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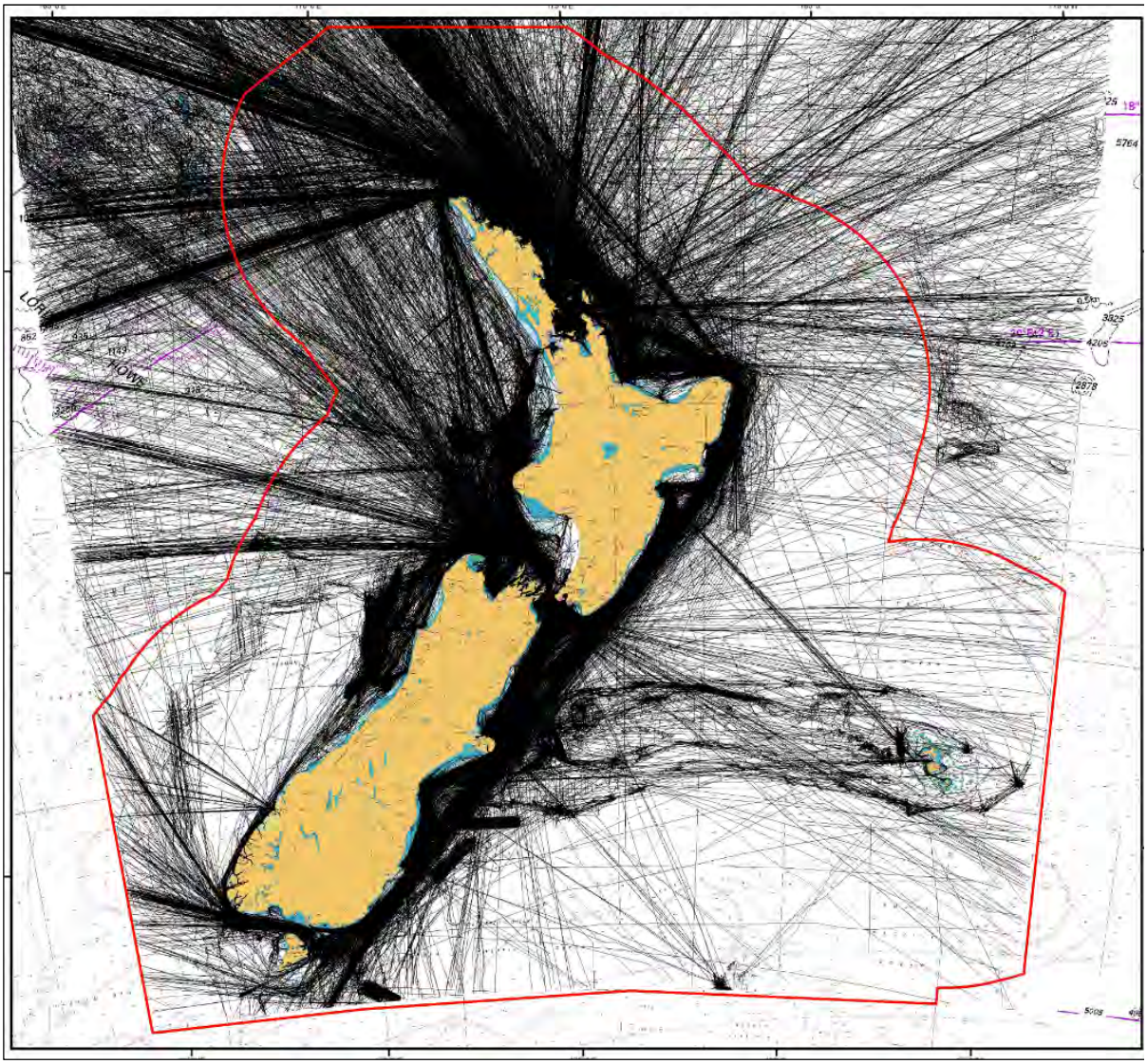
NEW ZEALAND HYDROGRAPHIC RISK ASSESSMENT - NORTH ISLAND



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MARICO MARINE NEW ZEALAND LTD

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NEW ZEALAND HYDROGRAPHIC RISK ASSESSMENT - NORTH ISLAND

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ABBREVIATIONS

Abbreviation	Detail
ATBA	Area To Be Avoided. An IMO approved routeing tool, which is printed on the chart, where a sea area is close to SOLAS traffic in accordance with agreed criteria. ATBAs are normally used in sea areas of high ecological value to a coastal state, such as a marine reserve.
AIS	Automatic Identification System
ALARP	As Low as Reasonably Practicable
AtoN	Aid to Navigation
b	Billion
CATZOC	Category of Zone of Confidence in data, an IHO S57 attribute of the MQual object. Referenced as ZOC.
CPZ	Cable Protection Zone
DG	Dangerous Goods
DOC	Department of Conservation
DQWG	Data Quality Working Group
DUKC	Dynamic Under Keel Clearance
DWT	Deadweight, a measure of a vessel's weight carrying capacity, including the steel weight of its structure.
ECDIS	Electronic Chart Display Information System
EEZ	Exclusive Economic Zone
ENC	Electronic Navigational Chart
FIGS	Freight Information Gathering System
FSA	Formal Safety Assessment
GDP	Gross Domestic Product
GIS	Geographic Information System
GRT	Gross Registered Tonnage
GT	Gross Tonnage
ha	Hectare
HW	High Water
IHO	International Hydrographic Organization
IMO	International Maritime Organisation
ISS	International Space Station
ITU	International Telecommunications Union (Marine communication standards)
km	Kilometre

Abbreviation	Detail
kt	Knot (unit of speed equal to one nautical mile per hour)
LAT	Lowest Astronomical Tide
LOA	Length Overall
LW	Low Water
m	Metre
M	Million
ML	Most Likely
MMSI	Maritime Mobile Service Identity. A series of nine digits, uniquely identifying a vessel, sent in digital form by an AIS transponder.
MNZ	Maritime New Zealand
MPI	Ministry for Primary Industries
MQual	Accurate quality of data, an area within which a uniform assessment of the quality of the data exists.
nm	Nautical Mile
NtoM	Notice to Mariners
PEC	Pilotage Exemption Certificate
POAL	Ports of Auckland Limited
RoRo	Roll-on / Roll-off vessel
S-AIS	Satellite (received) Automatic Identification System
SBM	Single Buoy Mooring
SOLAS	The International Convention for the Safety of Life at Sea
STCW	Standards of Training Certification and Watch keeping
T	Tonnes
T-AIS	Terrestrial (received) Automatic Identification System
TEU	Twenty Foot Equivalent Unit, based on the volume of a twenty foot container
UNCLOS	United National Convention on the Law of the Sea
VHF	Very High Frequency (radio communication)
VMS	Vessel Monitoring System
VTS	Vessel Traffic Service
WC	Worst Credible
ZOC	Zone of Confidence

1 INTRODUCTION

This report is part of four documents which report on a Hydrographic Risk Assessment for the sea area comprising the New Zealand Exclusive Economic Zone (EEZ) excluding the Sub-Antarctic islands (south of 48°S latitude) and the Kermadec Island shelf, and was carried out 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.

This Risk Assessment uses Geographic Information System (GIS) spatial analysis techniques to identify areas of hydrographic risk using data-based evidence. The data used is in layers (39) with a base layer of a 12 month traffic record, taken from AIS data. The study uses this comparative risk technique to assist LINZ to effectively prioritise future hydrographic surveys and charting improvements throughout the EEZ.

This Hydrographic Risk Assessment identifies important areas of benefit for charting improvements, based on the needs of contemporary shipping for the provision of accurate and adequate nautical charts. From this analysis, LINZ can develop a survey and charting development programme that will span a number of years. The prioritisation and content of the work programme will be part of the LINZ decision-making process associated with planning of its resource deployment.

The main report is in three parts; a New Zealand Overview (15NZ236-A), the North Island (this document) and the South Island, 15NZ236-C. There is a separate Synopsis (15NZ236-D) – the fourth component.

This report (15NZ236-B) includes:

- An overview of the material needed to understand this report, and
- The detailed results of the North Island risk assessments.

For a more complete understanding of the background information and methodology of the risk project as well as overall discussions and conclusions, the Overview Document (15NZ236-A) needs to be consulted.

1.1 BACKGROUND

The use of risk-based techniques to prioritise a hydrographic work programme provides added value to the selection of candidate areas for hydrographic survey. The LINZ Hydrographic methodology, between varieties of coastal areas, each with differing bathymetry and trading/growth

characteristics. Risk is only one factor that the methodology takes into account. For example, the economic activity in an area dictates the ship types and sizes that serve the area, but information about the potential for economic growth has also been used, as realisation of that potential may result in an increase in vessel traffic volume, and possibly vessel type and size. Thus there are three key components (risk, ship types and sizes; economic growth) that, when combined, provide the evidence required to promote one area over another for hydrographic survey prioritisation.

A location with outstanding environmental status provided the fourth factor in prioritisation; an incident in any area sensitive to environmental damage provides increased consequence impact. Environmental damage in an area with economic activity linked to environmental utility provides further consequence impact. Grounding consequence in both environment and economics is related to the release of bunkers or cargo. Environmental status is therefore attached to risk, which is linked to vessel size and type.

The maritime trade around the New Zealand coast, in common with the rest of the world, has changed dramatically in recent decades. Larger, faster cargo vessels are calling at fewer hub ports, feeder services have increased and there has been a dramatic increase in cruise ship calls, with visits by large vessels to remote locations becoming increasingly common place. This trend of growth is projected to continue.

The risks associated with the use of out of date chart data have therefore increased significantly in recent years and there is a need to systematically re-survey many areas around the NZ coast. There is both a budgetary and a practical need, though, to prioritise. This report considers a methodology to enable prioritisation. It is risk based, but combines the economic drivers with the risk considerations. This process is a crucial base for survey planning, as comprehensive statistical data was available in few areas. It was also unknown if groundings have occurred that could be directly linked to out of date or inaccurate charts, therefore the risk work was mainly proactive.

The prioritisation process is not only risk based, but transparent against set criteria. It also needs to be clearly documented, systematic and recorded in a uniform manner. To achieve this, the methodology and required input data was uniformly applied across the candidate harbours, coastal and ocean areas.

The overall severity of impacts from a marine accident on a coastal zone is dependent on a large number of factors. Areas of economic success or environmental importance can be severely affected, but severity of impact is dependent on their distance from the casualty. Longer term impacts on trade, especially tourism, are also lessened the greater the distance from the event.

Severity of consequence are thus geographically relevant and the best way to assess such impacts is to employ a Geographical Information System to evaluate the risk.

This risk based result will significantly benefit hydrographic decision-making and will identify the areas that are priority candidates for charting improvements.

1.2 PROJECT SCOPE

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

In more detail, this comprises:-

- Decoding, cleaning and post-processing to prepare a fused AIS data set, made up from raw Terrestrial and Satellite AIS data. AIS data is transmitted by all SOLAS ships in service over 350 gross tons and some NZ domestic registered vessels. A small number of non-SOLAS foreign vessels (e.g. superyachts) also transmit AIS data.
- Undertaking a programme of data gathering throughout New Zealand, categorised by the boundaries of each Regional Council region (stakeholders included Regional Councils, port & harbour companies). This included the development of a Data Catalogue, ordered by Regional Council jurisdiction.
- Provision of traffic analysis of all SOLAS vessel types and domestic vessels, including traffic frequency, density and type.
- Developing risk criteria appropriate to the NZ data volume and ship traffic types.
- Developing a hydrographic risk model using the developed risk criteria.
- Developing a hydrographic chart benefit model for New Zealand waters.
- Provision of a purpose-built database to catalogue and store all the data gathered.

1.3 OFFICIAL NAUTICAL CHARTS

Reliable up-to-date nautical chart information is vital for safe navigation. As the New Zealand Hydrographic Authority (NZHA), LINZ charts the country's surrounding sea and environs, from the South West Pacific to the Antarctic, as mandated by the International Hydrographic Organisation (IHO), to meet NZ's treaty law obligations under SOLAS[1].

[1] **IMO SOLAS Chapter V, Regulation 9 Hydrographic Services**

Nautical charts and nautical publications, such as sailing directions, light lists, notices to mariners, tide tables and other nautical publications necessary for the intended voyage, are required under SOLAS Regulations to be carried on board; to be adequate and to be up to date, for all SOLAS vessels.[2]

Additionally, Maritime Rules Part 25 sets out the requirements for the carriage of charts and nautical publications on ships. It applies, with certain specified exceptions, to commercial vessels of 12 metres or more in length overall that operate within enclosed water limits and all commercial vessels operating outside the enclosed water limits.

The mariner must also use the largest scale chart available and suitable for the type of navigation being undertaken.

1.4 DATA USED IN THE PROJECT

1.4.1 AUTOMATIC IDENTIFICATION SYSTEM DATA (AIS)

A full 12 months record of shipping traffic using New Zealand waters has been used as a core input into the Hydrographic Risk Assessment. Traffic was broken down into ship types as transmitted by AIS transponders fitted to all internationally trading vessels ('SOLAS' vessels) and most domestic vessels carrying passengers for commercial gain (.i.e. entered into SSM or MOSS). Covering a twelve month span, this is the most comprehensive record of ship traffic used on any New Zealand based safety assessment[3], which has been corrected against ship data held by the ITU.

The terrestrially recorded AIS traffic record was supplied by Marico Marine from their national recording database. Additional data was supplied by LINZ from the NZ Government system, which assisted in a QA of the data record and infill where the reception record could be improved. Both terrestrial data sets were used to provide a database with the best records of coverage.

For areas where no terrestrial coverage was available, Satellite recorded AIS (S-AIS) data was used. The primary S-AIS data was sourced from exactEarth, with infill provided by S-AIS recorded by Orbcom in the Government system. ExactEarth satellite data was used because of its frequency of data update as well as superior recording of time in relation to a vessel's position. This improved the link between terrestrial datasets (which are real time) and satellite, which suffers some delay until

[2] **IMO SOLAS Chapter V Regulation 27 Nautical Charts and Nautical Publications**

[3] **The most recent coastal safety review used a three month record of AIS data.**

the data is downloaded to a ground station, at which time the time stamp is added to the received data[4].

As any S-AIS data is not recorded real time and is intermittent in nature, tracks will be linked together by a computer, not necessarily reproducing the exact track taken by a vessel. Where data showed tracks in obvious error (e.g. crossing land), these were manually corrected. Thus the final track database used for the project will contain some minor inaccuracies and should not be relied on as an exact record of any vessel.

1.4.2 ADDITIONAL DATA COLLECTED

A key component of the risk assessment was the gathering of location information and local data to support the identification of risk areas and provide local input to assist with prioritising future hydrographic surveys.

Harbour Masters, Councils' representatives, Port Company 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 stakeholders, augmented with data publically available from the internet.

Where GIS shapefiles of sensitive sites and other data sets were available from stakeholders, principally from Councils' Tier 2 Marine Oil Spill Plans, these were uploaded directly into the GIS risk model.

Shapefiles of Marine Reserves were supplied by the Department of Conservation (DOC); the Ministry for Primary Industries (MPI) supplied data sets of fishing vessel routes for the study year.

1.5 NEW ZEALAND CHARTING DEFINITIONS

Hydrographic charts have two functions: marine navigation and information sources. Most hydrographic offices have an obligation to provide nautical chart cover of their national waters and any other waters under their jurisdiction, to such an extent and on such scales as to permit safe navigation for all classes of vessel from the smallest to the largest, throughout coastal waters including large ports to minor inlets of purely local interest.

[4] **AIS data does have a time within it, but this is a time breakdown within a second to allow two AIS transponders in an area to synchronise transmission and reception (and thus avoid data collisions). AIS "time" does not include minutes (or hours), so remote reception needs to add those time elements when the data is received. Dependent on any delays from transmission to reception.**

1.5.1 CHART ADEQUACY

Charting scales, extents of coverage and quality of seafloor coverage all combine to denote chart adequacy. The adequacy of nautical charts is complex but the components overall that contribute to the LINZ measure of charting adequacy can be represented by the diagram below.

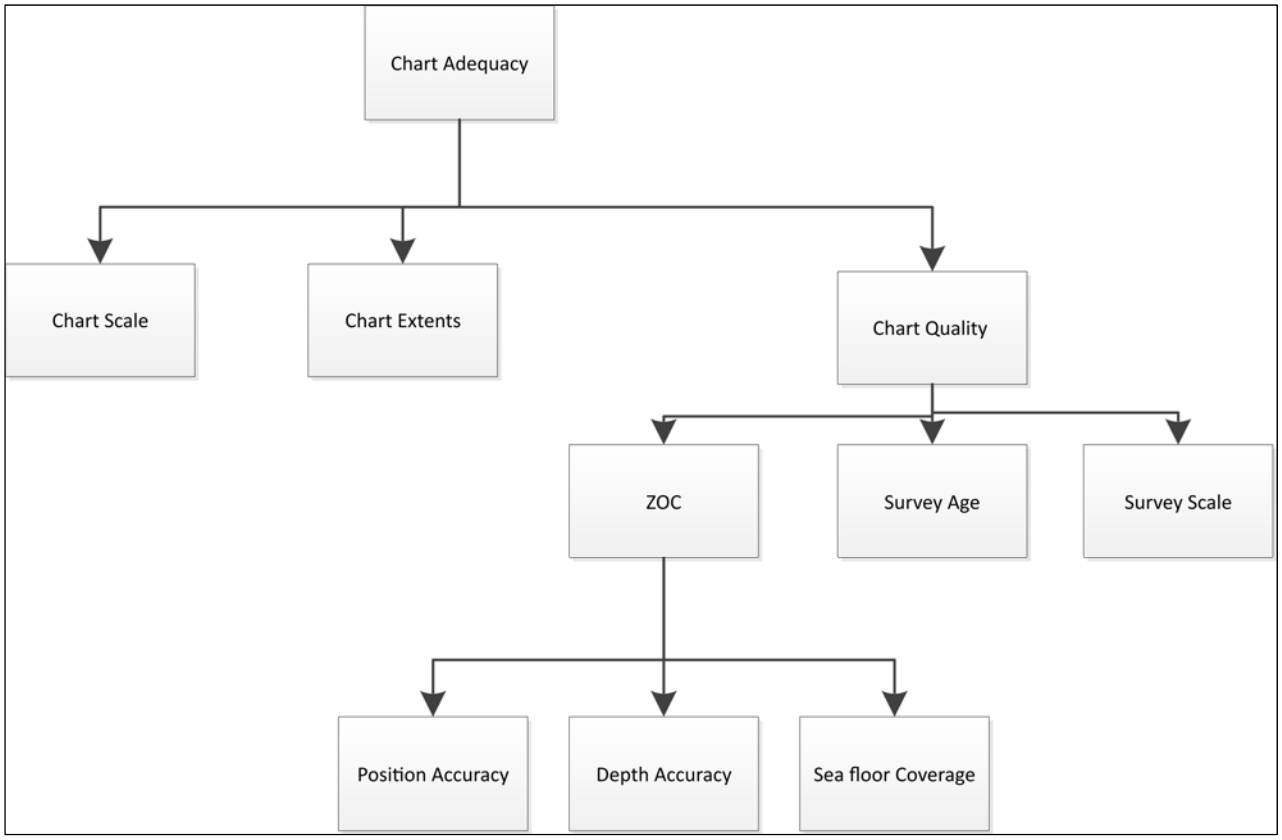


Figure 1 : Chart Adequacy

1.5.2 CHART SCALE

National nautical chart series usually encompass the largest scale publications available, showing the detailed configuration of the seabed offshore. Information about the shape of the seabed is used by a variety of users other than navigators: dredging contractors, construction engineers, defence departments and so on.

The combined effect of the requirements of marine navigation and providing an information source has caused the national chart series to cover national waters in varying detail, reflected by the large scales used for port plans, and usually the existence of at least two continuous coastal series, one on a relatively large scale, the other slightly smaller.

With the advent of ECDIS (Electronic Chart Display Information System), the IHO members have agreed recommended scale ranges for

- Offshore charting
- Coastal charting
- Harbour Approach charting
- Berthing charting

The New Zealand charting area under consideration includes coastal, approach and harbour charts of scales from 1:75,000-1:4,000,000 for medium scale coastal charts, to 1:5,000-1:75,000 for large scale or harbour charts. These charts are all published on the WGS 84 geodetic datum. All New Zealand Charts for the area inside the EEZ now have depths and heights in metres. Previous versions with depths in fathoms and heights in feet have all been withdrawn.

By policy, LINZ use the following guidance for the scales of their NZ chart portfolio. A range of different scales are recommended for the stated type of navigational use, which sets the scales for printed charts. The LINZ policy is in accordance with the IHO recommendations for navigation type.

LINZ Navigational Purpose Scale Ranges (Paper Charts)			
Subfield	**Navigation**	**Purpose**	**Available Compilation Scales for ENC charts**
1	Overview	>=3,000,001	1:3,000,000
2	General	800,001 – 3M	1:3,000,000 1:1,500,000 1:700,000
3	Coastal	80,001 – 800K	1:700,000 1:350,000 1:180,000 1:90,000
4	Approach	25,001 – 80K	1:90,000 1:45,000 1:22,000
5	Harbour	8,001 –25K	1:22,000 1:12,000 1:8,000
6	Berthing	>=8K	1:8,000 1:4,000

Table 1 : LINZ Paper Chart Compilation Scale

A ship's ECDIS will comply with the standard scale table (**Table 2**) when a charting range is selected on the ECDIS system. Setting the range on an ECDIS will select the chart data scale nearest to the chosen setting. For harbour approaches, the system should automatically change scale to the charting scale as recommended. This provides the mariner with a paper charts scale to ENC Scale Conversion. The paper chart compilation scale is rounded down to the nearest ENC compilation Scale (e.g. Paper Chart 20,000 = ENC 12,000).

One of the key tests in the charting benefit model is to determine if chart data is available at the right scale (as recommended by IHO) for the navigational purpose of the area in which a vessel was navigating.

Radar Range / Standard Scale Table (ENC)	
Selectable Range (in nautical miles)	**Standard Radar Scale (rounded)**
200	1:3,000,000
96	1:1,500,000
48	1:700,000
24	1:350,000
12	1:180,000
6	1:90,000
3	1:45,000
1.5	1:22,000
0.75	1:12,000
0.5	1:8,000
0.25	1:4,000

Table 2 : IHO ENC Compilation Scale

1.5.3 CHART EXTENTS

LINZ produces official nautical charts for safe navigation in New Zealand waters and is in addition the charting authority for the sea areas south of New Zealand to Antarctica as well as a significant area of the South-West Pacific.

This hydrographic risk assessment covers from the NZ coast to the NZ Economic Exclusion Zone, excluding the Sub-Antarctic islands (south of 48°S latitude) and the Kermadec Island shelf.

1.5.4 CHART QUALITY

Chart quality may be said to comprise of three factors: Zone of Confidence (ZOC); survey age and survey scale. LINZ has policy to add the MQual Charting Quality CATZOC rating to its charts and has done this to almost all of its coastal charting series[5]. The CATZOC rating is of help to the navigator as well as a Hydrographic Risk assessment and presently the rollout programme extends to the Coastal Chart portfolio.

[5] **Not all Hydrographic offices have this policy, which makes LINZ a leader in this area; others are following. As Hydrographic Risk is much better informed by the ZOC rating of a chart, this LINZ policy is important.**

To date, New Zealand has provided quality indicators on all of its hydrographic charts by way of Source Data Diagrams and Diagrams of Sounding Line Density.

1.5.4.1 ZONE OF CONFIDENCE

The IHO Data Quality Working Group (DQWG) developed ZOCs as a solution for the assessment and display of hydrographic data quality to support safe and efficient navigation. Areas covered by hydrographic surveys are classified by identifying various levels of confidence with respect to depth accuracy, position accuracy, thoroughness of seafloor search, and the characteristics of the survey. Six ZOC have been developed - A1, A2, B, C, D and U. To decide on a ZOC Category, all conditions outlined in columns 2 to 4 of the table must be met.

1	2	3		4	5
ZOC[1]	**Position Accuracy[2]**	**Depth Accuracy[3]**		**Seafloor Coverage**	**Typical Survey Characteristics[5]**
A1	± 5 m + 5% depth	= 0.50 + 1%d		Full area search undertaken. Significant seafloor features detected[4] and depths measured.	Controlled, systematic survey[6] high position and depth accuracy achieved using DGPS or a minimum three high quality lines of position (LOP) and a multibeam, channel or mechanical sweep system.
		Depth (m)	Accuracy (m)		
		10 30 100 1000	± 0.6 ± 0.8 ± 1.5 ± 10.5		
A2	± 20 m	= 1.00 + 2%d		Full area search undertaken. Significant seafloor features detected[4] and depths measured.	Controlled, systematic survey[6] achieving position and depth accuracy less than ZOC A1 and using a modern survey echosounder[7] and a sonar or mechanical sweep system
		Depth (m)	Accuracy (m)		
		10 30 100 1000	± 1.2 ± 1.6 ± 3.0 ± 21.0		
B	± 50 m	= 1.00 + 2%d		Full seafloor coverage not achieved; uncharted features, hazardous to surface navigation are not expected but may exist.	Controlled, systematic survey achieving similar depth. But lesser position accuracies than ZOCA2, using a modern survey echosounder[5], but no sonar or mechanical sweep system.
		Depth (m)	Accuracy (m)		
		10 30 100 1000	± 1.2 ± 1.6 ± 3.0 ± 21.0		
C	± 500 m	= 2.00 + 5%d			

1	2	3		4	5
ZOC[1]	Position Accuracy[2]	Depth Accuracy[3]		Seafloor Coverage	Typical Survey Characteristics[5]
		Depth (m)	Accuracy (m)	Full seafloor coverage not achieved, depth anomalies may be expected.	Low accuracy survey or data collected on an opportunity basis such as soundings on passage.
		10 30 100 1000	± 2.5 ± 3.5 ± 7.0 ± 52.0		
D	worse than ZOC C	worse than ZOC C		Full seafloor coverage not achieved, large depth anomalies may be expected.	Poor quality data or data that cannot be quality assessed due to lack of information.
U	Unassessed – The quality of the bathymetric data has yet to be assessed				

Table 3 : CATZOC Categories

Figure 2, below, shows the Zone of Confidence ratings for the LINZ portfolio in New Zealand coastal waters.

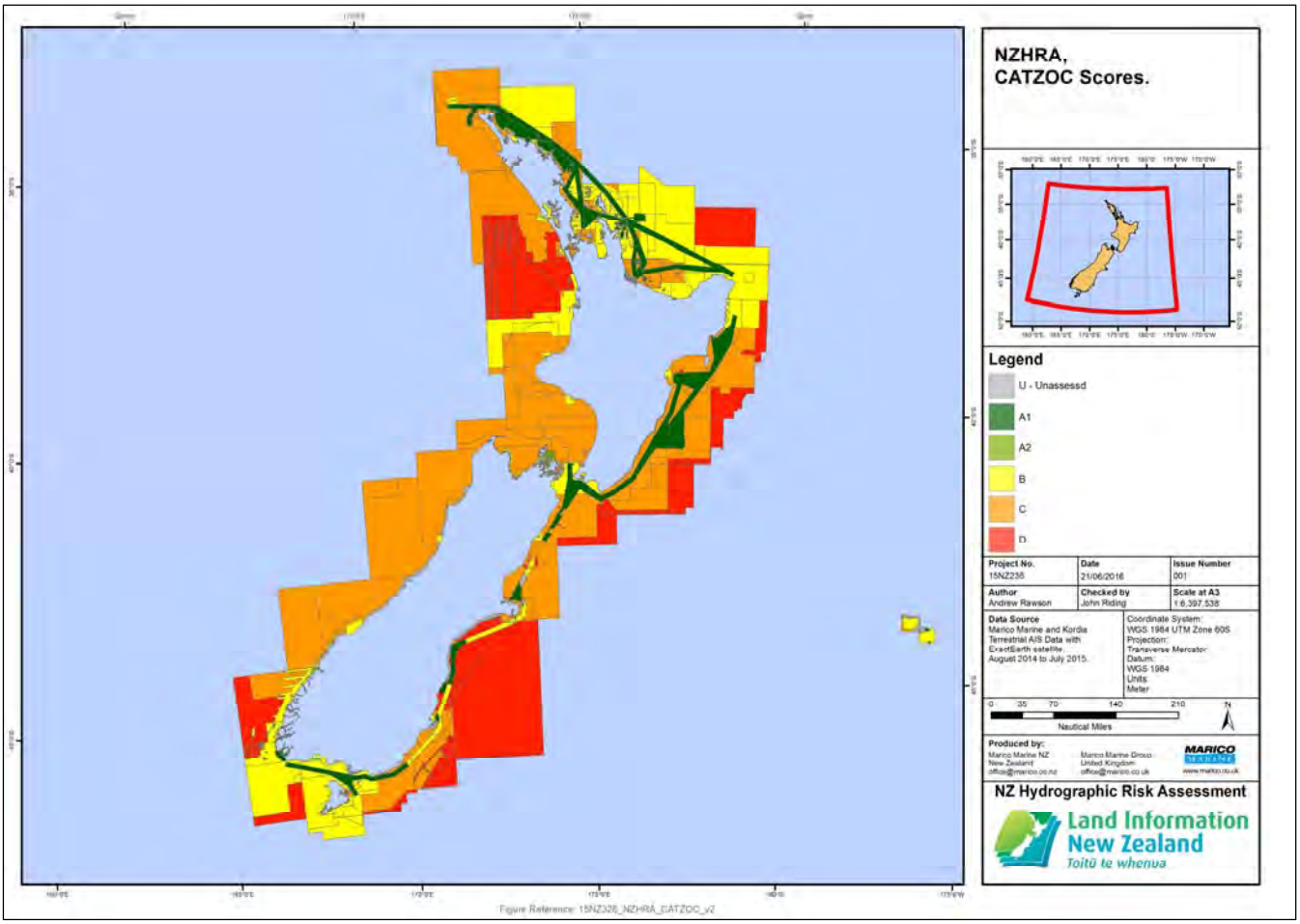
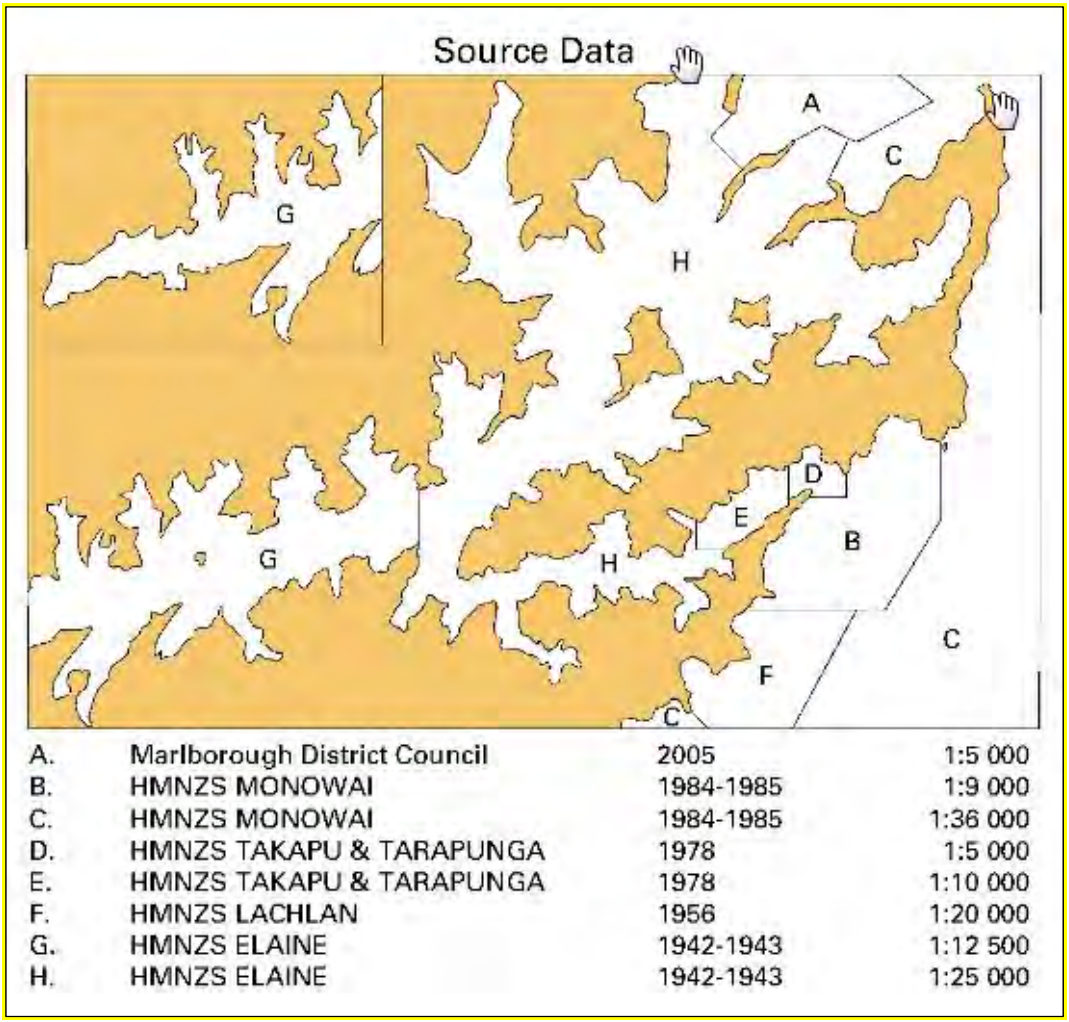


Figure 2 : Zone of Confidence for NZ Chart Portfolio

1.5.4.2 SURVEY AGE

Whilst in general, the main New Zealand ports may have been surveyed within the last 20 years, significant parts of the main ports' published charts rely on surveys conducted over 60 years ago. For example, Marlborough Sounds chart NZ6153 has large areas of survey data dating from 1956, including sections of Tory Channel and Queen Charlotte Sound (northern approach to Picton). These routes incorporate the Cook Strait ferry services, with over 1.2M passenger transits each year, see **Figure 3,** below.

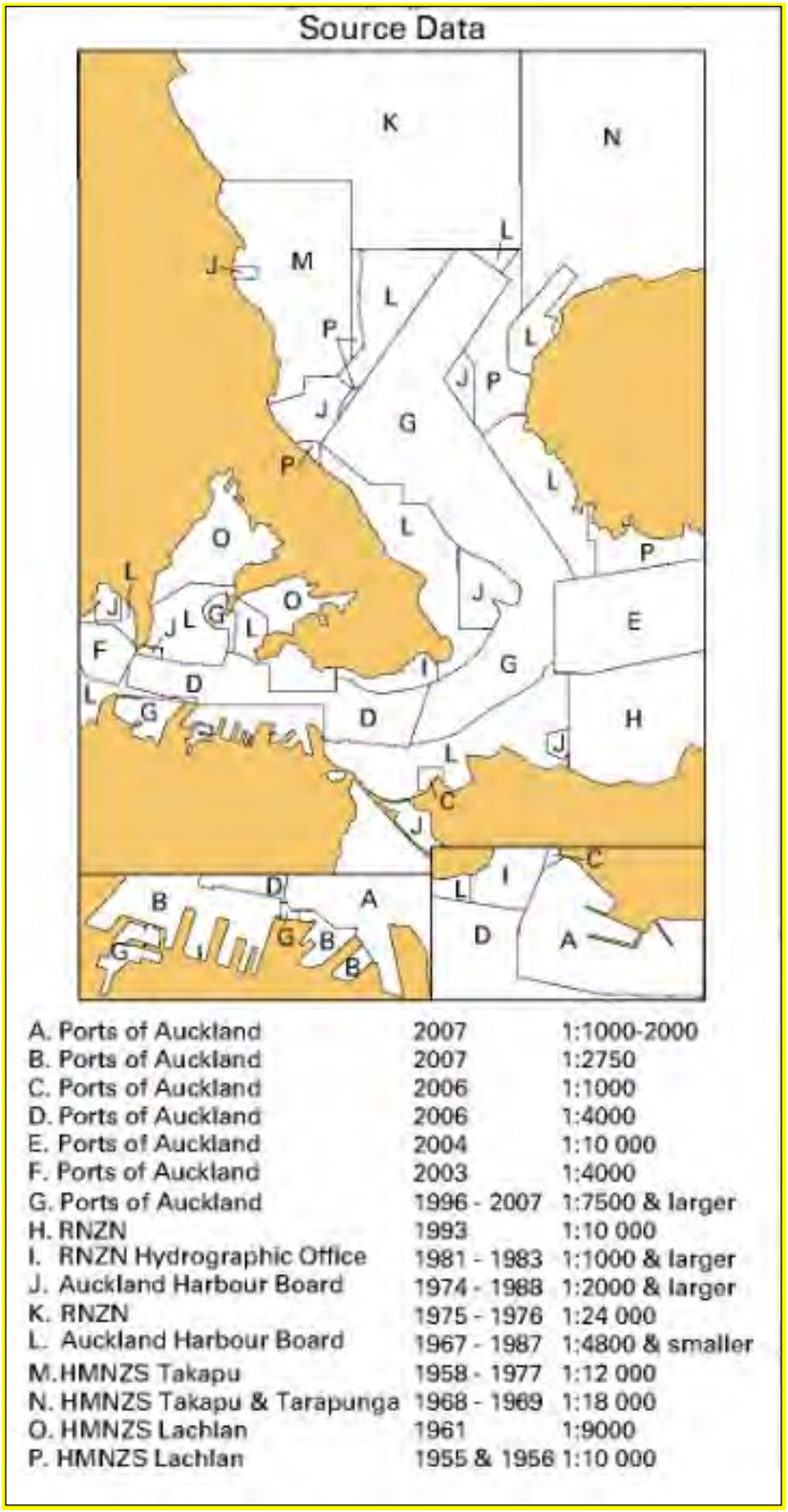
Anecdotal reports from Port operators and Harbour Masters indicate that these areas may have in fact been regularly sounded, for example by port or Harbour Master workboats, but the data has either not been passed on to LINZ for updating the charts, or has been passed on to LINZ but not incorporated into the charts. There remains concern with the underlying problem of liability associated with not updating charts



A.	Marlborough District Council	2005	1:5 000
B.	HMNZS MONOWAI	1984-1985	1:9 000
C.	HMNZS MONOWAI	1984-1985	1:36 000
D.	HMNZS TAKAPU & TARAPUNGA	1978	1:5 000
E.	HMNZS TAKAPU & TARAPUNGA	1978	1:10 000
F.	HMNZS LACHLAN	1956	1:20 000
G.	HMNZS ELAINE	1942-1943	1:12 500
H.	HMNZS ELAINE	1942-1943	1:25 000

Figure 3 : Chart NZ6153 Marlborough Sounds – 1942 Source Data

Auckland Harbour East chart NZ5322, which includes the main approach channel to the Port of Auckland (with over 1500 ship calls in 2014) shows small areas adjacent to the main shipping channel, that were last surveyed in 1955. (Refer **Figure 4)**



A. Ports of Auckland	2007	1:1000-2000
B. Ports of Auckland	2007	1:2750
C. Ports of Auckland	2006	1:1000
D. Ports of Auckland	2006	1:4000
E. Ports of Auckland	2004	1:10 000
F. Ports of Auckland	2003	1:4000
G. Ports of Auckland	1996 - 2007	1:7500 & larger
H. RNZN	1993	1:10 000
I. RNZN Hydrographic Office	1981 - 1983	1:1000 & larger
J. Auckland Harbour Board	1974 - 1988	1:2000 & larger
K. RNZN	1975 - 1976	1:24 000
L. Auckland Harbour Board	1967 - 1987	1:4800 & smaller
M. HMNZS Takapu	1958 - 1977	1:12 000
N. HMNZS Takapu & Tarapunga	1968 - 1969	1:18 000
O. HMNZS Lachlan	1961	1:9000
P. HMNZS Lachlan	1955 & 1956	1:10 000

Figure 4 : Chart NZ5322 Auckland Harbour East - 1955 Source Data

The size of vessels and the accuracy of navigation now possible using satellite derived positioning are significantly different from the original intended purposes for which many existing charts were derived. The mariner is advised accordingly, both during training and by remarks on the charts and source data advice. This mitigates liability risk by providing clarity of chart limitations.

Despite this, there remains a reasonable concern that inadequate and inaccurate nautical charting could adversely affect safety of life at sea and the protection of the marine environment. It may also inhibit maritime trade, thereby adversely affecting the economy of some regions. There remains a potential for liability associated with not providing fit for purpose charts.

1.5.5 NZ CHART PORTFOLIO

The New Zealand official chart Portfolio comprises some 242 charts, which fall within the IHO recommended range for navigational purpose as follows:-

Navigational Purpose Scale Range	No. of Charts
General	10
Coastal	47
Approach	70
Harbour	82
Berthing	33
Total	**242**

Table 4 : New Zealand Chart Portfolio

2 HYDROGRAPHIC RISK RESULTS - NORTHLAND REGION

2.1 INTRODUCTION – NORTHLAND REGION

Northland Region covers over 5% of the country's total area. Several large natural harbours are found on Northland's east coast, from Parengarenga close to the region's northern tip, past Whangaroa and the Bay of Islands down to Whangarei Harbour, on the shores of which is situated the region's largest population centre.

Numerous islands dot the region's east coast, notably the Cavalli Islands, the Hen and Chicken Islands, Mokohinau Islands and the Poor Knights Islands. The region's population is largely concentrated along the east coast.

The region's west coast is renowned for its impressive sand dunes. Kaipara Harbour, on the west coast, is shared with the Auckland Region's boundary running through the centre. Kaipara is the largest enclosed harbour and estuarine system in New Zealand, with over 800 km of coastline.

The region of Northland has a sub-tropical oceanic climate with warm humid summers and mild wet winters. Due to its latitude and low elevation, Northland has the country's highest average annual temperature. Rainfall is typically plentiful all year round. It can be very windy in exposed areas and occasionally Northland experiences gales, sometimes in association with the passage of depressions of tropical origin. Sea breezes occur most frequently in summer.

Northland region is a favourite tourist destination, especially the Bay of Islands area. Diving and fishing are popular activities, especially around the Bay of Islands and the Poor Knights Islands.

Five percent of New Zealand's recreational boaters are based in Northland. There are 2,800 swing moorings in Northland, giving some idea of the popularity of recreational boating here. Northland's ports of entry for vessels arriving from overseas are Opua and Whangarei.

2.1.1 WHANGAREI HARBOUR

Whangarei's expansive harbour is extensively tidal with much of the harbour being mud flats and exposed sand bars at low tide. The harbour is home to New Zealand's only oil refinery, at Marsden Point. There are three port facilities within the confines of Whangarei Harbour. Northport and Refining New Zealand are both based at Marsden Point and Golden Bay Cement terminal is located at Portland.

Shipbuilding and repair facilities are available in the harbour for vessels up to 1,800 tonnes.

There are currently seven marinas in Northland, ranging in size from 25–300 berths. Whangarei can accommodate over 500 boats in three marinas. There are two marinas in the Bay of Islands, and one each in Tutukaka and Whangaroa Harbours.

2.1.1.1 NORTHPORT - WHANGAREI

Whangarei is a commercial port with tanker and freighter calls. Northport is primarily used for the export of forest products, but the terminal's multipurpose facility can handle a wide range of cargoes and their associated vessel types, including logs, woodchips, veneer, kiwifruit and fertiliser.

2.1.1.2 REFINING NEW ZEALAND

Refining New Zealand has two oil jetties at Marsden Point which serve the country's only oil refinery. Products include petrol, diesel and aviation fuel. A restricted area is in place around the New Zealand Refining Company's tanker wharves east of Northport.

New Zealand Refining plans to apply for resource consents to dredge the entrance channel: the refinery's customers are currently only able to import 600,000 to 700,000 barrels of crude oil monthly rather than a tanker's full capacity of 1M barrels because of draught limitations in the entrance channel. The plan is to employ tankers of the same size (Aframax), but to facilitate an increased cargo lift facilitated by the vessels operating at the deeper design draught.

2.1.1.3 PORTLAND

Further up the harbour, Portland has one jetty which serves the Golden Bay Cement Company cement works. Currently one specialised bulk cement vessel and a tug/barge use this facility on a regular basis.

2.1.2 BAY OF ISLANDS

The Bay of Islands lays claim to having 144 islands which provide extensive sheltered waters and safe anchorages for thousands of cruising and fishing boats, especially over the summer. The Bay is one of the most popular fishing, sailing and tourist destinations in the country, and has been renowned internationally for its big-game fishing since American author Zane Grey publicised it in the 1930s.

Tourist and excursion trips carry over 1M passengers annually around the scenic islands. Whale and dolphin watching trips are also popular activities.

2.1.2.1 BAY OF ISLANDS – OPUA

The Port of Opua is no longer used by commercial cargo vessels. Today the main users of the wharf are the local fishing and charter industries. However, occasionally a boutique cruise ship visiting the Bay of Islands will use the Opua wharf. The adjacent swinging basin is reported to have shoaled since the large commercial vessels discontinued manoeuvring nearby the wharf.

Opua is New Zealand's northernmost port of entry for overseas vessels, and is a Customs and Ministry of Agriculture and Fisheries (MAF) arrival port. It is a popular destination for cruising yachts owing to its sheltered, deep water anchorage, and numerous facilities for cruisers, including the 250-berth Opua Marina. More than 350 yachts cleared into NZ at the Opuas' entry port during the 2014 winter season.

2.1.3 WHANGAROA HARBOUR

Whangaroa Harbour is popular both as a fishing spot in its own right and as a base for deep-sea game fishing. A small fleet of charter and game fishing boats operate from the marina at Whangaroa and mussel barges work the extensive acreages of farmed mussels that occupy the shallows of the harbour. There are extensive mangrove swamps at the head of Whangaroa harbour.

The approach to the harbour has deep water and entry is spectacular with a narrow, high rock-walled entrance. Vessels up to 100m LOA, 4.0m in draught and/or a maximum of 4,000 GT may enter Whangaroa Harbour without a pilot. The harbour is not suitable for vessels over this size.

2.1.4 MANGAWHAI HARBOUR

Mangawhai is a small seaside town south of Whangarei on the east coast with a sheltered harbour dominated by extensive sand dunes. Between 1953 and 2004, 750,000 cubic metres of sand were removed from the northern inlet at Mangawhai. Most of this sand was dredged from near the shore for use in Auckland's construction, until sand mining was stopped in 2004. Like most of Northland's east coast estuaries recreational boating, mainly for fishing, is a popular activity especially over summer. There is currently no commercial vessel traffic based in Mangawhai.

2.1.5 MANGONUI / RANGAUNU / HOUHORA HARBOURS

These three tidal estuary harbours are all on Northland's east coast. A discharge and ice facility used by the commercial fishing fleet is located on the Mangonui wharf. The largest fishing vessels to use Mangonui's amenities for discharging fish are 270GT.

Rangaunu, the fifth largest harbour in NZ, is a popular estuary for fishing, with extensive areas of mangroves and tidal sandflats. It is a habitat of international significance for migratory wading birds.

Game fishing charter boats and a small commercial fishing fleet operate out of Houhora Harbour.

2.1.6 PARENGARENGA HARBOUR

Parengarenga Harbour is the northernmost estuary of New Zealand and one of the country's major wading-bird habitats. Located at the northern end of the Aupouri Peninsula, the harbour extends inland for over 10 km. At low tide, 5,700 ha of intertidal sandflat are exposed to the thousands of wading birds that congregate in the harbour to feed. The white sand of Kokota Sandspit, at the southern head of Parengarenga Harbour, was dredged to provide a source of high purity silica sand for glassmaking until 1997.

2.1.7 HOKIANGA HARBOUR

The Hokianga estuary on Northland's west coast extends inland for 30 km from the Tasman Sea. It is navigable by small craft for some 24 km from the entrance, although there is a dangerous bar across the mouth. Historical records indicate that more than 16 ships have been lost on the Hokianga bar. Most were sailing ships that came to grief when leaving fully laden and became caught in the wind shadow cast by South Head where the deep water lay.

Hokianga's North Head has towering, white sand dunes, some up to 170 m high. The South Head near the coastal village of Omapere was once a signal station for shipping but there is no commercial shipping these days visiting the Hokianga.

Rawene township on a narrow peninsula in the middle of Hokianga Harbour, is linked by car ferry to Kohukohu on the harbour's northern shore.

Dolphins and Orca are commonly seen in the harbour and a tour operator runs day cruises on the tidal harbour waters.

