS - RISK PLOTS

The Overview, North Island and South Island reports provide plots of all recorded traffic within the NZ EEZ, excluding the Kermadec Islands and southern waters. They also include plots of the resulting hydrographic risk, as well as plots by Regional Council Jurisdiction, showing where charting improvements show benefit. The reports analyse traffic, hydrographic risk and charting benefit regionally, with the main ports addressed separately. Areas of Heightened or Moderate Risk Levels with Positive Charting Benefit are identified and summarised in this section.

1.1 NORTH ISLAND

The following plot, **Figure 5**, identifies areas in the North Island where the comparative charting benefit is positive with an associated elevated risk level. There are 11 important areas in the North Island that arise out of the risk assessment and are shown in the plot. These are discussed by individual area in the earlier part of this synopsis.

1.1.1 SOUTH ISLAND

Figure 6, identifies areas in the South Island where the comparative charting benefit is positive with an associated elevated risk level. There are 20 important areas in the North Island that arise out of the risk assessment, which are shown in the plot. These are discussed by individual area in the earlier part of this synopsis.

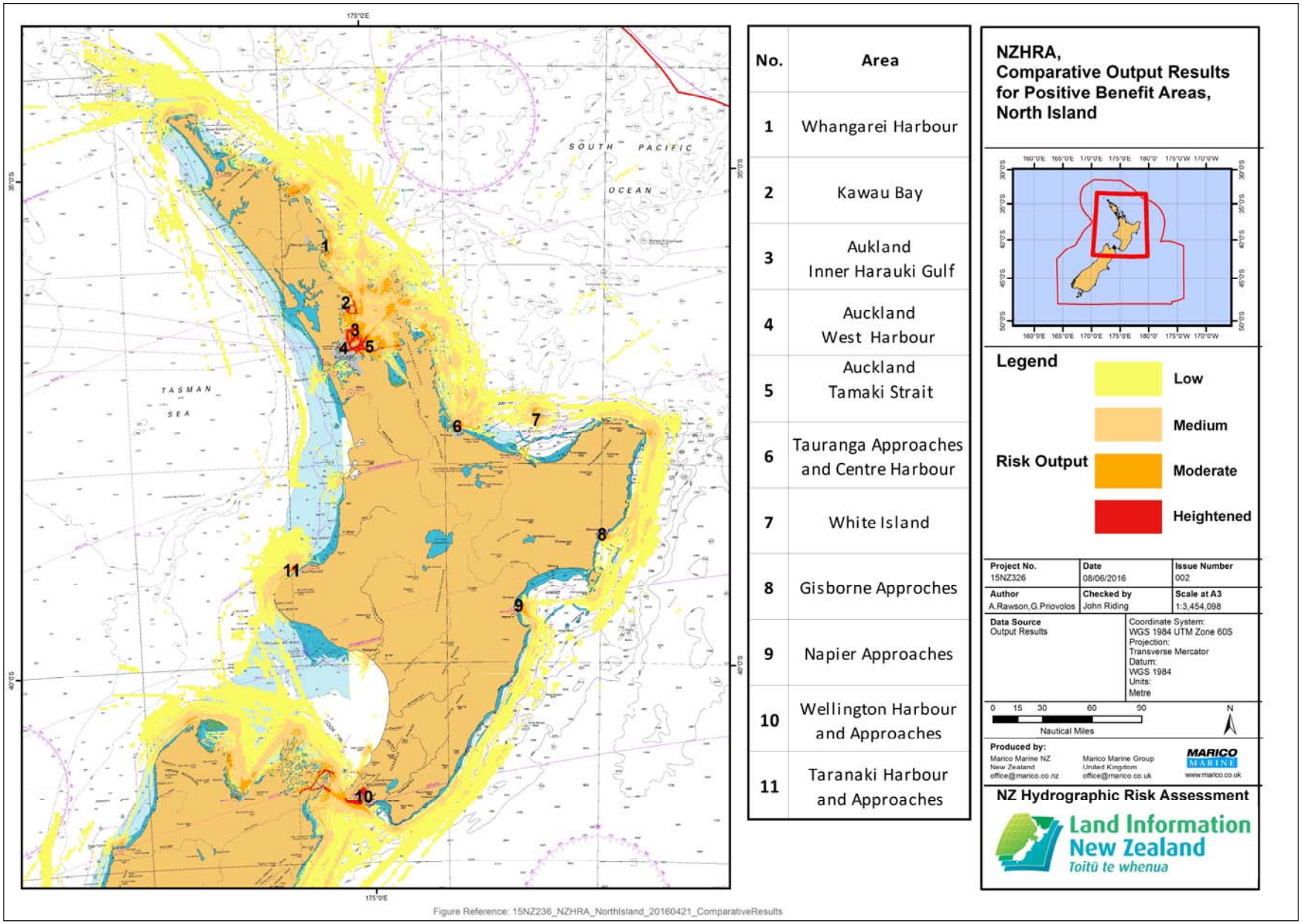

Figure Reference: 15NZ236_NZHRA_NorthIsland_20160421_ComparativeResults

Figu

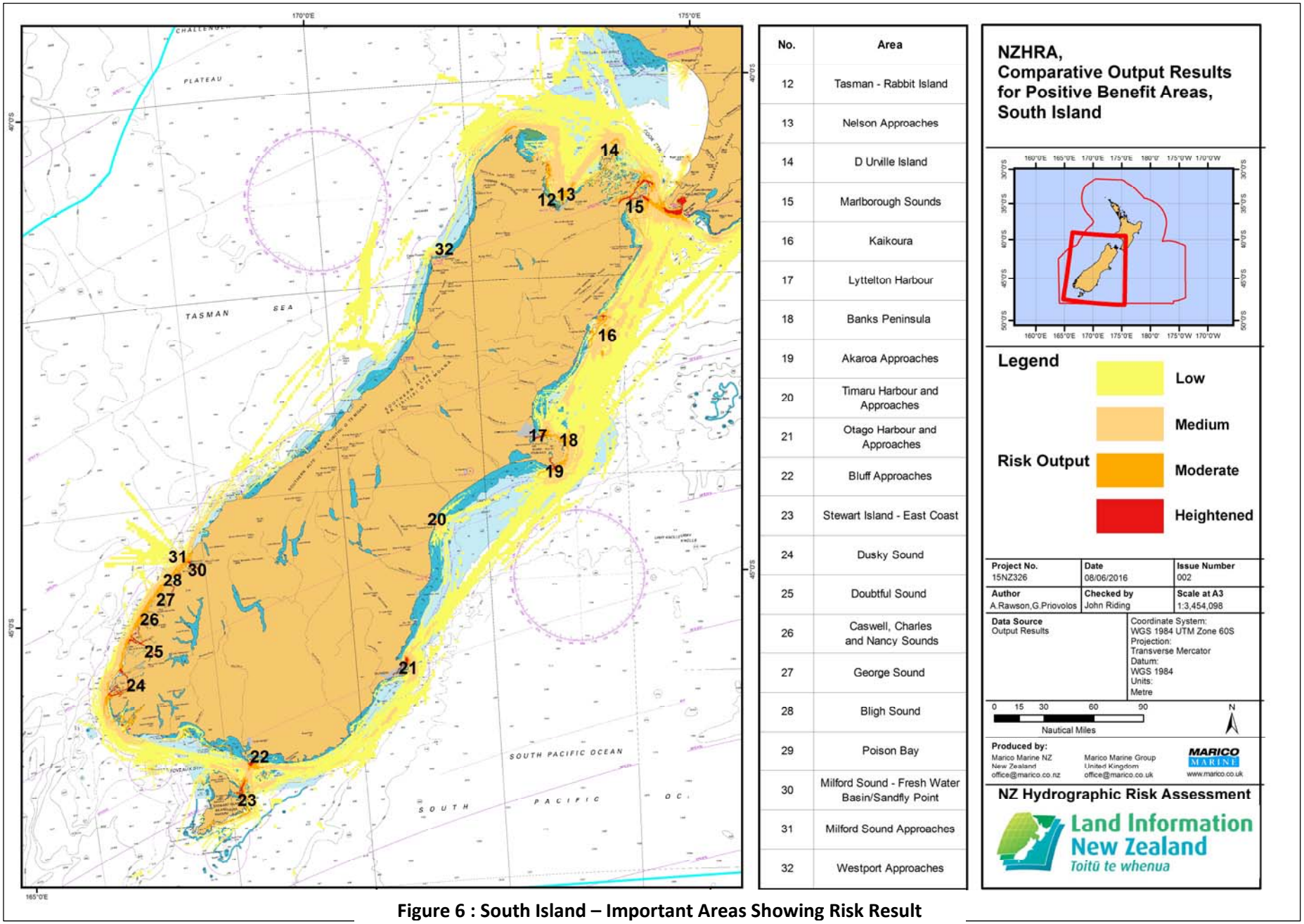

Figure 6 : South Island – Important Areas Showing Risk Result