2.1.8 KAIPARA HARBOUR

By area, the Kaipara Harbour is one of the largest harbours in the world. It covers 947 km^2 at high tide, with half of the harbour exposed as mudflats and sandflats at low tide. The Kaipara Harbour is broad and mostly shallow, with spring tidal flows reaching 5 knots in the entrance channel. The harbour includes 125 square km of mangrove forest and is a migratory bird habitat of international significance.

The harbour provides significant areas of suitable breeding grounds and habitats for juvenile fish and is the single most significant wetland for fish: 98% of all snapper on the west coast of the North Island were originally juveniles from nurseries in the Kaipara Harbour.

The Kaipara is separated from the Tasman Sea by two large sandbank peninsulas and a bar entrance. Despite the perilous bar at the harbour entrance, the Kaipara was a busy timber port from the 1860s, shipping thousands of tonnes of kauri timber and kauri gum. The sandbanks at the entrance shift and change position, and are known locally as '*the graveyard*'. The entrance is said to be responsible for more shipwrecks than any in New Zealand (the accuracy of this varies, with reports of 43 to 100 lost vessels). The Kaipara is rarely used today for commercial shipping.

Around 200,000 m^3 of sand is mined each year from the entrance and tidal deltas of the Kaipara. This sand contributes over half the sand requirements for Auckland.

Aquaculture is important in Kaipara Harbour with almost 45% of New Zealand's Pacific Rock Oysters being farmed here.

2.1.9 AREAS OF RISK ASSESSMENT SIGNIFICANCE – RESERVES, ECOLOGICAL, CULTURAL

Northland Region has three marine reserve areas. To the North of Cape Reinga lie the Three Kings Island Marine Reserve, some 30nm offshore. In 1981, the ocean surrounding the Poor Knights Islands, 12nm off the east coast of Northland, was established as New Zealand's second marine reserve. The marine reserve extends for 800m offshore around the Poor Knights Islands. An IMO 'Area To Be Avoided' (ATBA) is in force around the Poor Knights Islands and inshore. Vessels over 45m LOA are not permitted to enter this ATBA.

The Whangarei Harbour Marine Reserve comprises two inter-tidal sites covering approximately 2.5% of the Whangarei Harbour.

Northland region is well endowed with coastal reserves and has significant areas of ecologically important tidal estuaries, mangroves and wetlands.

2.1.10 ECONOMIC SUMMARY

The GDP of Northland region is estimated at $5.8b in 2014, 2.2% of the National GDP. Over 150,000 people live in Northland 3.7% of NZ's population. Tourism contributed $218M to the region over the project year. House prices climbed 12% in this region over the year, accompanied by an increase in retail spending, one contributing factor for this being an increase in tourism.

Cruise passengers and crew injected $13.4M into the region's economy during the year.

2.2 TRAFFIC ANALYSIS – NORTHLAND REGION

This section provides plots of all traffic within the Northland Region. A plot of all vessel types recorded in the Northland Region, for the study year 2014-15, is shown below.

Types of commercial vessels using Northland's ports include:

- General and Break-bulk
- Bulk Carrier - Cement
- Tankers
- Passenger cruise
- Passenger and vehicular ferries
- Charter boats
- Tugs, barges and workboats

2.2.1 ALL TRAFFIC – NORTHLAND

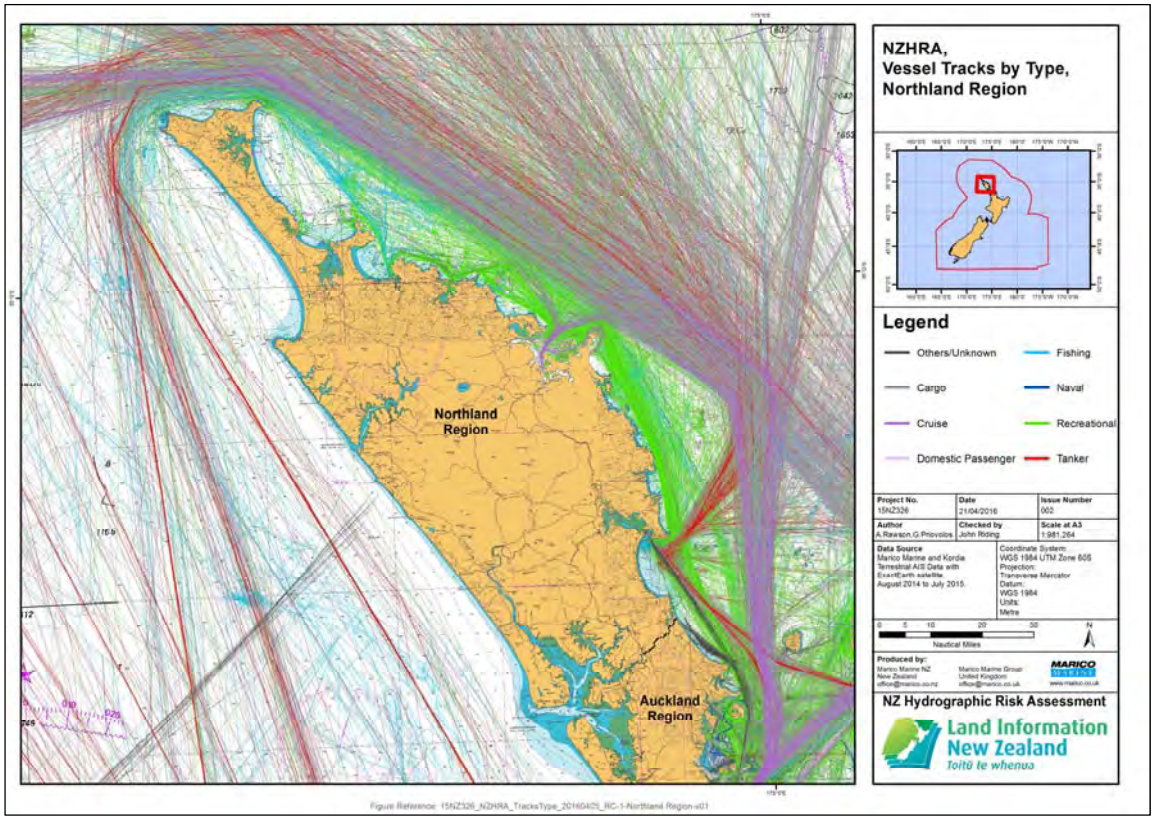


Figure 5 : Plot of all Traffic in Northland Region, by Vessel Type

As can be seen in **Figure 5** most traffic is concentrated on the region's east coast. Tankers converge on the refinery at Marsden Point; cruise ships call at Bay of Islands and recreational vessels dominate the region's inshore east coast. The majority of cargo vessel tracks bypass this region, although

Northport is currently expanding its cargo operations. Almost all the cargo, larger cruise and tanker vessels pass outside the Poor Knights Islands in accordance with the ATBA.

From a routeing perspective, some large vessels, including tankers are recorded closing within 3nm off Surville Cliffs (near North Cape) and Cape Reinga. Although water depth may be adequate, a vessel suffering a breakdown has limited drifting time for rectification before needing assistance.

2.2.1.1 ALL TRAFFIC DENSITY – NORTHLAND

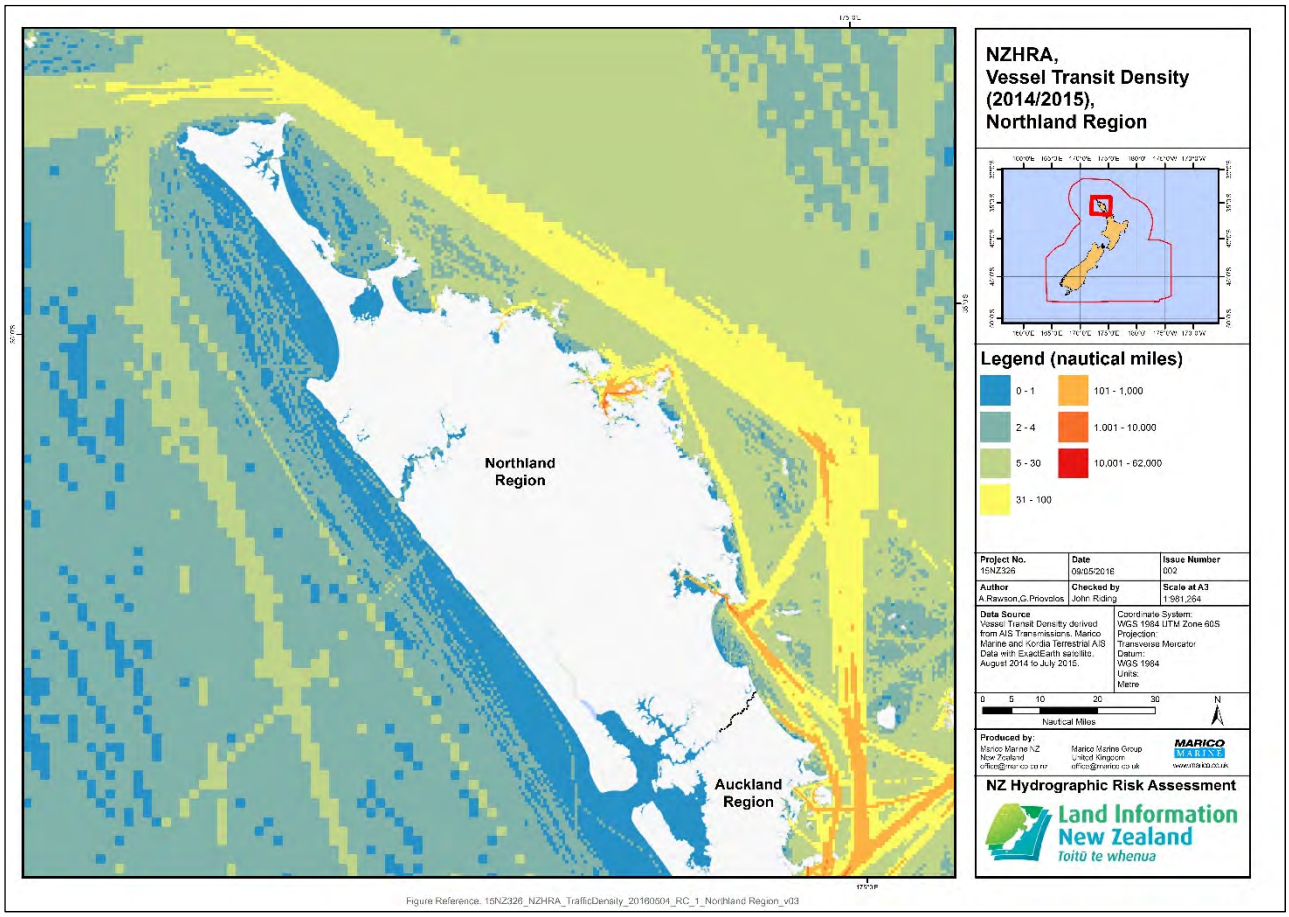


Figure 6 : Plot of Vessel Traffic Density in Northland Region

The Traffic density plot for Northland shows the dominance of traffic volume along the east coast of the North Island. There are well defined dense routes between Cape Reinga and Auckland, with the majority of traffic passing outside the Poor Knights Islands (the location of a Marine Reserve and ATBA). A natural area of traffic 'bunching' occurs where the voting pattern of vessels' passages is to take the shortest transit around the seaward perimeter of the ATBA. The inshore route through the ATBA is used by small vessels.

2.2.1.2 ALL TRAFFIC – WHANGAREI HARBOUR

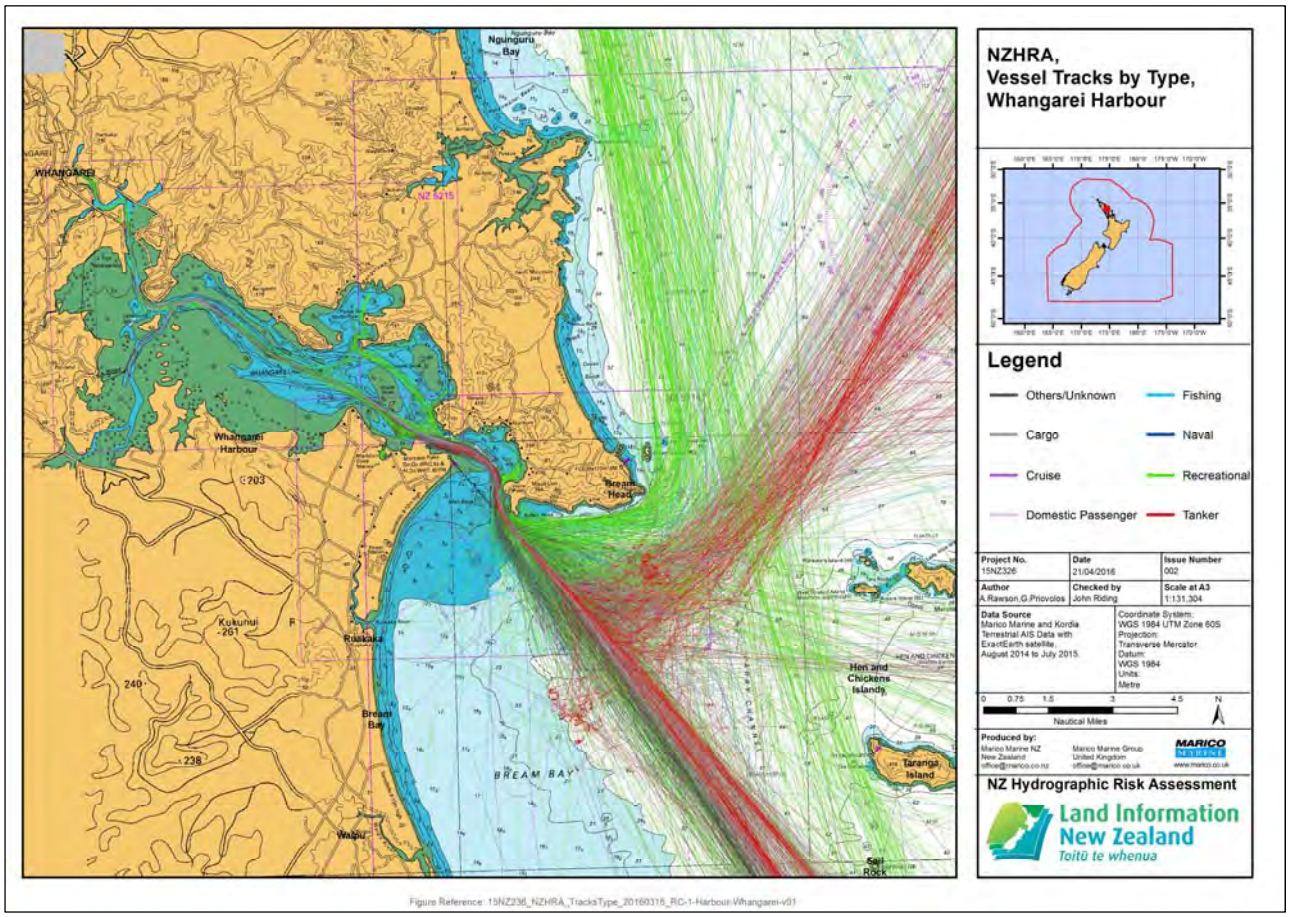


Figure 7 : Whangarei Harbour by Traffic Type

2.2.1.3 ALL TRAFFIC - BAY OF ISLANDS

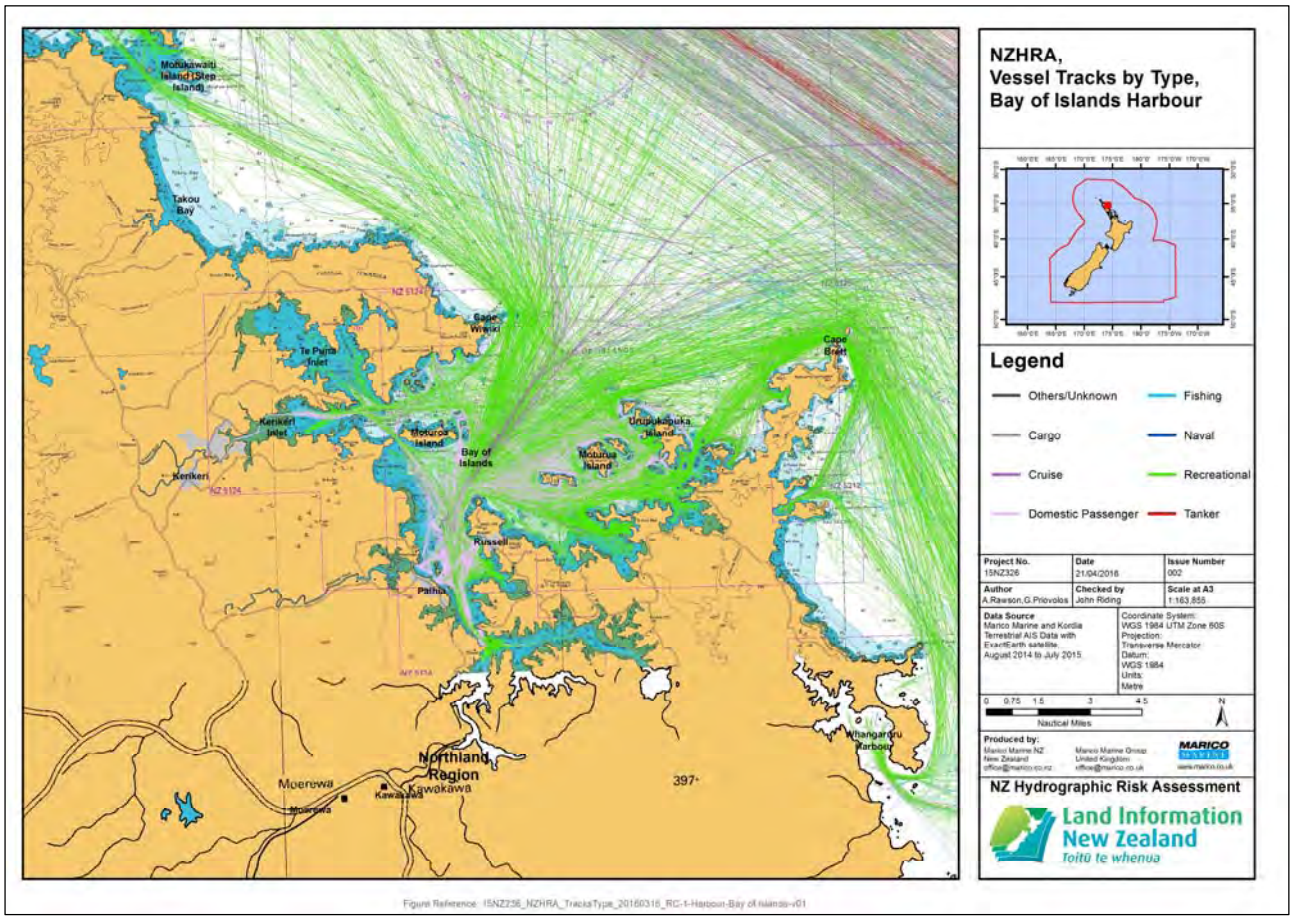


Figure 8 : Plot of All Vessel Types in the Bay of Islands

The overall breakdown of traffic in the Bay of Islands area is shown above. It is a centre of North Island recreational use, many of which also cruise to other locations in the region. It is also an active location for passenger vessels in general. Traffic is further broken down in this section where it is relevant to the Hydrographic Risk Assessment.

2.2.2 CRUISE VESSELS - NORTHLAND

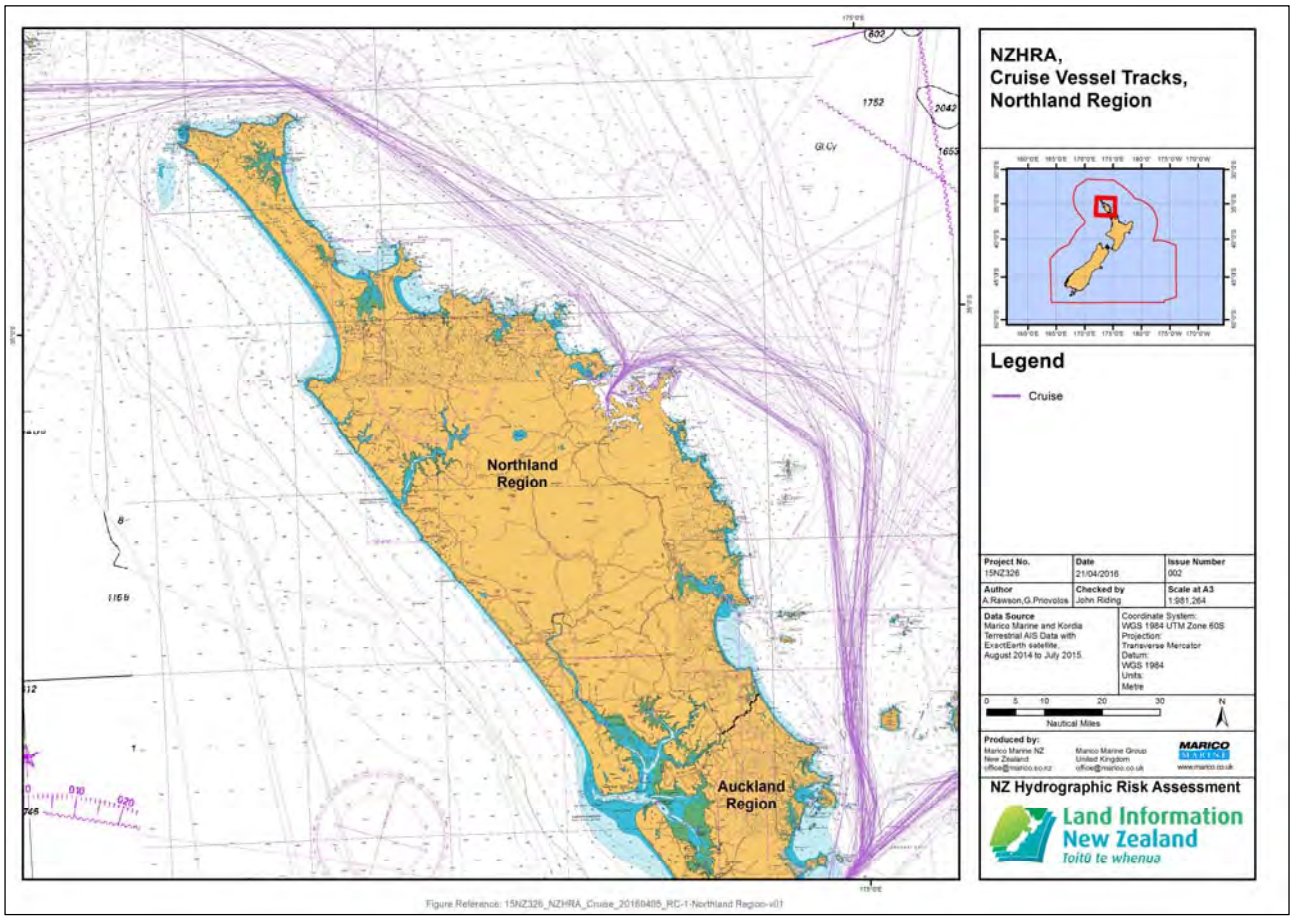


Figure 9 : Cruise Vessel Routes - Northland

Cruise vessel activity is shown in **Figure 9**. Most, but not all, cruise vessels operate on the east coast of Northland. The Bay of Islands is a popular destination for the cruise market, however a number of cruise vessels transited through the Northland region on direct passages between Auckland and Australia without stopping here.

Several smaller cruise ships entered Whangaroa Harbour, and a boutique cruise vessel explored some of the harbours and bays on the east coast of the region, with two making the inshore passage through the Poor Knights Islands ATBA. This has a limiting criteria of 45m LOA: of the two cruise vessels taking that transit, one was of 498 GT (42m length) and below the limit; the other was 1,779 GT (60m length), considerably outside the limiting parameters of the ATBA (although still a small cruise vessel).

Otherwise cruise vessel activity in the Northland region was restricted to visiting the Bay of Islands.

Cruise vessels are recorded as contributing $13.4M into the Northland economy in the 2014-15 cruise season.

2.2.2.1 CRUISE VESSELS - BAY OF ISLANDS

The Bay of Islands is a popular destination for cruise vessels with 43 ship visits during the project season. **Figure 10** below, presents a plot of their transit locations, with most anchoring off the approaches to the towns of Russell and Waitangi and then taking passengers ashore by tender. Only the smaller and boutique passenger ships travel further up harbour to the port of Opua.

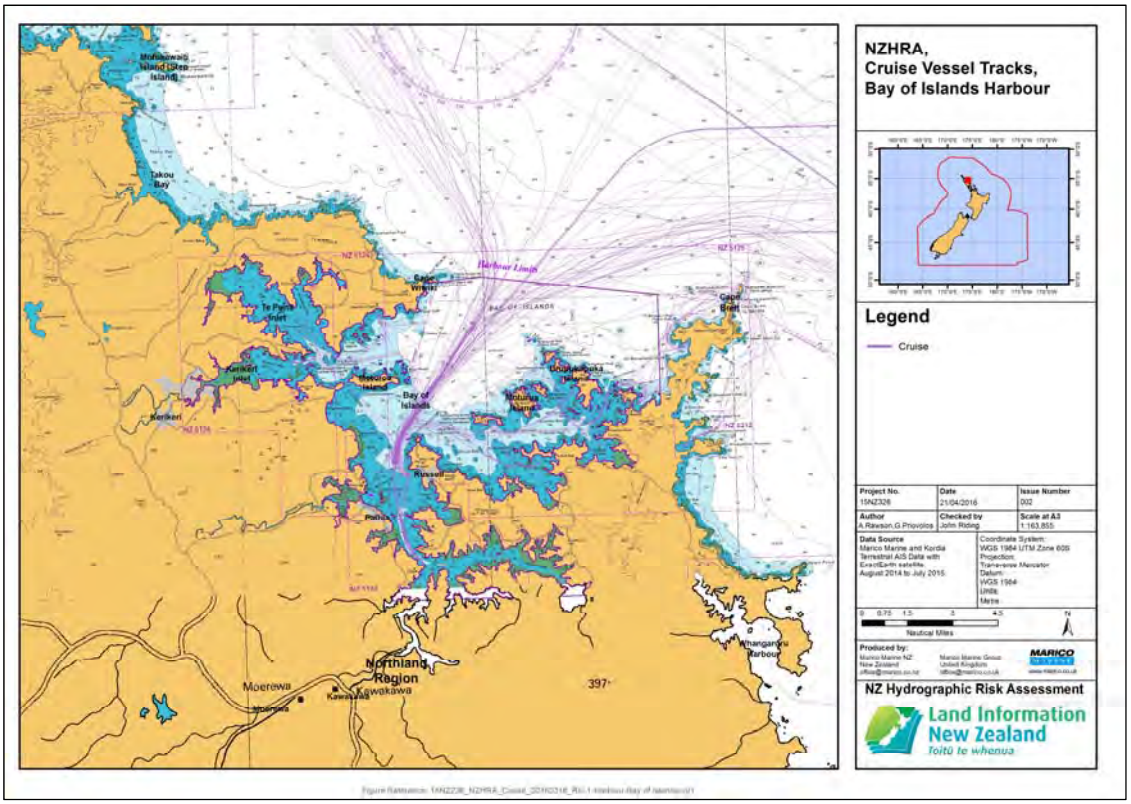


Figure 10 : Plot of Cruise Vessels in Bay of Islands - 2014 to 2015

2.2.3 DOMESTIC PASSENGER TRAFFIC - NORTHLAND

Domestic Passenger Vessels recorded in Northland Region are predominantly confined to the Bay of Islands area. The few domestic coastal tracks represent coastal sailing passenger operations, one based in the Bay of Islands and the other based in Auckland.

Over 1M passengers used the Bay of Islands' ferry and excursion services. A small passenger/vehicular ferry service exists at Rawene on the Hokianga Harbour.

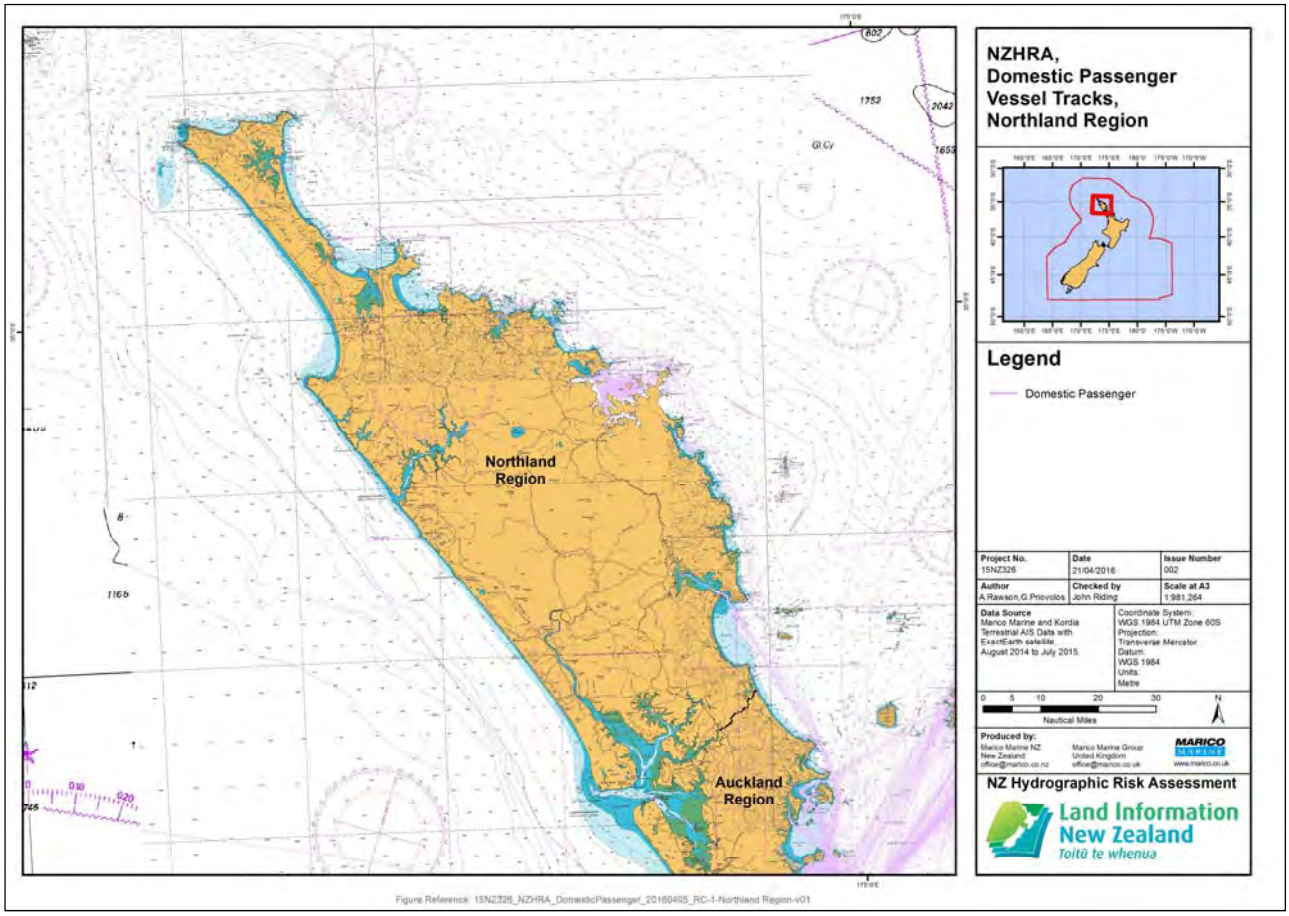


Figure 11 : Domestic Passenger Services - Northland

2.2.3.1 DOMESTIC PASSENGER TRAFFIC - BAY OF ISLANDS

There is significant domestic passenger vessel activity in the Bay of Islands confines in a 12 month period. An extensive range of different cruises is on offer to view the picturesque Bay of Islands. Popular tourist attractions include trips to the famous Hole in the Rock, landing ashore at Urupukapuka Island and the chance to see dolphins, whales and other marine life.

Passenger ferries run frequently between Russell, Paihia and Waitangi, and water taxis take visitors out to the islands for day trips. Two car ferries run continuously between Opua and Okiato, making more than 120 trips each day.

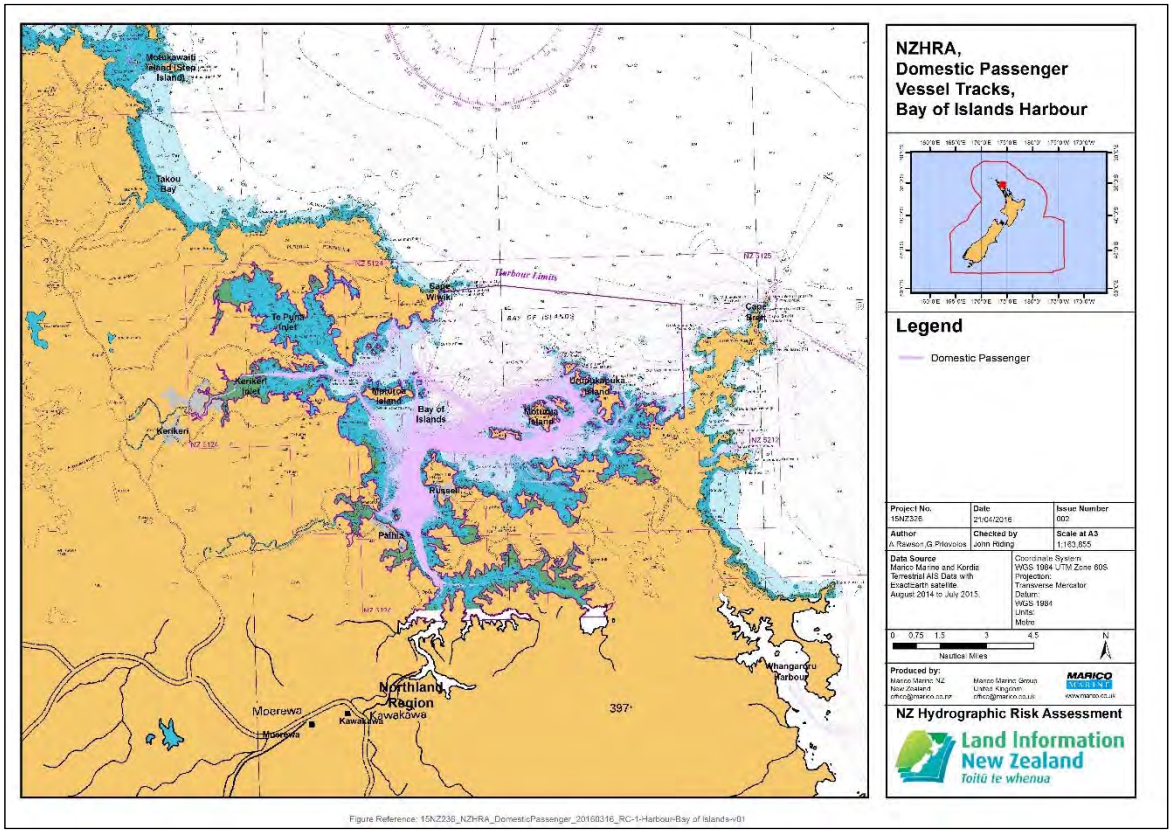


Figure 12 : Extents of Domestic Passenger Vessel Activity – Bay of Islands

2.2.4 TANKER TRAFFIC – NORTHLAND

In a 12 month period, there is a considerable volume of tanker traffic transiting the Northland region, some of which are of significant size (Aframax Tankers are mostly used for crude

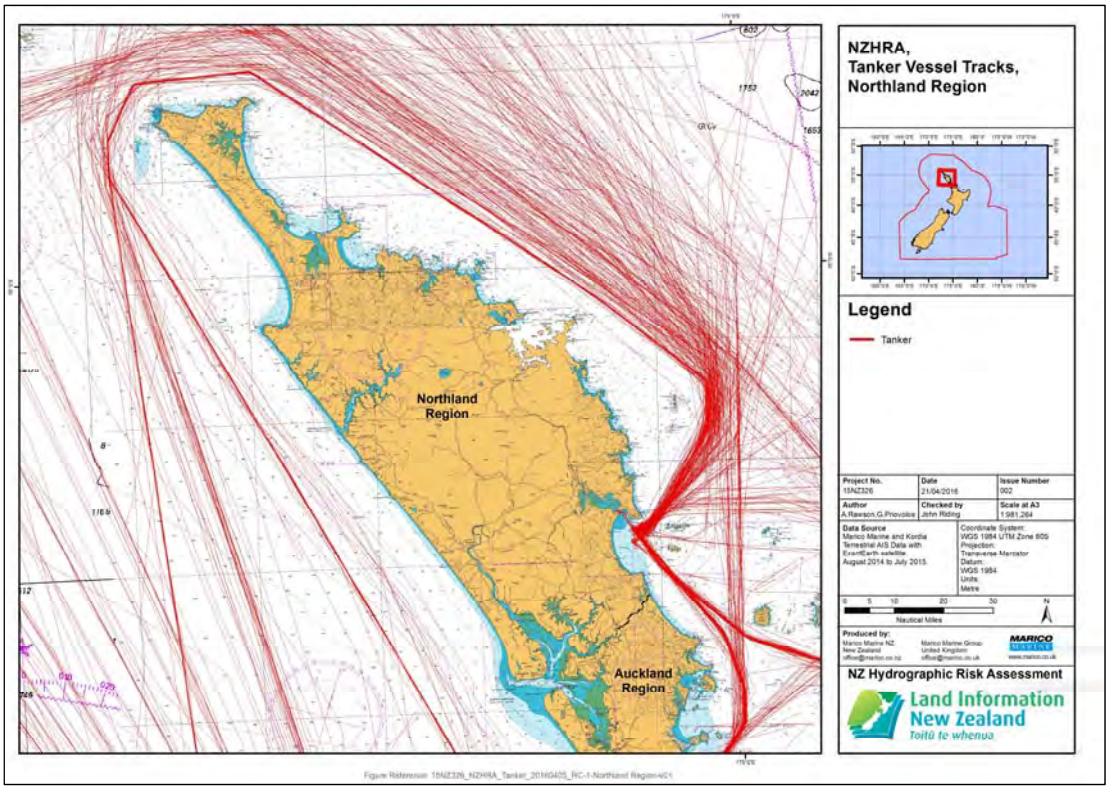


Figure 13 : Plot of Tanker Traffic - Northland Waters

transport to the Northland refinery at Marsden Point). The thicker track record shown in the plot is from a series of transits by the NZ coastal products tankers along the same track. It shows their use of ECDIS and passage planning to closely follow planned routes around the NZ coast.

2.2.5 TANKER TRAFFIC - WHANGAREI

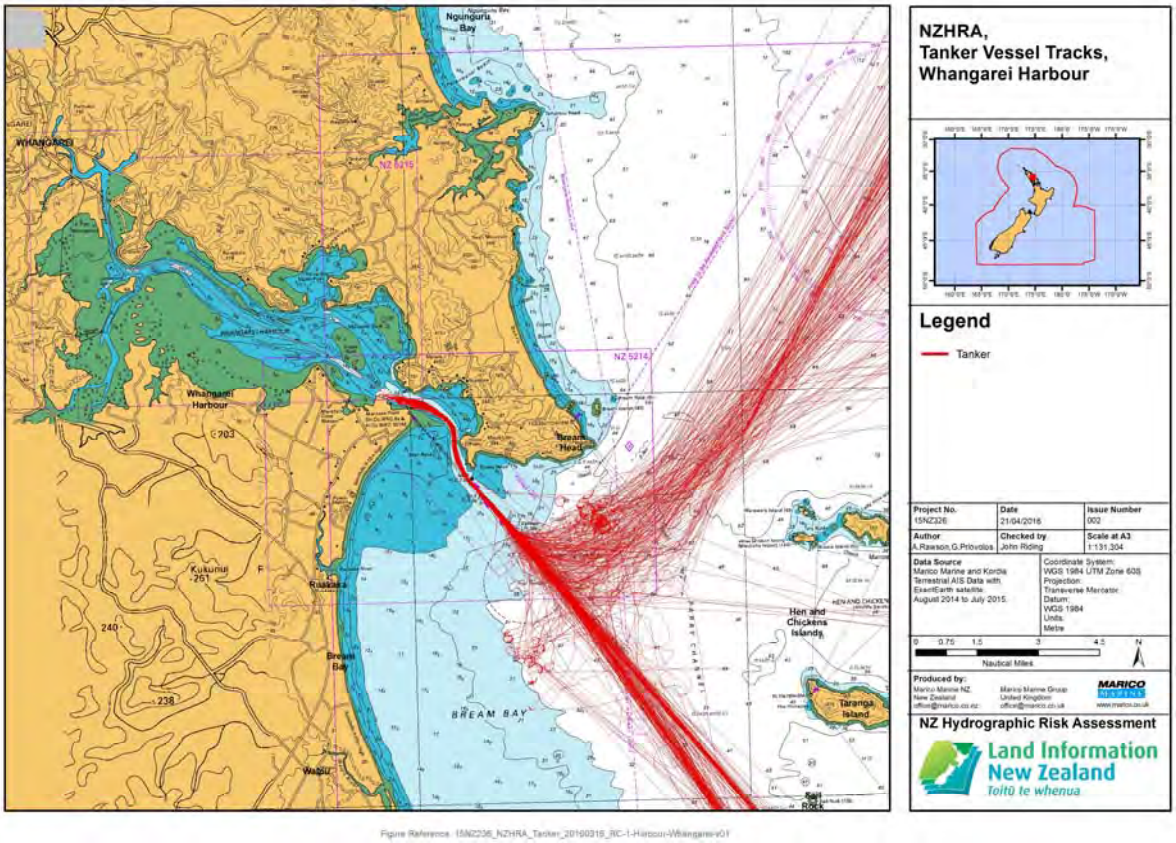


Figure 14 : Tanker Tracks – Whangarei Harbour

Access by tankers through the Whangarei Harbour entrance shows a consistent pattern of tracks, with anchorage areas in Bream Bay clearly visible. The concentration of traffic into the harbour channel via the buoyed channel is natural.

2.2.6 FISHING VESSELS - NORTHLAND

Fishing vessels operate extensively around the east coast of the Northland region: there is virtually no east coast bay, estuary or harbour that is not visited by fishing boats at some time during the year. The fishing fleet are transient, following the fish and moving from port to port according to the season.

Patterns on the region's west coast are different, with an exposed coast, few harbours and no offshore islands for shelter, so the fishing vessels that operate here are larger and tend to fish further offshore.

2.3 HYDROGRAPHIC RISK – NORTHLAND REGION

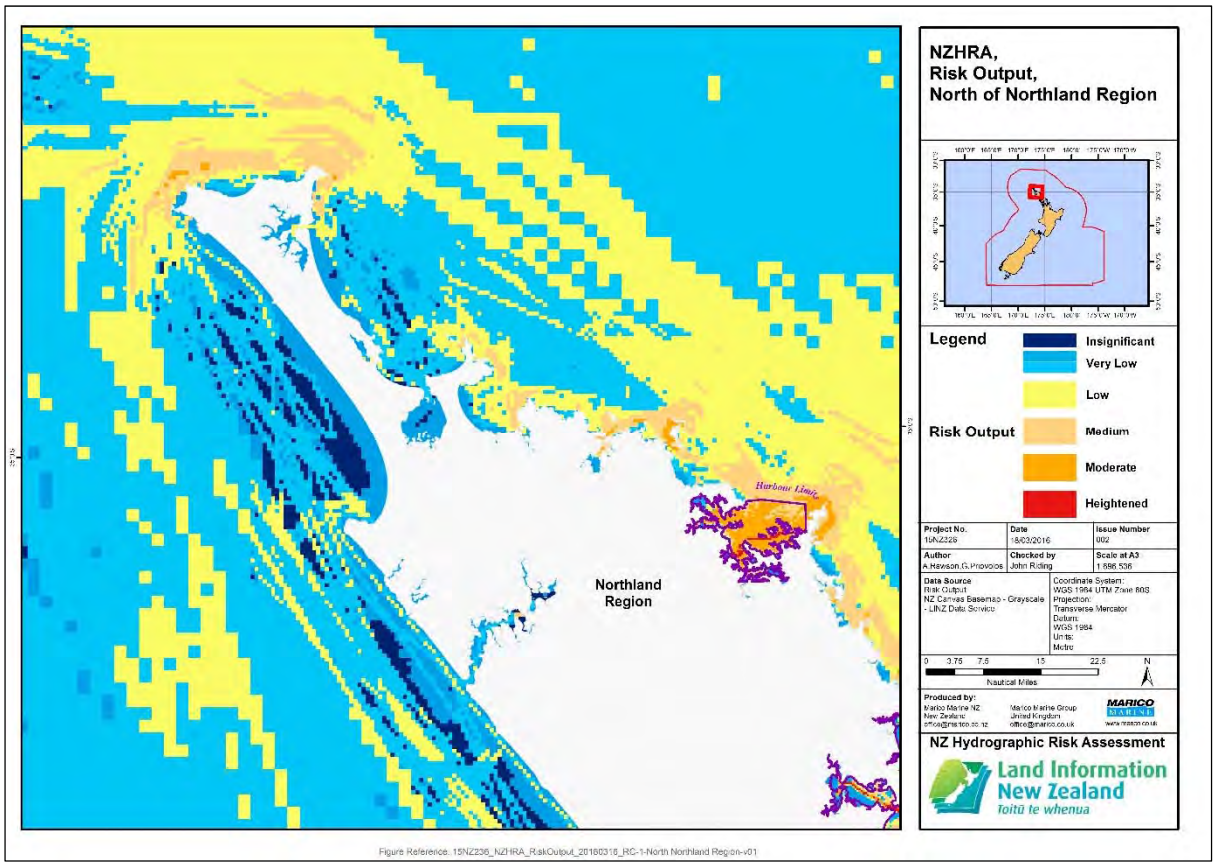


Figure 15 : Overview of Hydrographic Risk – Northland Region

Hydrographic Risk overall in Northland provides a low to moderate rating on the east coast and low to insignificant on the west coast. There are concentrated areas of heightened hydrographic risk present in the Bay of Islands and Whangarei Harbour. The risk is reflected in the traffic patterns for Northland.

The Marsden Point approach channel is relatively busy and trade at Northport is expanding steadily. Hydrographic risk is heightened in the channel, which is to be expected, given the large tankers using the terminal. The older chart data for the harbour route into Whangarei Town terminals is the factor influencing some areas of heightened risk here.

In the case of the Bay of Islands, the area of heightened risk relates to a combination of the cruise vessel stop, but predominantly the high domestic passenger volume on ferry routes and the day trips out of Paihia and Russell, **Figure 16**.

2.3.1 HYDROGRAPHIC RISK - BAY OF ISLANDS

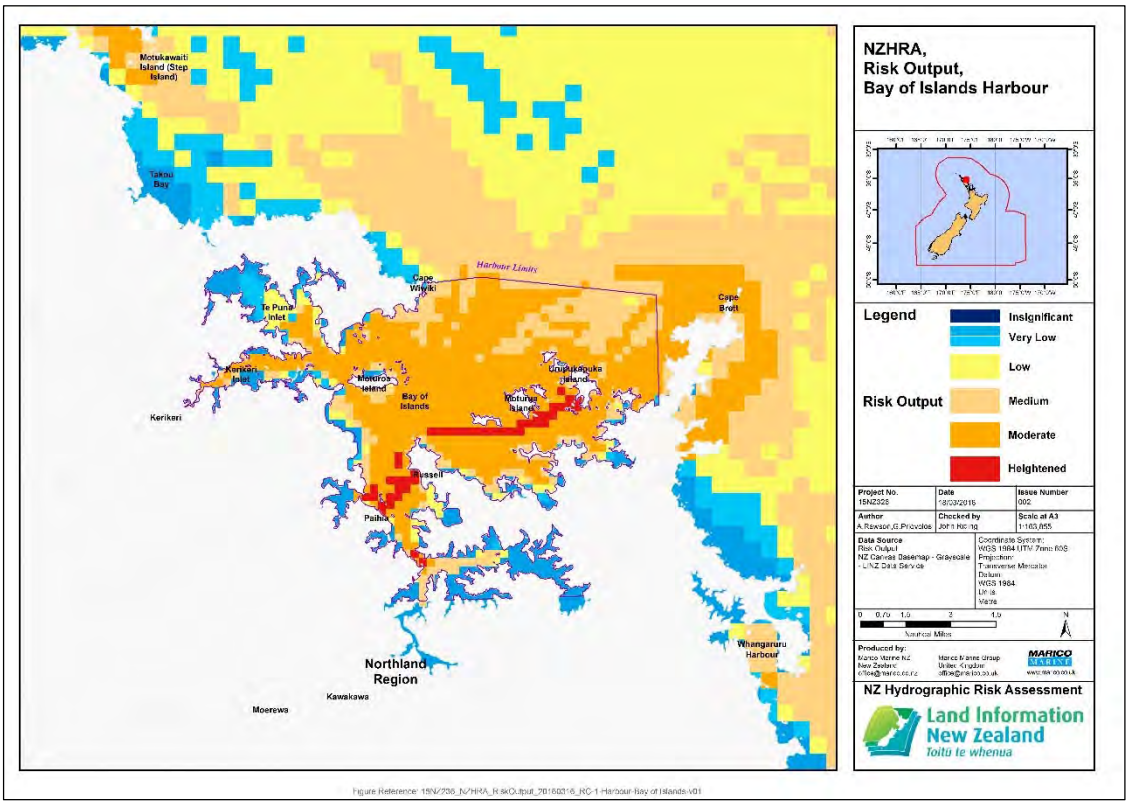


Figure 16 : Hydrographic Risk – Bay of Islands

Hydrographic risk in the Bay of Islands is heightened because of the busy tourist excursion routes from Paihia and Russell through the islands to Urupukapuka, the destination for many trips. Also highlighted is the vehicle ferry route between Okiato and Opua and the approaches to the jetty at Waitangi where cruise ships land their passengers. Charting in these areas of heightened risk is up to date and of appropriate scale.

2.3.2 HYDROGRAPHIC RISK – WHANGAREI HARBOUR

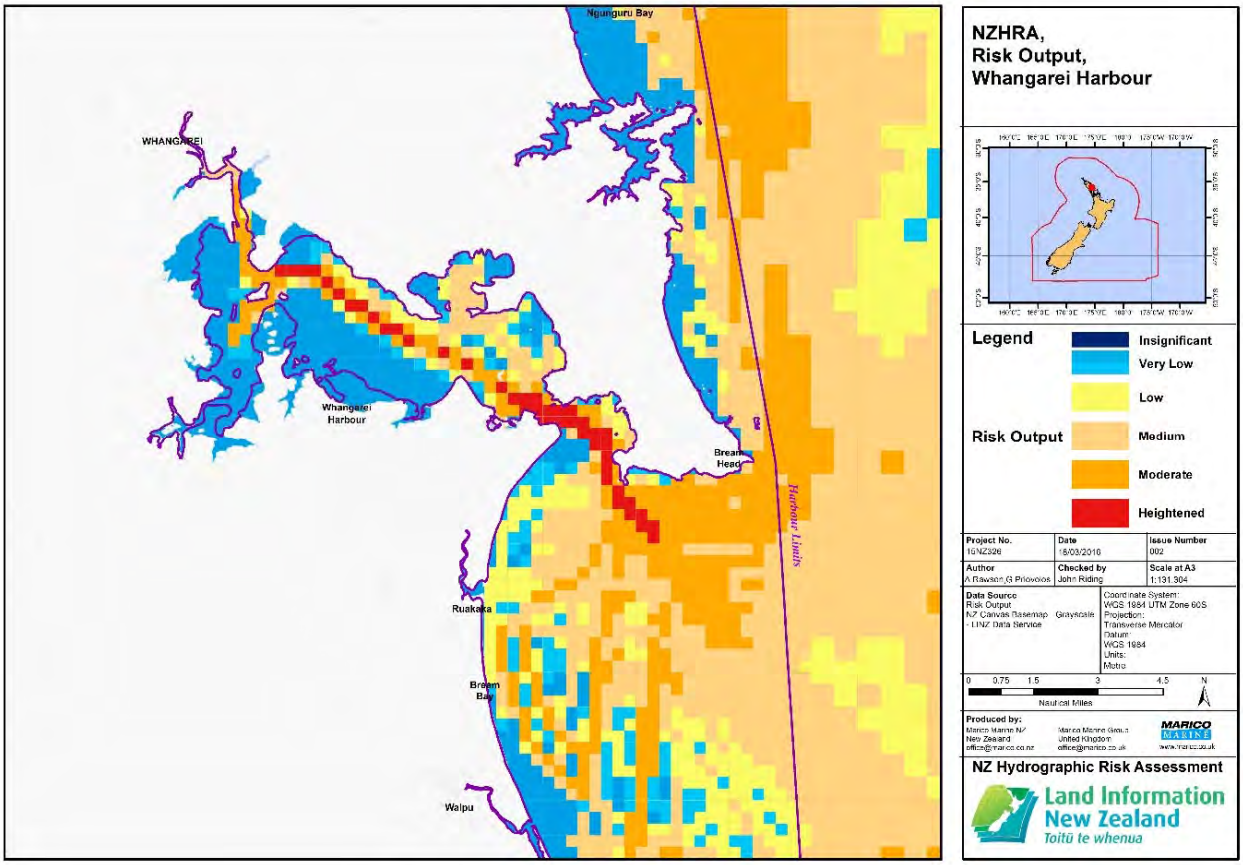


Figure 17 : Hydrographic Risk - Whangarei Harbour

Heightened Risk shows in the Marsden Point approach channel, the narrow harbour entrance and also in the channel up the harbour as far as the Portland Cement Terminal turn-off.

2.4 CHARTING BENEFIT - NORTHLAND OVERVIEW

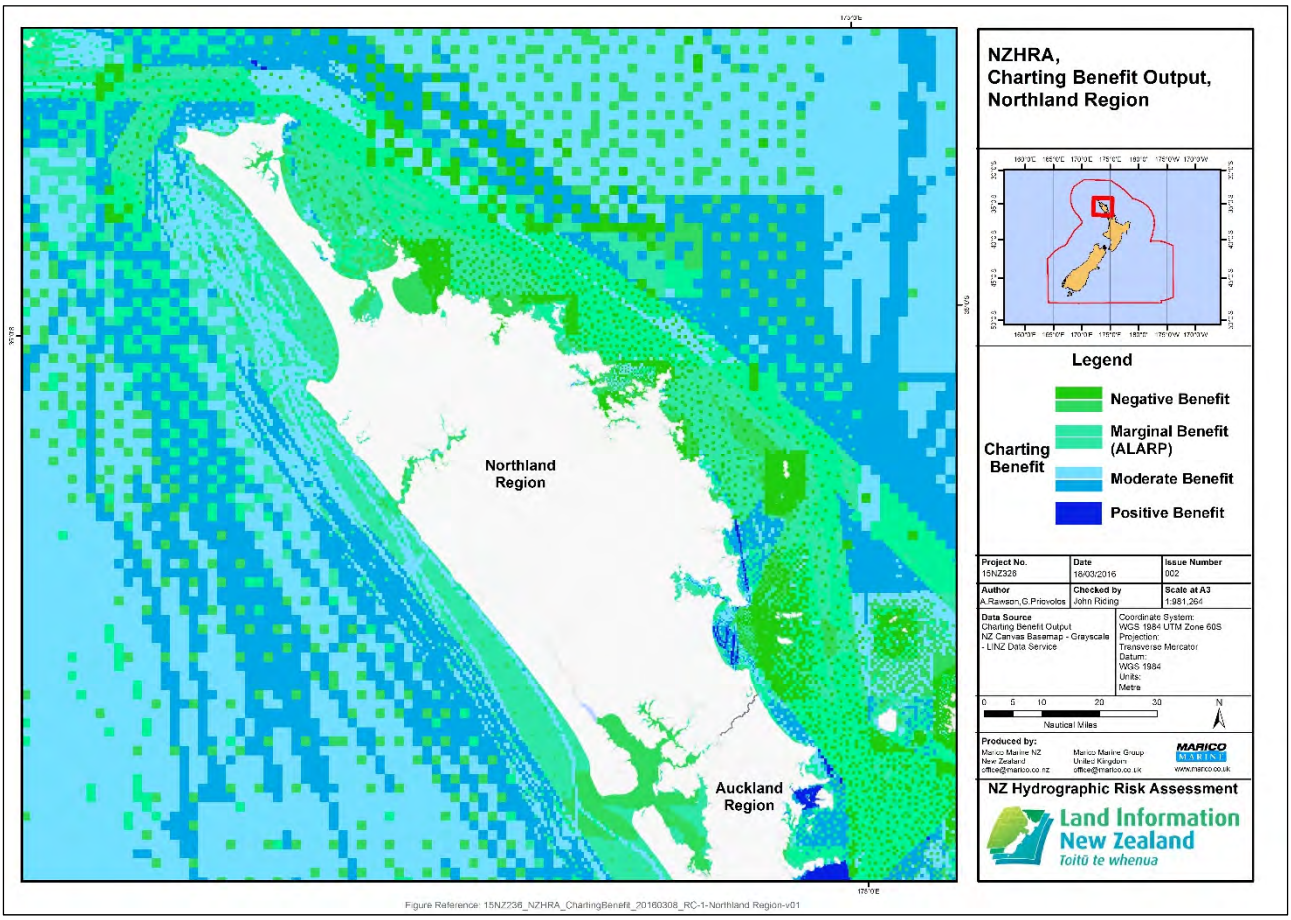


Figure 18 : Chart Benefit Plot – Northland Region

The charting benefit result shows that charting in the Northland region overall is to a good standard. Areas where hydrographic risk is high have mostly been addressed through recent surveys to a modern standard, which provides a charting benefit result as low (or marginal to negative benefit).

2.4.1 CHARTING BENEFIT - BAY OF ISLANDS

Figure 19 and **Figure 20** show the charting benefit for the Bay of Islands and Whangarei Harbour. **Figure 19** shows that benefit in the Bay of Islands is moderate to marginal overall, with some benefit available from improving charting in the outer area of the Bay of Islands Harbour Limits. However, the cruise ship anchorages off Russell and the areas of dense domestic ferry and excursion traffic are already improved to a standard appropriate for the area.

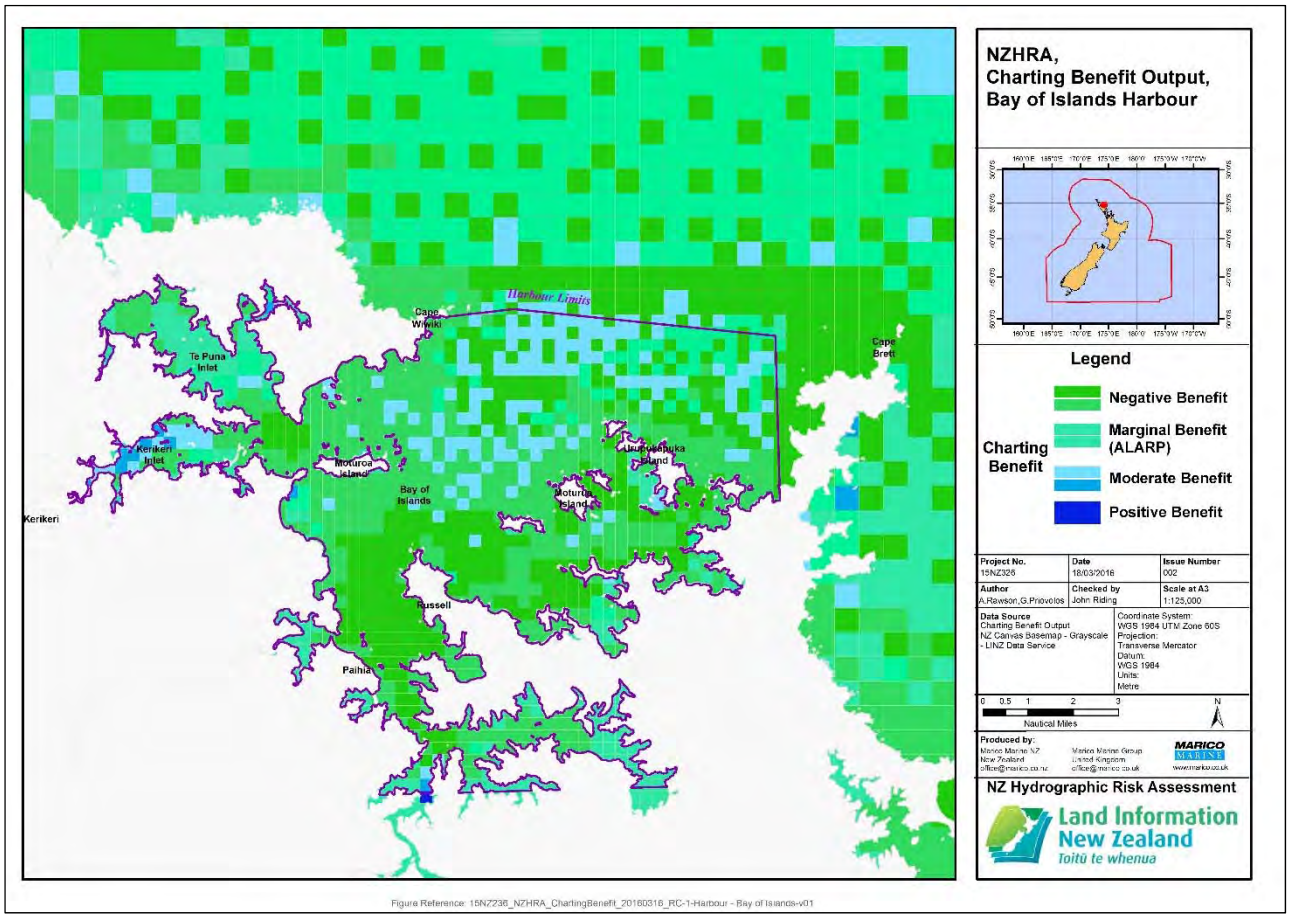


Figure 19 : Charting Benefit is Moderate to Marginal in Bay of Islands

2.4.2 CHARTING BENEFIT - WHANGAREI HARBOUR & APPROACHES

Whangarei Harbour shows benefit accrues for charting upgrades in Bream Bay as well as the areas around berths at Marsden Point. The designated anchorage area also shows a review is worthwhile, as is the case with parts of Bream Bay. The inshore coastal passage north from Whangarei to the Bay of Islands is used by smaller craft, but as charting has not been updated since the ATBA was introduced, a positive benefit also shows along the coastal area of highest use (noting that this is mostly smaller, shallow vessels, but there are some rule-breaking incursions by larger vessels).

The positive benefit in Whangarei Harbour entrance 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. Additionally, off the port's berths where the chart is marked with the maintained dredged depth and the individual channel sounding depths are not published, the Chart Benefit model will show a high benefit on the basis of it being a harbour channel with no point-sounding data. Anomalies like this are highlighted for review.

At Portland Bulk Loading Wharf, where bulk cement is loaded into a dedicated vessel, a moderate benefit shows, as this area is charted at 1:18,000 scale with no berthing scale insert.

In the case of the channel from Northport upstream towards the town of Whangarei, some of this is surveyed by the Northport operation (a regular trade of bulk cement still uses the channel as far as Portland Reach, alongside traffic through the lower Hatea River for the Whangarei Wharves and the ship builders/repairers.) A moderate benefit shows for the channel between the harbour entrance and the turn-off to Portland Reach.

There is a commonly used and charted anchorage in the Approaches to Whangarei, in the middle of Bream Bay, (south of the area marked 'Foul Ground'). This was partly surveyed in 2000-04 and partly in 1962; the seafloor quality nearby is described as 'Rock' which could be interpreted to mean poor holding. These, combined with a Coastal scale chart, where an Approach scale would be recommended, have resulted in the charting benefit result here.

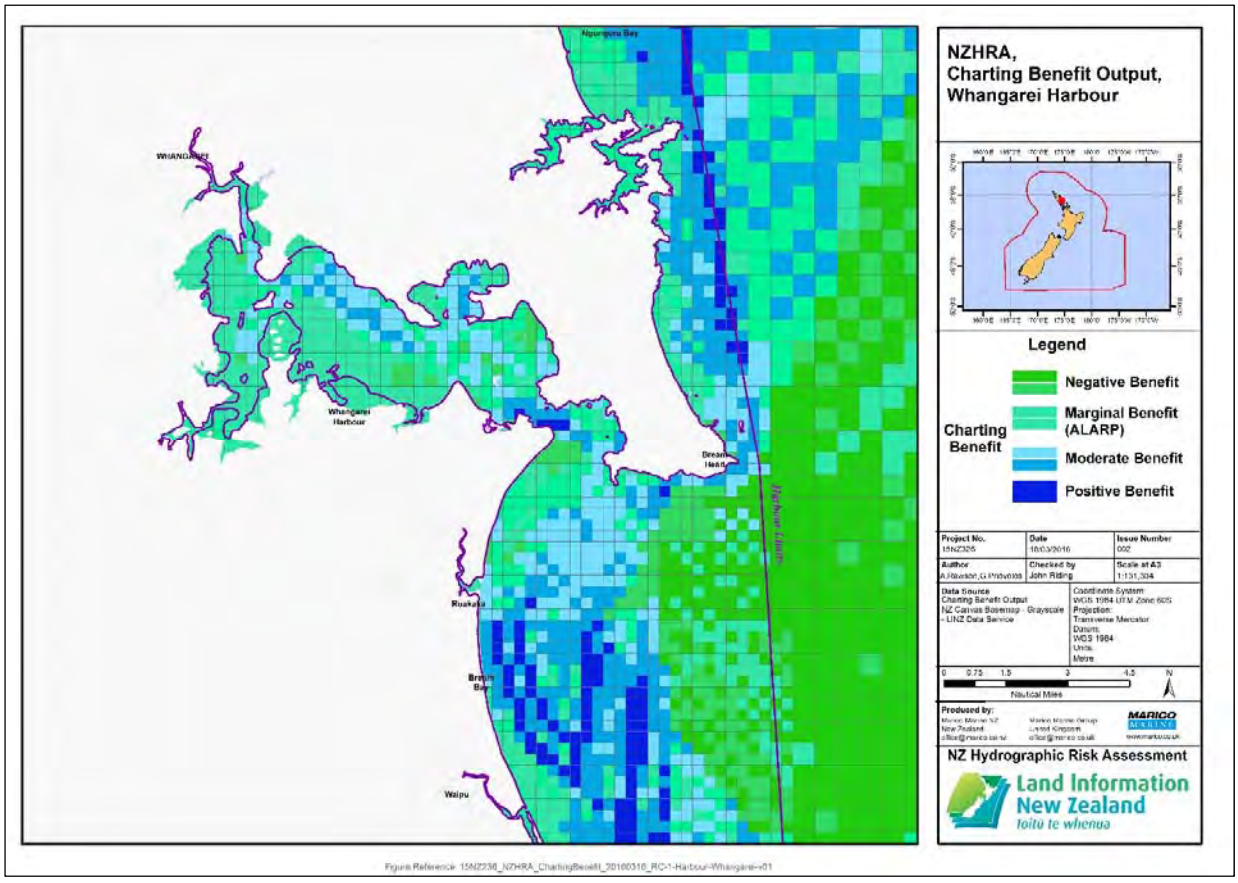


Figure 20 : Charting benefit is Positive in Bream Bay.

3 HYDROGRAPHIC RISK RESULTS - AUCKLAND REGION

3.1 INTRODUCTION – AUCKLAND REGION

During summer, fine weekends and public holidays, Auckland's Hauraki Gulf and harbours experience a significant volume of maritime traffic, large and small. Numbers of movements on any given day though are dominated by recreational craft activity[6].

The Hauraki Gulf has typically sheltered waters with little swell due to the protection from Great Barrier Island. Winds can be strong and gusty at times, especially in exposed coastal areas. Although gale force winds can occur in any month, they are most frequent in winter. Sea breezes occur most frequently between November and March.

Storms of tropical origin affect Auckland about once or twice each year, mainly between the months of December and April. They usually bring heavy rain and strong easterly winds.

The airflow over Auckland is predominantly from the southwest. A short, steep south-westerly sea can build up in the harbour and approaches, especially when the tide is against the wind.

This has resulted in new marinas and facilities being constructed north and east of the city, further away from the strong tidal influences near the city, giving recreational boaters a shorter passage home against the southwest wind.

3.1.1 WAITEMATA HARBOUR

Located on New Zealand's east coast within the Hauraki Gulf, Waitemata harbour is the site of Auckland's main port.

The main shipping channel is dredged and marked with beacons and buoys. There are extensive shallows either side of the dredged channel, so the majority of larger vessels remain in the main channel with direct courses from either the north, passing inside Little Barrier Island, or from the east via Colville Channel, both courses converging near Tiritiri Matangi Island and thence via the dredged channel to the port.

A motorised barge delivering sand mined from Pakiri Beach accounts for all the close inshore traffic on the east coast, north of Kawau Island and Leigh.

[6] **A survey by MNZ in 2014 indicated that there were around 230,000 recreational boats in Auckland with one in four households owning a boat of some type.**

Bulk carriers pass beneath the Auckland harbour bridge to access the Chelsea Sugar Refinery berth.

In Auckland's upper harbour, channels wind their way around extensive drying sand and mud flats. The regular ferry routes are all marked with buoys or beacons, however ferries operating on the West Harbour route have to take care at low water to not ground. A note on Chart NZ5323 (Auckland Harbour West) states that dredged areas may not be regularly maintained.

Passenger ferry routes across harbour and out to Waiheke Island, Coromandel and other Gulf destinations, dominate the traffic tracks.

A large number of the passenger vessel tracks to unusual places are from the Auckland-based youth development training vessel *Spirit of New Zealand*.

Defence Areas exist around the Devonport Navy Base, with restrictions that may be imposed at any time.

Commercial ship anchorages are designated within the inner harbour, east of the harbour bridge, as well as north of Rangitoto Island on both sides of the main shipping channel.

Pilot boarding grounds Alpha and Bravo are both located north of Rangitoto Island, inside the designated Rangitoto anchorages.

3.1.1.1 PORTS OF AUCKLAND LIMITED

The operational centre for Ports of Auckland Limited (POAL) is on Waitemata Harbour. The port recorded 1,541 vessel visits in the 2014-2015 study year. Fergusson Container Terminal has 5 quay cranes and more than 40 straddles carriers. The bulk of the containerised cargoes transfer over this wharf.

Bledisloe Terminal is a multi-purpose wharf that handles mostly imported vehicles and some project cargoes. Overflow containers from Fergusson Wharf are also handled here.

In addition, there are three general cargo wharves: Freyberg Wharf, which handles mostly break-bulk cargoes like coal, sand, gypsum and wheat; Jellicoe Wharf where timber, steel and vehicles are amongst the general cargoes worked; and Captain Cook Wharf which is used for the import of vehicles. Marsden Wharf is no longer used for working cargo, but is used for storage of imported vehicles.

Passenger cruise vessels berth at Queens and Princes Wharves: Auckland is a key 'exchange' port, where passengers start or finish their cruises.

In 2014, the port handled over 900,000 TEU and 5.6M tonnes of break-bulk cargo. Over 200,000 vehicles were imported.

Five tugs are currently operated by POAL on Waitemata harbour, along with two Pilot boats and a survey vessel. Pilotage is compulsory for vessels over 500 gross registered tonnes.

A small fleet of fishing vessels is based at Onehunga, varying in numbers according to the season.

Aids to Navigation (AtoNS) such as lights, beacons and buoys are maintained by POAL on both harbours, and a signal station is maintained at Manukau Heads.

3.1.1.2 CHARTING INFORMATION OBSERVATIONS – PORT OF AUCKLAND

The Auckland approach channel was dredged to 12.5m in 2007. A note on the chart states that dredged areas may not be regularly maintained, although commercial interests would indicate that the main shipping channels are maintained regularly.

Chart source data for the Auckland Harbour East chart dates back as far as 1955 in a few areas, some of which are close to the main shipping channel.

3.1.2 MANUKAU HARBOUR

The Manukau Harbour is one of the most extensive inlets on the west coast of NZ, with a water area of 394 km^2. However, most of this harbour consists of tidal sand bars, with navigation restricted to a few clearly defined channels. Across the entrance, a curving sand bar is situated several miles offshore, and the three unmarked bar entrances are extremely narrow. In common with most NZ bar entrances, the channels are likely to move after weather events.

In addition to the main commercial port on the Waitemata Harbour, POAL operate a fully-manned traffic management signal station at South Head on the bar entrance to the Manukau Harbour to service the port of Onehunga. This port has become too shallow relative to the size/draught of modern vessels. The construction of a new cement import facility on the Waitemata Harbour, scheduled for 2016 completion, is the final phase of a move of coastal freight operations from Onehunga. If the signal station is subsequently closed down transit mitigation would be reliant on charting only.

An LPG tanker crosses the bar infrequently to connect with a take-off point near the airport, but no vessel tracks were recorded for this activity over the year in question.

3.1.3 KAWAU BAY

Kawau Island is a popular destination for pleasure craft cruising the Hauraki Gulf, located 45km north of Auckland. The sheltered waters of Kawau Bay provide good fishing and sailing and there are many

sheltered anchorages for boaters. There is a small marina and swing mooring area in the shelter of Sandspit. Entry into Kawau Bay for mariners is via a narrow northern passage, marked with AtoNs, or via two passages to the south of Kawau Island.

Kawau Bay is a frequent anchoring spot for the sail training ship *Spirit of New Zealand*: many of the passenger vessel tracks recorded in Kawau Bay are from this vessel.

Ferry passengers are carried on the short, but frequent, sheltered water passage between Sandspit and Kawau Island, located 45kms north of Auckland. A water taxi/charter fishing boat operates out of Sandspit. A number of holiday homes are located on the island and there are many places of interest on Kawau Island for day visitors

A Note on charts of the area states that Kawau Bay is a Restricted Area for vessels over 500GT or 40m LOA.

3.1.4 GREAT BARRIER ISLAND

Port Fitzroy, located on the western side of Great Barrier Island, is a sheltered anchorage very popular with recreational vessels. The Port Fitzroy wharf is used for vessel refuelling, watering and provisioning. The vehicle/passenger ferry from Auckland berths alongside at the Port Fitzroy wharf once weekly with occasional extra calls as required.

Boutique passenger ships anchor in the picturesque bays of Port Fitzroy, landing their passengers ashore in tenders. Locally-based mussel barges work the mussel farms located around the island.

Dangerous goods (DGs) such as LPG and fuel oil transit across the wharves at Tryphena harbour and Whangaparapara, both located on Great Barrier's west coast, south of Port Fitzroy.

Small inshore fishing vessels, many of them targeting crayfish, operate out of the sheltered harbours on the west coast of Great Barrier Island.

A Note on charts of the area states that Port Fitzroy and Whangaparapara Harbour are Restricted Areas for vessels over 500GT or 40m LOA.

3.1.5 MAHURANGI, WHANGATEAU AND LEIGH HARBOURS

There are other small estuary harbours located on the region's east coast, for example Mahurangi, Whangateau and Leigh. These are mostly used by small recreational boats. Numerous local boat ramps facilitate launching of trailered boats, mostly for water skiing, fishing and diving.

Sand mining off Auckland's Pakiri beach has seen much controversy over the years. One company has resource consent for removal of 76,000 cubic metres of close-shore sand per year, transported to Auckland using tug and barge.

A separate operator has a consent to take up to 2M m^3 of sand between Pakiri and Little Barrier Island during the next 20 years.

3.1.6 AREAS OF RISK SIGNIFICANCE - RESERVES, ECOLOGICAL, CULTURAL

The port of Auckland is located within the Hauraki Gulf Marine Park, and is one of the few places with a semi-resident population of the critically endangered Bryde's Whales. As these whales are vulnerable to ship strike, the port and the shipping industry have agreed on a 'Hauraki Gulf Transit Protocol for Commercial Shipping' which, as well as avoidance and reporting arrangements, limits vessel speed in the Hauraki Gulf and recommends appropriate approach routes to the port.

Little Barrier Island is one of New Zealand's pest-free nature reserves, and home to a multitude of endangered species. The island contains the most intact native ecosystem in New Zealand. A permit is required to visit the island.

Tiritiri Matangi Island is a wildlife sanctuary and is a significant New Zealand conservation project.

3.1.7 ECONOMIC SUMMARY – AUCKLAND REGION

Auckland is NZ's largest city and home to about a third of the nation's population. The city is the economic capital of NZ and accounts for 35% of the economy. As such it is the most significant contributor to the NZ economy and a major hub for passenger operations (both SOLAS vessels and domestic passenger services).

The POAL provide a key economic link to the Auckland region, with the ports handling a varied range of cargos, with the most significant vehicle import hub in the country. In terms of passenger traffic (including cruise ships), it is an order of magnitude greater than any other NZ harbour, with a mature water-based commuting system.

The diversity of cargo types are at high volumes for New Zealand. The cargo summary is expanded further in the section below.

Auckland plays an important role nationally as a hub for the tourism services sector. There are many multinational/national company headquarters in the city, which is also a conduit for international investment and connectivity throughout New Zealand.

Auckland is the headquarters for around two-thirds of New Zealand's top 200 companies and has the second-highest average household income in the country, reportedly marginally behind that of Wellington.

3.2 TRAFFIC ANALYSIS – AUCKLAND REGION

Types of commercial vessels using Auckland Region's ports include:

- Container
- General and Break-bulk
- Tankers
- Car carriers
- Passenger cruise
- Passenger and vehicular ferries
- Charter boats and water taxis
- Tugs, barges and workboats

3.2.1 ALL TRAFFIC - AUCKLAND REGION

A plot of traffic in the Auckland Region for 2014-2015, broken down by type is shown in **Figure 21**. This includes traffic using Manukau Harbour, with the full extent of traffic in the Hauraki Gulf showing in **Figure 22.**

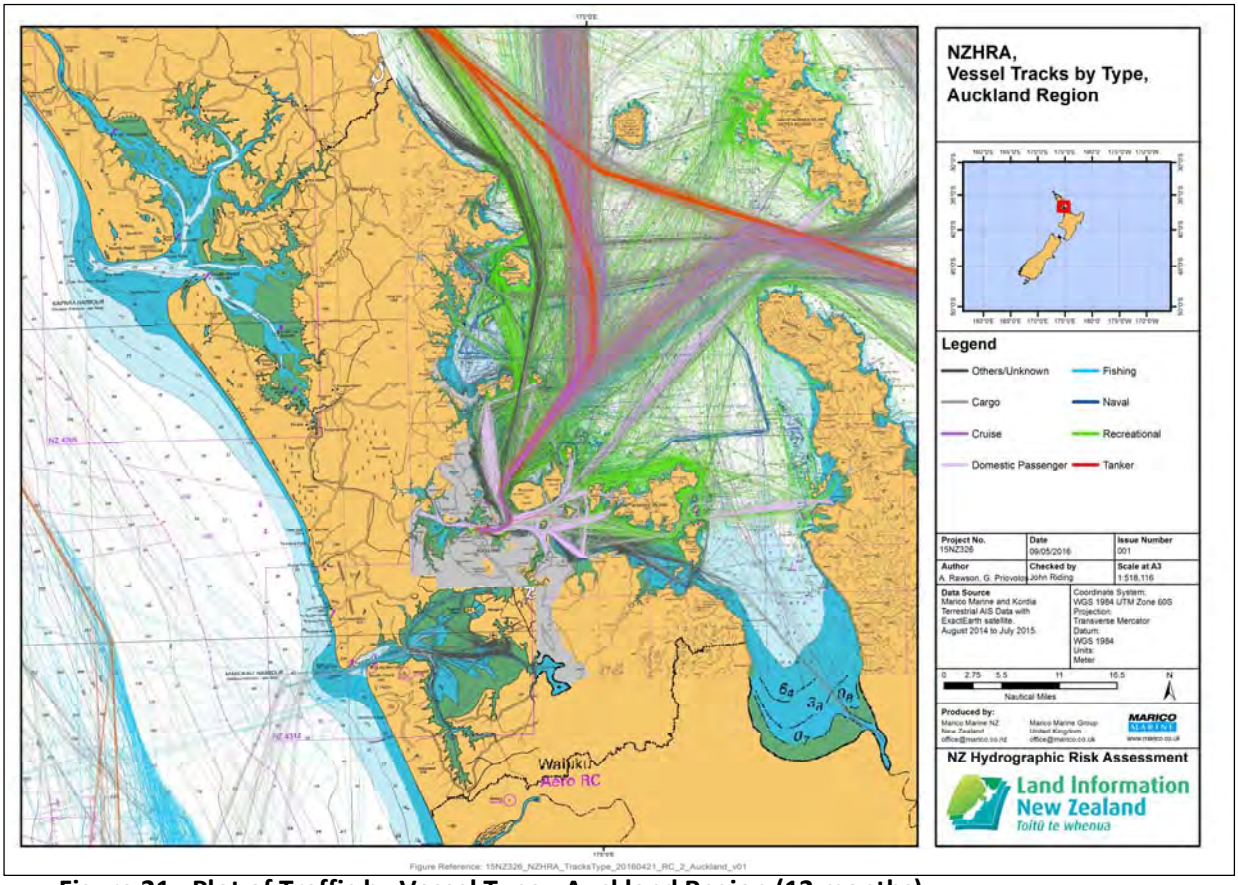


Figure 21 : Plot of Traffic by Vessel Type - Auckland Region (12 months)

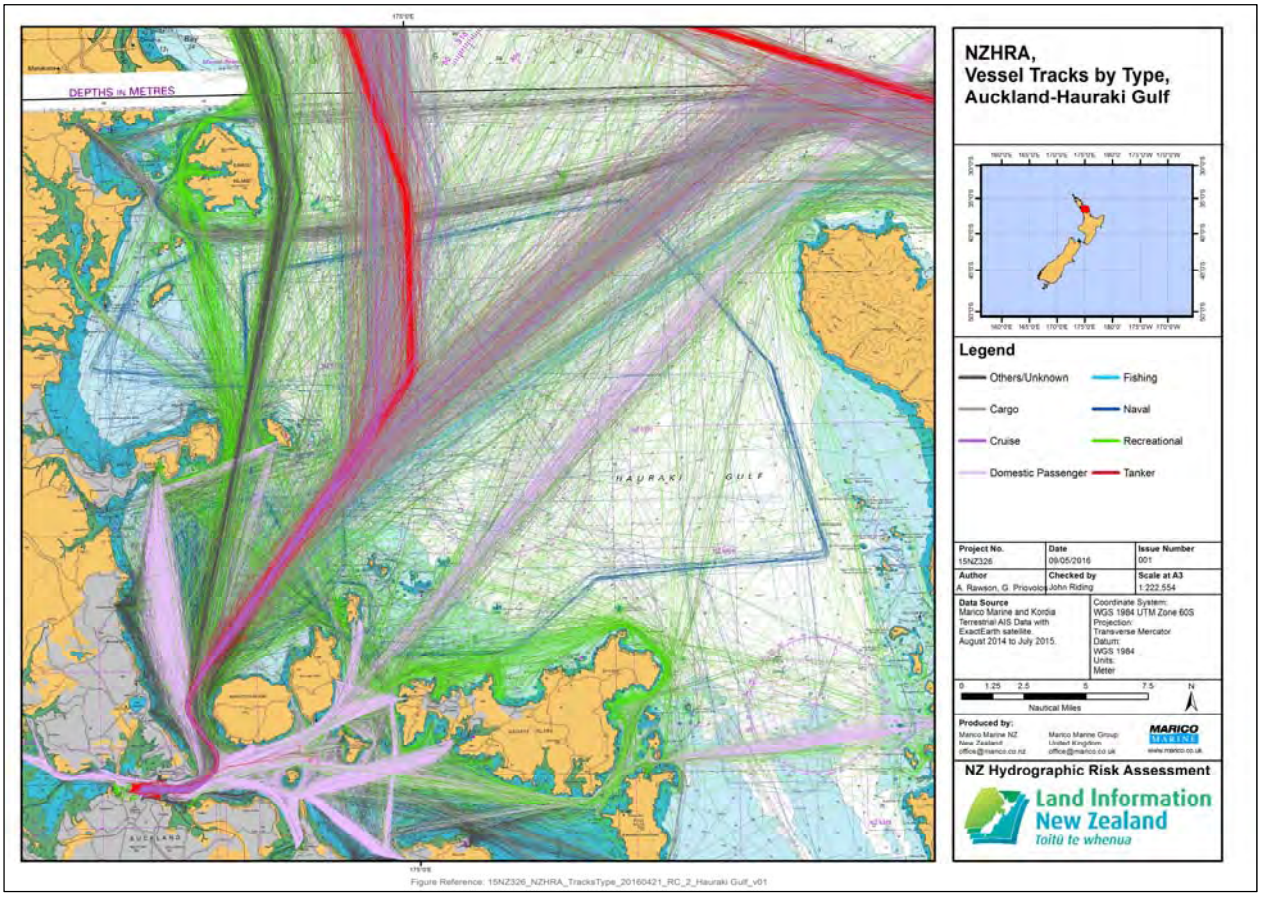


Figure 22 : Traffic Overview across the Hauraki Gulf (12 months)

3.2.2 ALL TRAFFIC DENSITY – AUCKLAND REGION

The traffic density plot clearly lays out the routes in and out of Auckland.

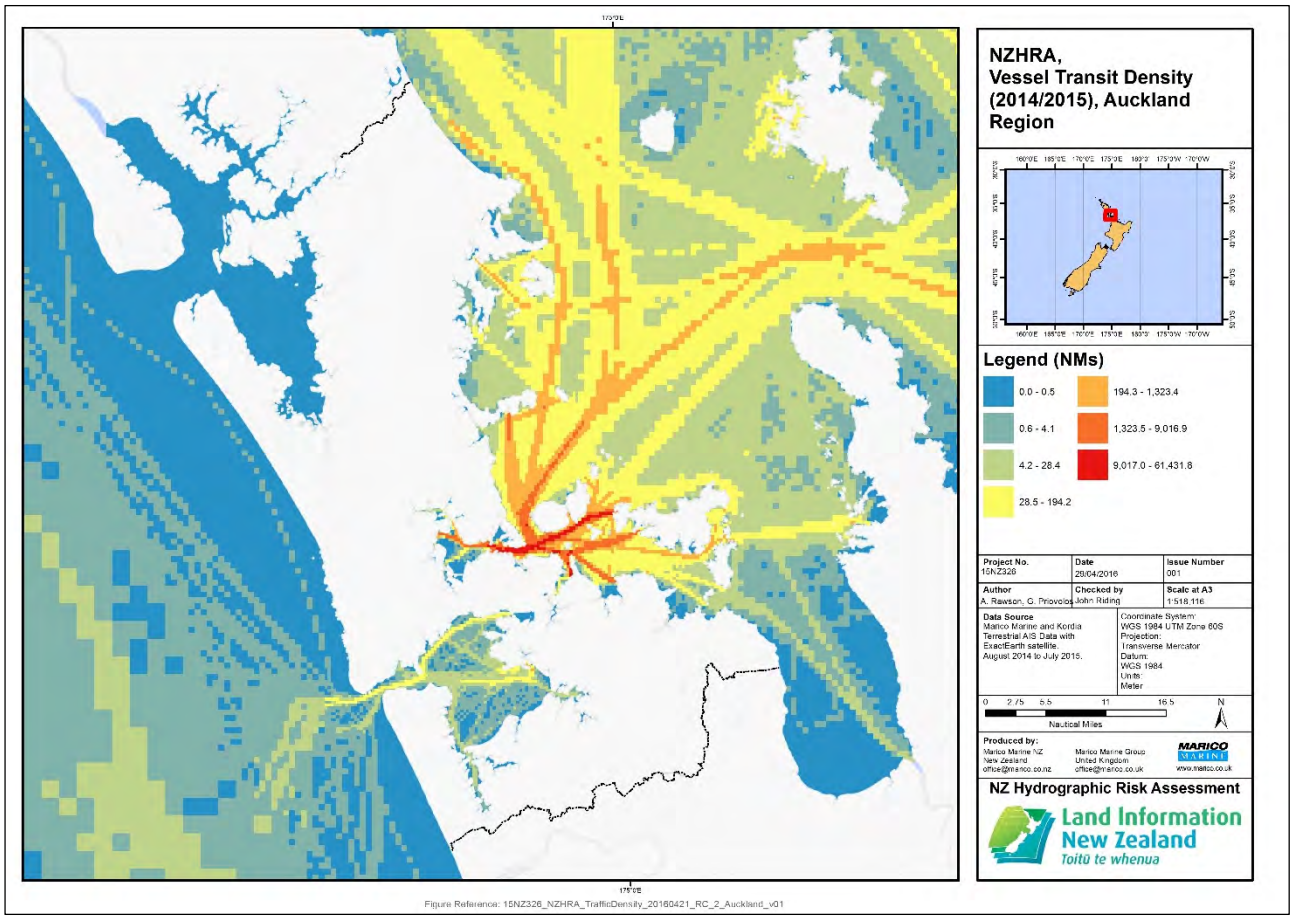


Figure 23 : Plot of Traffic Density in Auckland Region

3.2.3 CARGO VESSELS – AUCKLAND REGION

Cargo vessels track in and out of Auckland, generally following well-worn routes, however a number of large cargo vessel tracks indicate passing distances of less than 1nm to charted rocks and islands.

Cargo vessels pass close to the southern side of Little Barrier Island, with smaller vessels venturing to less than 1nm of the nature sanctuary.

A small number of cargo vessels use the Manukau port of Onehunga.

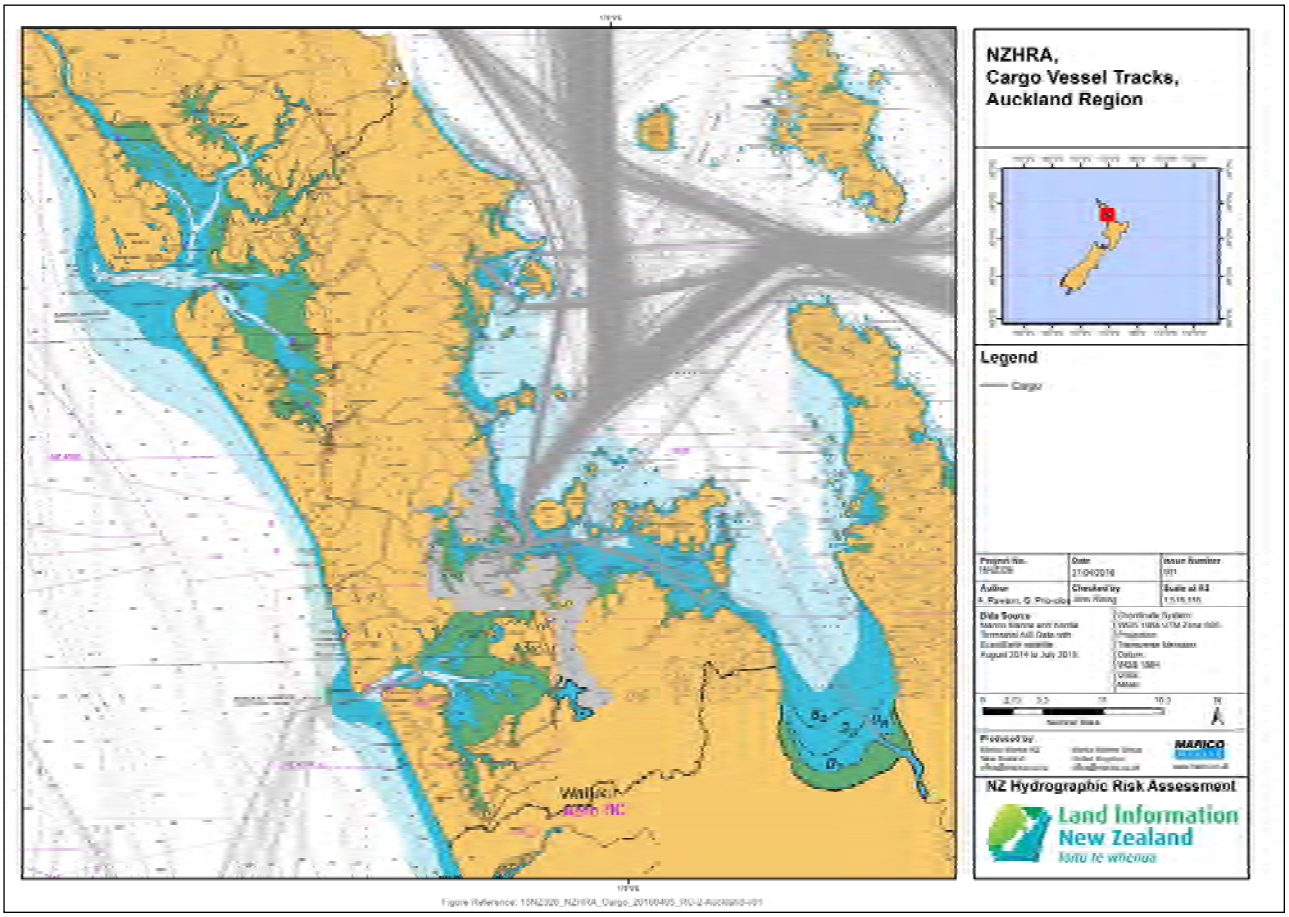


Figure 24 : Cargo Vessel Routes – Auckland Region

3.2.4 CRUISE VESSELS – AUCKLAND REGION

Auckland is growing strongly as a cruise destination, with 89 cruise vessel visits recorded in 2014/15, which is down from 100 in 2013/14. Data gathering confirmed this fall is predicted to be reversed in the 2015/16 season and going forward according to bookings. Overall, Auckland's cruise vessel visits have increased annually from 62 in 2010, with further growth expected; most if not all cruise vessels have Auckland as a destination. One vessel operates out of Auckland for the summer season, with plans reported for a second vessel. Cruise ships brought a recorded total of 195,944 cruise ship passengers into Auckland during the 2014/15 cruise season, showing the significance of this trade from an economic perspective. The general use of the waterways with the routes taken by cruise vessels in the 12 months, July 2014 to June 2015, is shown below in **Figure 25,** with detail shown in **Figure 26** and **Figure 27 .** The vessel transit voting pattern is mostly to follow the designated and marked channel. However this is not always the case, especially with smaller 'boutique' vessels. Even large cruise vessels are not of significant draught (with the exclusion of vessels designed for

North Atlantic transit service), so any further track consistency, if required, would need to be achieved by recommended routeing.

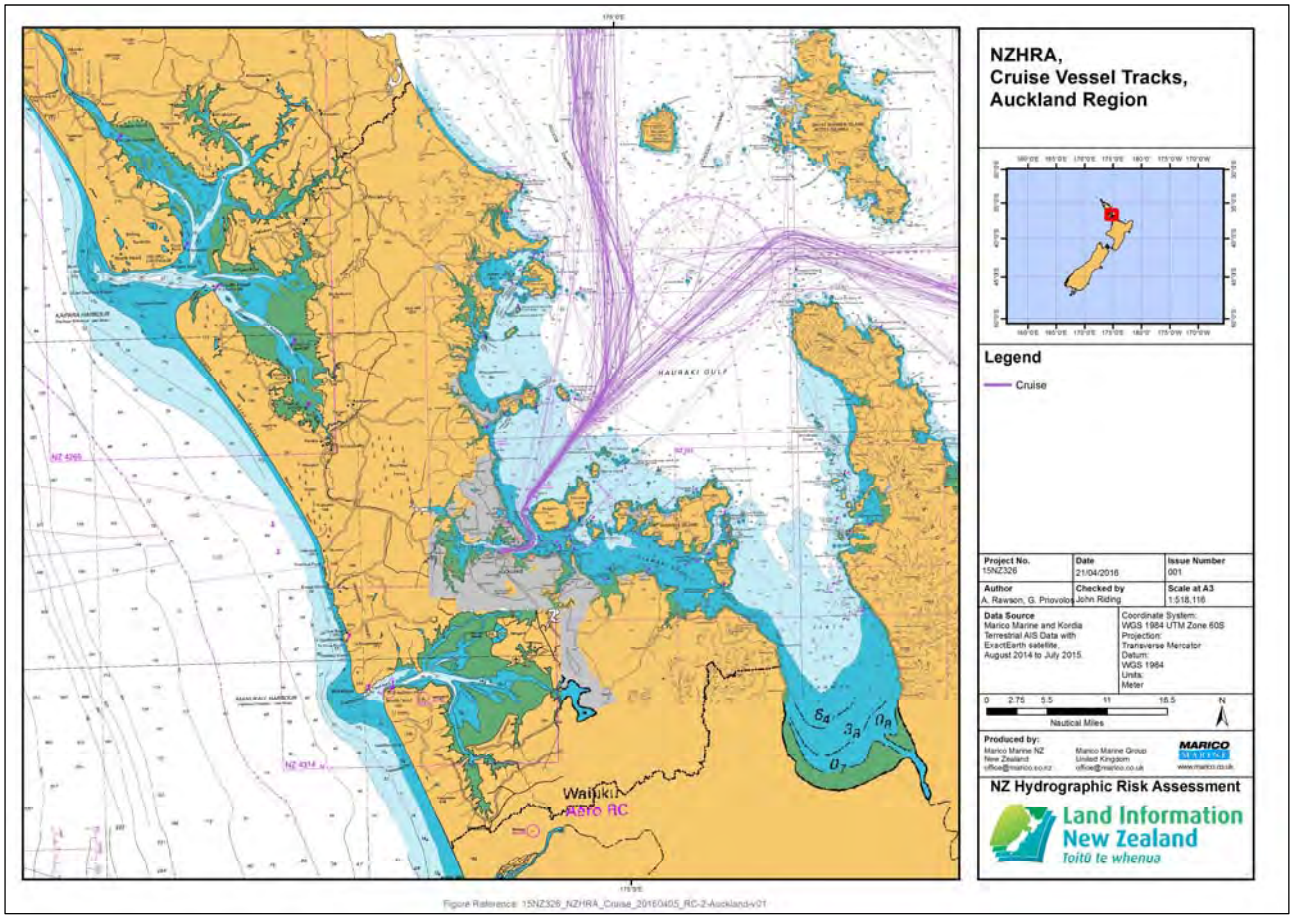


Figure 25 : General Routes taken by Cruise Vessels in the Hauraki Gulf

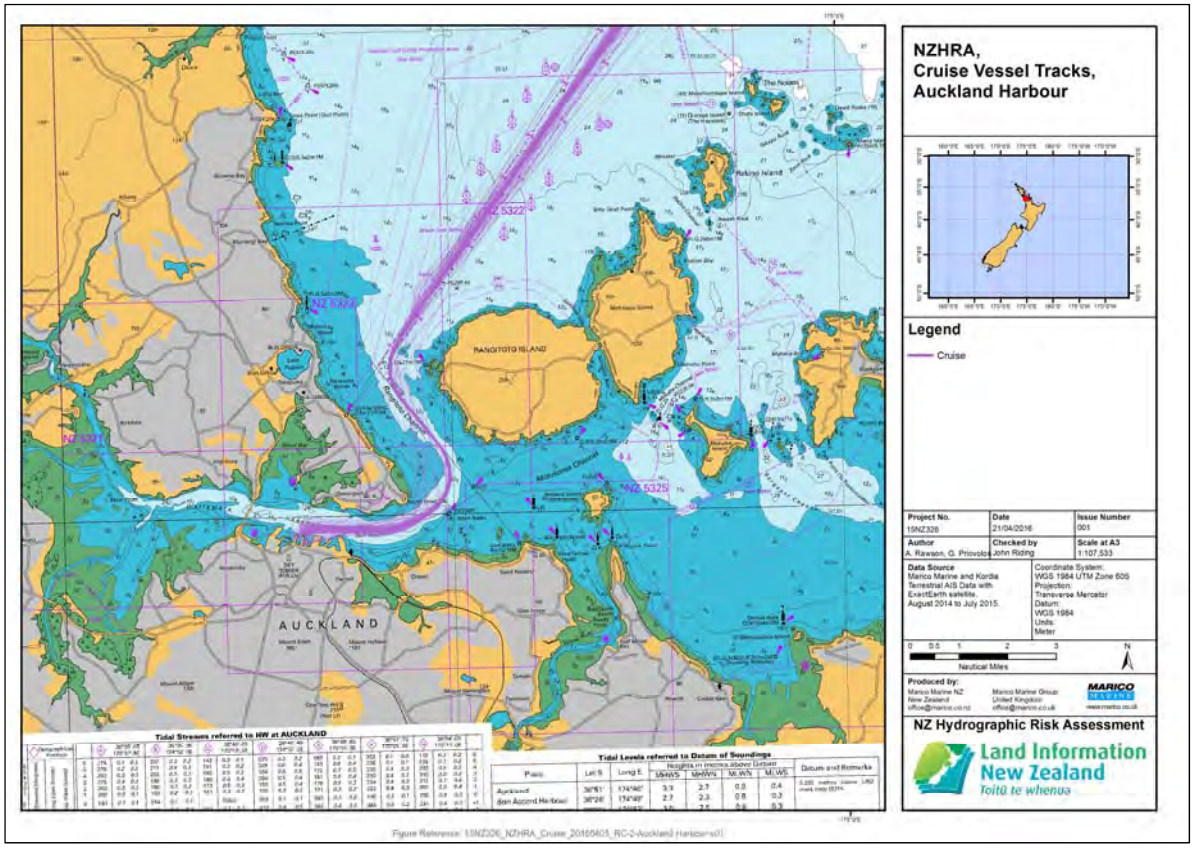


Figure 26 : Cruise Vessel tracks into Port of Auckland

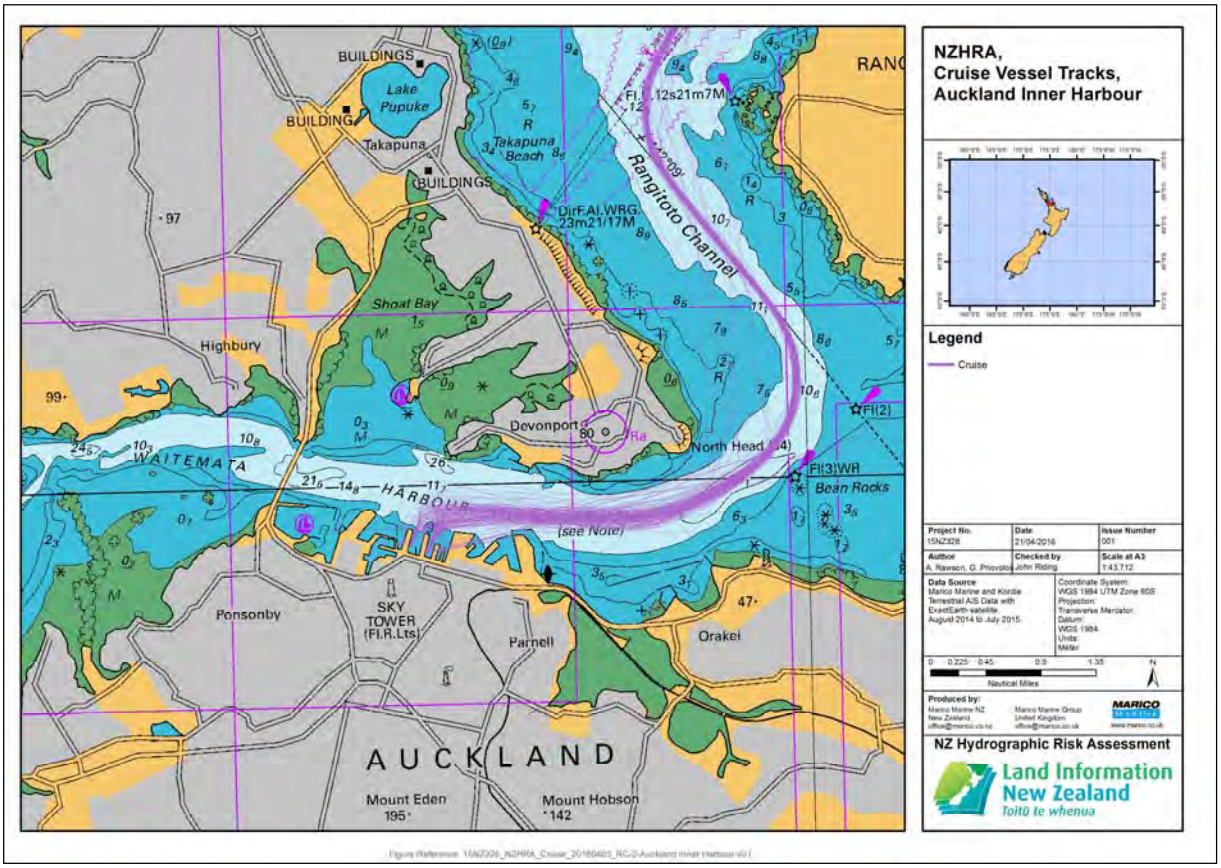


Figure 27 : Cruise Vessels Using Auckland Harbour Terminals

3.2.5 DOMESTIC PASSENGER SERVICES - AUCKLAND HARBOUR

Auckland harbour's ferries carry around 5.4M passengers per year, most of which are commuters; passenger numbers are in the public domain. Of this total, the Auckland-Waiheke ferry service carried 2M passengers and the Auckland-Devonport ferry service conveyed 1.9M passengers.

Ferries between the city and the upper harbour carried almost 600,000 commuters. Ferry routes to coastal destinations, for example Stanley Bay, Gulf Harbour, Great Barrier Island and Coromandel carried over 600,000 persons. These routes may be clearly seen on the traffic plot for this region.

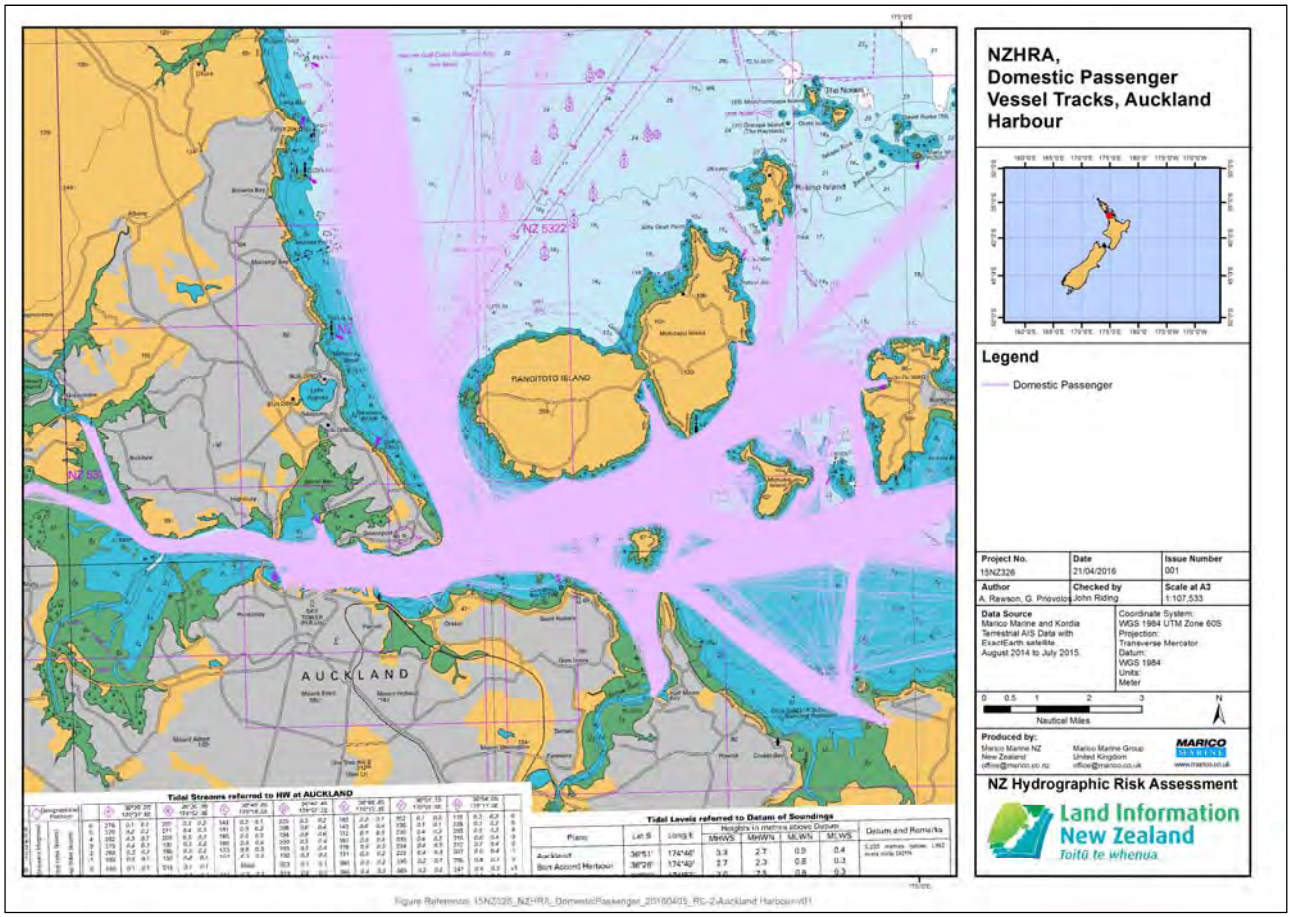


Figure 28 : Domestic Passenger Routes – Auckland Harbour

3.2.6 TANKER TRAFFIC – AUCKLAND

Tankers follow the main shipping channels in and out of the port. Tankers also cross the Hauraki Gulf on coastal passages, not calling into Auckland, with a number of tankers passing through the Colville Channel, and to the south of Little Barrier Island when transiting between other coastal ports and Marsden Point refinery.

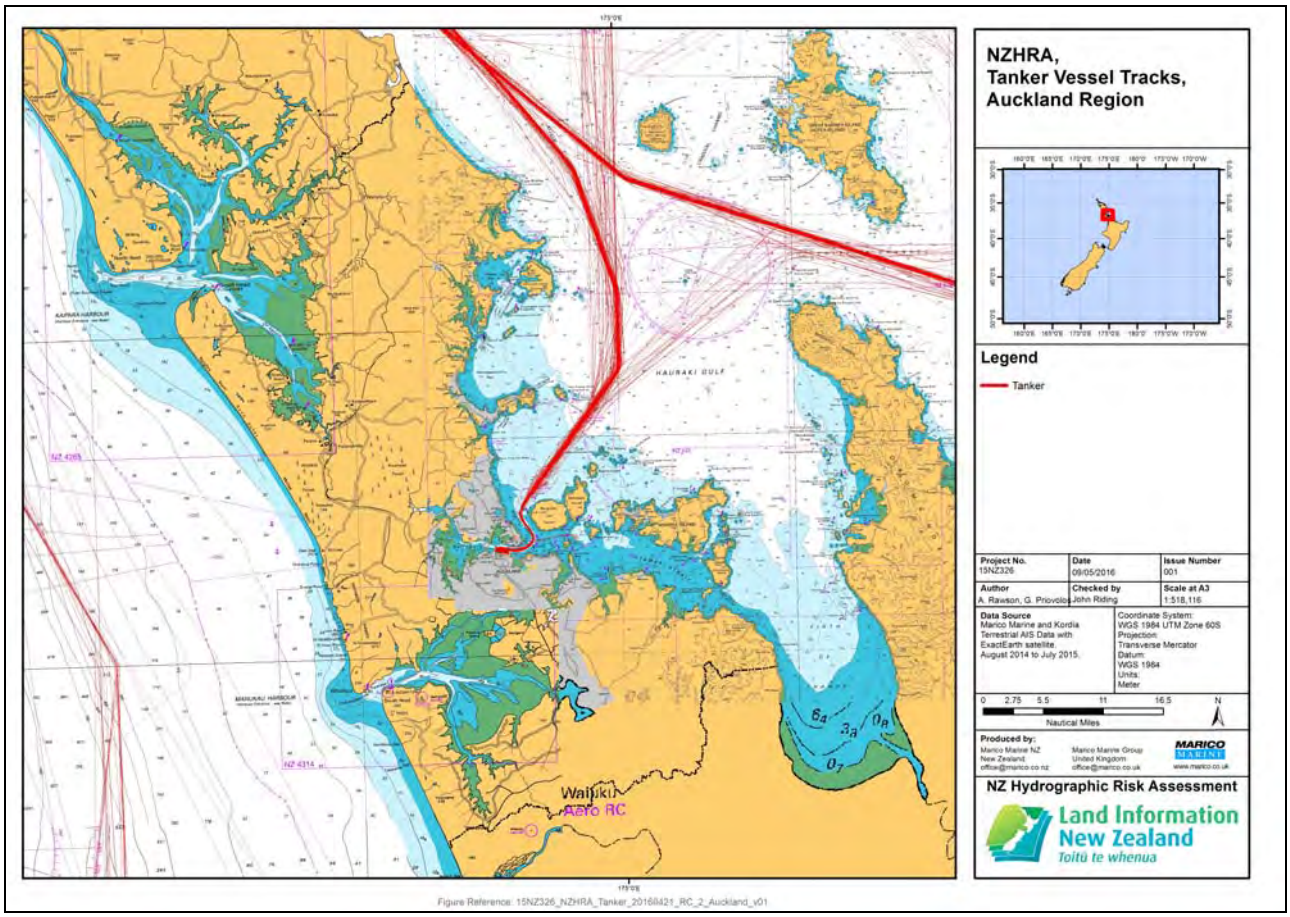


Figure 29 : Auckland Hauraki Gulf Tanker Tracks

The majority of the tanker tracks showing around the Auckland wharves are from the 3,900 gross-ton bunker tanker *Awanuia*, which loads fuel at Northland's Marsden Point refinery and supplies bunkers to ships berthed alongside the wharves in Waitemata Harbour.

A small number of chemical, fuel oil and LPG tankers use the remaining city tanker berths at Wynyard Wharf. A Naval tanker uses the Navy base at Devonport.

3.2.7 COMMERCIAL FISHING VESSELS

All the larger fishing vessels in this region are fitted with AIS, so are represented in the AIS traffic data recorded. Smaller fishing vessels not carrying AIS were accounted for using data from interviews and statistics. Around 3,500 – 4,000T of fish are landed across the Viaduct wharves at Auckland annually. The Hauraki Gulf Marine Park is reported to produce one third of NZ's total commercial snapper catch. Traffic patterns show that most locally-based fishing vessels return through the main shipping channels to discharge their catch in the city at the Viaduct wharves.

3.2.8 Recreational Fishing Vessels

The Hauraki Gulf comprises popular recreational fishing grounds, with an estimated 37% of NZ's recreational fishers using the Hauraki Gulf Marine Park.

Aerial surveys estimate that up to 1,000 recreational boats are out on a typical Saturday, Sunday or holiday during the summer months. The areas around Rangitoto, Motutapu and Motuihe Islands reportedly provide for significant recreational fishing activity. Estimates are taken from aerial counts of vessels observed to be fishing, combined with a survey of recreational fishers returning to key boat ramps. Up to 3,000 boats per square km were counted during aerial surveys over peak summer months of 2011-2012. Many of these boats are trailer boats, using the large number of boat ramps in the region.

3.2.9 Recreational Craft in General

Other types of recreational vessels include sail boats and pleasure launches. Their traffic patterns are random, but are intensified around marina entrances and sheltered bays.

Popular destinations for boaters include sheltered bays at Waiheke Island and the inner islands; Kawau Bay and, for the more seaworthy vessels capable of longer passages, Coromandel Peninsula and Great Barrier Island. Traffic routes to these destinations can be clearly seen on the traffic plot.

Recreational vessels using the Manukau harbour are mostly small trailer boats, some of which cross the Manukau bar to fish in open west coast waters.

3.3 HYDROGRAPHIC RISK - AUCKLAND

3.3.1 OVERVIEW RESULT – AUCKLAND REGION

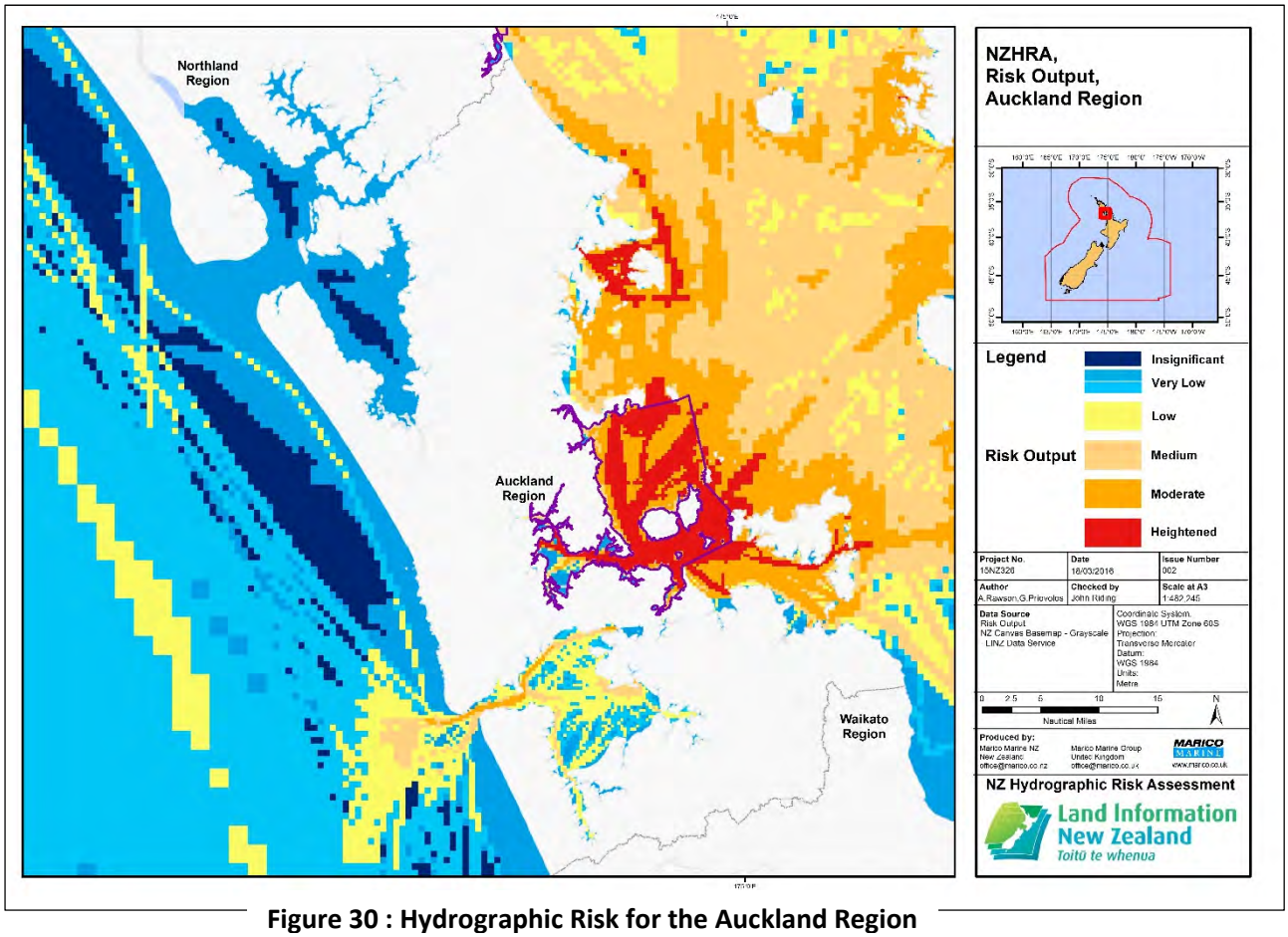


Figure 30 : Hydrographic Risk for the Auckland Region

The hydrographic risk result for Auckland is interesting. It is driven by high traffic levels, when domestic passenger services are taken into account. Some of the chart source data for the Auckland Harbour East chart dates back as far as 1955 in a few areas, some of which are close to the main shipping channel. However, the harbour experiences significant traffic use and passenger routes have large passenger volumes present in a 12 month period. As the traffic analysis shows, there is also considerable traffic passing either side of Rangitoto Island, on routes out to Great Barrier Island as well as the Coromandel Peninsula. Growing use of the area by Cruise vessels (boutique) is also apparent.

3.3.2 HYDROGRAPHIC RISK - KAWAU HARBOUR

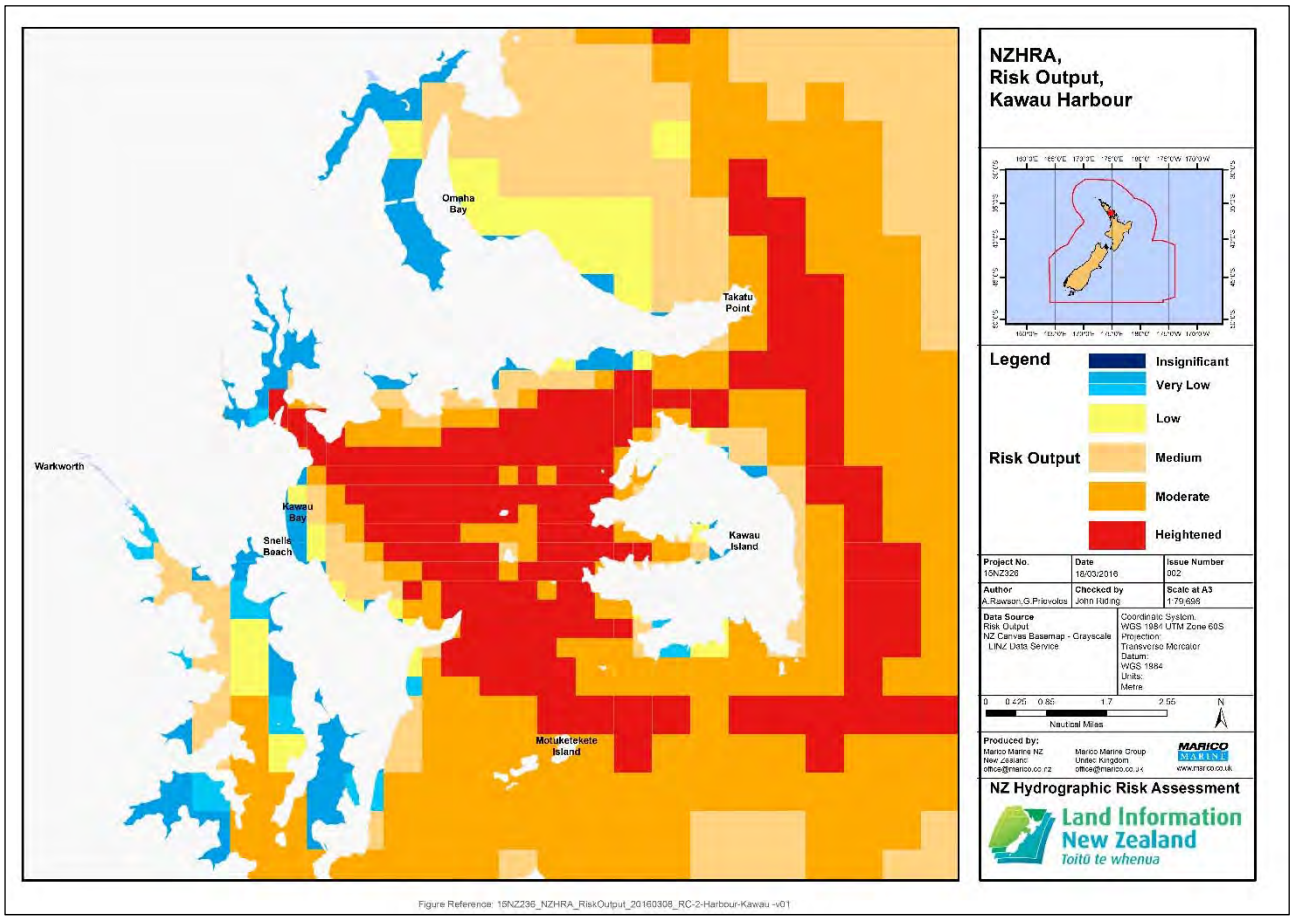


Figure 31 : Hydrographic Risk – Kawau Bay

Kawau Bay provides an interesting result, as its waters show heightened risk. This is not related to large SOLAS vessels, rather it is a high volume of smaller craft use. A modest marina is located in the same area: a large amount of tug, barge and dredge traffic is associated with extensions to this marina. Vessel tracks for passenger vessels in this harbour include numerous extended visits from the Sail Training Vessel *Spirit of New Zealand* which frequents this area, carrying 40 trainees at a time. Considerable charter vessel use is also evident and recreational use in this area is significant. The charting in the area is from the 1975 and the extents of scales need reviewing.

These factors, in combination with the presence of an adjacent marine reserve provide a consistent score of heightened risk in this harbour area. It is one of a few areas of the NZ waters where the map cells provided heightened risk scores without large and deep draught vessels being present. The restricted area for vessels ensures that no vessels greater than 500GT or 40m LOA use Kawau Bay.

3.3.3 HYDROGRAPHIC RISK - AUCKLAND - INNER HAURAKI GULF

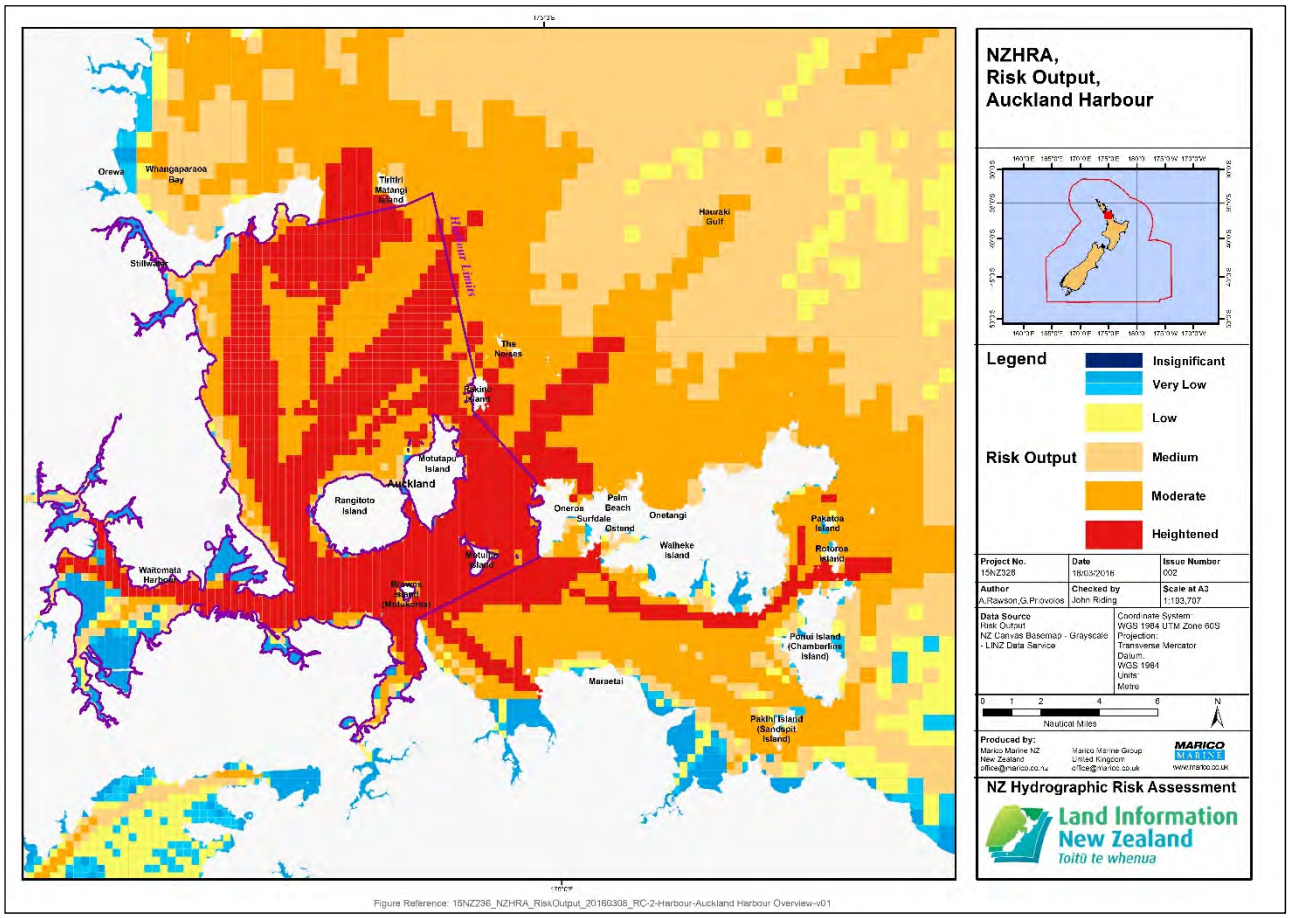


Figure 32 : Hydrographic Risk - Auckland Eastern Approaches and Inner Hauraki Gulf

Auckland's inner Hauraki Gulf has heavy commercial vessel use, domestic ferry traffic routes, high charter vessel traffic as well as extremely high recreational use. In addition, the ZOC C low accuracy survey in parts and the heightened risk from the age of the source data, dating from 1970 in parts of the busy main ship approaches to the port, contribute to the heightened risk.

3.3.4 HYDROGRAPHIC RISK - AUCKLAND – WEST HARBOUR

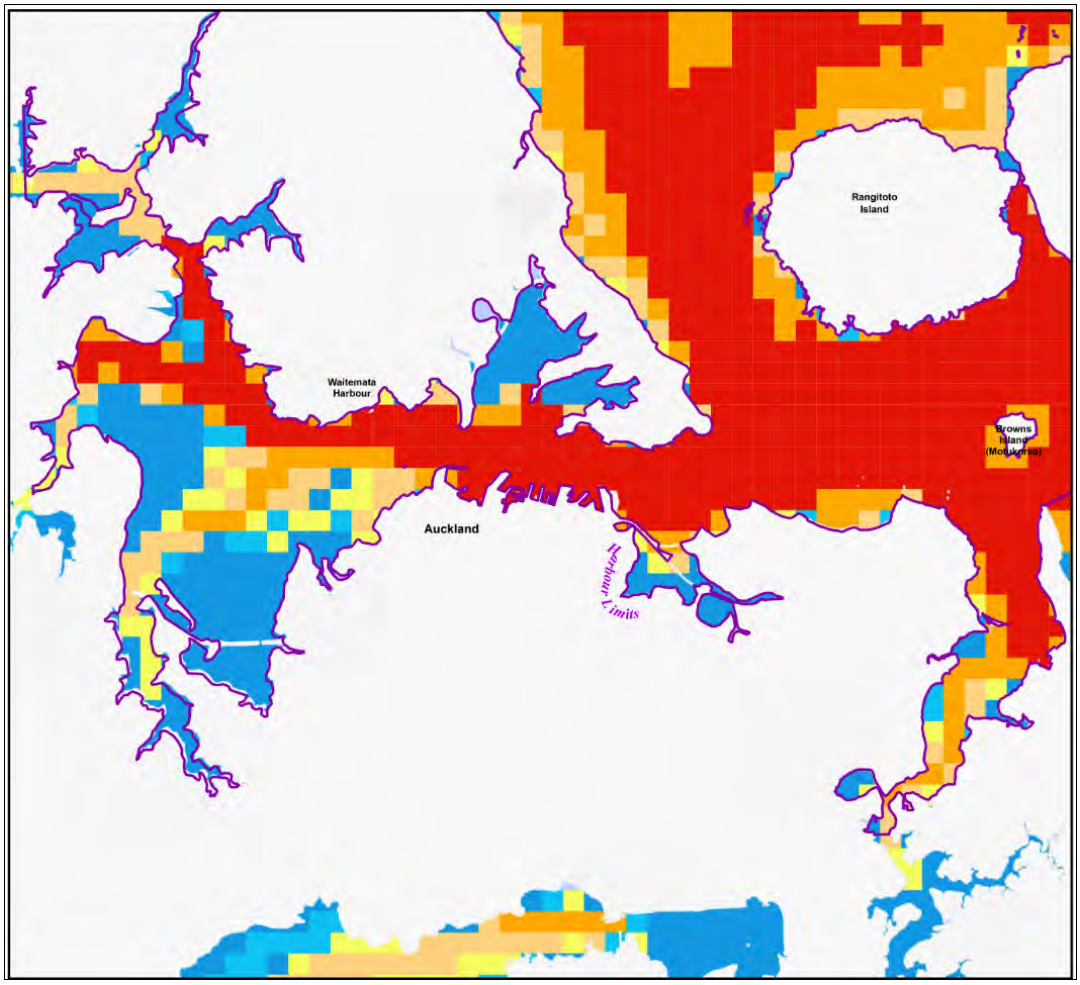


Figure 33 : Auckland – West Harbour Channels

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.

3.3.5 HYDROGRAPHIC RISK - AUCKLAND – TAMAKI STRAIT

Auckland's Tamaki Strait and approaches from Rangitoto to Waiheke Island show a high risk mainly due to the survey age for almost the whole area from 1968-69, combined with very high domestic passenger and recreational traffic routes.

The approaches to Half Moon Bay and Pine Harbour Marinas show heightened risk due to the high traffic volumes.

3.4 CHARTING BENEFIT – AUCKLAND REGION

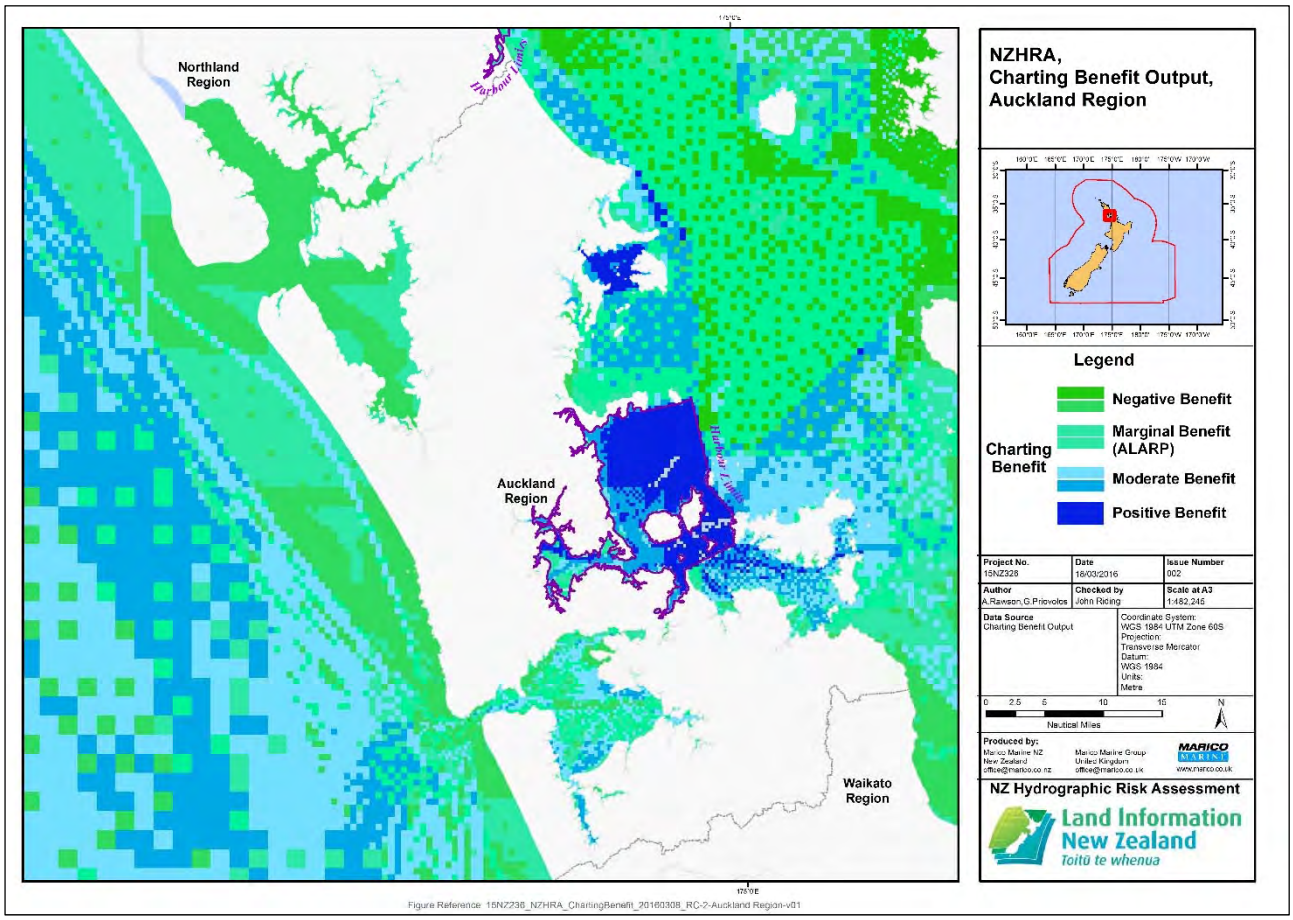


Figure 34: Chart Benefit Plot Showing a Positive Benefit for Inner Hauraki Gulf

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.

3.4.1 CHARTING BENEFIT - KAWAU BAY

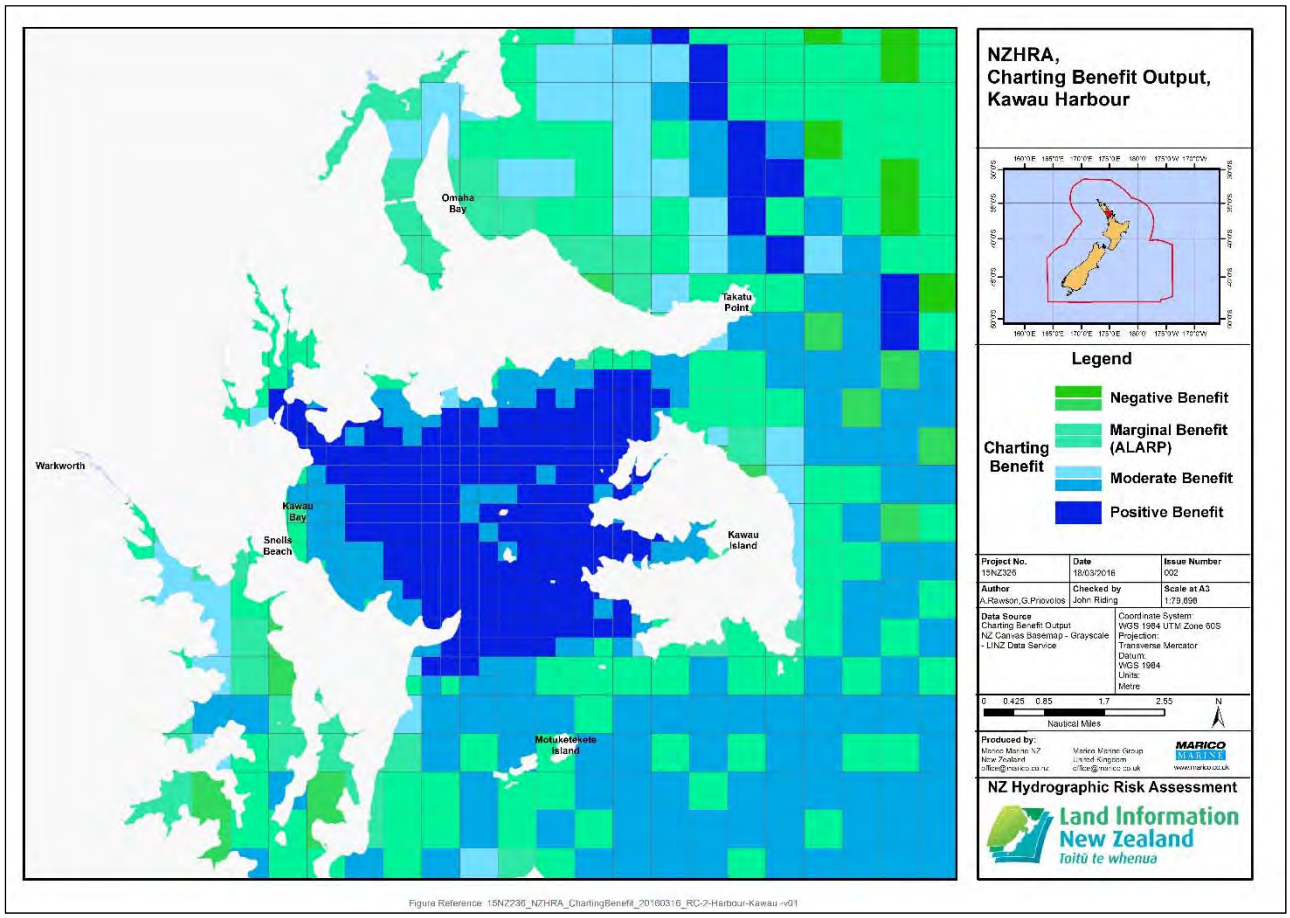


Figure 35 : Positive Charting Benefit – Kawau Bay

The benefit result is interesting in the case of Kawau Bay. A limit of harbour extents had to be added to allow the GIS model to test the charting standard in this area in terms of the scale for harbour waters, against the recommended scales of use. There is notable passenger traffic transiting this area, most of which is provided by the ferry and charter vessels. Improvements in the seafloor coverage within Kawau Bay can be considered.

3.4.2 CHARTING BENEFIT - AUCKLAND – INNER HAURAKI GULF

There are areas in the whole of the inshore Auckland area, where charting benefit will accrue if charting is upgraded. This includes some of the Auckland passenger routes. However a feature of this result is the scale of the charting in this area, when compared to IHO recommendations (See **section 1.5.2**). It should be noted that the deep draught shipping channels in the approaches to this important port are already surveyed to adequate standard; the benefit calculation is being driven by the risk and the overall charting scales in the area. The offshore area of the outer Hauraki Gulf provide a negative benefit result, reflecting the adequacy of charting in this area in relation to the

navigational need. The west coast of the Auckland region shows minimal benefit in a charting upgrade, with the chart data for the entrance bar being recent (but note the system does not take account of a shifting bar, only survey age).

3.4.3 CHARTING BENEFIT - AUCKLAND – WEST HARBOUR

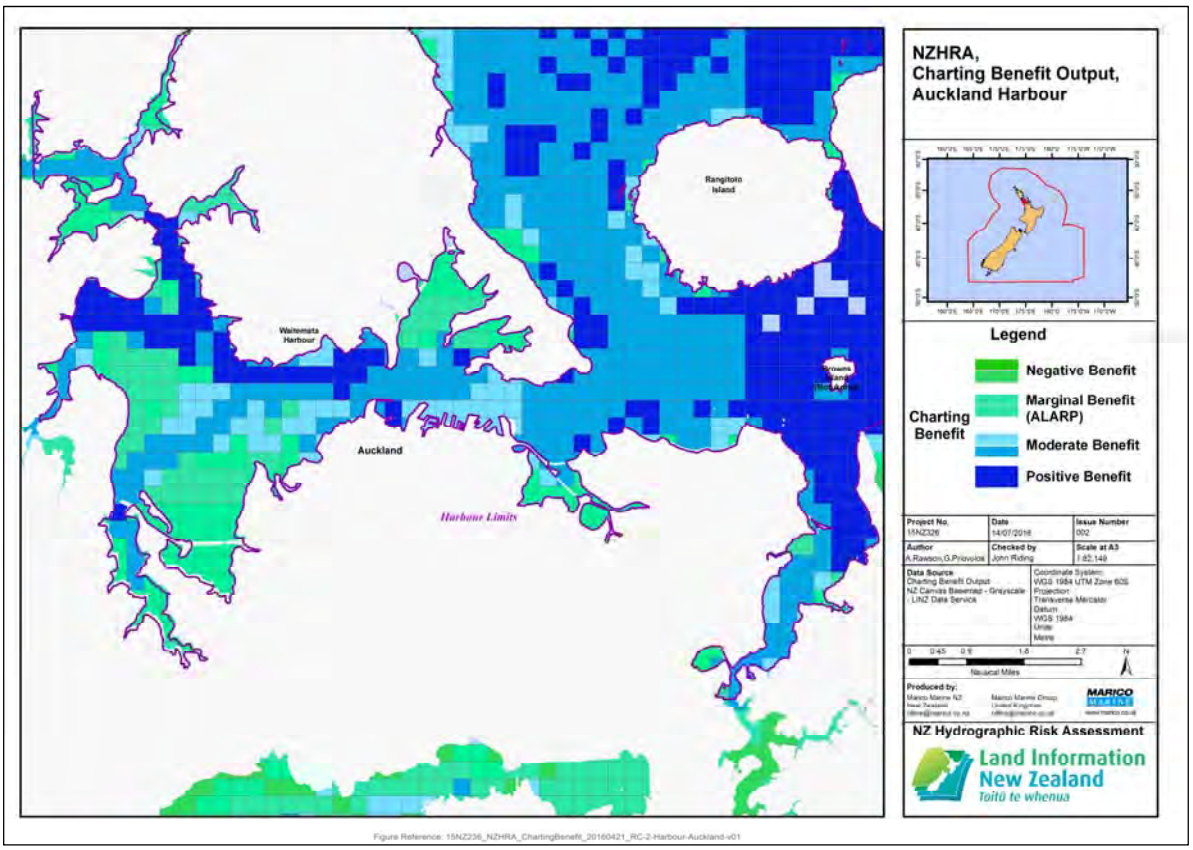


Figure 36 : Auckland Harbour – West Shows Selective Positive Benefit

There is no Berthing scale chart for West Park Marina or Beach Haven Wharf areas, which highlights reasons for the result. The area of ZOC C charting standard combines with high ferry passenger traffic and charting age to give a charting benefit for West Auckland.

3.4.4 CHARTING BENEFIT - AUCKLAND – TAMAKI STRAIT

Auckland's Tamaki Strait and Eastern approaches show a positive charting benefit mainly due to the survey age for almost the whole area from 1968-69, combined with very high domestic passenger and recreational traffic routes and low accuracy survey data by modern standards. The approaches to Half Moon Bay Marina were surveyed in 2007. These provide a positive benefit result due to high traffic volume, which includes passenger and vehicular ferries to multiple destinations. Pine Harbour Marina, which has heavy domestic passenger and recreational traffic, was surveyed in 1968-69 and is charted at Approach scale of 1:40,000, providing positive charting benefit.

4 HYDROGRAPHIC RISK RESULTS - WAIKATO REGION

4.1 INTRODUCTION

The Waikato region is the fourth largest region in the country. The region stretches from the Bombay Hills and Port Waikato in the north, south past Raglan and Kawhia Harbours to Mokau on the west coast, and across to encompass all of the Coromandel Peninsula on the eastern side, covering most of the central North Island.

The Waikato region, especially on the western side, is exposed to prevailing west and southwest winds from the Tasman Sea, with mild, humid conditions. Coromandel and Waihi have many frosts and fog events. Waikato is renowned for the high number of fog days.

High profile tourist and coastal recreation attractions are based around the eastern Coromandel Peninsula. Most of the 3M visits per year to the Coromandel Peninsula are by New Zealanders (88%). The Thames-Coromandel district's usual population of around 27,000 grows by six times as much over the Christmas holiday period, when campers and holiday makers arrive.

During summer, fine weekends and public holidays, the area around the Coromandel Peninsula, Whitianga and the Mercury Islands experiences a significant volume of recreational traffic. Fishing and diving are the most common recreational boat-based activities. There are 800 swing moorings in the region, mostly based on the west coast of the Coromandel Peninsula.

The Great Mercury Islands are renowned for their fisheries. Other recreational attractions include diving; big game fishing; kayaking and shellfish gathering, especially scallops. Commercial activities include crayfishing; dredging for scallops, trawling; setlining; charter fishing and tourism.

Cathedral Cove, to the south of Mercury Bay, named for its cathedral like arch through the limestone cliff, is a popular tourist destination, only accessible by boat or on foot.

The Waikato Region is second only to the Marlborough Sounds in the importance of aquaculture development – both in terms of the number of farms, and total area farmed. The primary site for Waikato aquaculture is the Firth of Thames, which has sheltered waters, ease of access, a favourable climate, good water quality and the availability of nutrients.

Evidence of the region's geothermal origins can be found in hot springs, notably at Hot Water Beach on the peninsula's east coast.

The volcanic rocky outcrop of Cuvier Island is located in the Colville Channel 8nm north of Great Mercury Island. Cuvier Island lighthouse guards the eastern approach to Auckland Harbour and the

Hauraki Gulf. This significant lighthouse marks the first sight of land for ships coming in from the Pacific. Heavy fog often surrounds the island.

The Aldermen group of islands and rocks, the remnants of a volcanic cone, is located 10nm east of Tairua and is designated a wildlife sanctuary. The islands are not marked with navigation lights but are situated on the direct route between Tauranga and Auckland. Several navigation hazards extend out from this group of precipitous rocks and islands and many of the rocks and shoals rise abruptly from the seabed.

4.1.1 WEST WAIKATO REGION - PORT TAHAROA

South of Kawhia is the Taharoa Offshore Iron Sand Terminal. The iron sand slurry is pumped via pipeline to an offshore single buoy mooring (SBM) where it is transferred to a bulk carrier for export to Asia. A tug/workboat based in Kawhia Harbour attends the Taharoa SBM to transfer lines to the 175,000 DWT iron sand vessels. A barge is towed to the SBM when maintenance work is required on the buoy.

4.1.2 WEST WAIKATO REGION - RAGLAN HARBOUR

The Whaingaroa or Raglan Harbour is on the rugged west coast of the North Island. The harbour covers 35km^2 and has 220km of coastline. Around 70% of its high tide surface area is intertidal. North of the harbour mouth there are extensive dunes and dune-dammed lakes. Like the beaches, the dunes are rich in iron sand and have been considered for mining.

Raglan is best known for its surf with a series of notable surf breaks. A charter boat operates cruises on the harbour and a number of fishing charter boats operate out of Raglan. A small inshore fishing fleet also operates out of Raglan.

4.1.3 WEST WAIKATO REGION - KAWHIA HARBOUR

Kawhia Harbour is a large inlet on the west coast of the North Island approximately midway between Auckland and New Plymouth, covering more than 6,000ha. The harbour is sheltered from the Tasman Sea by a buffer of forested black sand dunes.

More than half the profusely indented harbour is shallow or tidal, and five main estuaries are all navigable by launch at high tide.

A bar at the entrance effectively obstructs large shipping from using the port, however fishing and charter boats cross the bar for deep-water fishing. Game fishing is popular in the season. Fishing in

the harbour is good, and a number of small craft ply the Kawhia harbour waters. A wide variety of shellfish are plentiful.

4.1.4 EAST WAIKATO REGION - WHITIANGA HARBOUR

Whitianga is located on the eastern side of the Coromandel Peninsula. Historically Whitianga was a centre for boat building, kauri milling, flax milling, gold mining and gum digging. For many years, it was a leading timber port, with sailing ships coming to load timber. Today Whitianga has no commercial cargo shipping, but serves as a small regional centre with local fishing, farming and a thriving eco-tourism industry, based on the nearby Te Whanganui-a-Hei (Cathedral Cove) Marine Reserve and unusual rock formations around Hole in the Rock.

A small passenger ferry crosses the harbour from Whitianga to Ferry Landing, operating almost continuously during the summer, carrying locals, tourists and school children. An inshore fishing fleet is based here, discharging fish, crayfish and scallops at the town wharf. Commercial charter boats operate from the town wharf all year round. A green lipped mussel processing facility is situated in Whitianga.

The Mercury Bay Game Fishing Club currently has 2,000 members with a long history of game fishing. During the game fishing season there are multiple fishing competitions with hundreds of competing vessels and anglers.

A 191 berth marina caters mainly for larger launches, the destination for most of which is usually the Mercury group of islands or the game fishing waters further out. The harbour accommodates around 150 swing moorings. The Whitianga Waterways development comprises 385 sections that have been constructed, with the development around 20% complete. Waterfront sites have been created with approximately 100 vessels permanently stationed on their owner's jetties.

Mercury Bay and Tairua are vulnerable to tsunami effects.

4.1.5 EAST WAIKATO REGION - TAIRUA

Tairua has a largely sandy estuary harbour enclosed by a long barrier spit. The harbour is 6 km^2 in area, over half of which is intertidal. It is sheltered from the sea by the Pauanui sand spit and Paku Mountain, and has a bar entrance.

Tairua is a popular holiday destination, with activities including charter fishing, game fishing, diving, and surfing. Several islands lie off the harbour, notably Slipper Island to the southeast and the Aldermen Islands 20 km to the east. A 95 berth marina is currently under construction in Tairua harbour. A small ferry crosses the harbour with passengers and school children from Pauanui.

The coastal wetlands, extensive seagrass beds and intertidal sand flats of Tairua Harbour provide habitat for a wide variety of marine invertebrates, fish, shellfish and birdlife.

4.1.6 EAST WAIKATO REGION - WHANGAMATA

The town of Whangamata has two ocean beaches, divided by a nearby island, Hauturu. Both beaches are popular for swimming and surfing. There is an extensive estuary at the north end of the town containing a marina, wharf, swing and pole moorings, and a bar entrance that restricts the size of vessels using the harbour. Depths on the bar are subject to frequent change. Several charter and fishing boats operate out of Whangamata Harbour.

The Whangamata estuary is the shallowest in the North Island, with approximately 75% of the estuary's water volume leaving on the low tide. Extensive seagrass beds and mangroves occur throughout the estuary. A 209 berth marina is located in this estuary.

Whangamata Bar is an iconic surf break. The beach also has a good surf break when the conditions are favourable.

Another smaller estuary, the Otahu River, at the south end of the beach is shallow and not suitable for craft larger than trailer boats.

4.1.7 EAST WAIKATO REGION - COROMANDEL HARBOUR

Located on the west coast of the Coromandel Peninsula, Coromandel town is on the edge of the Coromandel Harbour. At one time Coromandel Harbour was a major port serving the peninsula's gold mining and kauri industries. Today, the town's main industries are tourism and mussel farming.

Coromandel is the North Island's aquaculture capital, with aquaculture farmers producing more than 20% of New Zealand's mussels and oysters – both for local consumption and for export.

The Coromandel region grows around 30,000T of mussels annually in offshore farms around the coastline of the Coromandel Peninsula with the main concentration in the vicinity of Coromandel harbour. There are around 20 mussel barges operating out of Coromandel and Te Kouma Harbour, located adjacent to, and south of, Coromandel Harbour, servicing the aquaculture operations. Mussel farm fishing is a popular tourist fishing option around Coromandel town. The Coromandel's production of mussels is estimated to be worth over $40M to the local economy.

Coromandel also has significant oyster farming operations, some of which also earn money from tourism and oyster tasting. A processing facility for oysters is located south of Coromandel township; several oyster barges operate as far afield as Te Kouma Harbour.

Partly due to the shallow and silty nature of the Firth of Thames, recreational boating numbers are lower on this coast than on the clear waters of the east Coromandel Peninsula, but snapper and flounder fishing are popular recreational activities, especially over the summer when the bays are crowded with holiday makers. The Firth of Thames provides an important fishery of local significance with flounder and snapper the main species caught.

A daily passenger ferry connects Coromandel with Waiheke Island and Auckland city centre.

4.1.8 EAST WAIKATO REGION - THAMES

Thames is a historic town situated at the south-east corner of the Firth of Thames. The opening of the Thames gold field 1867 saw the establishment of the town of Thames. Milling of kauri forests was a large industry in Thames at the turn of the century, with flounder fishing also an important industry. When the gold mining and kauri logging industries began to decline, draining of the Hauraki Plains in the 1930s opened up the area for farming. Mussels were dredged from the Firth of Thames from 1920-1960s until declining catches saw full-time dredging cease in 1967. The Firth of Thames is now an important aquaculture site.

4.1.9 CHARTING INFORMATION OBSERVATIONS – DATA GATHERING

A new large scale chart for Whitianga was published in August 2015 and one for Mercury Bay in June 2014 based on recent surveys to modern standards.

4.1.10 AREAS OF RISK ASSESSMENT SIGNIFICANCE – RESERVES, ECOLOGICAL, CULTURAL

Te Whanganui-A-Hei (Cathedral Cove) Marine Reserve at Hahei is on the east coast of the Coromandel Peninsula, approximately 5nm southwest from the Hole in the Wall passage, in Mercury Bay, and is the only marine reserve in the Region.

Most of the Mercury Islands and The Aldermen Islands are designated as Wildlife Sanctuaries / Nature Reserves, administered by the Department of Conservation. These offshore islands are used for relocation of threatened wildlife. Additionally, these islands all form part of the Hauraki Gulf Marine Park, which was established in February 2000. The Hauraki Gulf Marine Park covers the Hauraki Gulf, Waitemata Harbour, Firth of Thames and the east coast of the Coromandel Peninsula.

Located at the eastern end of the Colville Channel, Cuvier Island is not accessible to the public. The island is now a predator free nature reserve administered by the Department of Conservation.

The Firth of Thames is one of New Zealand's three most important coastal stretches for shorebirds. More than a 100 migratory bird species live around the edge of the Firth of Thames on the Miranda

foreshore. Most of the bird species using the intertidal mud and sand flats are migratory, a large proportion coming from the Northern Hemisphere to spend their winter season (New Zealand summer) in the Firth of Thames.

4.1.11 WAIKATO REGION - ECONOMIC SUMMARY

The Waikato region's total GDP was $16.5b for the year ended March 2011. This represents 8.5% of New Zealand's GDP.

4.2 TRAFFIC ANALYSIS – WAIKATO REGION

As there is no deep water land-based port in the region, the majority of commercial vessels transit close by the Waikato region but do not stop. The majority of large commercial vessels transiting between Auckland and Tauranga pass outside, but close to, Red Mercury Island. A few commercial vessels use the Hole in the Wall passage day and night, mostly in order to decrease the steaming distance to reduce costs and/or save time. Included in the types of vessels using this narrow passage are large passenger cruise liners, which use the spectacular passage as a tourist attraction. Tankers generally transit offshore but there are a minority that transit close to exposed shorelines.

Naval vessels occasionally use the Hole in the Wall passage and anchor in Mercury Bay.

A busy dive and fishing charter fleet operates out of Whitianga, as well as tourist sight-seeing operations. Dive and fishing charter boats anchor regularly at Great Mercury Island and in nearby sheltered bays on the mainland like Opito Bay, Kennedy Bay and Waikawau Bay.

4.2.1 WEST WAIKATO REGION - ALL TRAFFIC

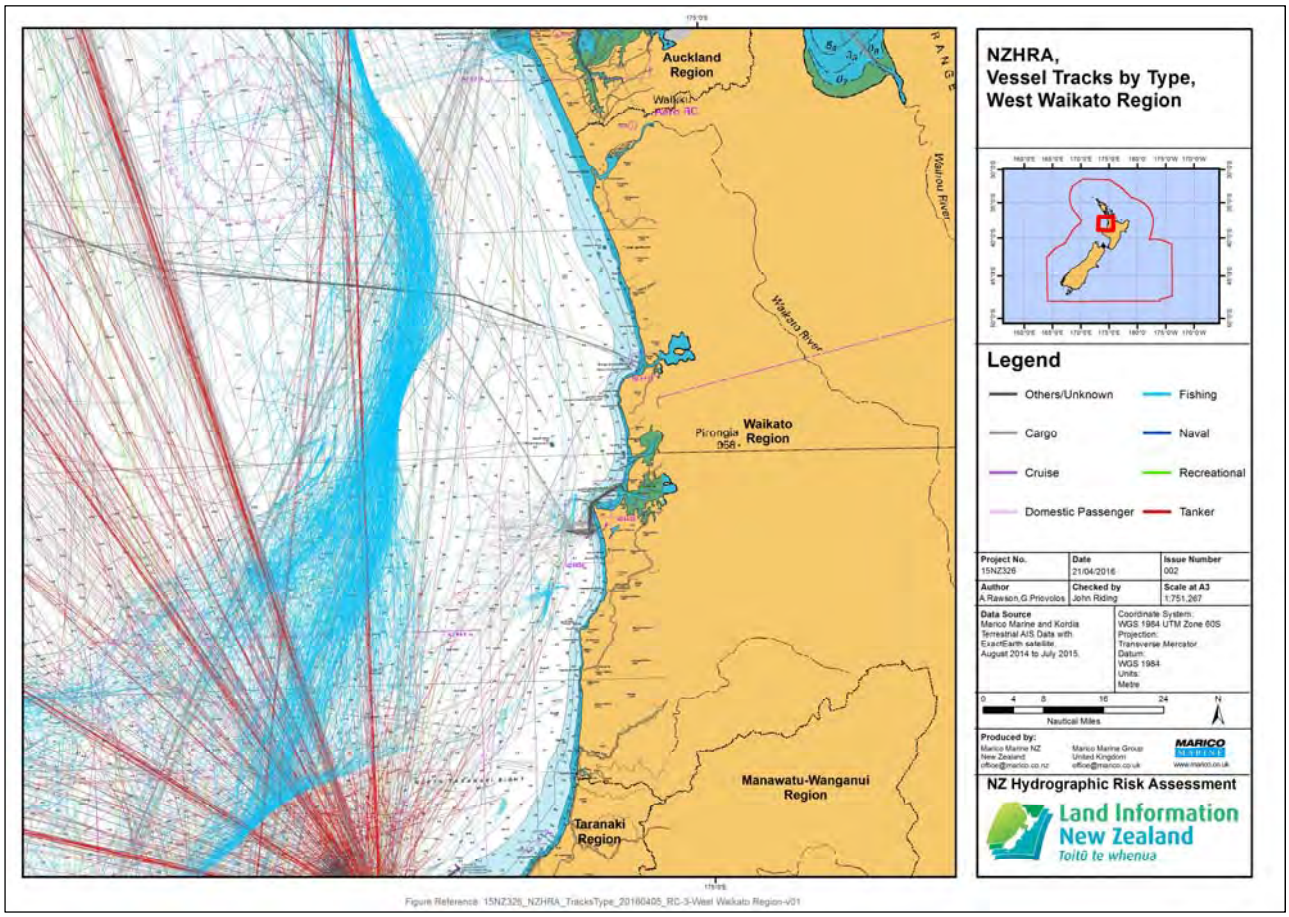


Figure 37 : Plot of All Traffic – West Waikato Region

The traffic level on the coast of the west Waikato region is low. The majority of large vessels remain well offshore; although the area has historically attracted tankers waiting orders. Most of these wait in the approaches to Taranaki, although some occasionally stooge (slow steam) in the Waikato inshore area. There is significant fishing activity outside the 12nm limit over the period of a year.

4.2.2 WEST WAIKATO REGION - TRAFFIC DENSITY

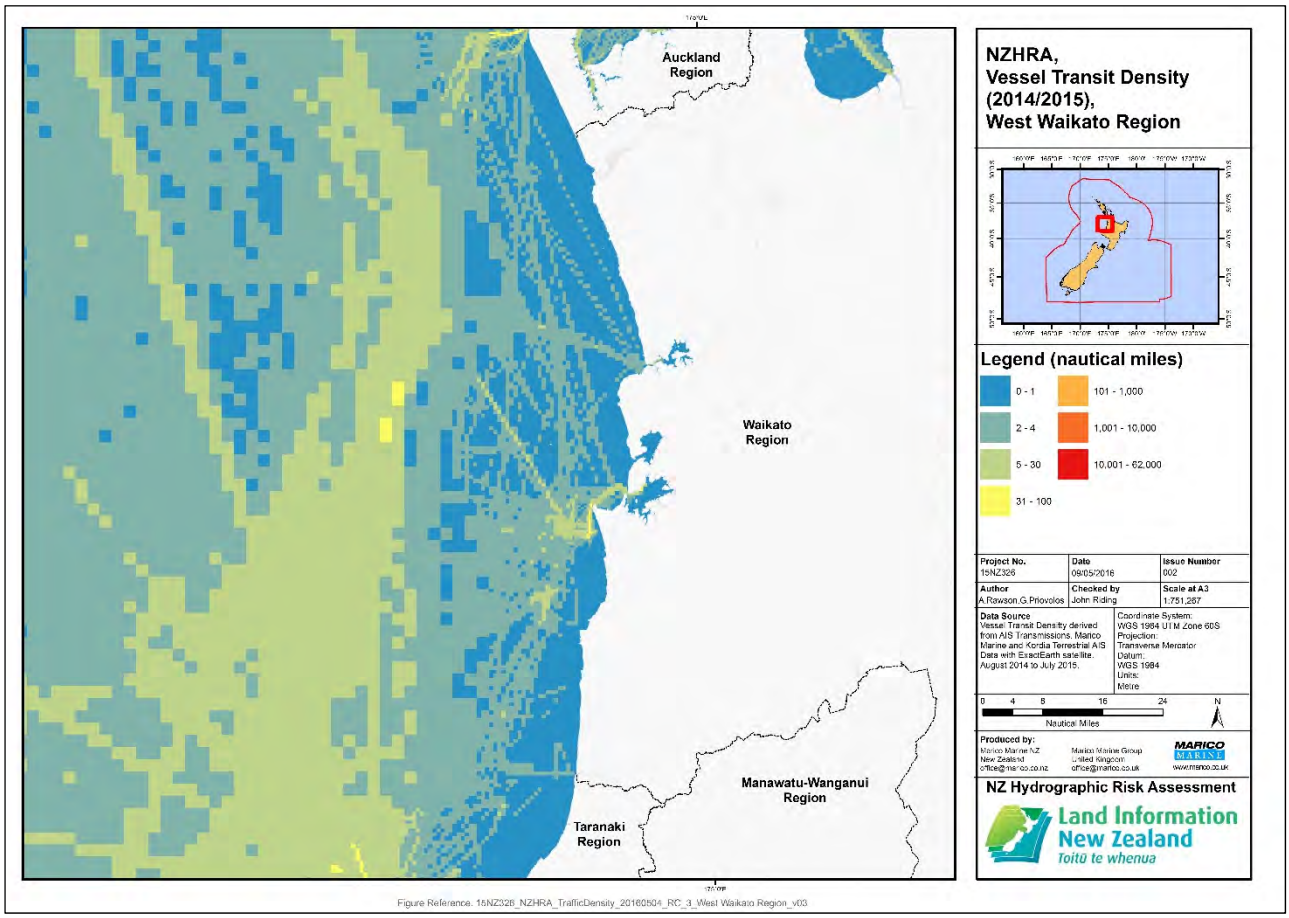


Figure 38 : Traffic Density Offshore From West Waikato Coast is Low Overall

On the West Waikato side, the traffic density is low overall and mostly well offshore.

4.2.3 WEST WAIKATO REGION – PORT TAHAROA - CARGO VESSELS

Bulk carriers using the offshore port of Taharoa, on Waikato's west coast, stand off the SBM waiting for suitable weather conditions to moor and take on iron sand slurry.

Some smaller coastal cargo traffic passes by the Waikato region offshore, using the port of Onehunga.

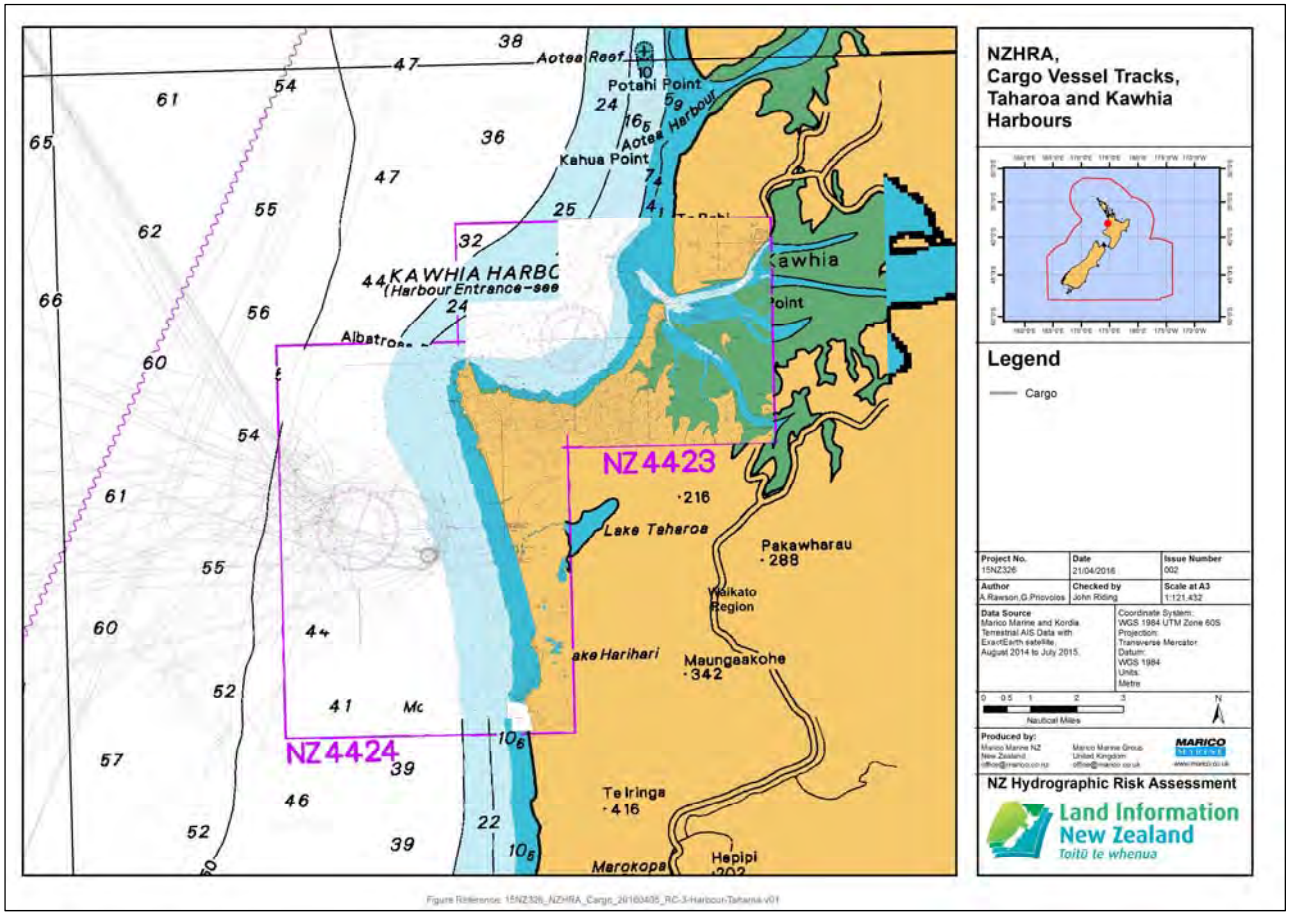


Figure 39 : Cargo Vessel Tracks - Port Taharoa

4.2.4 WEST WAIKATO REGION - TANKER TRAFFIC

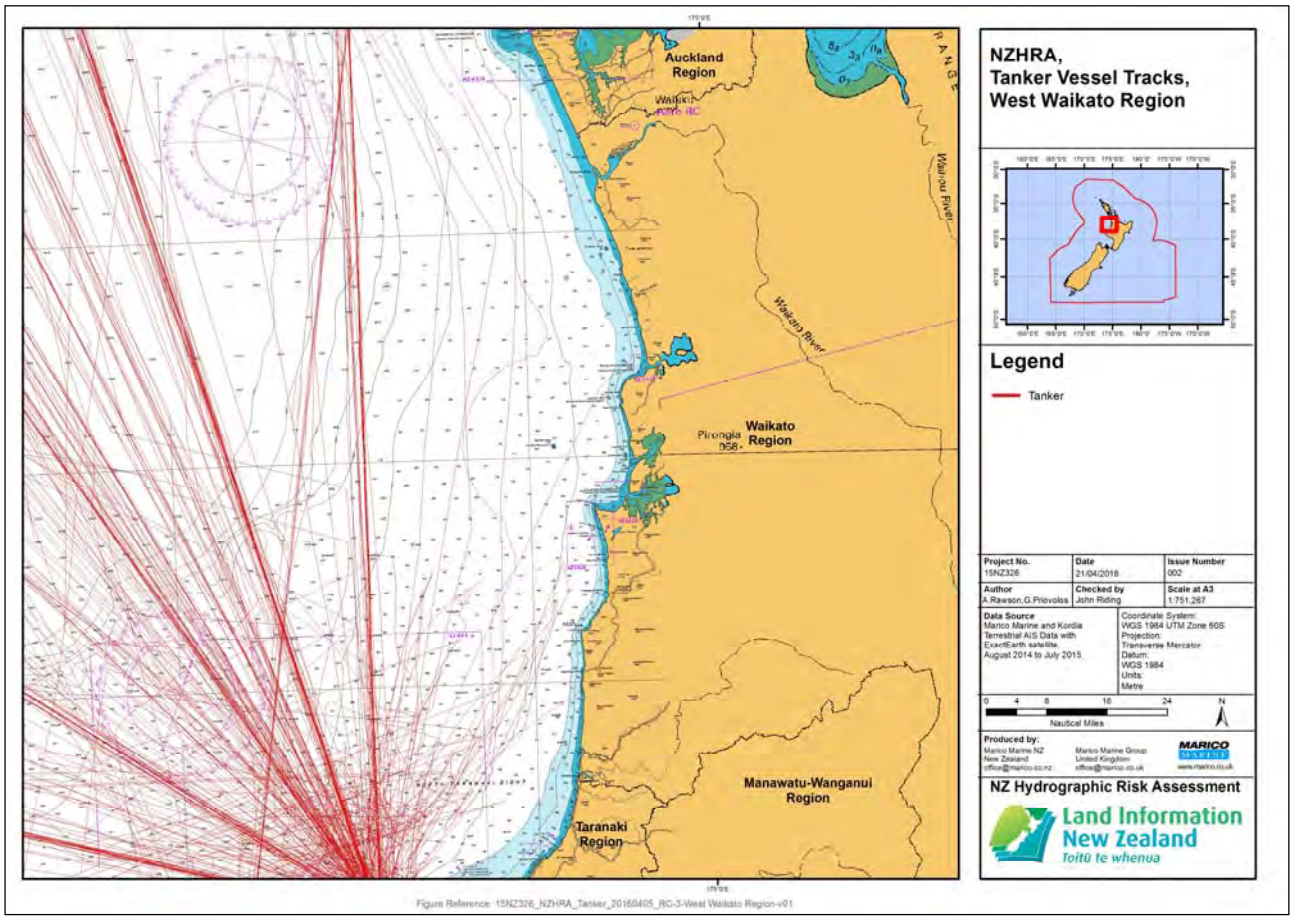


Figure 40 : Tanker Tracks –West Waikato Region

Tankers transiting on the west side of Waikato Region are mostly offshore. However the plots also suggest evidence of some tankers approaching within 4nm of the coast whilst slow steaming (stooging). Presumably this is either waiting for weather conditions to improve or for orders or berthage at Taranaki.

4.2.5 WEST WAIKATO – COMMERCIAL FISHING VESSELS

On the rugged west coast of the Waikato region, the larger offshore fishing vessels operate off the coast outside the 12 mile limit, but discharge their catch elsewhere. A few smaller inshore craft fish these western coastal waters, ranging between 10-15metres in length, mostly based in Raglan and Kawhia.

4.2.6 WEST WAIKATO – RECREATIONAL FISHING VESSELS

Small numbers of recreational fishing vessels operate out of Raglan and Kawhia harbours.

4.2.7 WEST WAIKATO – RECREATIONAL VESSELS

Small numbers of recreational vessels operate with the sheltered waters of Raglan and Kawhia harbours, but elsewhere in the West of the Waikato region are scarce.

4.2.8 EAST WAIKATO REGION - ALL TRAFFIC

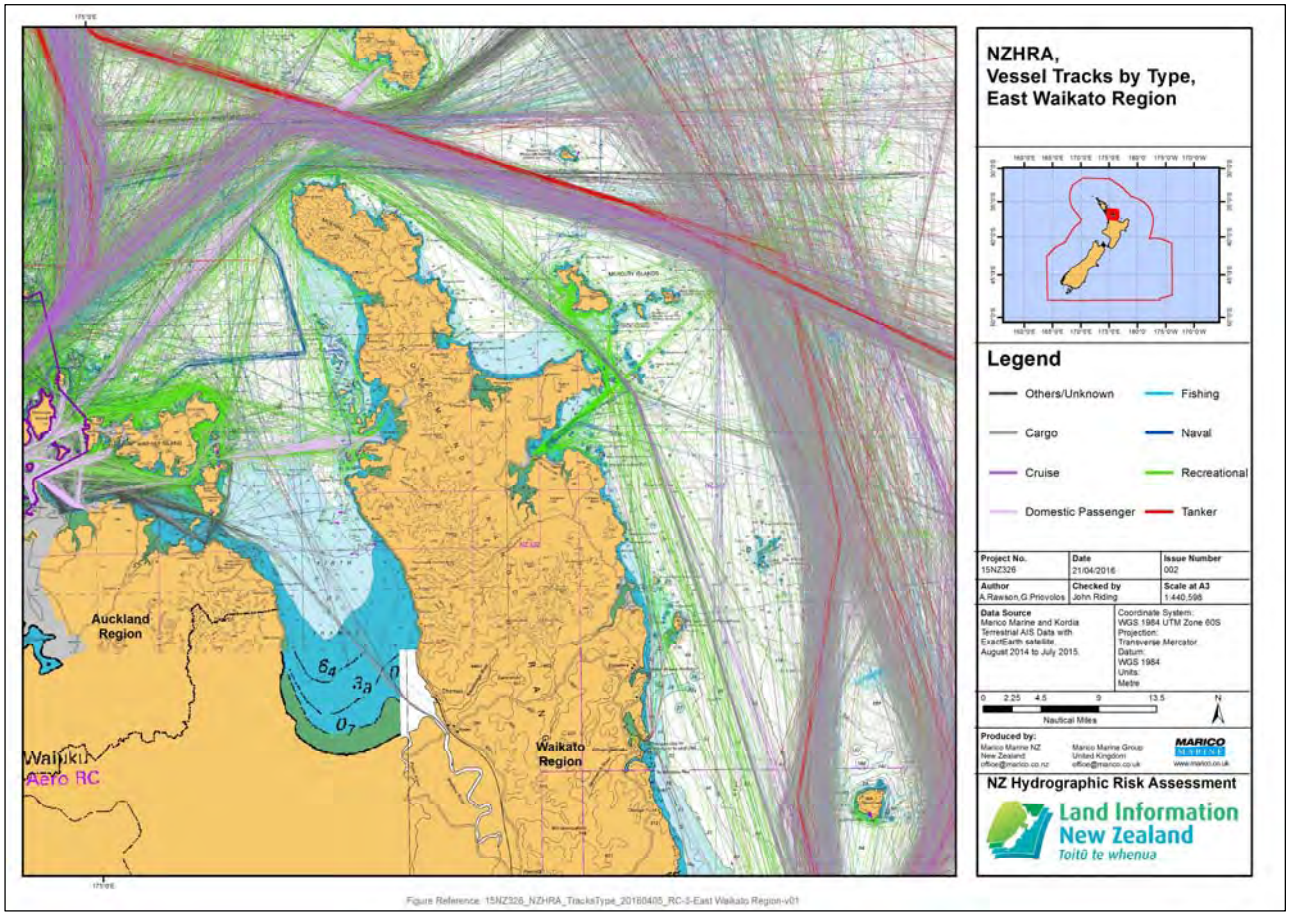


Figure 41 : Traffic Plot of all Vessel Types – East Waikato

The East Waikato region has a quite significant level of offshore traffic, but few vessels of any size are calling there. Even Cruise vessel stops by boutique cruise vessels are infrequent. There is a clear route of inshore traffic, some of which is not necessarily that small. The passenger ferry route between Auckland and Coromandel is clearly visible.

4.2.9 EAST WAIKATO REGION - TRAFFIC DENSITY

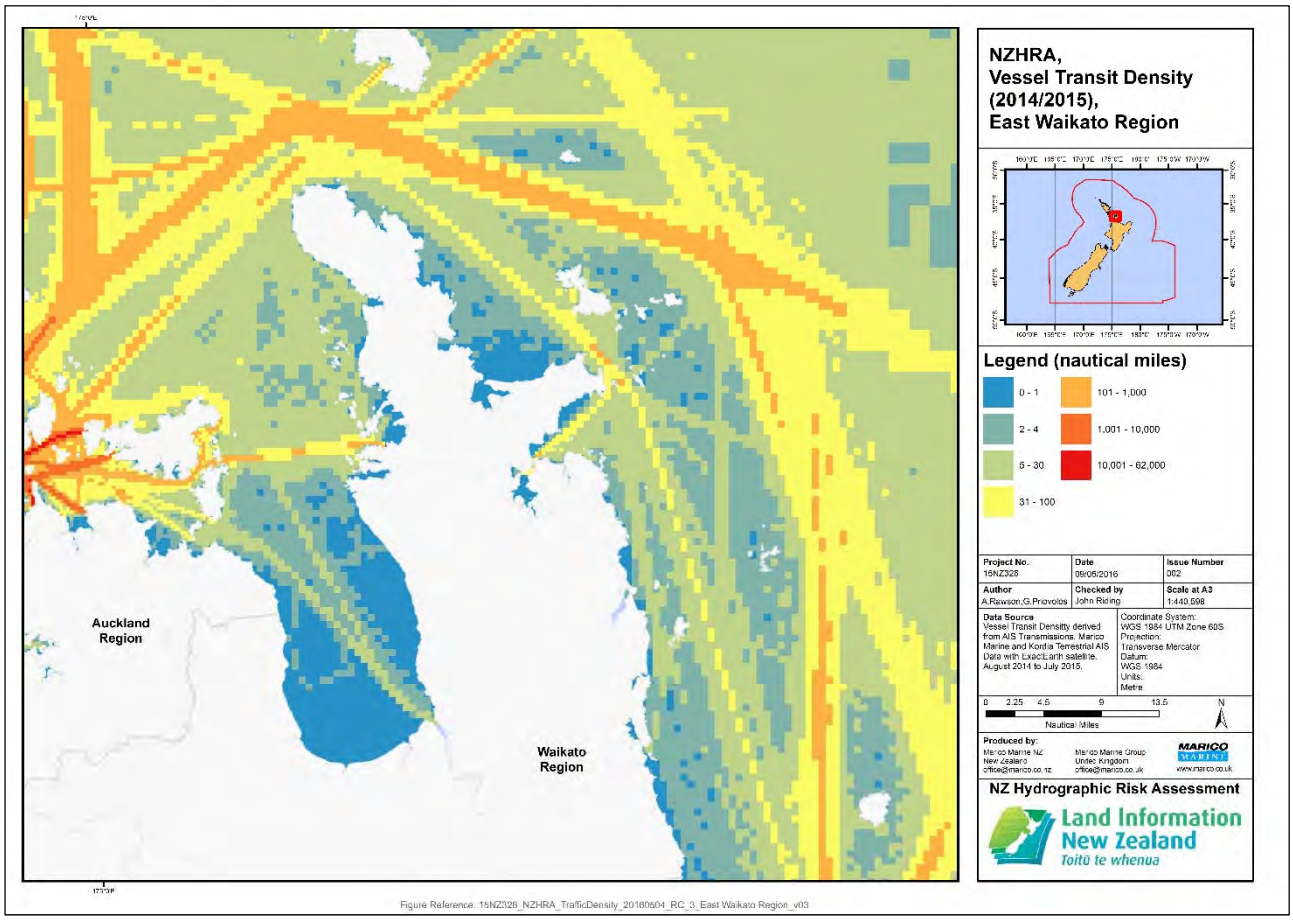


Figure 42 : Traffic Density – East Waikato

Figure 42 shows the traffic routes through the East Waikato region. The plot clearly shows the more dense transit route offshore, but also an important inshore coastal route around the Coromandel Peninsula. The sea area through the Hole in the Wall transit is confined, explaining the increase in density in that location. However, there is also an increase in density close inshore at the northern tip of the peninsula.

4.2.10 EAST WAIKATO REGION - CARGO VESSELS

As there is major commercial port on Waikato's east coast, cargo vessels pass close by but do not stop. One large cargo vessel transited through the Hole in the Wall passage during the 12 months; the other cargo vessel tracks were from smaller, NZ-based cargo vessels.

Large cargo vessels slow steam back and forth at the entrance to the Firth of Thames presumably waiting for a berth or cargo at the Port of Auckland. A self propelled barge loads aggregate from the Waihou River at Kopu in the Firth of Thames, accounting for all the cargo vessel tracks into the southern Firth of Thames.

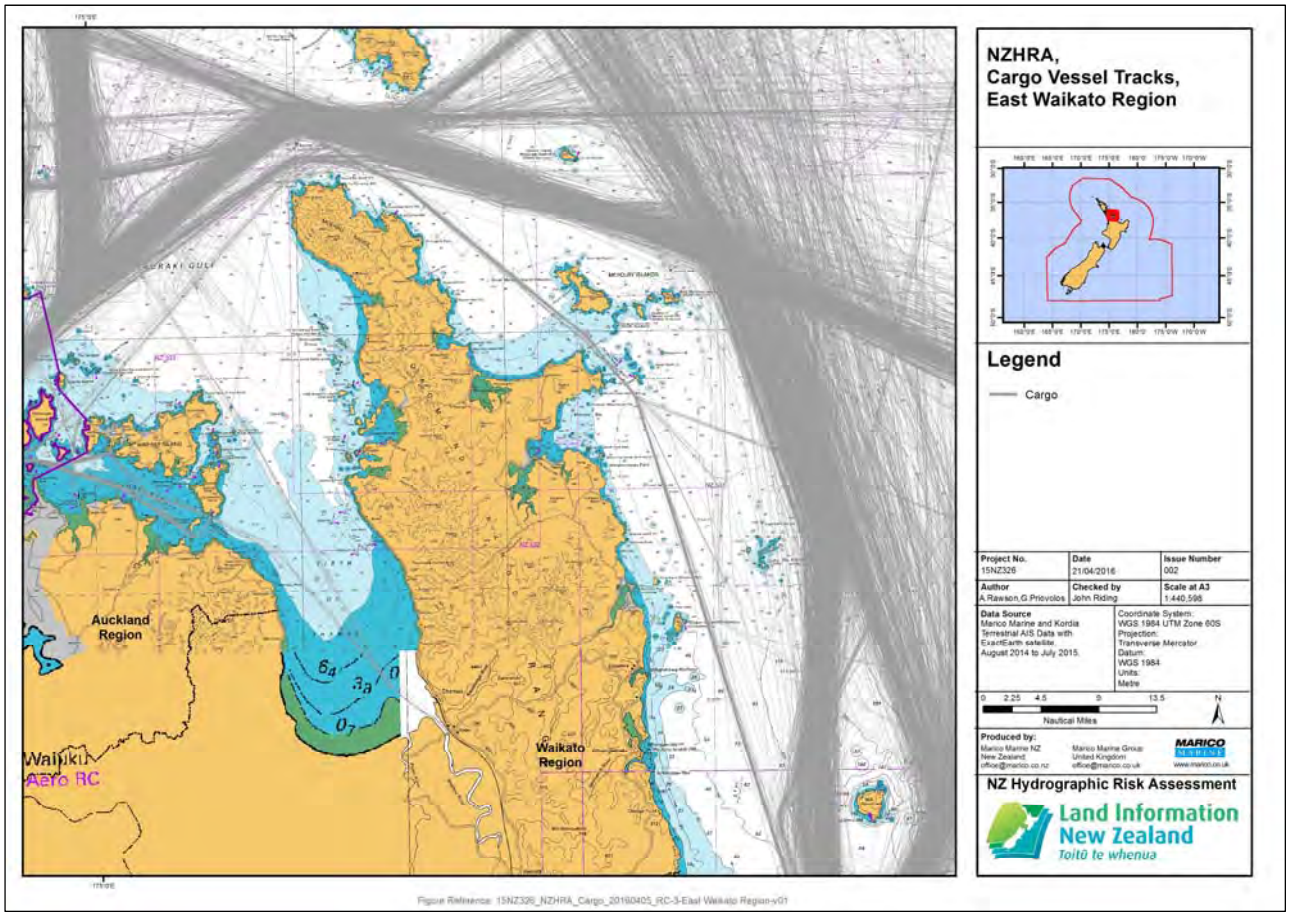


Figure 43 : Cargo Vessels - East Waikato Region

4.2.11 EAST WAIKATO REGION - CRUISE VESSELS

Cruise vessels occasionally anchor in Buffalo Bay/Mercury Bay and ferry their passengers ashore for sightseeing expeditions to the Hole in the Rock area, however none was recorded in the project year. Several larger cruise vessels transited through the Hole in the Wall passage, passing less than half a mile to the west of Old Man Rock, and a number passed inside The Aldermen Islands en-route between Auckland and Tauranga. One of these vessels was surprisingly large, 288m in length and 115,906 GT.

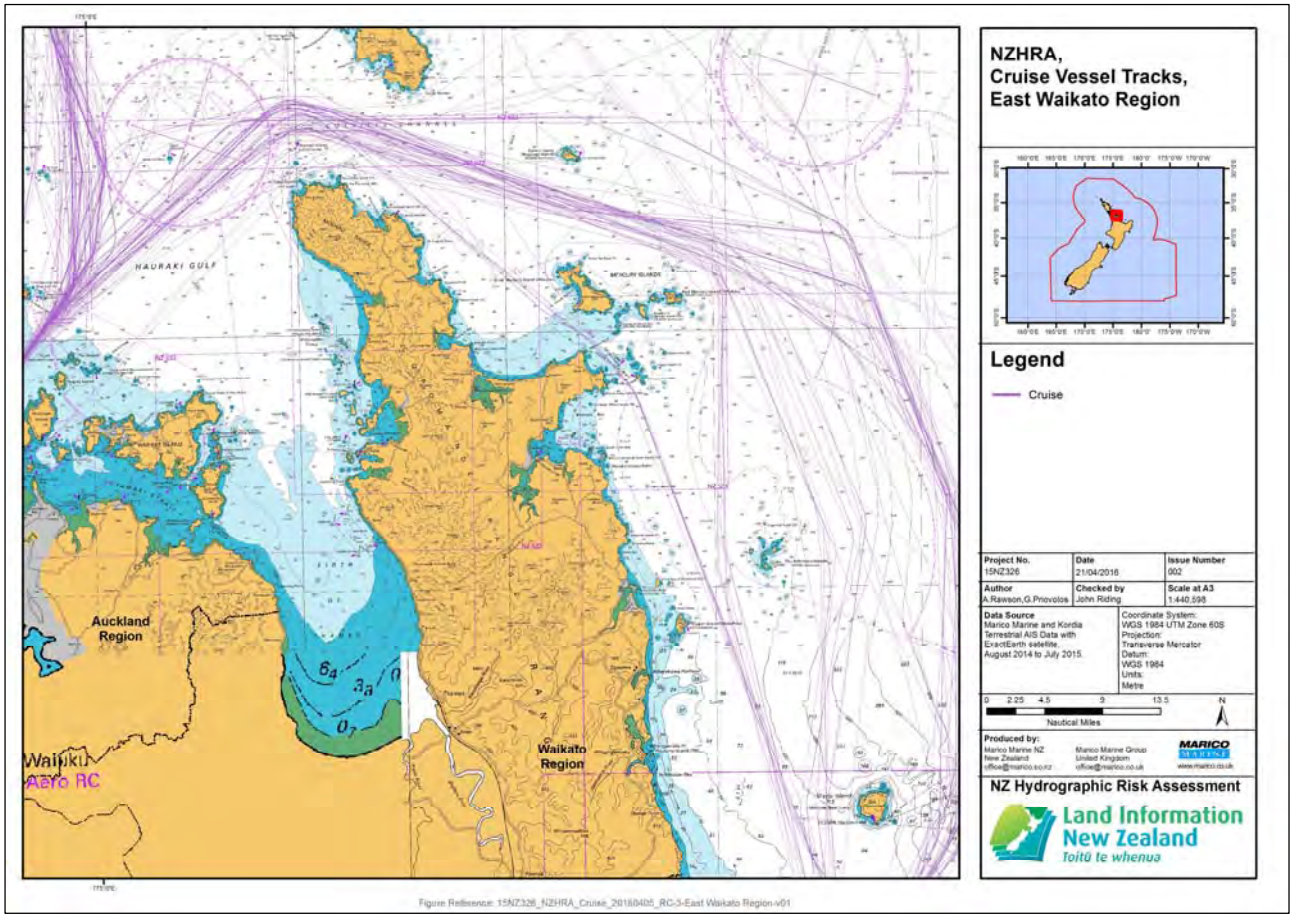
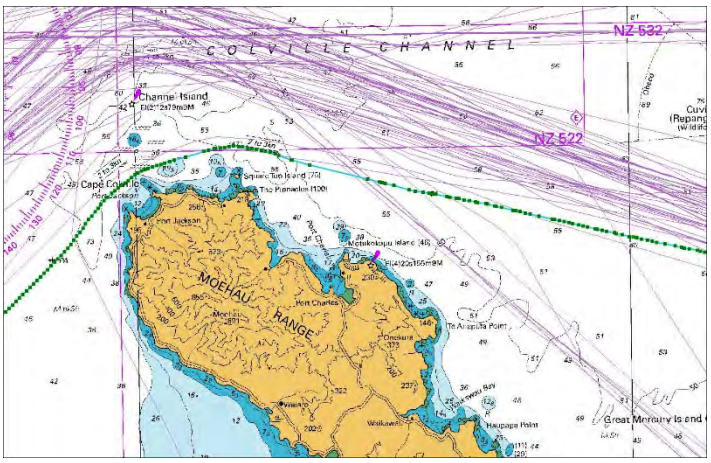


Figure 44 : Cruise Vessels - East Waikato Region



As is the case with other transits in this area, some cruise vessels are transiting close to the coast in a manner that is not congruent with reasonable expectations of navigational safety[7]. The chart is clearly showing numerous tidal races/overfalls in the transit area. The inset plot shows a record of one of these cruise vessel tracks passing close inshore at Cape Colville and data points are shown, confirming that the data received record is also consistent/valid (green line of data points). Without routeing requirements, cruise vessels will (and obviously do) track close in to coastlines. They generally have good ECDIS systems facilitating accurate navigation. This data precision highlights the potential for a casualty scenario in a remote area that is difficult to respond

[7] **This transit record was made by a large passenger vessel on two occasions. The tracks are less than one mile offshore and data quality is good.**

to, in the event of propulsion failure. Navigational safety margins in this area may need to be reviewed outside the scope of the Hydrographic Risk assessment.

On the western side of the Coromandel Peninsula, only one boutique passenger cruise vessel explored the Firth of Thames, as far south as the picturesque Te Kouma Harbour, south of Coromandel Harbour. No passenger cruise vessels were recorded on the west coast of the Waikato region.

4.2.12 EAST WAIKATO REGION - DOMESTIC PASSENGER SERVICE

The east/west Auckland-Coromandel commuter/passenger ferry route may be clearly seen on the traffic plot, making a round trip each day in summer; with fewer trips in winter. There are inshore domestic passenger services, mostly charter, which operate to and from Auckland. Passenger volumes were determined for the project and remain confidential to the operators. Volumes are significant enough for the risk to be registered.

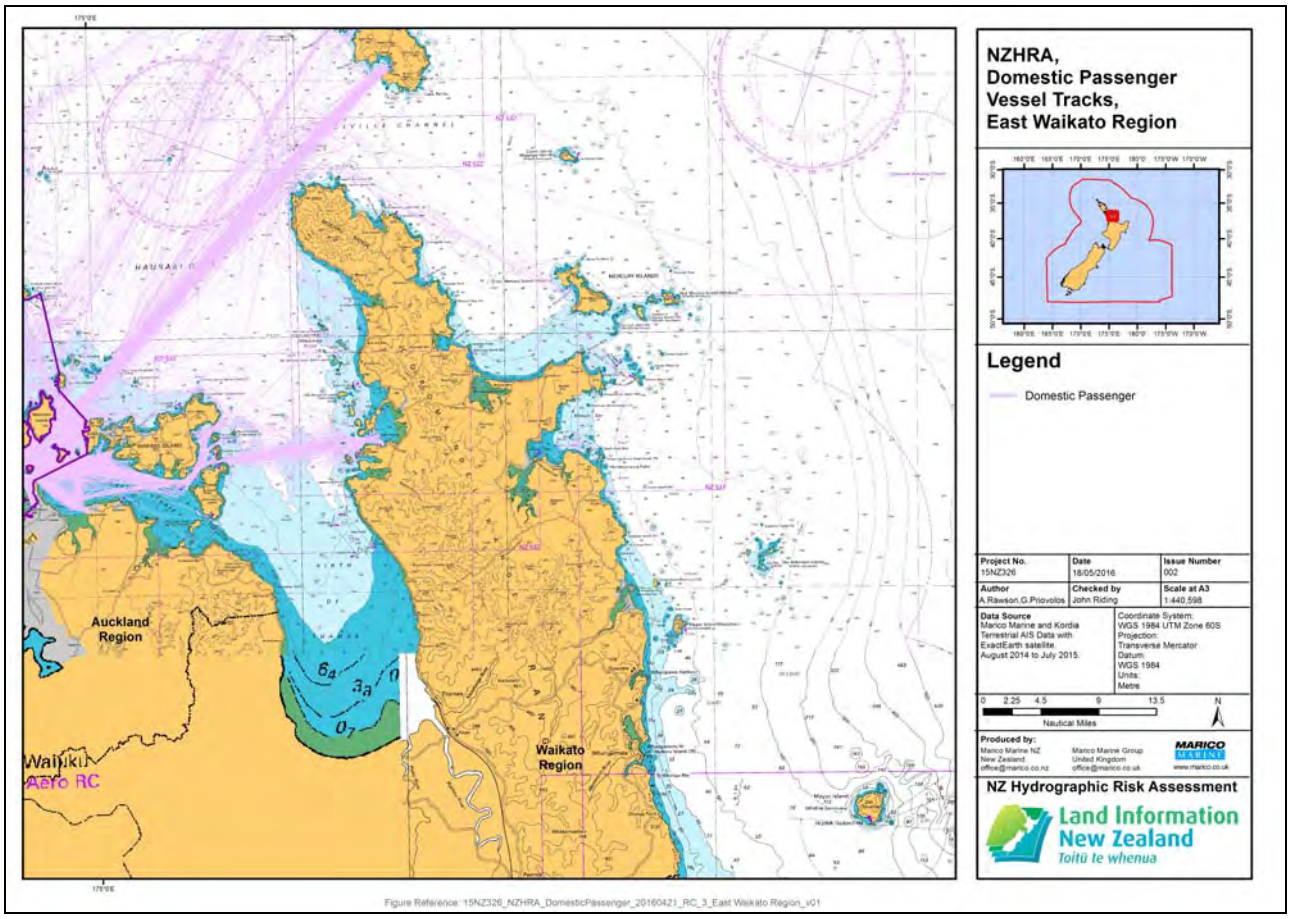


Figure 45 : Domestic Passenger Routes – East Waikato

4.2.13 EAST WAIKATO REGION - TANKER TRAFFIC

Although tanker traffic through the Waikato Region is considerable, there are no tankers visiting Waikato ports. However, given their choice of routeing into and out of Auckland, improved coastal routeing requirements may need to be considered for this environmentally important area.

The track records show some Tankers, albeit a small number, passing within 2nm of the Mercury Islands. In a propulsion breakdown scenario, which is realistic, there is little drifting time available for rectification before a vessel is heading into danger near these Nature Reserves.

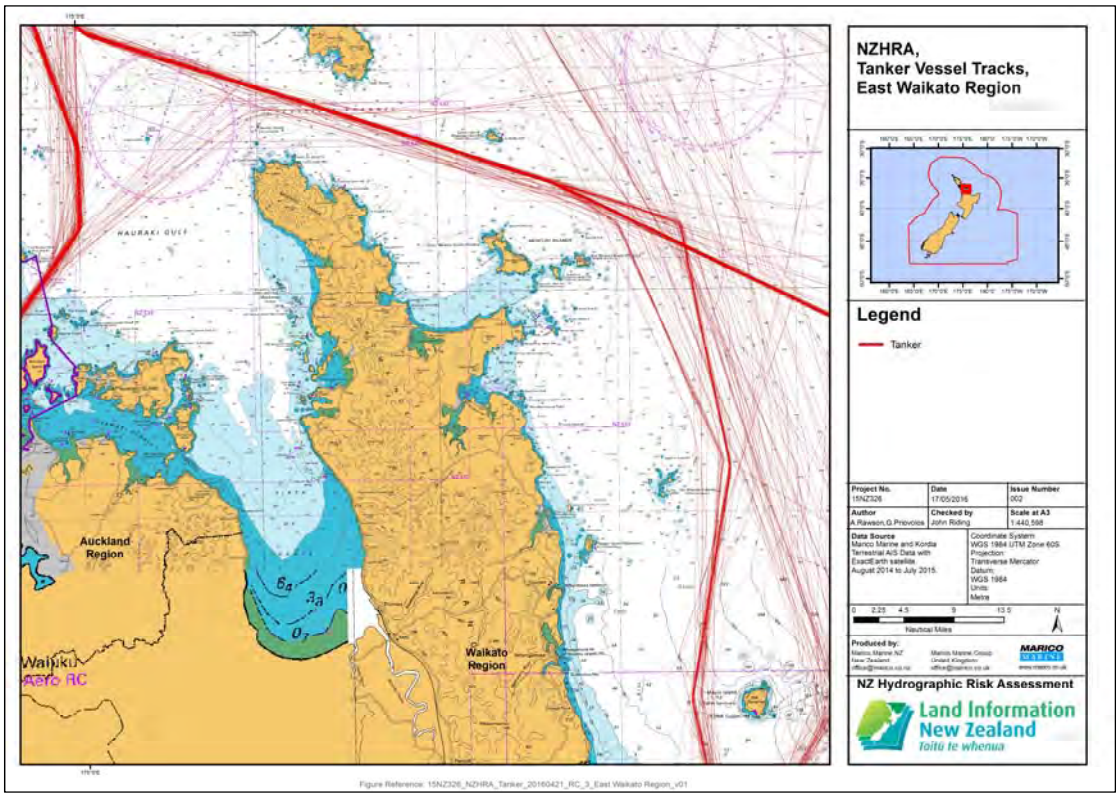


Figure 46 : Tanker Traffic – East Waikato Region

More worryingly, in the case of Coromandel Peninsula's Cape Colville, a chemical tanker took transits inshore of Channel Island and passed within 1.7nm of its northern point. The vessel did this in February 2015 and April 2015 (two separate transits).

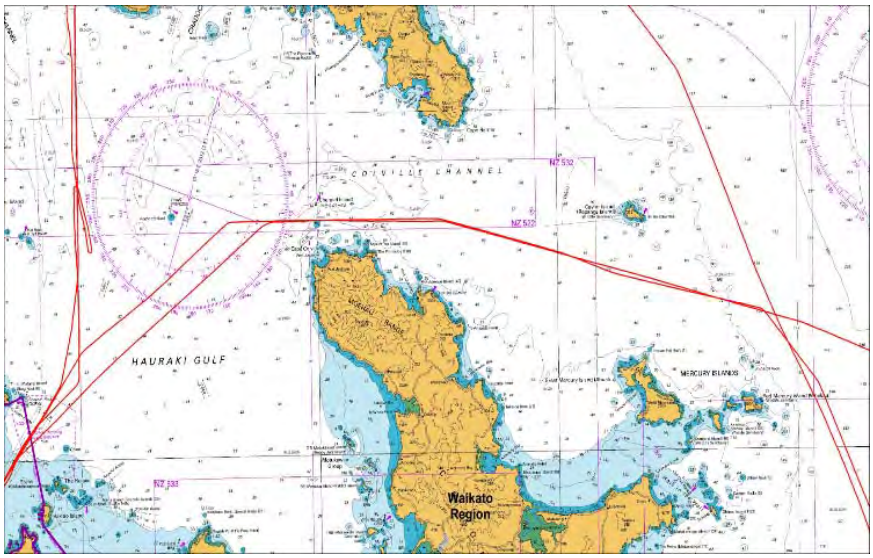


Figure 47 : Tanker Transit – Cape Colville

These are extreme case examples, but it should be noted this is only one example. The chart for this coastal zone is marked with tidal overflow hazards, indicating high tidal currents and adverse sea and weather conditions are frequently experienced here as a result of the 'funnelling' effect of the land each side of the Colville Channel. There appears to be a need for further review in this area. It is relevant to charting as routeing measures that work, in the experience of authors, are those published on the Official Charts.

4.2.14 EAST WAIKATO - COMMERCIAL FISHING VESSELS

Fishing vessels of all sizes operate extensively throughout the eastern side of the Coromandel Peninsula. Whitianga is the main base for Waikato region's inshore fishing fleet. Seasonal scallop boats operate out of Whitianga and Coromandel. Up to 20 charter fishing vessels operate from Whitianga and 12 charter fishing operators take passengers on day trips from Coromandel, with lesser numbers from other harbours in the region.

The Cray fish fleet is around 12 vessels operating, June to March. The majority unload at Whitianga wharf. A small Scallop fleet (about 7 vessels) operates seasonally from the wharf. These vessels change over once quota limits are reached, to work the west coast for Albacore tuna.

Five Seine and longline fishing vessels operate out of Coromandel Harbour.

4.2.15 EAST WAIKATO - RECREATIONAL FISHING VESSELS

The eastern coast of the Waikato region contains popular recreational fishing grounds, with the Mercury Bay; Mercury Islands and Coromandel Peninsula areas being outstanding for all types of recreational fishing.

Dozens of runabouts from the mainland frequent Great Mercury Island's Home Bay during the scallop season, and fish and dive around the island group all year. These craft are launched from the many boat ramps in the area, and regularly travel long distances for the excellent fishing and diving opportunities around the area. Recreational fishing boats operate from all the small harbours on East Waikato's coasts.

4.2.16 EAST WAIKATO REGION - RECREATIONAL VESSELS

Great Mercury Island has many sheltered anchoring locations and up to 200 mostly recreational vessels can be found anchored around the island each day over the summer. The Waikato Regional Council has approximately 2000 Jet Skis registered to the region. Many of them frequent the Mercury Bay area throughout the summer months. Many small beach-launched craft operate from the popular beaches north and south of Whitianga along the region's east coast.

An unknown number of recreational vessels operate out of Whangamata, Tairua, Coromandel and Thames with additional small craft operating in sheltered bays, estuaries and rivers.

4.3 HYDROGRAPHIC RISK – EAST WAIKATO REGION

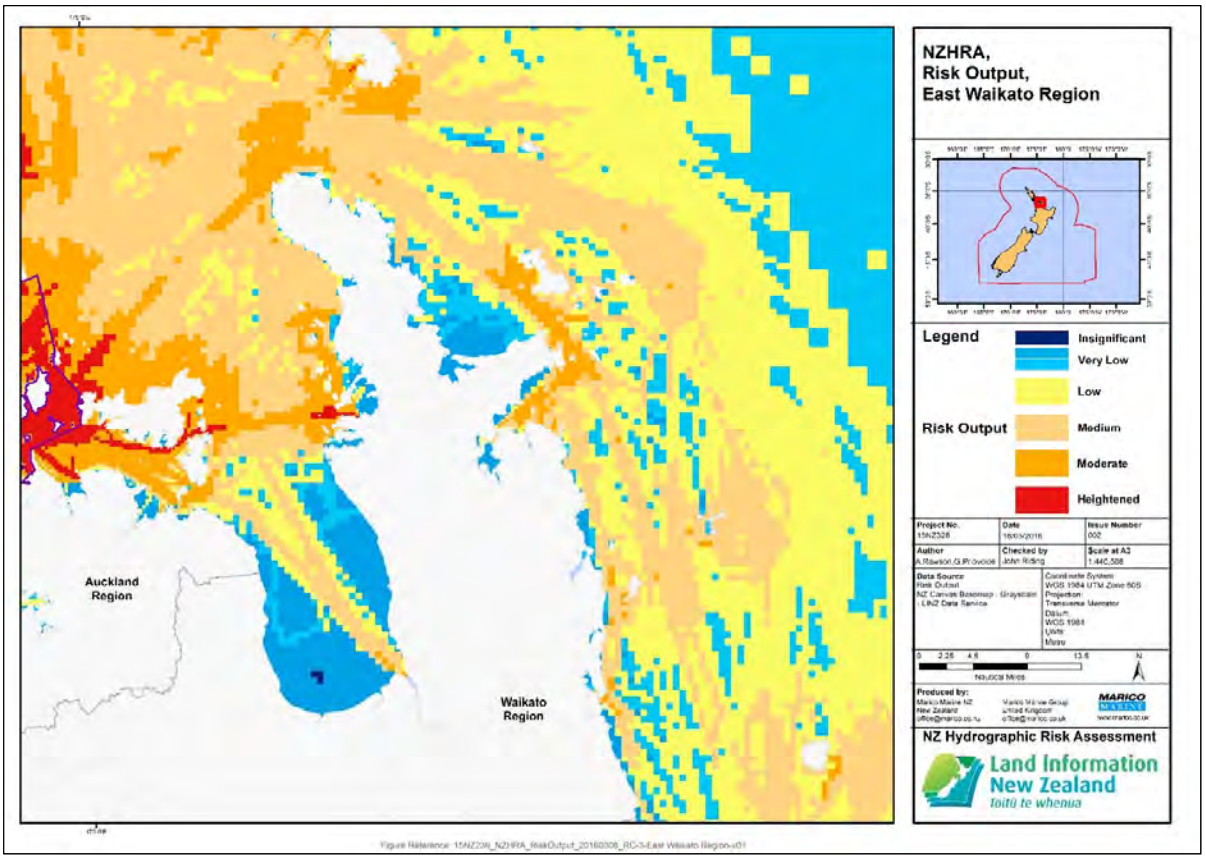


Figure 48 : East Waikato Hydrographic Risk Plot

There are isolated area of heightened risk in East Waikato, which occur out of Coromandel where there are domestic passenger services and charter fleets. There are areas of moderate hydrographic risk showing, along the approaches to Whitianga and the East coast through the Hole in the Wall. There is further moderate risk in the waters of the northern tip of the Coromandel peninsula (Cape Colville Colville Channel).

4.4 HYDROGRAPHIC RISK – WEST WAIKATO REGION

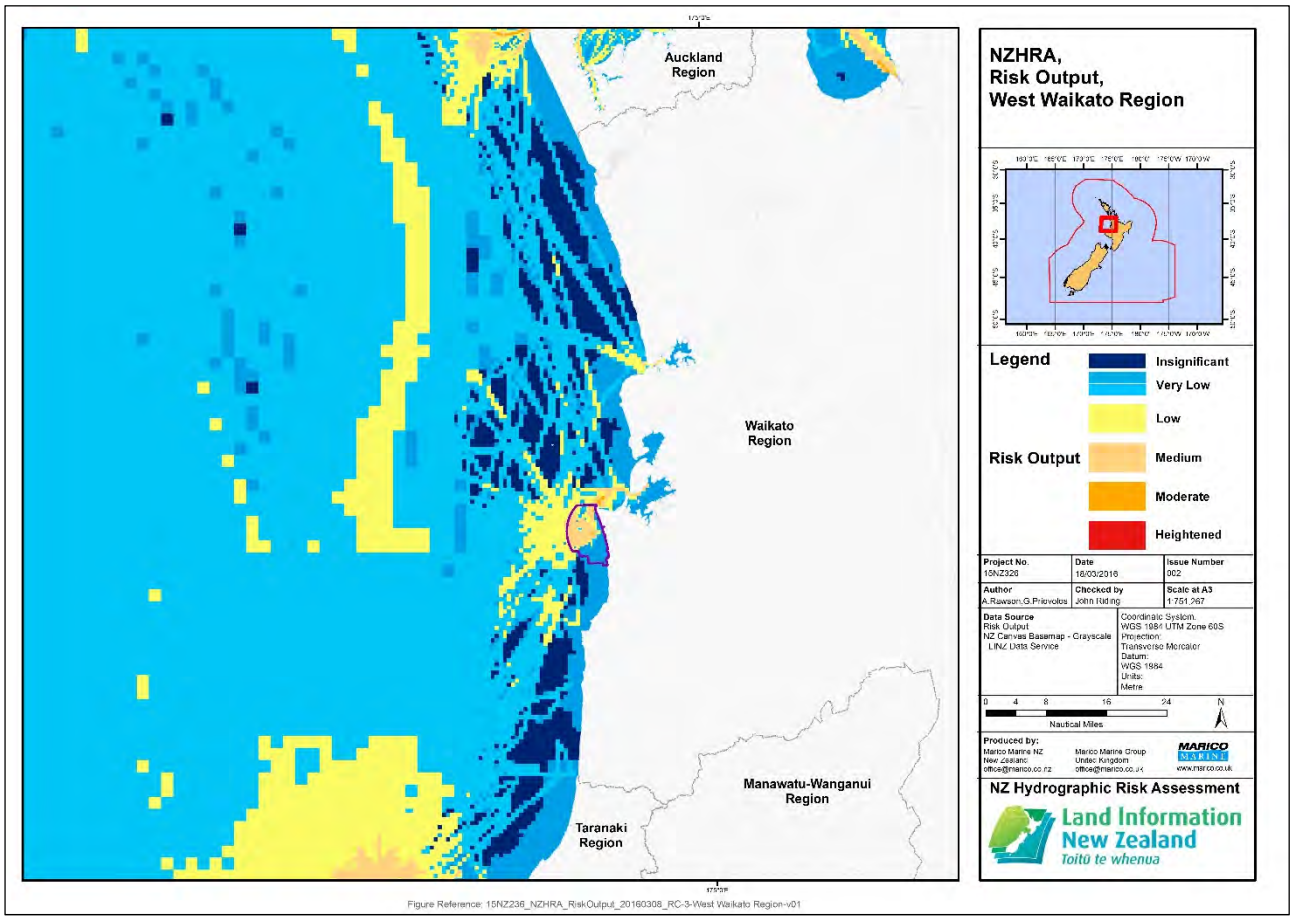


Figure 49 : Hydrographic Risk – West Waikato

Hydrographic Risk is overall low to insignificant on the west coast of the Waikato Region. An area of medium risk occurs within the Taharoa Harbour area, which is associated with the increasing number of large bulk carriers loading at the Taharoa offshore SBM (Single Buoy Mooring).

4.5 CHARTING BENEFIT – EAST WAIKATO REGION

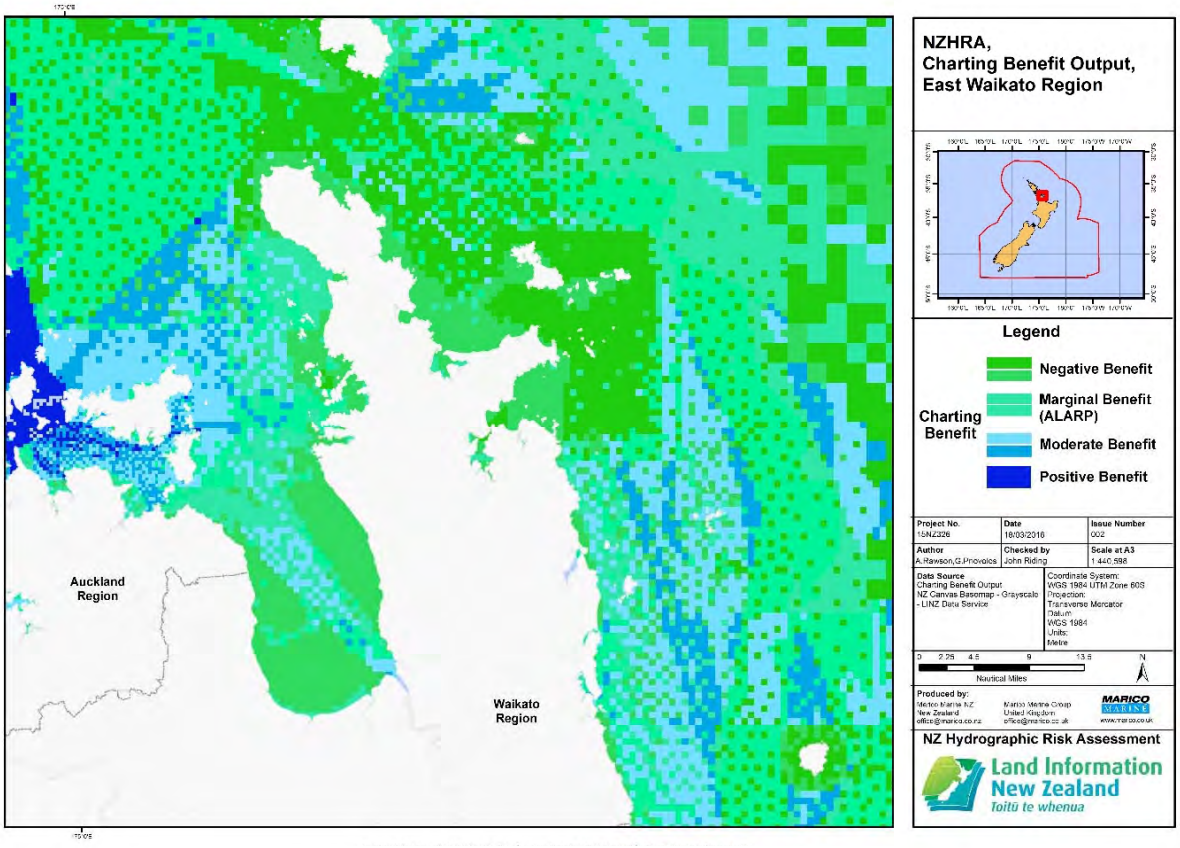


Figure 50 : Charting Benefit – East Waikato Region

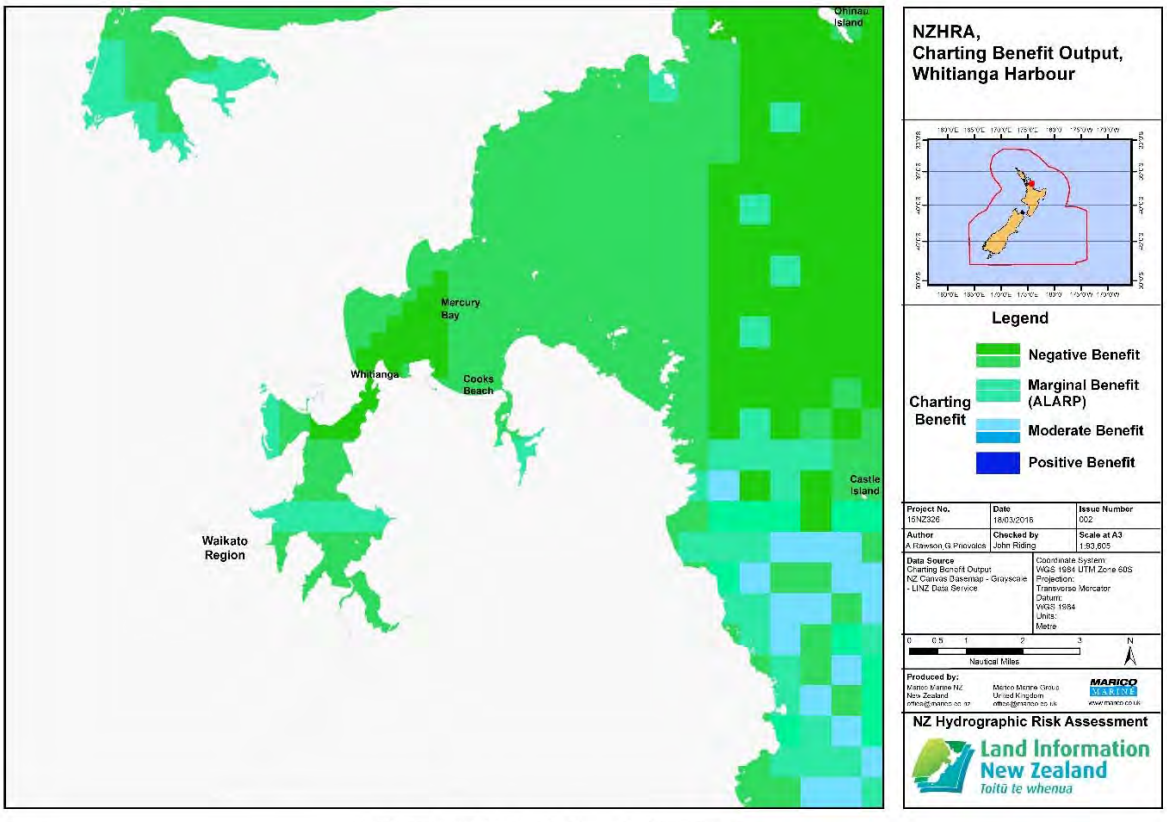


Figure Reference: 15NZ326_NZHRA_ChartingBenefit_20160316_RC-3-Harbour-Whitianga-v01

Figure 51 : Charting Benefit – Whitianga Harbour

There is moderate charting benefit result for the east coast south of Mercury Bay, between Whitianga and Waihi Beach, elsewhere there are marginal or negative benefit results for most of the area, including Whitianga Harbour.

4.6 CHARTING BENEFIT – WEST WAIKATO REGION

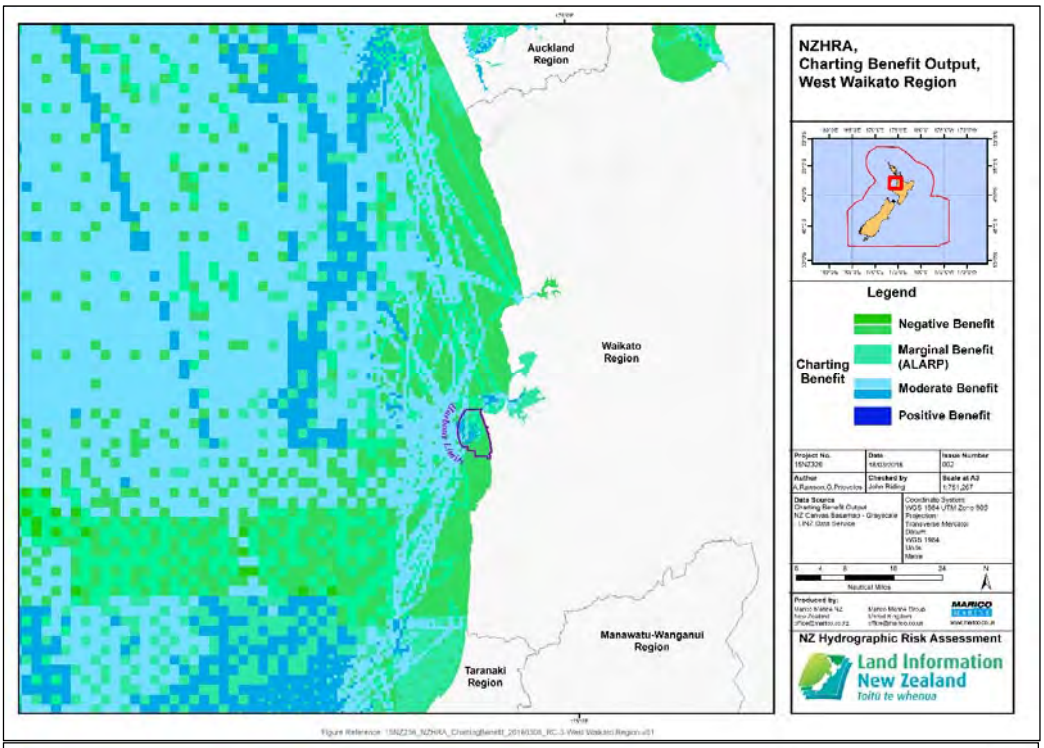


Figure 52 : Charting Benefit – West Waikato

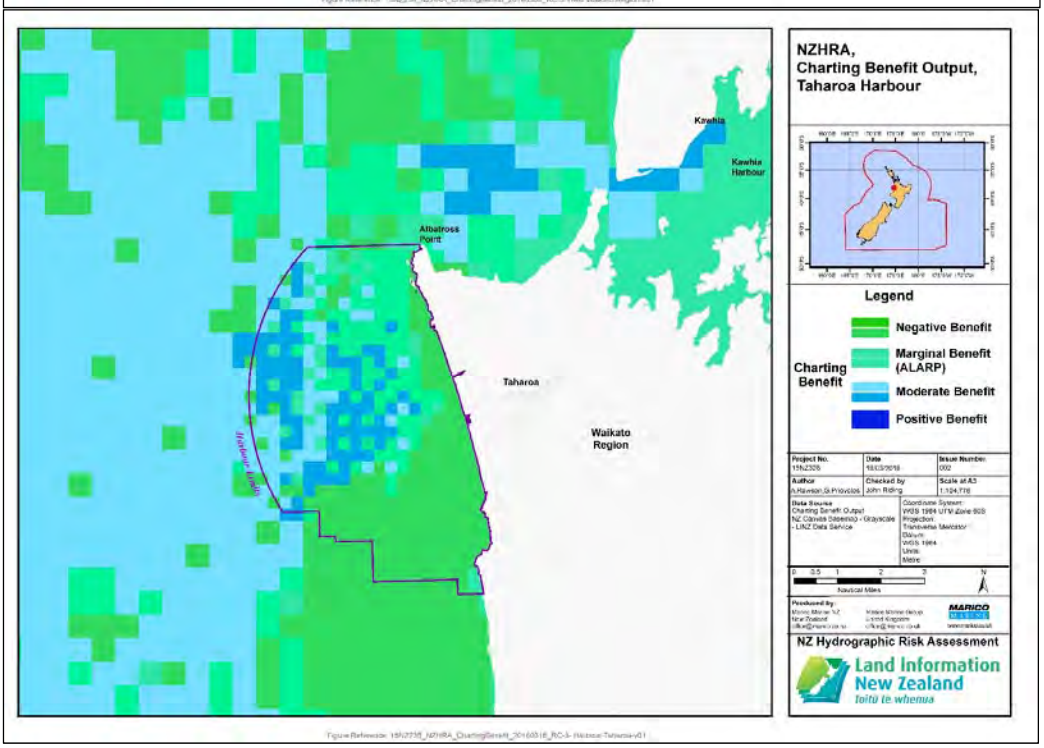


Figure 53 : Charting Benefit – Taharoa Harbour

Waikato shows moderate to negative charting benefit on the west coast of the region, including Taharoa Offshore Terminal.

5 HYDROGRAPHIC RISK RESULTS - BAY OF PLENTY REGION

5.1 INTRODUCTION

The Bay of Plenty, the fifth-most populous region in New Zealand, is one of the fastest growing regions in New Zealand. The coastal Bay of Plenty contains eighteen islands, notably the active volcano White Island, which lies 50km from the coast in the eastern bay. Other large islands include Mayor Island, Matakana Island, Motiti, and Moutohora Island.

Situated along a faultline, Tauranga and the Bay of Plenty experience frequent seismic activity, and there are several volcanoes around the area, most notably the active volcano of White Island.

The Bay of Plenty is a popular holiday destination due to the warm and sunny summer climate and public sandy beaches. Whale watching is a growing attraction as the number of whales such as blue whales and humpback whales migrating into bay waters began to recover. Several operators run 'swim with dolphins' tours.

The prevailing winds in the bay are south-westerly. Sea breezes often occur on warm summer days. The Bay of Plenty is exposed to the north-east and large ocean swells can occasionally disrupt shipping movements. A wave measuring device at A-beacon, located at the entrance to Tauranga Harbour, has recorded waves up to 10m in height at least once a year during winter storms.

Storms of tropical origin affect Tauranga about once or twice each year, mainly between the months of December and April. They usually bring heavy rain and strong easterly or north-east winds.

The Bay of Plenty is the main producing area in New Zealand of kiwifruit, citrus and sub-tropical fruit. The area produces approximately 80% of the country's total kiwifruit crop. The area is the predominant region for producing grapefruit, tangelos, nashi, avocados, feijoas, tamarillos and passionfruit. Kiwifruit exports from the Port of Tauranga amounted to 690,000 tonnes in the project year.

5.1.1 TAURANGA HARBOUR

Tauranga Harbour is one of New Zealand's largest natural harbours. It is protected from the Pacific Ocean by Matakana Island, which stretches some 24 km between the northern Katikati entrance at Bowentown and the deeper Tauranga entrance at Mount Maunganui. The harbour is a large tidal estuary with an area of some 200 km^2 and a tidal range of between 1.0m (at neaps) and 2.0m (at springs). Approximately 290M tonnes of water flow through the entrances for each tidal change. This tidal flow generates currents over 4 knots in the main entrance channel and up to 7 knots in the

Bowentown entrance channel. Most large commercial shipping movements therefore take place around slack water.

During northerly and easterly gales, breaking seas may be experienced in the entrance channel, particularly on an ebb tide. The main entrance approach is dredged giving a minimum depth of 14.1m. Work is in progress to deepen the dredged channels to accommodate vessels of up to 14.5m draught at low water and with an overall length of up to 347m.

Inner harbour navigable channels have been dredged to 12.9m and are marked with beacons and buoys. The Western Channel and anchorage has silted up and is now closed to large commercial shipping, although barges and tugs anchor here occasionally when sheltering from adverse weather.

The Tauranga Harbour area is a popular holiday destination with its safe, sheltered waters. Throughout the harbour there is an abundance of jetties, launching ramps and ski lanes to cater for the many small boat operators. An extensive network of harbour reserve areas are located all around the harbour's margin.

At Bowentown, the northern entrance to Tauranga Harbour, the entrance is dominated by an extensive shallow sand bar, which stretches more than 2 nm out to sea.

5.1.1.1 PORT OF TAURANGA

The Port of Tauranga, situated in Tauranga Harbour, is the principal export port of New Zealand and also the only natural deep water port between Auckland and Wellington providing safe berthage in all weathers.

Port arrivals and departures are programmed around the strength of the tidal flow in the entrance and take place day and night. Due to the strength of the tidal flow in the harbour entrance, all vessels are assigned an individual grade inward and outward dependent on LOA, draught, manoeuvrability, engine power and past history. This grade is used to allocate a tidal window to a vessel for the safe entry and exit of that vessel.

Pilotage is compulsory for merchant vessels of over 250 GT: the pilot boarding area is about 2.5nm north-east of A-Beacon.

The port's principal exports include butter, cement, cheese, kiwifruit, logs, milk powder, onions, steel, timber, wood pulp and general cargo. The main imports are cement, chemicals, coal, fertiliser, grain, bulk liquid and petroleum products, salt, steel, vehicles and general cargo.

On the Mount Maunganui side of the port, over 2km of linear wharf is used mainly for bulk and break-bulk cargoes. A container terminal with 7 cranes servicing three berths is situated at Sulphur

Point on the Tauranga side of the harbour. Vessels of post-Panamax size are able to berth at the Sulphur Point Wharf.

There are extensive shallows in the harbour and approaches outside of the dredged channels, so all larger vessels remain in the designated main channel from their berths until at sea, clear of A-Beacon.

In 2014 the Port of Tauranga recorded 1,612 ship departures, or a total of 3,224 ship movements. The port handled almost 20M tonnes of cargo over the project year, including 760,000 TEU.

The Port of Tauranga operates the Customer Service Centre which is manned 24 hours a day, seven days a week for control of shipping, and is equipped with Radar, AIS and VHF (listening watch on VHF Channels 16 and 12.) Three tugs are available with two new tugs each of 74T bollard pull and an older tug of 50T bollard pull.

Discharge of tanker products is carried out at a dedicated tanker berth. Chemical tankers discharge and load at the same facility, as do molasses and bulk cement tankers.

Ten designated ship anchorages, each outside the harbour in open water in around 30m depth, stretch between Motiti Island and the Katikati Entrance.

The Port of Tauranga also operates the country's first inland port, MetroPort, situated in South Auckland, handling in excess of 180,000 TEUs per year.

5.1.2 WHAKATANE HARBOUR

Whakatane Harbour is a river port primarily servicing a limited commercial and charter fishing fleet. The shallow bar entrance to the Whakatane Harbour can be difficult at times, but because of its proximity to rich inshore fishing grounds, the port provides access for up to 15,000 pleasure vessel movements annually. Whakatane claims the distinction of being the yellow fin tuna capital of NZ with the annual yellow fin tournament attracting up to 800 anglers.

Maintenance dredging of the shallow entrance channel is regularly undertaken by the local Council.

There are 35 swing moorings at Whakatane, with the number of moorings capped at a level that enables all moored vessels to be berthed alongside wharves during times of flood.

The Whakatane Yacht Club has 18 berths within its marina facility.

The Whakatane Harbour area is used for a variety of recreational activities including rowing, sailing, fishing, kayaking and white-baiting.

A domestic traffic route from Whakatane carries over 15,000 passengers, mostly tourists, annually to visit the active volcano of White Island. A smaller number visit Whale Island, an offshore wildlife reserve.

5.1.3 OHIWA HARBOUR

Ohiwa Harbour lies 11 km east of Whakatane, with entry governed by a shallow bar at the entrance. The harbour itself covers an area of approximately 26.4 km², and is relatively shallow, exposing around 80% of its seabed at low tide.

Steamships operated up and down the Bay of Plenty coast from the late 1860s. Ohiwa Harbour was important at that time because it remained workable when the shallow Whakatane and Opotiki Harbours could not be used. Vessels of up to 1,000 tonnes once berthed at the Port Ohope Wharf in Ohiwa Harbour, but with improving land transport and the difficult bar entrance, commercial cargo vessels stopped using the wharf in 1966.

The Ohiwa Harbour is now used recreationally for a wide range of activities, including fishing, boating, water-skiing, sailing, shellfish gathering, swimming, kayaking, yachting, windsurfing and birdwatching. There are 34 registered swing moorings at Port Ohope.

5.1.4 CHARTING INFORMATION OBSERVATIONS – DATA GATHERING

Extensive areas of the approaches to Tauranga were last surveyed in the early 1960's, however corridors comprising of most of the main shipping approaches were surveyed in 2004 and 2006. Hydrographic surveys carried out for salvors during the '*Rena*' grounding brought to light charting discrepancies the majority of which were subsequently resolved with the issue of new edition charts for the area.

An area within a 2 nm radius of Astrolabe Reef has been made an Exclusion Zone for vessels greater than 500 GT under a Bay of Plenty Regional Council Bylaw. This Bylaw also excludes vessels greater than 500 GT from passing close to other nearby reefs and rocks.

5.1.5 ECONOMIC SUMMARY

The GDP of the Bay of Plenty region was estimated at $11.9b in 2014, 5.2% of New Zealand's national GDP. The region's total population is currently over 300,000.

The Bay of Plenty region is very reliant on export industry with over 30% of employment deriving from export based activity, compared to 25% nationally.

While middle-income levels in the region are relatively similar to the national average, the region as a whole has a lower proportion of high income (>$70,000) and a higher proportion of low income (<$25,000) people. This trend is especially marked in the East.

In the 2014 season 240,000 cruise ship passengers and crew injected over $45M to the region.

5.1.6 AREAS OF RISK ASSESSMENT SIGNIFICANCE – RESERVES, ECOLOGICAL, CULTURAL

Mayor Island (Tuhua) is the summit of a volcano rising from the sea floor and has experienced frequent eruptions over the past 120,000 years, with the last one about 6,000 years ago. The most striking feature of the volcanic rocks of Mayor Island is the black obsidian, a natural glass formed by the rapid cooling of silica-rich lava. The island has had the conservation status of a wildlife refuge since 1953.

The Tuhua Marine Reserve surrounding the northern part of the island is a popular dive spot, renowned for its high water quality, unusual mix of deep sea and subtropical fish, and stunning geological features. Beyond the marine reserve, the waters around Mayor Island are prized by game fishermen - marlin, mako and swordfish are regularly caught here.

Moutohora (Whale Island) is a remnant of an eroded volcano. This is still an area of volcanic activity and there are hot springs on the island in several bays. In 1965 the island was declared a wildlife management refuge, with public access restricted to Department of Conservation concession holders and approved scientific parties.

White Island (Whakaari) is New Zealand's most active cone volcano, the peak of a much larger submarine mountain, which rises up to 1,600m above the nearby seafloor, making this volcanic structure the largest in New Zealand. Sulphur mining was attempted but was abandoned in 1914 after a lahar killed all 10 workers. The main activities on the island now are guided tours and scientific research. White Island is located 49km off the coast, with regular boat trips, guided tours and helicopter flights to the island. Around 15,000 passengers are carried to White Island each year from Whakatane.

The Volkner Rocks are three volcanic rock stacks attached to White Island. They rise from a depth of 200-400 m with near-vertical rock faces rising 112 m above sea level. The rocks are considered to be one of the best dive sites in the country and are located 55km from Whakatane. The underwater scenery and marine life in the marine reserve is spectacular with underwater visibility generally excellent due to low levels of sedimentation and run-off. Volkner Rocks Marine Reserve was established in 2006. Formerly the rocks were used as a bombing range by the New Zealand Air Force.

5.2 TRAFFIC ANALYSIS – BAY OF PLENTY

Types of commercial vessels transiting the Bay of Plenty and using the Port of Tauranga include

- Container
- General and Break-bulk; refrigerated; log carriers
- Tankers, including cement
- Passenger cruise
- Tugs, barges and workboats
- Passenger and vehicular ferries
- Fishing
- Charter, game-fishing boats and water taxis

5.2.1 TRAFFIC ANALYSIS – BAY OF PLENTY REGION

A plot of all recorded traffic in the Bay of Plenty Region, for the period July 2014 to June 2015 broken down by type is shown in **Figure 54**.

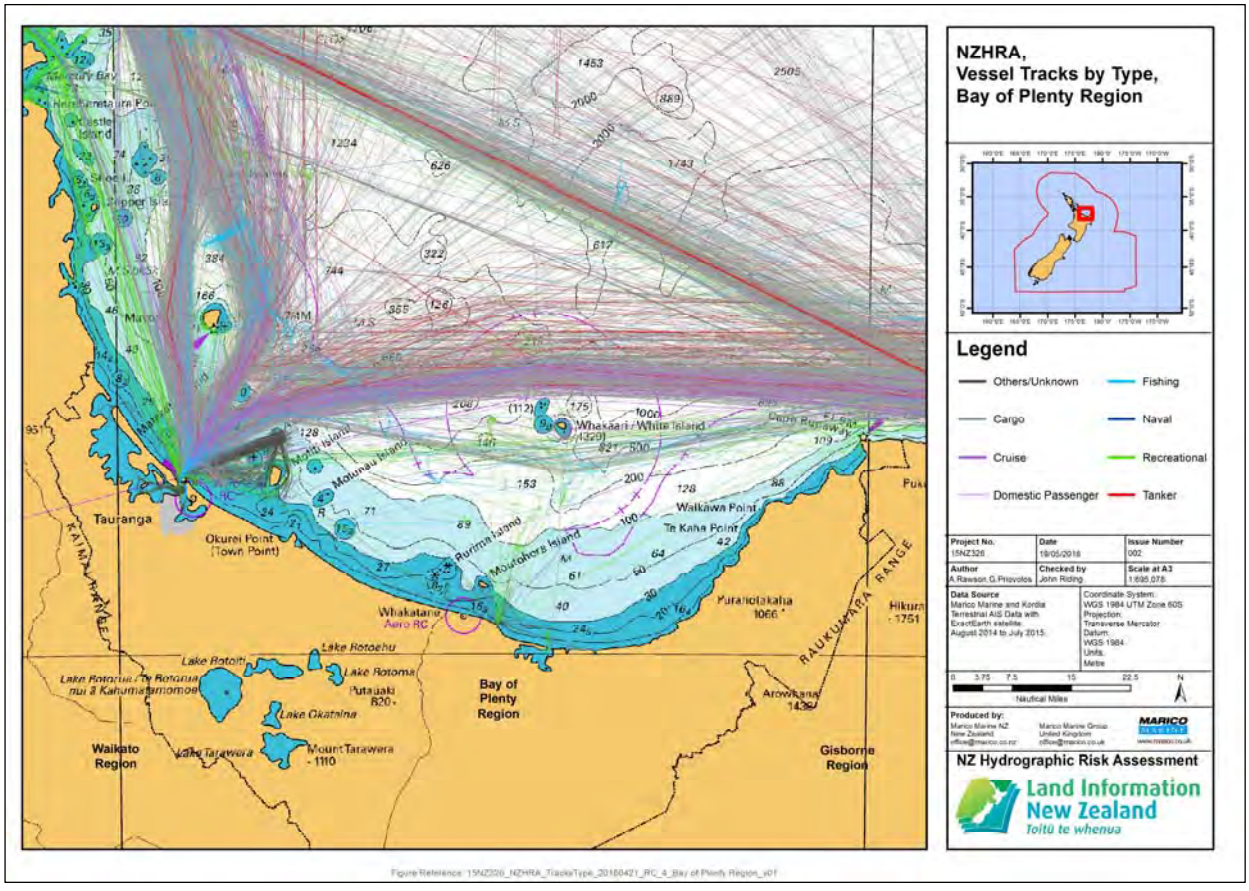


Figure 54 : Plot of Traffic by Vessel Type - Bay of Plenty Region

5.2.2 TRAFFIC DENSITY- BAY OF PLENTY REGION

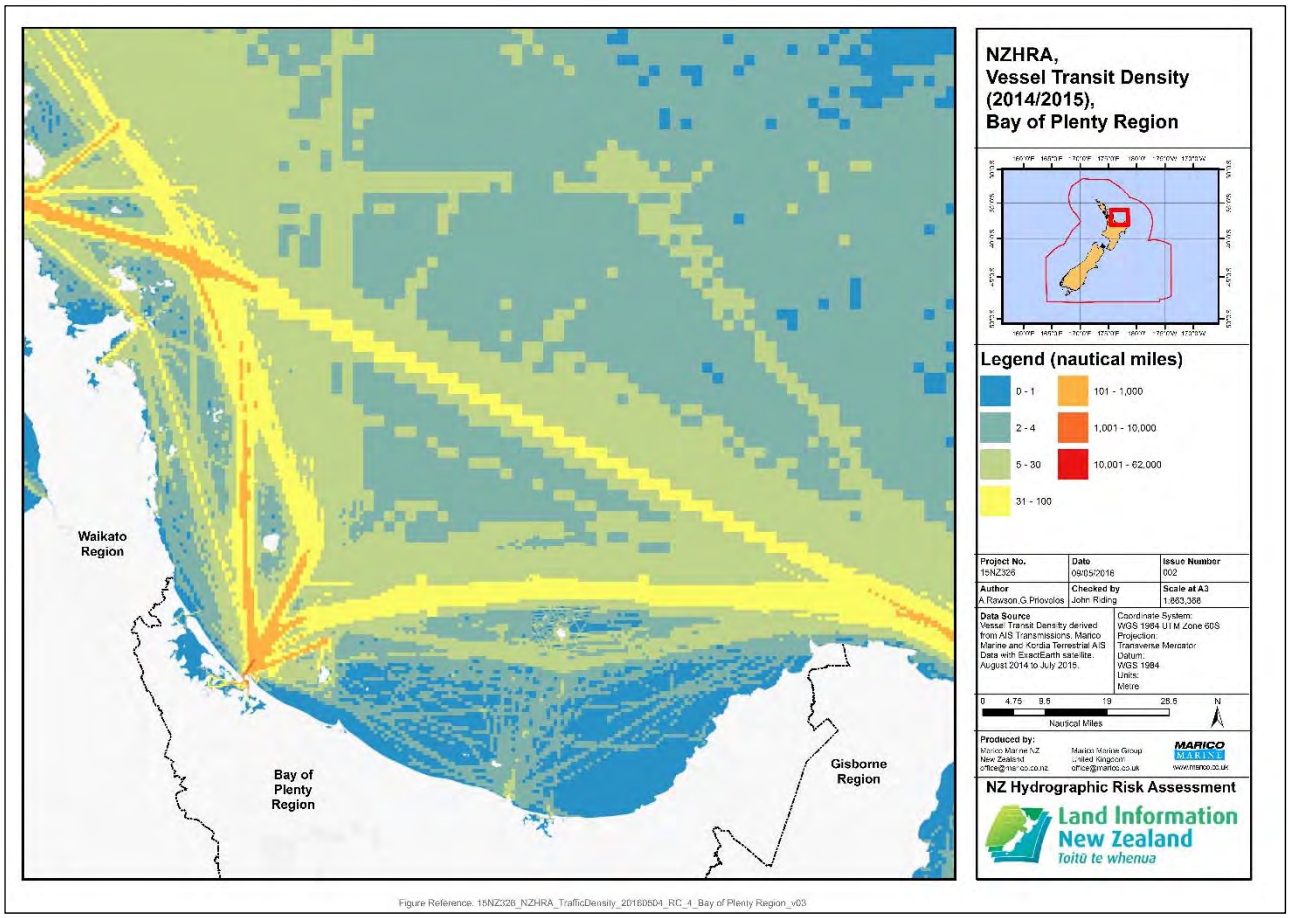


Figure 55 : Traffic Density - Bay of Plenty Region

5.2.3 ALL TRAFFIC - PORT OF TAURANGA

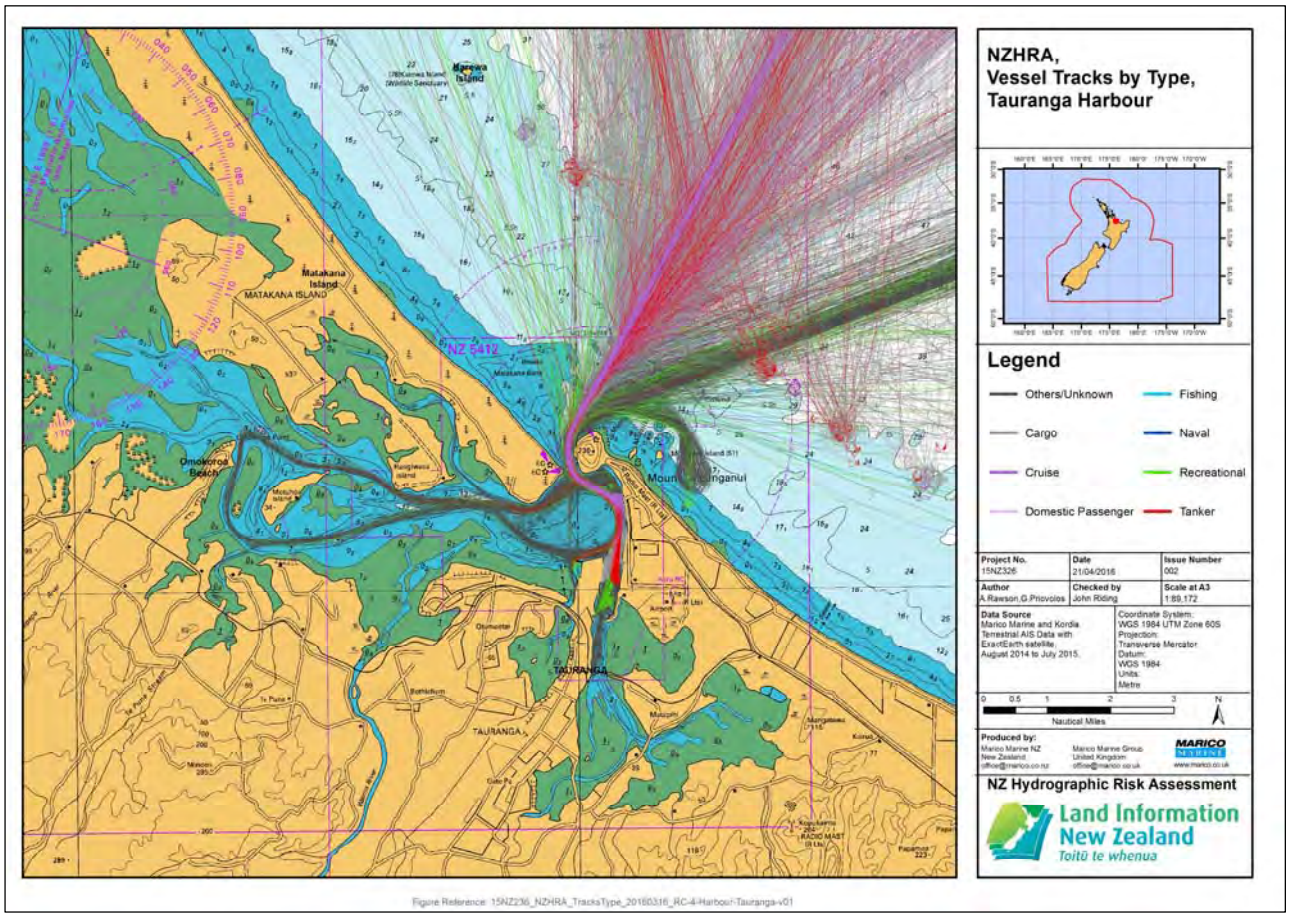


Figure 56 : Traffic By Ship Type – Port of Tauranga

5.2.4 ALL TRAFFIC - WHAKATANE

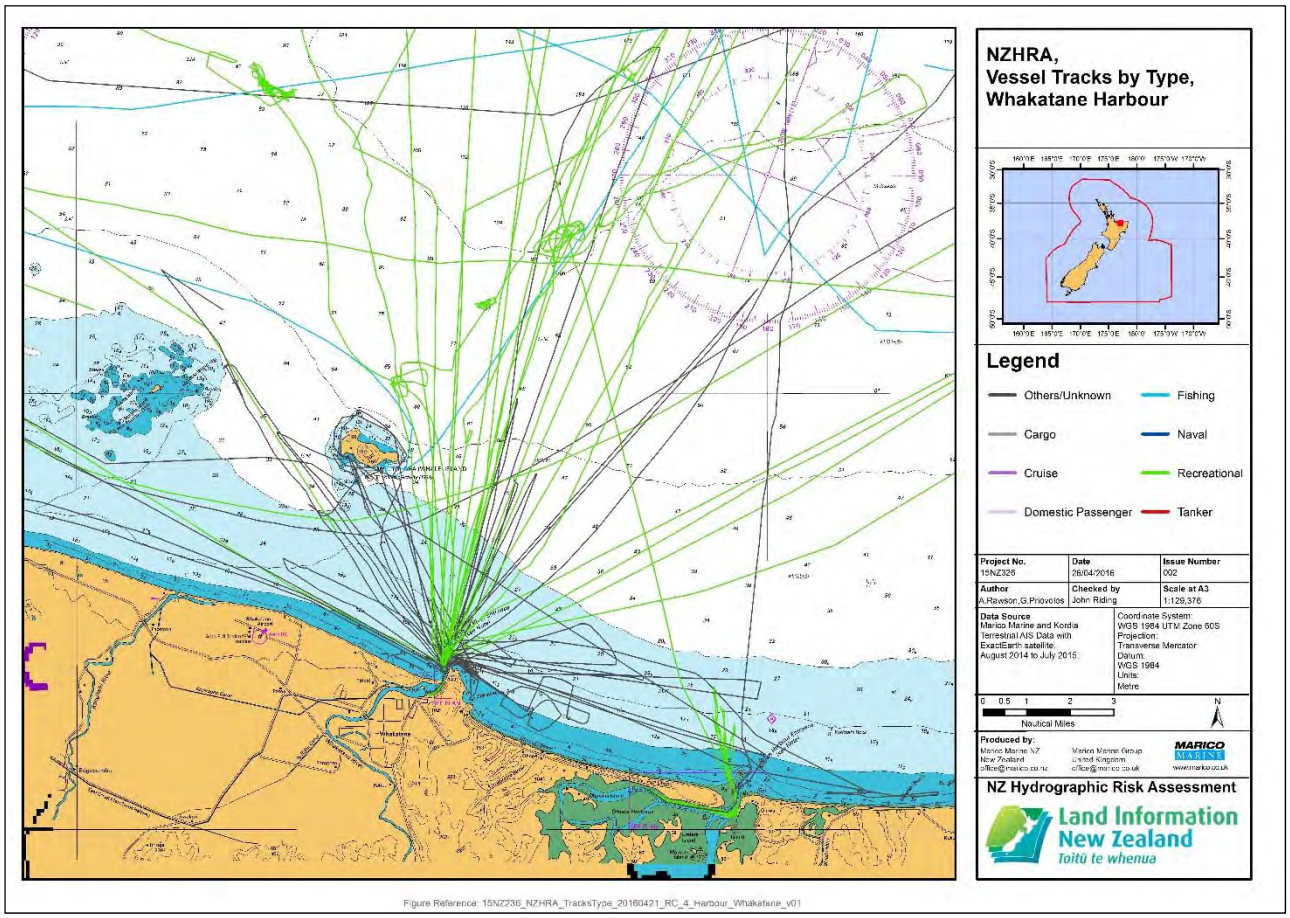


Figure 57 : Traffic Recorded by Vessel Type – Whakatane and Ohiwa

Whakatane AIS traffic does not include record of the domestic passenger vessels which use Whakatane as a base and transit to the White Island volcano. For the size of the bar harbour port, there is a considerable volume of recreational traffic.

5.2.5 CARGO VESSELS – BAY OF PLENTY REGION

From A-Beacon there are two main coastal routes for cargo vessels, one heading northwards, with similar numbers passing east of Mayor Island, as pass to the west. The other route is direct to East Cape, with the majority of vessels passing north of White Island. A lesser number of cargo vessels also bypass the Port of Tauranga, crossing the Bay of Plenty between East Cape and Colville Channel direct.

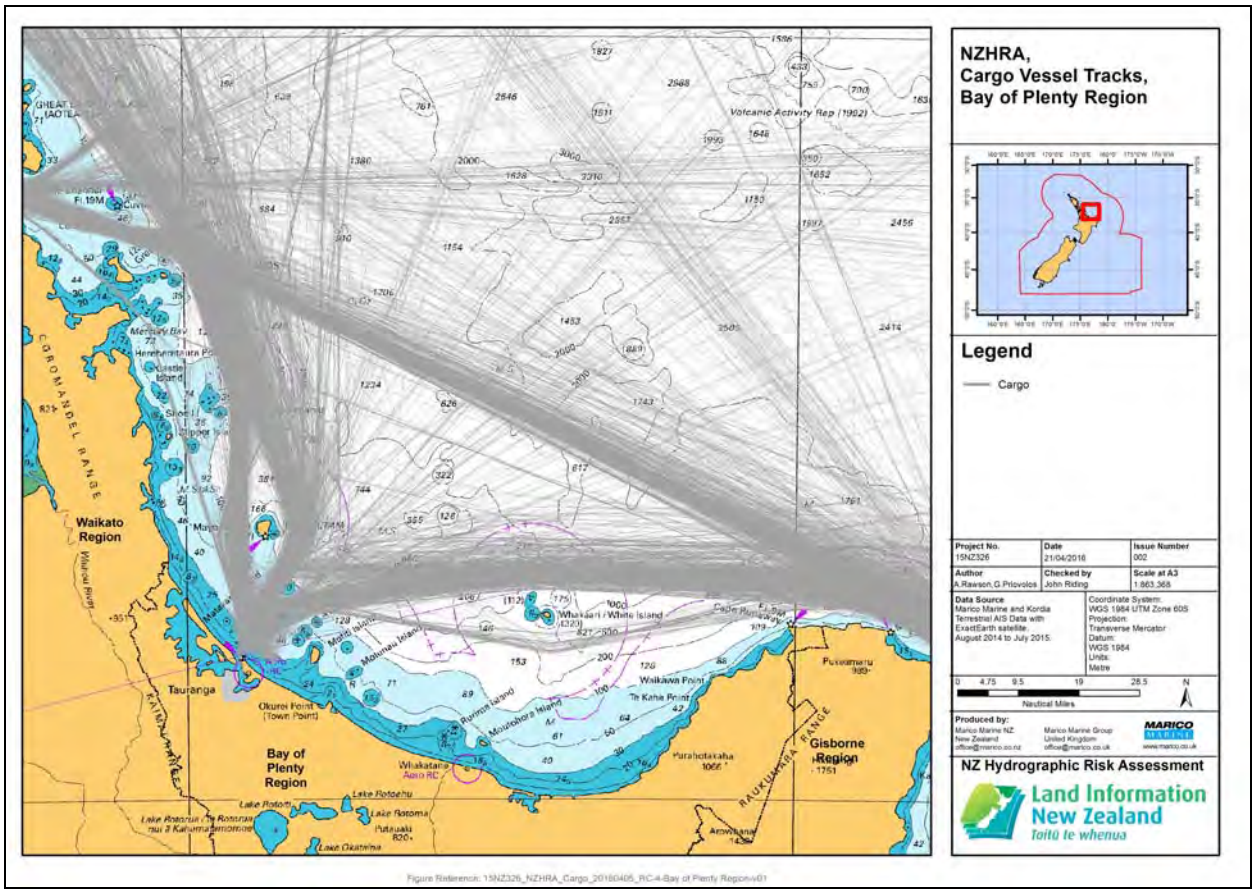


Figure 58 : Cargo Vessel Routes – Bay of Plenty

5.2.6 CRUISE VESSELS – BAY OF PLENTY

A record number of 84 cruise ships berthed at Mount Maunganui during the 2014 season. The trend for this port is for increasing numbers of cruise ships visiting. The port's current dredging programme will permit the larger cruise ships like *Ovation of the Seas*, 348m in length to use the port.

The 84 cruise ships brought nearly 150,000 passengers to the Bay of Plenty, generating an estimated $35 million of cash spent in the region over the season.

Cruise vessels often diverge from the direct routes into and out of the port, with some passing close inshore inside The Aldermen Islands and thence through the Hole in the Wall passage. A small number of cruise ships circle White Island, with a few anchoring there to put passengers ashore on the active volcano.

A plot of the routes taken by cruise vessels is shown below.

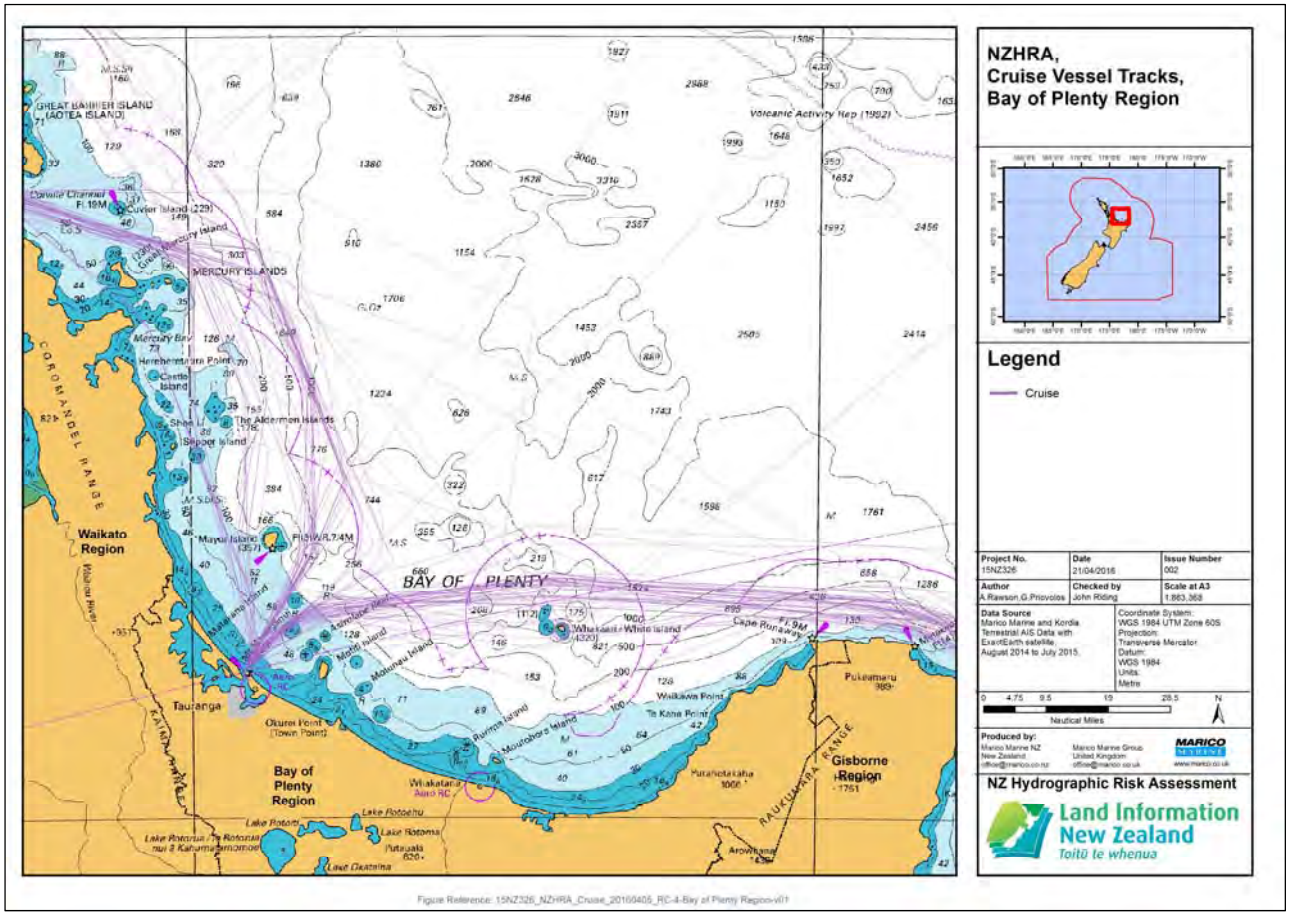


Figure 59 : Cruise Vessel Plot – Bay of Plenty Region

5.2.7 DOMESTIC PASSENGER SERVICES - TAURANGA

A vehicle ferry carries timber products from the forested Matakana Island to the mainland at Sulphur Point and Mount Maunganui. A passenger/vehicle ferry services the domestic traffic to Matakana Island from Omokoroa, located 6nm to the west of Tauranga. A small ferry carries senior school pupils daily from Matakana Island to the mainland.

Several ferry routes from the mainland to two different destinations on Matakana Island carry freight, vehicles and passengers on both scheduled and unscheduled trips within the harbour.

A small RoRo ferry carries freight and passengers to Motiti Island, located 12 nm east of the harbour entrance.

5.2.8 TANKER TRAFFIC – BAY OF PLENTY

Petroleum products, chemicals, cement and tallow are the main tanker products discharged at the Port of Tauranga. Tankers transit either side of Mayor Island, with one chemical/oil tanker passing just 1.5nm east of Mayor Island, clearing unmarked Tuhua Reef, east of Mayor Island by around 1nm.

The majority of tankers passed Mayor Island at 3-4nm off. Tankers regularly anchored at the designated anchorages outside the port.

Tankers follow the main shipping channels in and out of port. Tankers follow similar routes to cargo vessels, with the exception that they all pass to the north of White Island. Tankers and cargo vessels also transit directly across the Bay of Plenty on coastal passages, bypassing Tauranga.

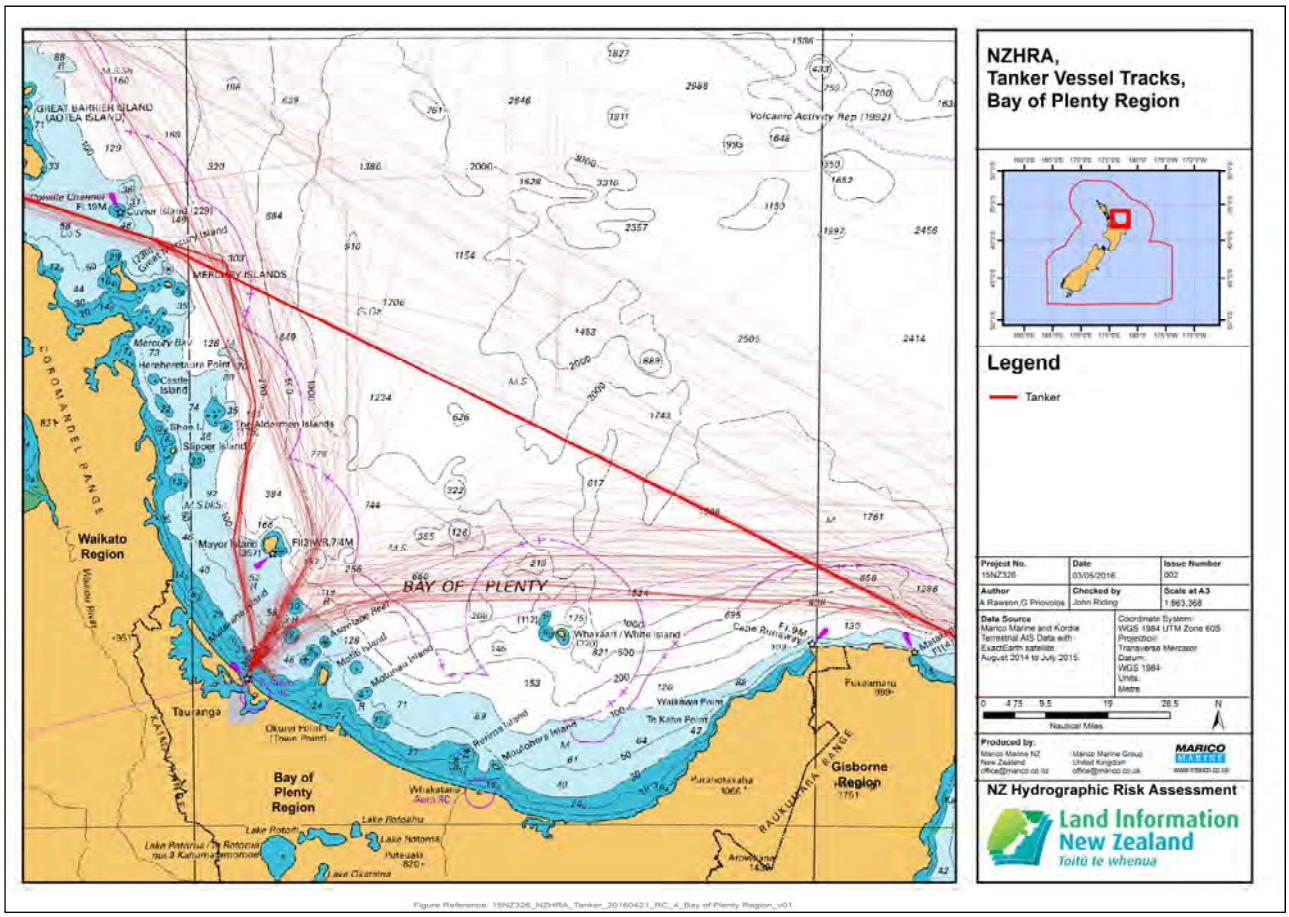


Figure 60 : Tankers – Bay of Plenty Region

5.2.9 COMMERCIAL FISHING VESSELS – BAY OF PLENTY

An inshore fishing fleet is based in Tauranga Harbour, with approximately 20 inshore fishing vessels calling Tauranga their home port. One of the larger fishing ports in NZ, up to 20,000 tonnes of seafood are landed each year in Tauranga, some of which is exported as high value chilled product to Japan, and some low value small fish (mackerel) shipped frozen mainly to African countries.

5.2.10 RECREATIONAL FISHING VESSELS – BAY OF PLENTY

Fishing is a very popular activity in the bay. Reef fishing, game fishing and diving are all popular pastimes in the Bay of Plenty. The majority of recreational vessels that leave Tauranga Harbour do

so for fishing. They tend to travel directly to their preferred destinations. With numerous offshore reefs, rocks and islands in the region, there are many good fishing spots.

It has been estimated by the Harbour Master, using boat ramp trailer counts and ramp survey data, that on a fine, weekend day, up to 1,000 boats use the harbour, many of them small trailer runabouts heading out for fishing. Popular fishing spots include Pudney Rock, Penguin Shoal, Okaparu Reef and Astrolabe Reef. In adverse weather conditions, many small boats fish in the shelter of the harbour.

The coast from Cape Runaway to Waihou Bay is the area where most blue marlin are caught in New Zealand waters. Off East Cape, where cold waters from the south meet warm currents coming down the east coast an upwelling from the deep brings plankton to the surface and this in turn attracts baitfish, which attract yellowfin, bigeye and southern blue tuna as well as striped and blue marlin. Arguably one of the most exciting game fishing events in New Zealand with up to 1,000 entries is the One Base Fishing Tournament organised by the Tauranga Game Fishing Club.

Recreational divers can explore shipwrecked vessels, local reefs and island outcrops in popular spots like Mayor Island and the Astrolabe Reef. Diving around the active marine volcano White Island is world class, offering prolific fish life and volcanic terrain.

5.2.11 Recreational Craft – Bay of Plenty

The largest proportion of New Zealand's recreational boaters live in the upper North Island - with 7% of them based in the Bay of Plenty.

Two marinas in Tauranga Harbour provide berthing facilities for over 1,000 craft. A further 3-400 boats are accommodated on swing moorings.

The Bay of Plenty is a popular area for pleasure boating and game fishing. Popular destinations for larger launches are the Mercury Islands and Great Barrier Island.

Other types of recreational vessels include sail boats and small runabouts. Their traffic patterns are random, but the larger marina-based vessels mostly head out of the harbour through the Tauranga entrance, while the smaller boats often utilise the tidal reaches of the harbour for fishing, with their traffic patterns intensified around deep harbour channels and estuary entrances to launching ramps.

Most classes of yachting sail on the harbour. Several yachting and boating clubs organise competitive events for centreboard type yachts. Larger yachts are catered for by three Yacht Clubs.

5.3 HYDROGRAPHIC RISK –BAY OF PLENTY REGION

5.3.1 HYDROGRAPHIC RISK - TAURANGA

Although survey age of the channels in the commercial port is less than 5 years, extensive areas of the outer approaches to Tauranga and most 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, provide a heightened risk to the Approaches to Tauranga.

Most of the centre harbour is ZOC B however the areas near Omokoroa and part of the Western Channel where there is a passenger/vehicular ferry are ZOC U, which combine with charting scale/extents to give a heightened risk result. A moderate risk shows for parts of the Western Channel, with heightened risk where there are ferry routes to Matakana Island and heavy recreational use out of both marinas.

Tauranga Harbour's main shipping channels show heightened risk due to the scale of the harbour chart at 1:10,000.

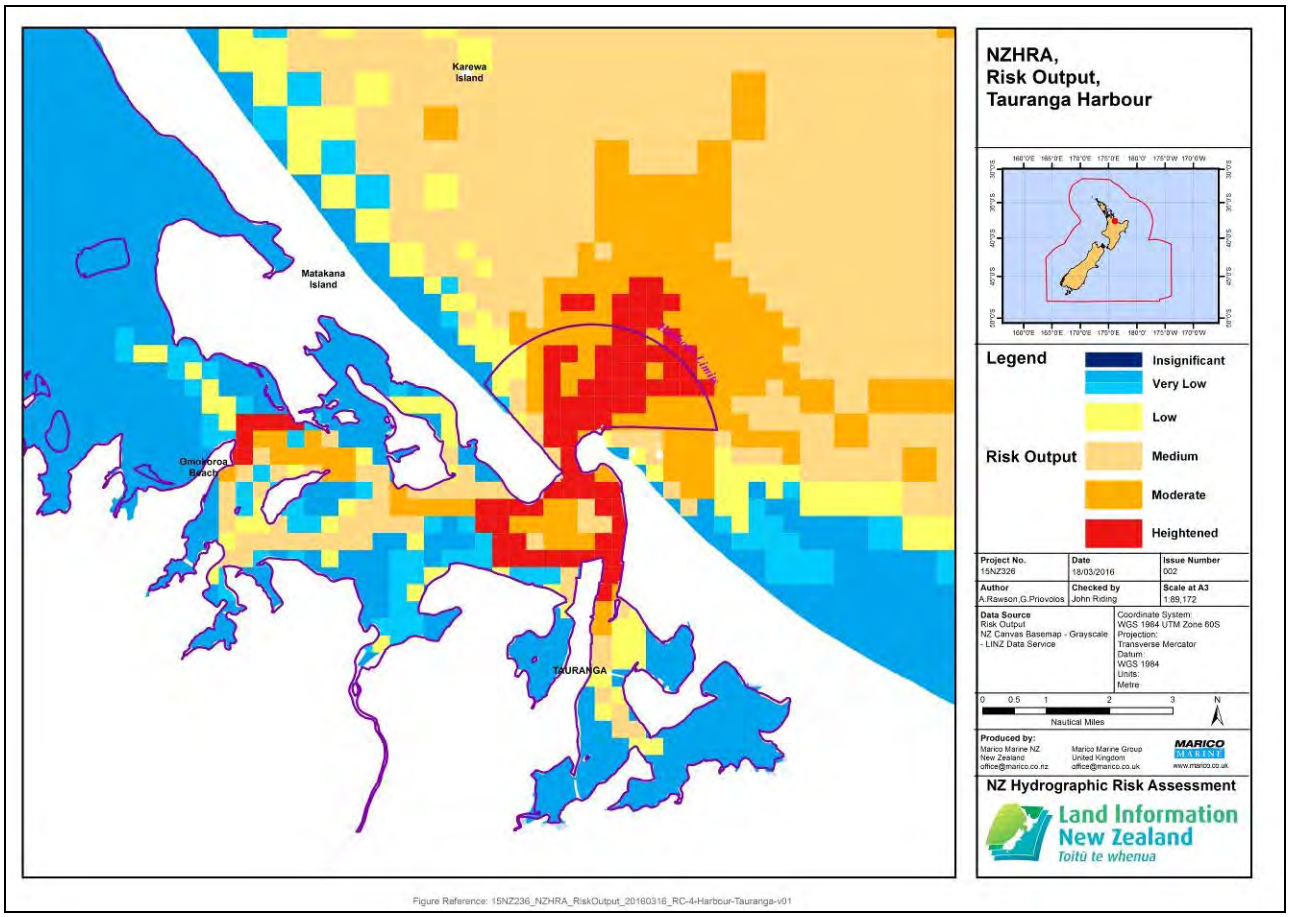


Figure 61 : Hydrographic Risk - Tauranga

5.3.2 HYDROGRAPHIC RISK – WHAKATANE

A moderate risk shows on the routes between Whakatane and White and Whale Islands, due to the domestic passenger routes here. A single cell of heightened risk shows at the bar entrance to Whakatane. Elsewhere in this area the risk shows as low or insignificant.

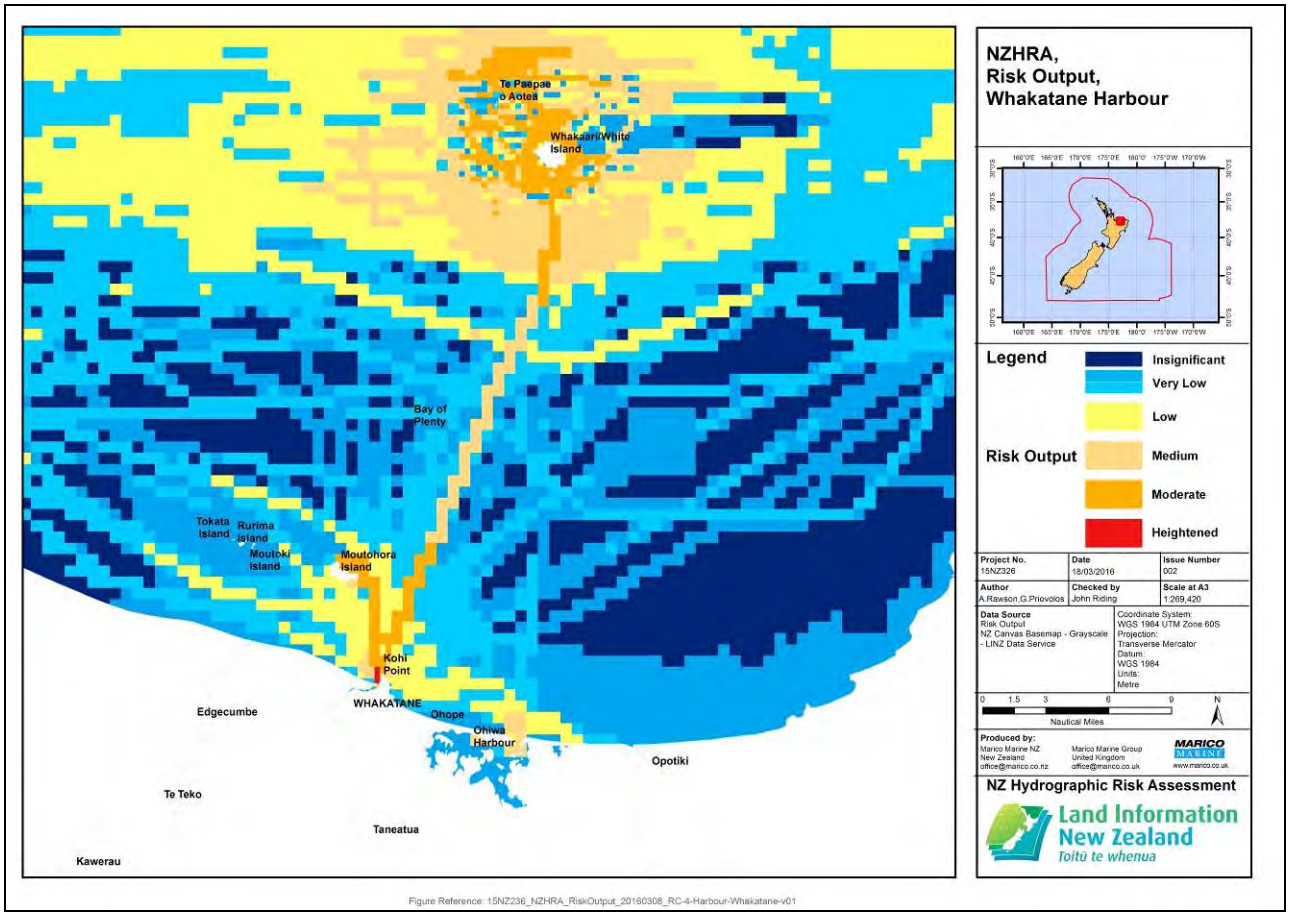


Figure 62 : Hydrographic Risk – Whakatane and White Island

5.3.3 HYDROGRAPHIC RISK – 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 seafloor data, giving no indication of quality of anchor holding. Increasing the risk is the private scenic reserve status of the island and its identification as an important bird breeding area.

5.4 CHARTING BENEFIT – BAY OF PLENTY REGION

5.4.1 CHARTING BENEFIT – PORT OF TAURANGA

The age of survey for the outer approaches to Tauranga and some of the designated ship anchorages combined with busy commercial traffic, provide a charting benefit to the Approaches to Tauranga.

The main shipping channels show a charting benefit due to the scale of the harbour chart.

Most of the centre harbour is ZOC B. However, the areas near Omokoroa and parts of the Western Channel where a passenger/vehicular ferry service transits are ZOC U. This combined with a chart scale of 1:40,000 (approach scale) and charting extents/scale, deliver a positive charting benefit in this area. The charting extents for Tauranga Harbour as far west as Omokoroa could usefully be reviewed.

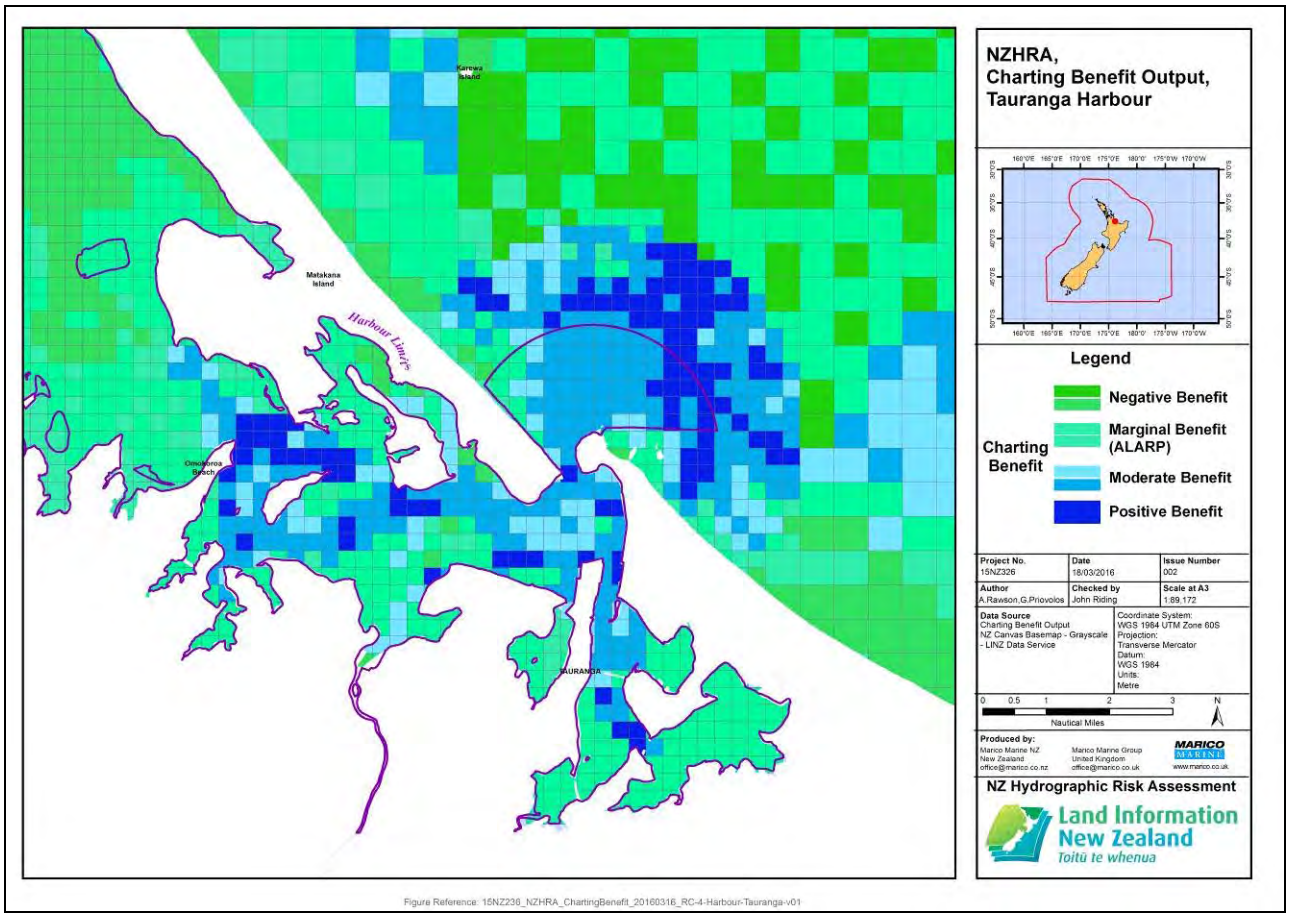


Figure 63 : Charting Benefit – Tauranga Harbour

5.4.2 CHARTING BENEFIT – WHAKATANE

Areas of moderate and positive charting benefits show along the passenger route from Whakatane to White Island. Further areas of positive charting benefit show on the east/west route for all vessel types passing north of Volkner Rocks.

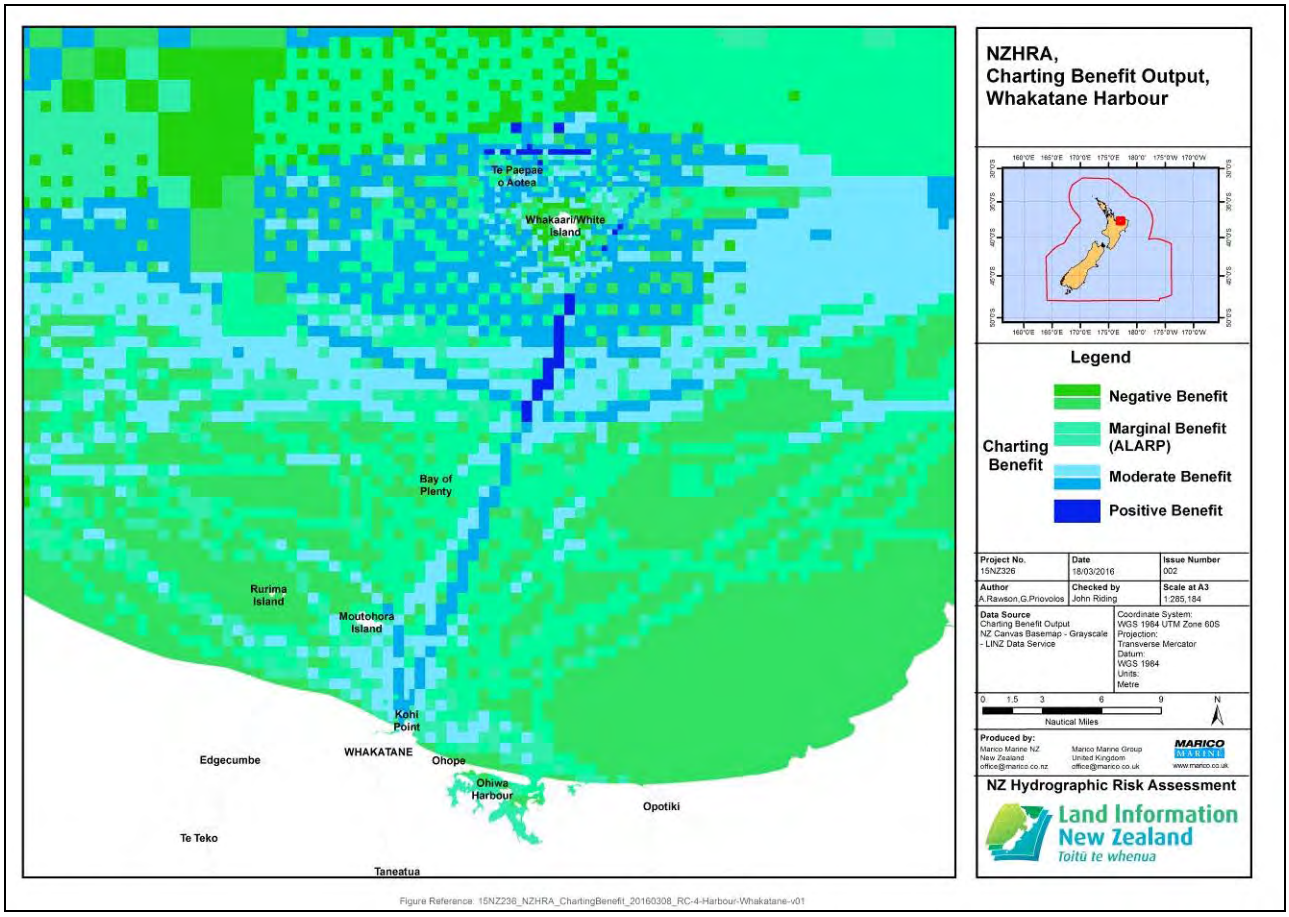


Figure 64 : Charting Benefit – Whakatane to White Island

5.4.3 CHARTING BENEFIT – WHITE ISLAND

Chart survey age and both domestic and cruise passenger traffic here combine with a ZOC C low accuracy survey to give a comparative charting benefit. Although water is deep around While Island, there are an increasing number of cruise vessels anchoring, whilst passengers visit the island by tender.

6 HYDROGRAPHIC RISK RESULTS - GISBORNE REGION

6.1 INTRODUCTION – GISBORNE REGION

The Gisborne region is sheltered by high country to the west and has a sunny climate with high sunshine hours. The city of Gisborne is located at the north end of Poverty Bay. The white cliff headland of Young Nick's Head at the south end of the bay is visible from the city. Gisborne is well known for its surf beaches.

Gisborne District Council is a unitary territorial authority, performing the functions of a regional council as well as those of a territorial authority. The region is sparsely inhabited and isolated, with small settlements mainly clinging to small bays along the eastern shore including former open roadstead ports of Tokomaru Bay and Tolaga Bay.

6.1.1 GISBORNE HARBOUR

Gisborne harbour is the home of many smaller fishing boats as well as ships primarily loading logs for export. The approach channel through 'The Foul Grounds' is charted as being dredged to 10.1m, while depths alongside the commercial wharves are charted at 4.0-6.5m.

The surges of the May 1960 Chile tsunami flooded Gisborne Harbour, and did widespread damage around the surrounding coast.

6.1.2 EASTLAND PORT

The port is owned by Eastland Group who specialise in regional infrastructure: ports, electricity distribution and transmission networks as well as electricity generation. Their operations include Eastland Port, Gisborne Airport and Eastland Network.

For Eastland Port, the 2014-15 year was one of consolidation, with a period of growth of log volumes plateauing. There was a slight decline in the port's overall export volume when compared to the previous year. In total, 2.2M tonnes were exported from the region during the 12 months to 31 March 2015, slightly reduced from a record 2.23M in the 2014 financial year. Export log volume was 98.4% of the port's total export volume, with log vessels generally part loading at Gisborne and topping off in Tauranga. The remaining 2% of cargo volume was a combination of plywood, squash, kiwifruit and fertiliser. From the data gathering visit the port presented a positive expectation of its growth opportunities.

Eastland Port has recently invested in a modern towage capability, with the new build ASD tug *Waimata* that arrived in October 2014.

The past few years have seen an increase in the general size of visiting vessels, particularly log carriers. Around six years ago Eastland Port was handling handy-size bulk vessels, of length 160m-170m and beam, 27.5m (17,000 GT). The port is now handling vessels up to 190m length, 32.5m beam and 30,000 GT (the so called handy-max bulk carrier).

Eastland Group also run the Inner Harbour marina which has 69 berths, providing berthage to a range of recreational and commercial vessels. It is active in maintaining its port access channels at their declared depth.

6.1.3 HICKS, WAIPIRO, TOKOMARU, ANAURA AND TOLAGA BAYS - EAST CAPE

Open to the east but providing good shelter from westerly conditions are five open roadstead ports, once used for coastal cargoes: Hicks, Waipiro, Tokomaru, Anaura and Tolaga Bays. These ports were also served by large meat freezer works, which are also now decommissioned. Today these ports are mostly used by small recreational craft, launched from trailers either on the beach or into an adjacent estuary. There was little or no traffic fitted with AIS transponders using these harbours in the 12 month data period used for the study.

6.1.4 CHARTING INFORMATION OBSERVATIONS – DATA GATHERING

Hicks, Waipiro, Tokomaru, Anaura and Tolaga Bays, all have Plans on Chart NZ5551. Hicks Bay was surveyed in 1988 and the other four bays in 1996. The chart source data for Gisborne records large areas of Poverty Bay as last surveyed in 1953. A new chart edition 2016 for NZ5571 released subsequent to the project year has mitigated the hydrographic risk

Numerous vessels anchor in these waters: three anchorage areas are designated in the centre of Poverty Bay and source data for at least two of these three anchorages is taken from surveys in 1986. The third anchorage is within the recently surveyed area on the recent chart edition (June 2016). The dredged channel through 'The Foul Grounds' is maintained by Eastland Port, with the chart recording source data from 2007. Later source data is available as the port surveys frequently.

6.1.5 AREAS OF RISK ASSESSMENT SIGNIFICANCE– RESERVES, ECOLOGICAL, CULTURAL

The Te Tapuwae o Rongokako Marine Reserve was established in 1999. The reserve lies approximately 16km north of Gisborne. Council has identified that Gisborne has three of 17 nationally significant surf breaks.

6.1.6 ECONOMIC SUMMARY - GISBORNE REGION

The sub-national GDP of the Gisborne region was estimated at US$1.031b in 2013, which was 1% of New Zealand's national GDP. Cruise vessel crews and passengers injected $1M into the local economy.

6.2 TRAFFIC ANALYSIS – GISBORNE REGION

6.2.1 ALL TRAFFIC ROUTES – GISBORNE REGION

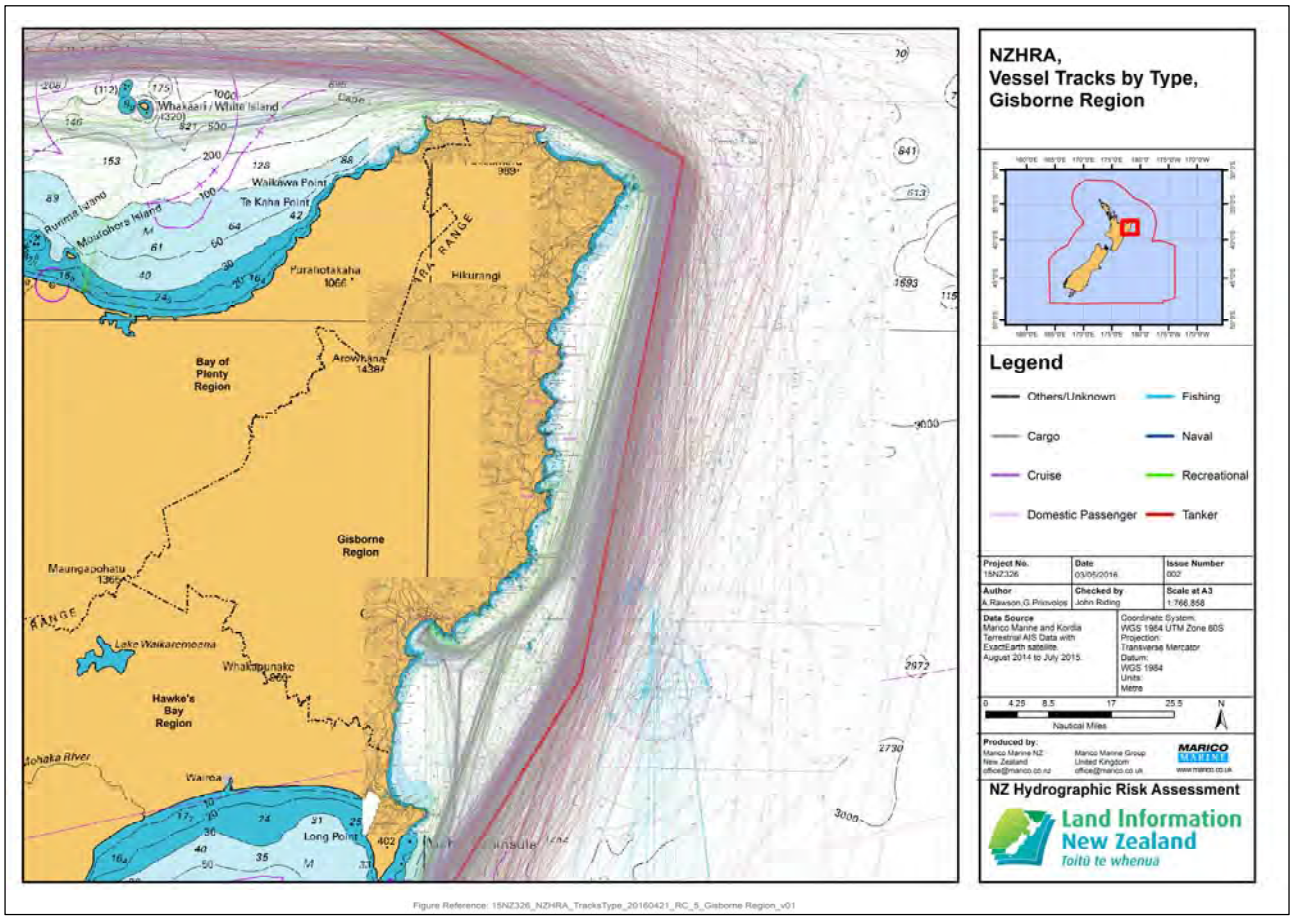


Figure 65 : Plot of all Vessel Traffic Transiting Gisborne Regional Waters

Some coastal traffic passes inside Ariel Bank; most passing traffic however transits outside these notorious rocks that break in heavy weather only. The types of commercial vessels using Gisborne Port include:-

- Log carriers
- Charter and fishing boats
- Fertiliser/bulk carriers
- Survey

There is no domestic passenger traffic recorded for Gisborne, although there is an active offshore fishing charter trade. Naval vessels occasionally visit.

6.2.2 ALL TRAFFIC DENSITY – GISBORNE REGION

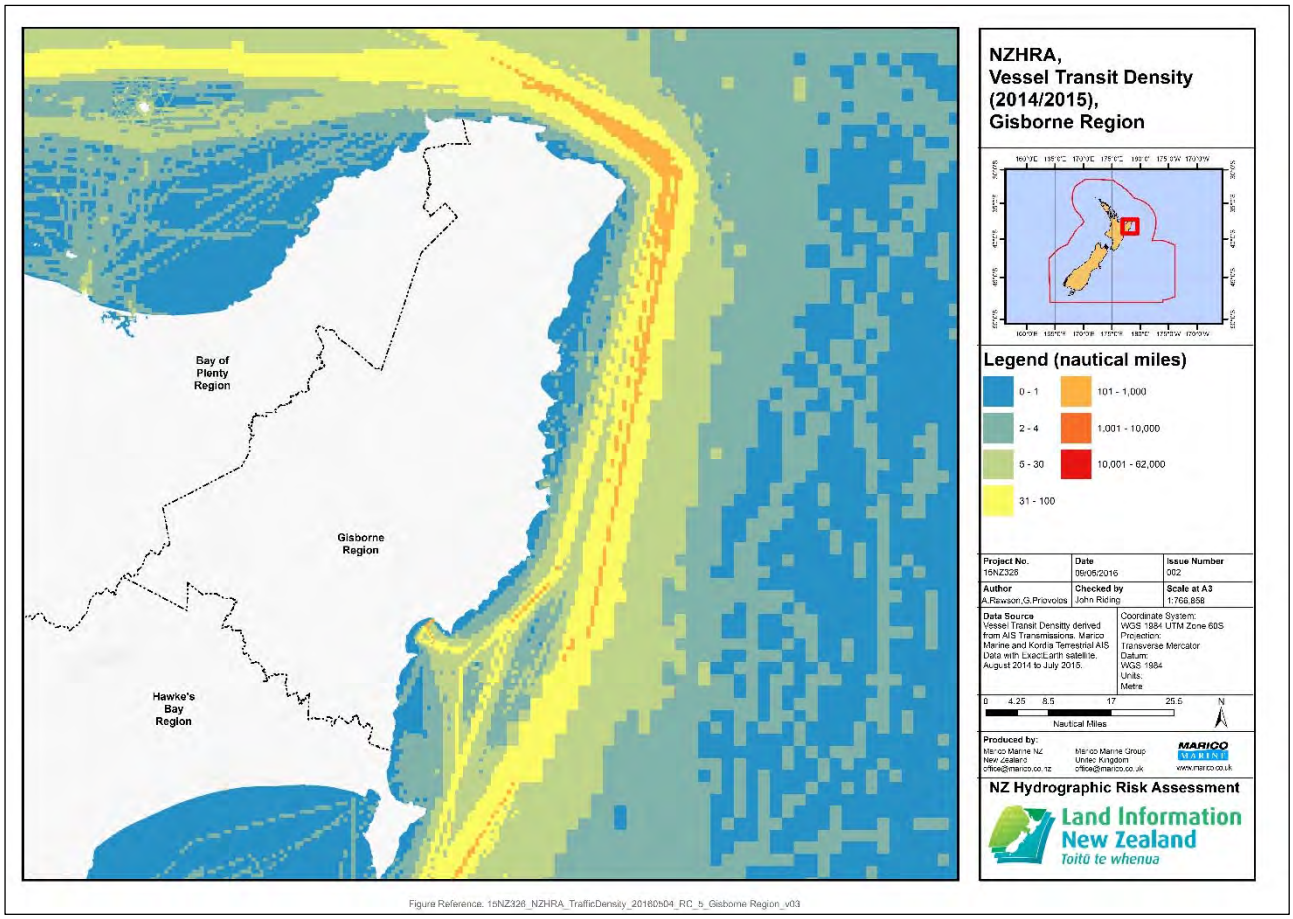


Figure 66 : Traffic Density Plot – Gisborne Region

The East Cape provides a natural location for traffic to converge as it rounds the cape. Although density is an order of magnitude lower than both the Auckland and Wellington areas, traffic in this area transits an exposed coastline with significant coastal current. Smaller vessels transit close inshore round East Cape. The density plot shows that convergence continues along the Gisborne Region shoreline, but this remains at significant distance offshore, which is influenced by Ariel Bank.

6.2.3 CARGO VESSELS – GISBORNE REGION

Numerous vessels are shown on the traffic plots as anchored in Poverty Bay, awaiting a berth or cargo. Most of these vessels are log carriers.

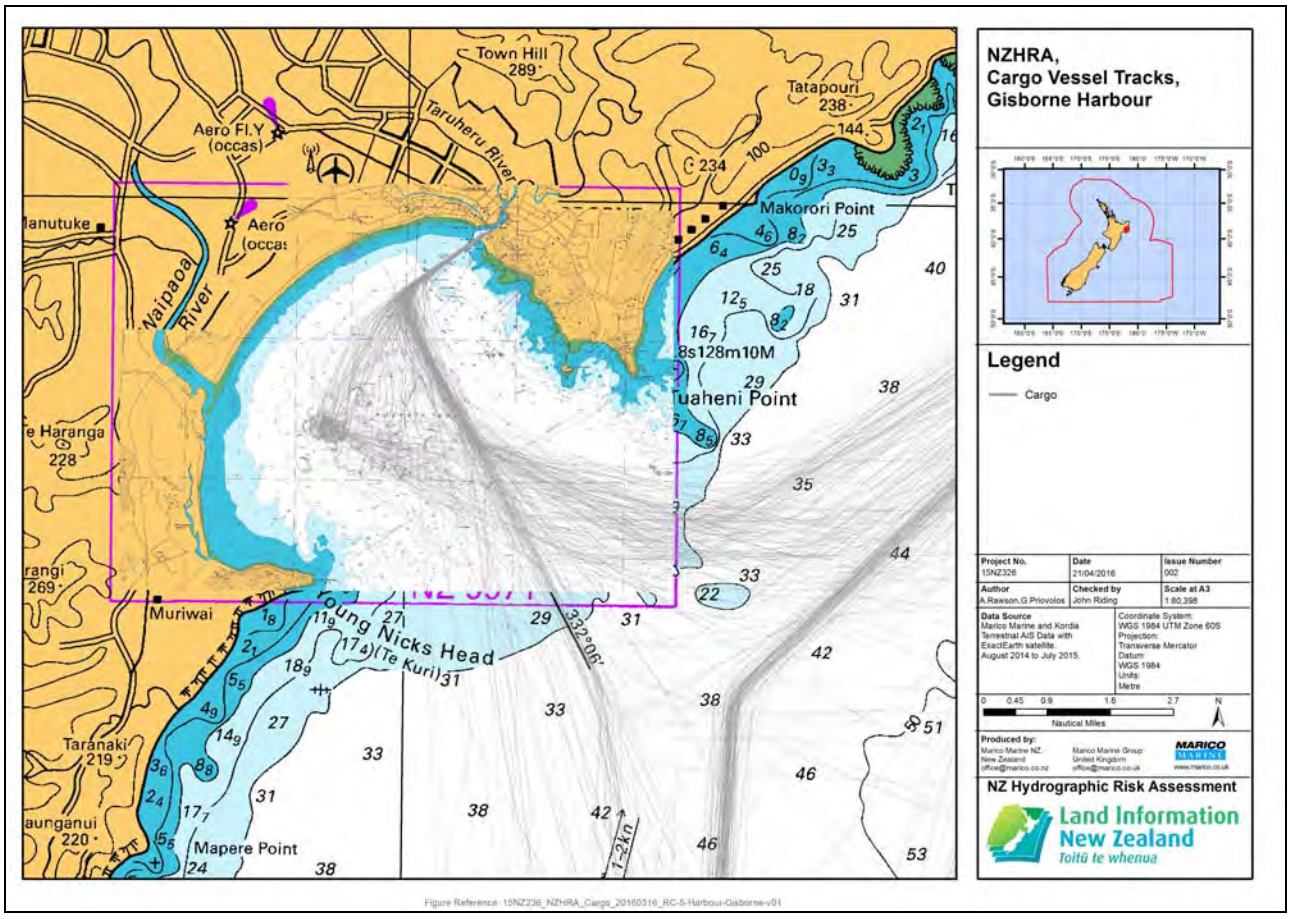


Figure 67 : Cargo Vessel Tracks - Gisborne

6.2.4 TANKER TRAFFIC - – GISBORNE REGION

All tankers passed outside Ariel Bank, with none visiting Gisborne. A concentration of tanker vessel routes exists around East Cape, with tankers passing 4nm or more off East Island.

6.2.5 COMMERCIAL FISHING VESSELS – GISBORNE REGION

Only two fishing vessels are recorded on AIS as having visited Gisborne, however thirty fishing vessels are registered in the region, suggesting many are not carrying AIS. The Hikurangi Trench, running along the east coast of the North Island, plunges to depths of 10,000m as close as 80 kilometres from the region's shore, creating cold, nutrient-rich waters that attract fish in large numbers.

Around 10 deep sea and big game fishing charter fishing companies operate out of Gisborne.

6.2.6 RECREATIONAL FISHING VESSELS – GISBORNE REGION

The Gisborne Tatapouri Sports Fishing Club is a hive of activity year round, but particularly over the summer months when a dozen regular competitions see a flurry of boats of all sizes bringing in fish

to weigh. The East Coast is popular for recreational fishing, being home to many types of fish including marlin, kingfish, groper, bluenose and tuna.

6.2.7 RECREATIONAL CRAFT – GISBORNE REGION

A yacht club operates at Kaiti Beach. There are three boat ramps in Gisborne; two on rivers that open into Poverty Bay beside the harbour, and one launching directly into the inner harbour.

6.3 HYDROGRAPHIC RISK – GISBORNE REGION

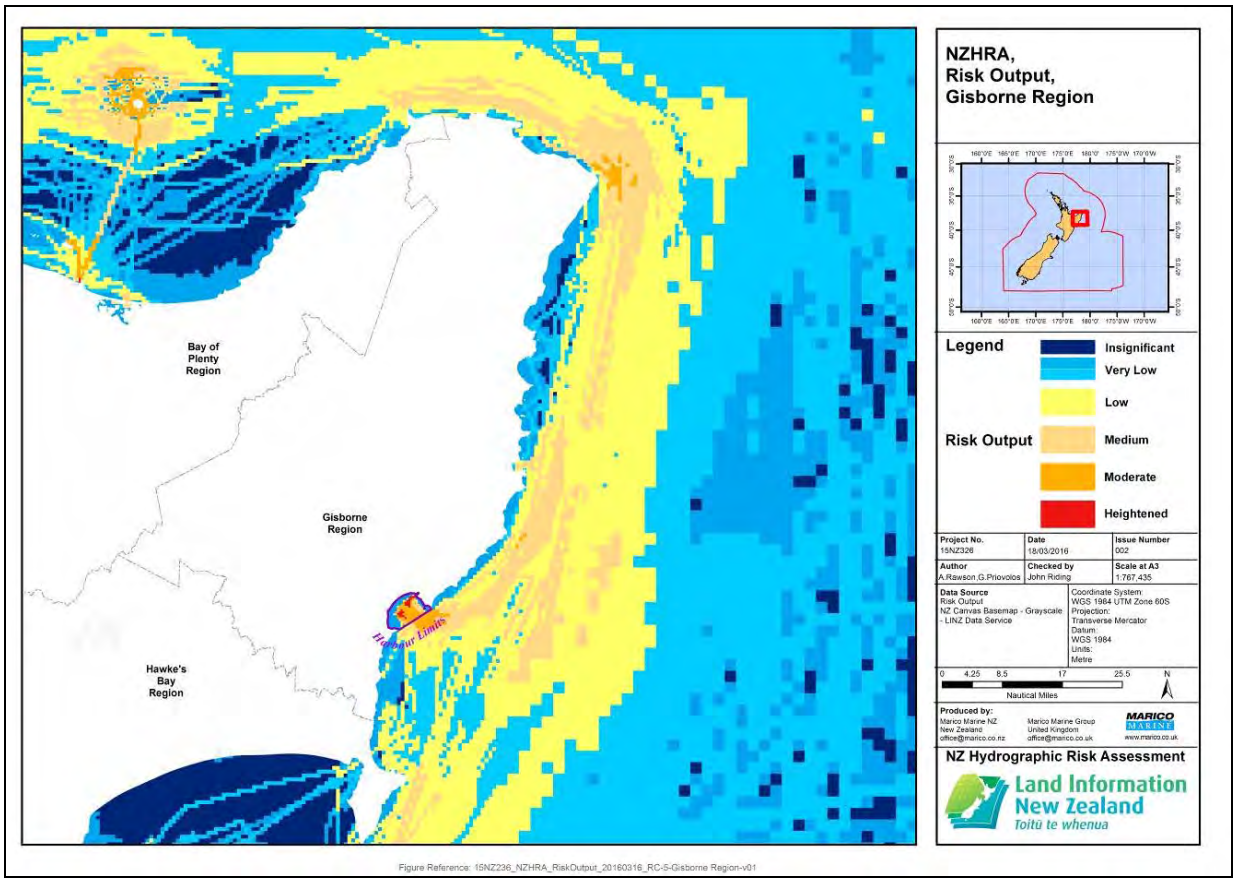


Figure 68 : Hydrographic Risk – Gisborne Region

Hydrographic risk is moderate to low for most of the Gisborne Region. A narrow approach route into Poverty Bay showing as heightened risk (below) including the harbour and dredged entrance approach, has in fact been recently surveyed, subsequent to the project year. An updated edition to the chart for this area was released in June 2016. However, some areas are outside the extents of recent surveys. These locations date back to 1953 surveys.

The designated anchorage areas that show heightened risk (the southern area in red, below) are all outside the latest survey areas and are also outside the SL4 shipping route surveyed by LINZ. Large

numbers of cargo vessels anchored in Poverty Bay, awaiting a berth or cargo: the majority of these vessels all anchored in the area last surveyed in 1953.

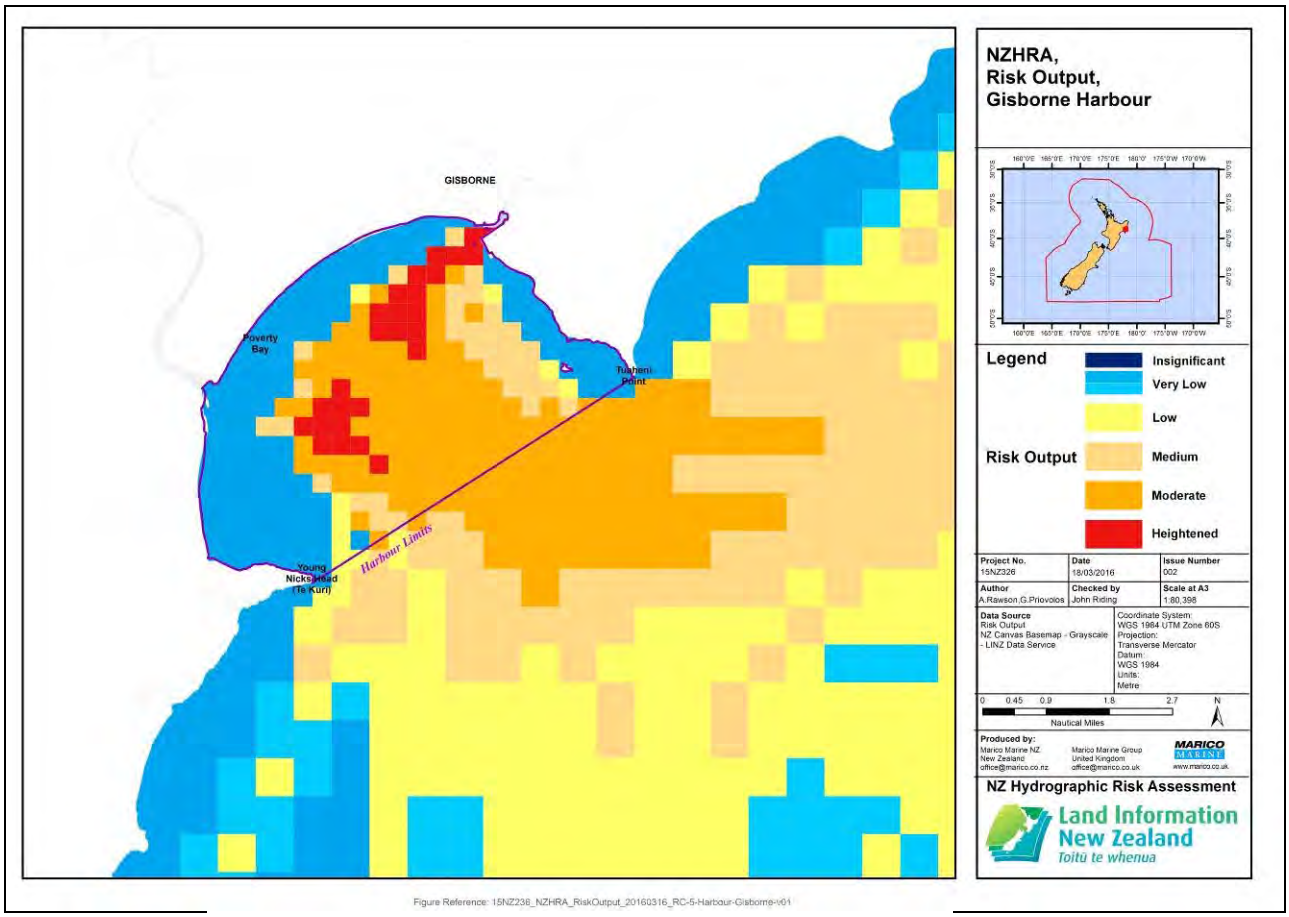


Figure 69 : Approaches to Gisborne Show Heightened Risk

6.4 CHARTING BENEFIT – GISBORNE REGION

Charting benefit is moderate to marginal for the offshore Gisborne Region. The areas showing positive charting benefit are in the harbour limit transits, which reflects the traffic profile, the vessel designated anchorage areas and areas of moderate benefit showing in the outer approaches along the coast. However much of the area within harbour limits that shows moderate benefit, has in fact been surveyed subsequent to the project year. This updated data is to be incorporated into all scales of charts of the area by June 2017.

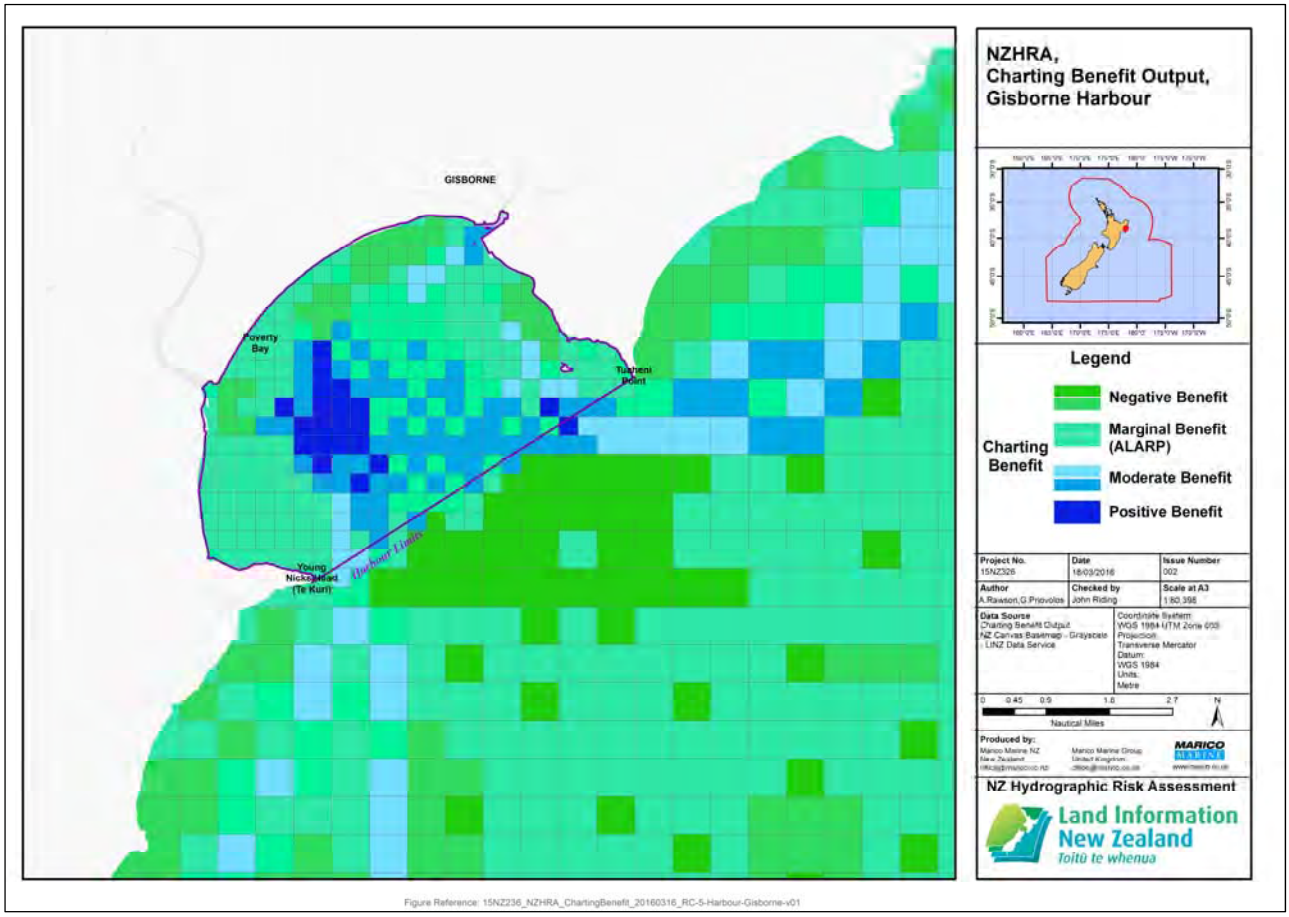


Figure 70 : Positive Charting Benefit in Gisborne Harbour

7 HYDROGRAPHIC RISK RESULTS - HAWKE'S BAY REGION

7.1 INTRODUCTION - HAWKE'S BAY REGION

Napier is the largest producer of apples, pears, and stone fruit in New Zealand. The region has also become an important grape and wine production area, with the grapes grown around Hastings and Napier being sent through the Port of Napier for export. Large amounts of sheep's wool, frozen meat, wood pulp, and timber also pass through Napier Port annually for export.

The climate is warm and relatively dry resulting from its location on the east coast. The coastline of the city was substantially altered by a large earthquake in 1931. The resulting topography puts the City of Napier in danger from a tsunami, as the current centre of the commercial city is near sea level. Napier's major tourist attraction is its Art Deco architecture; other attractions nearby include the Cape Kidnappers Gannet Colony.

Sailing, fishing and other water activities in Hawke's Bay are popular. The many rivers that flow through the region are used for water activities, such as jet boating, jet skiing, rowing, kayaking, fishing, white-baiting and swimming.

7.1.1 NAPIER PORT LIMITED - HAWKE'S BAY REGION

Napier Port, in the province of Hawke's Bay, is the fourth largest container terminal in the country and reports as the North Island's second largest export port by tonnage. The port has five wharves, four cranes and two tugs. A Dynamic Under Keel Clearance (DUKC) system is in use for vessel transit through the port approaches.

Napier Port is exposed to north-easterly conditions and experiences surge conditions at times. Shore moorings with shock dampers are provided to vessels by the port for use during surge conditions. Storm bollards are available for use in the event of strong winds and vessels must comply with any requirement to run out additional lines during storm conditions. Above 40 knots average wind speed shipping operations are suspended.

All vessels 40m LOA or over require pilotage. Outside pilotage limits two anchorages are charted, in 18 and 21m of water.

A new wharf is currently being planned in the port to handle the projected volume growth and larger vessels. A phased dredging program complements the development to facilitate entry by larger vessels into the new Napier facilities.

7.1.2 AHURIRI HARBOUR - HAWKE'S BAY

Ahuriri was one of the earliest settled areas in Napier; its shallow but sheltered waters offered safe mooring for sailing ships in the 19th and 20th centuries. Formerly the site of Hawkes Bays' main port, the earthquake of 1931 significantly lifted the seabed and the port became unsuitable for all but small vessels. The main port was relocated to its current site at the Port of Napier. There is now only around 2m water depth in the entrance to Port Ahuriri, which has been developed as an attractive waterfront area with cafes and restaurants along the quayside. There is a marina of 100 berths, located in the inner Ahuriri harbour, with a large number of the berths for commercial fishing boats, although some berths are used for charter fishing boats, pleasure craft, yachts and launches. A further 85 marina berths are located at the Napier Sailing Club at the south end of the Ahuriri Basin.

7.1.3 CHARTING INFORMATION OBSERVATIONS – DATA GATHERING

There are several areas marked 'un-surveyed' adjacent to the coast around Cape Kidnappers and Clifton on the Approaches to Napier chart, and large areas of this chart were last surveyed in 1954.

7.1.4 AREAS OF RISK ASSESSMENT SIGNIFICANCE – RESERVES, ECOLOGICAL, CULTURAL

A coastal marine reserve at Te Angiangi, south of Hawkes Bay, protects a piece of the coastline of approximately 1.3 nm^2. There are coastal reserves at Cape Kidnappers and Ahuriri.

7.1.5 ECONOMIC SUMMARY – HAWKES BAY REGION

Over the year ended June 2015, the region recorded an annual economic activity growth rate of 2.8%, compared to the national rate of 3.5%. The NZ Institute of Economic Research is forecasting a slower annual average growth of 0.5% for the wider Hawkes Bay-Gisborne region over the next five years, compared to a forecast 1.4% nationally.

Statistics NZ's latest regional GDP estimate for the Hawke's Bay Region is $6.6b.

Total international trade volumes handled at the Port of Napier during the June 2015 year, at approximately 3.2M tonnes, were down 9% on the previous year. Cruise passengers benefited the local economy, by $20.7M. The port of Napier is a crucial link in the seagoing trade profile of New Zealand and is an innovative port that punches above its weight, given the size of its breakwater enclosure. The port has ambitious expansion plans.

7.2 TRAFFIC ANALYSIS – HAWKE'S BAY REGION

7.2.1 ALL TRAFFIC ROUTES – HAWKES BAY REGION

The main types of commercial vessels using the Hawkes Bay Region include

- Container
- General and Break-bulk
- Bulk Carriers
- Tankers
- Livestock carriers
- Passenger cruise
- Fishing

There are also occasional visits by patrolling naval vessels. Tracks into and out of Napier Port are relatively straight-forward, tracking directly around Cape Kidnappers to the south of Hawke's Bay and south of Portland Island, Mahia to the north. Non-stopping traffic bound along the east coast of the North Island passes well clear of Napier. For the port itself, Pania Reef provides a natural navigation hazard, requiring a relatively long pilotage into the harbour enclosure.

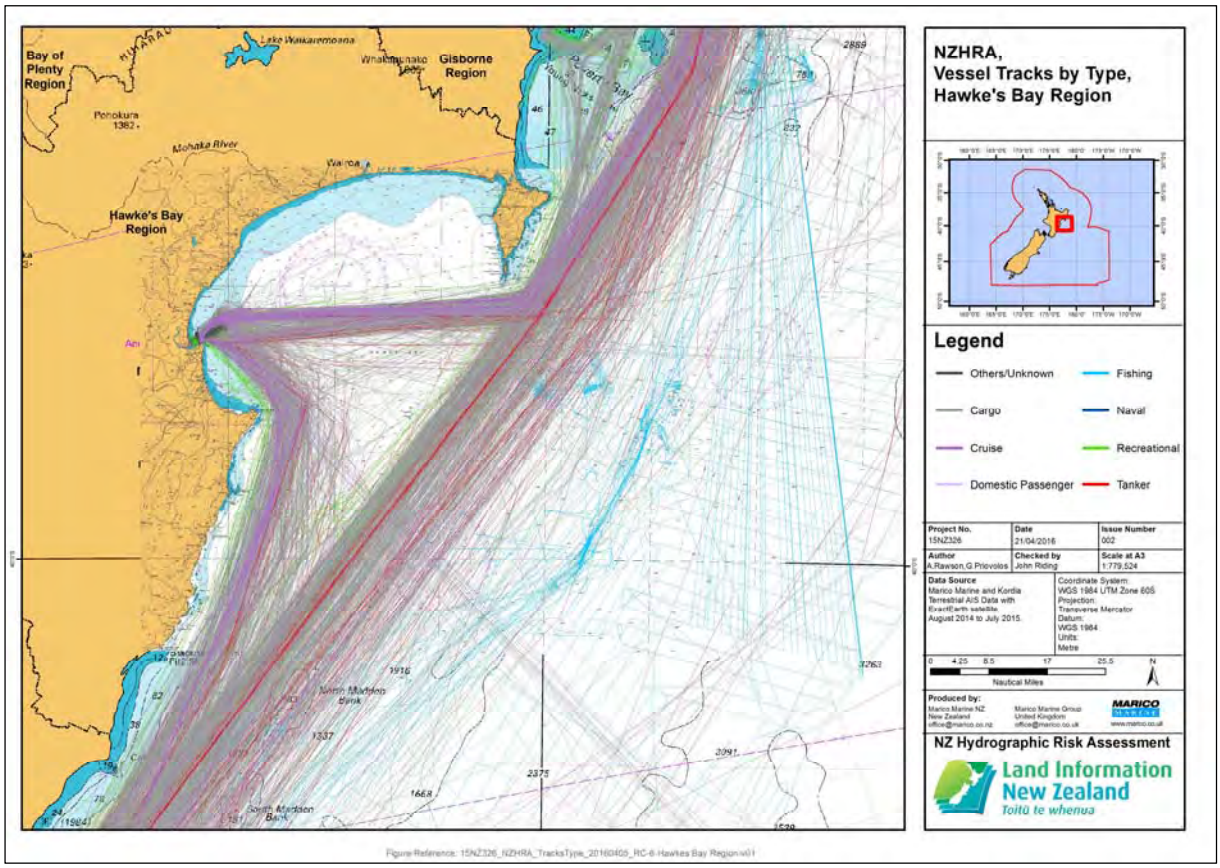


Figure 71 : Traffic Record by Type – Hawkes Bay Region

7.2.2 ALL TRAFFIC DENSITY – HAWKES BAY REGION

Although there is considerable traffic transiting the waters of Hawkes Bay in any year, much of it is offshore and passing traffic. Traffic into Hawke's Bay is generally light, with only a single naval vessel and one fishing vessel recorded, although there is more fishing traffic that was not recorded by AIS. Coastal traffic bound along the east coast of the North Island passes outside the Hawke's Bay waters, as may be seen from the traffic plots.

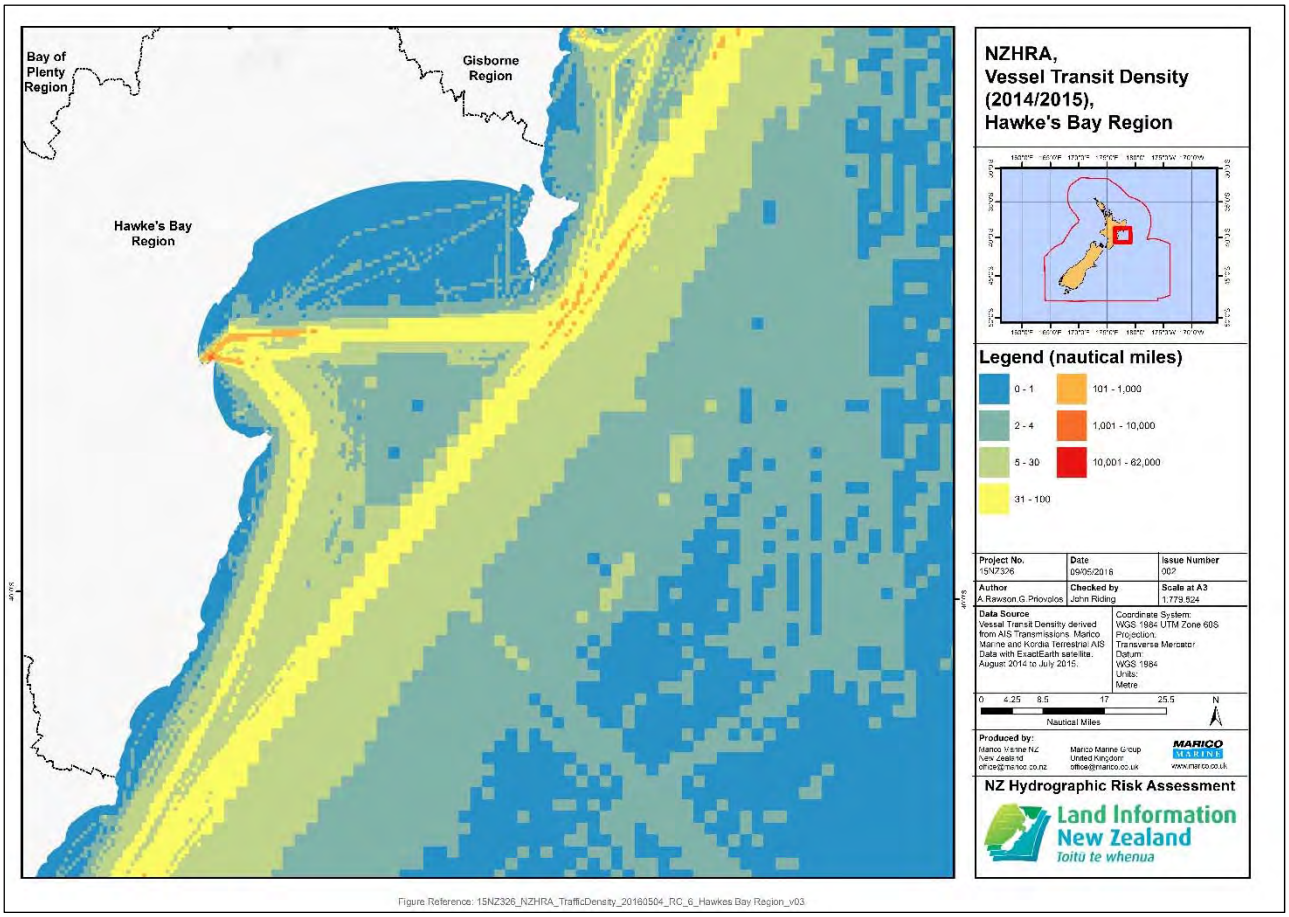


Figure Reference: 15NZ326_NZHRA_TrafficDensity_20160504_RC_6_Hawkes Bay Region_v03

Figure 72 : Plot of Traffic Density – Hawkes Bay Region

7.2.3 CARGO VESSELS – HAWKE'S BAY REGION

A total of 659 ship visits were recorded at the Port of Napier in the project year. This includes coastal traffic as well as foreign flagged vessels. Cargo vessels tracked around Cape Kidnappers to the south and pass clear of Portland Island, Mahia to the north. Napier has regular calls from coastal container vessels. Some cargo vessels were recorded standing on and off, most likely while waiting for a pilot or a berth. Passing traffic in the region is considerable, although it is well offshore. **Figure 73**, over the page, shows these vessel records, with an inset for the port of Napier record.

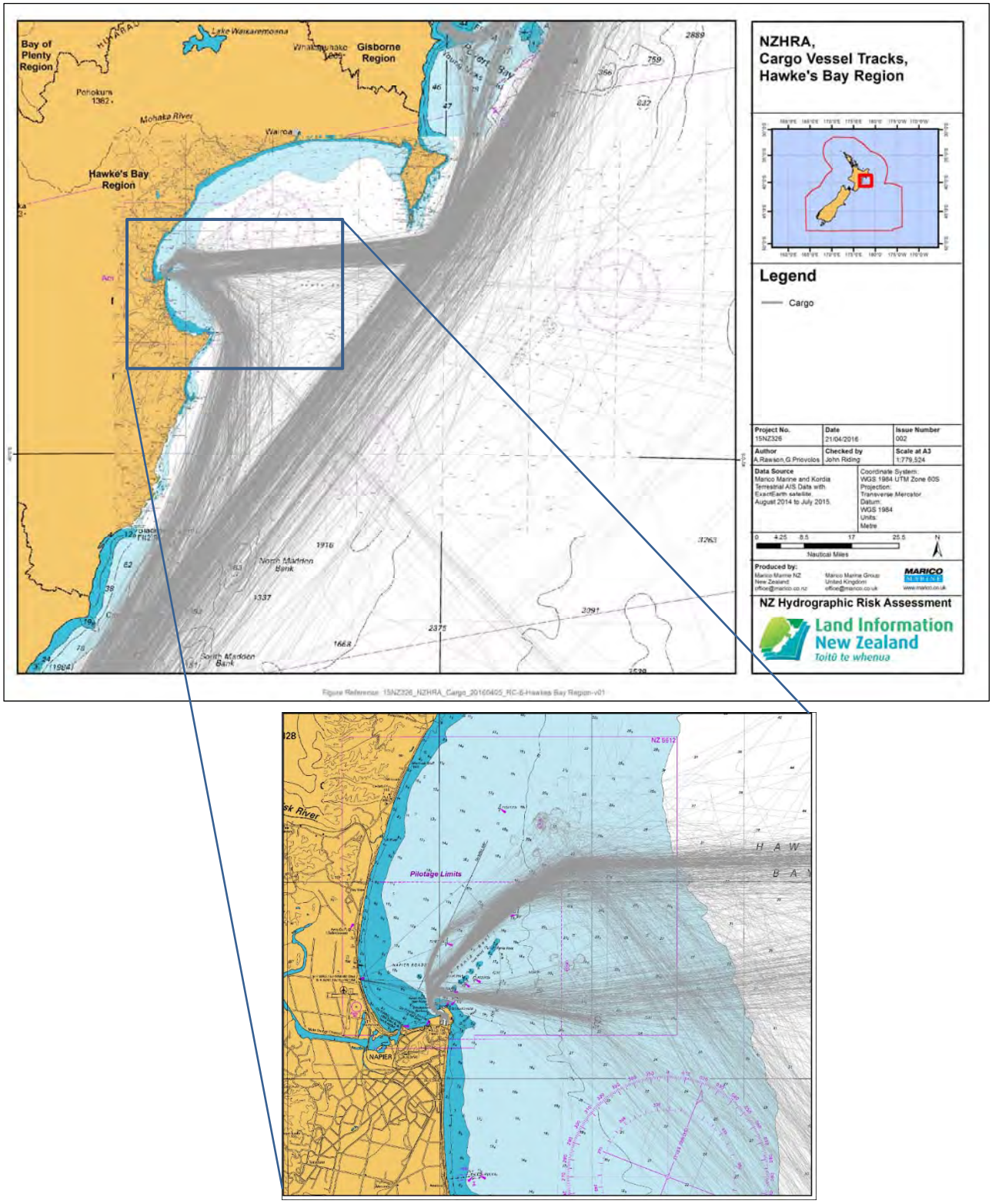


Figure 73 : General Cargo Vessels – Hawkes Bay and Napier

7.2.4 CRUISE VESSELS - HAWKE'S BAY REGION

Napier received 55 cruise vessels during the 20114-15 season. It has potential to attract more as a significant number transit past the port, especially the larger cruise vessels. Port development plans may facilitate visits from large cruise vessels.

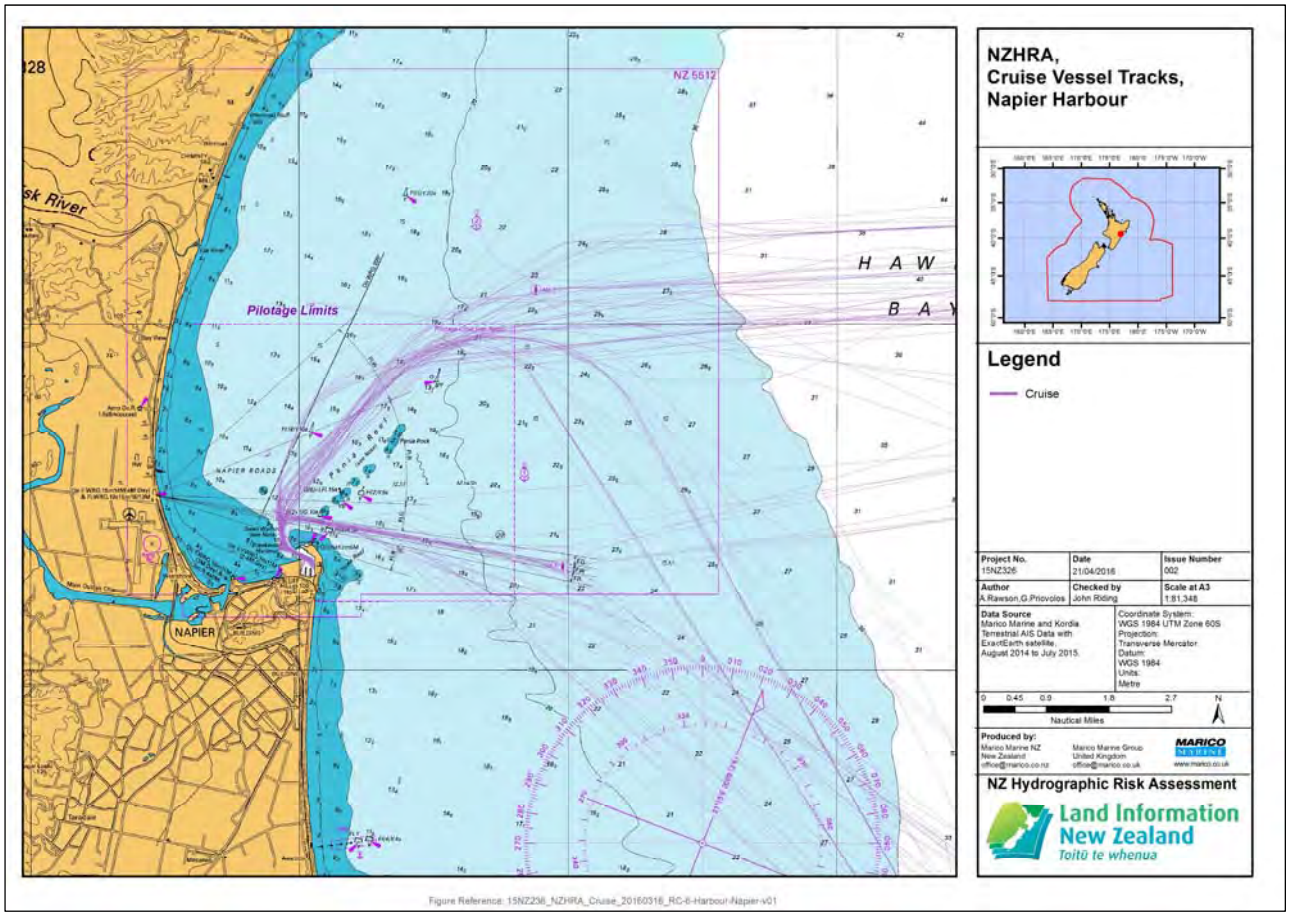


Figure 74 : Cruise Vessel Traffic into the Port of Napier

7.2.5 TANKER TRAFFIC - HAWKE'S BAY REGION

There are two clear routes taken by tankers into and out of Napier: north of Pania Reef, used by tankers transiting north; and south of Pania Reef, through the 0.25nm wide gap between Pania Reef and the Port, with almost half of the tankers that visited Napier during the year using this route, even when transiting to or from the north.

7.2.6 COMMERCIAL FISHING VESSELS – HAWKES BAY REGION

There are 40 fishing vessels currently based in Napier. Fishing vessels operating out of Napier are generally of the smaller inshore vessel type, not fitted with AIS. These craft operate along the length of the Wairarapa Coast and as far as north as East Cape. Track patterns of fishing vessels from AIS

produce some confusion, as although there is offshore fishing activity, the track record does suggest there were also fishing vessels providing offshore survey services in the Hawkes Bay region during the 12 month period of the data set.

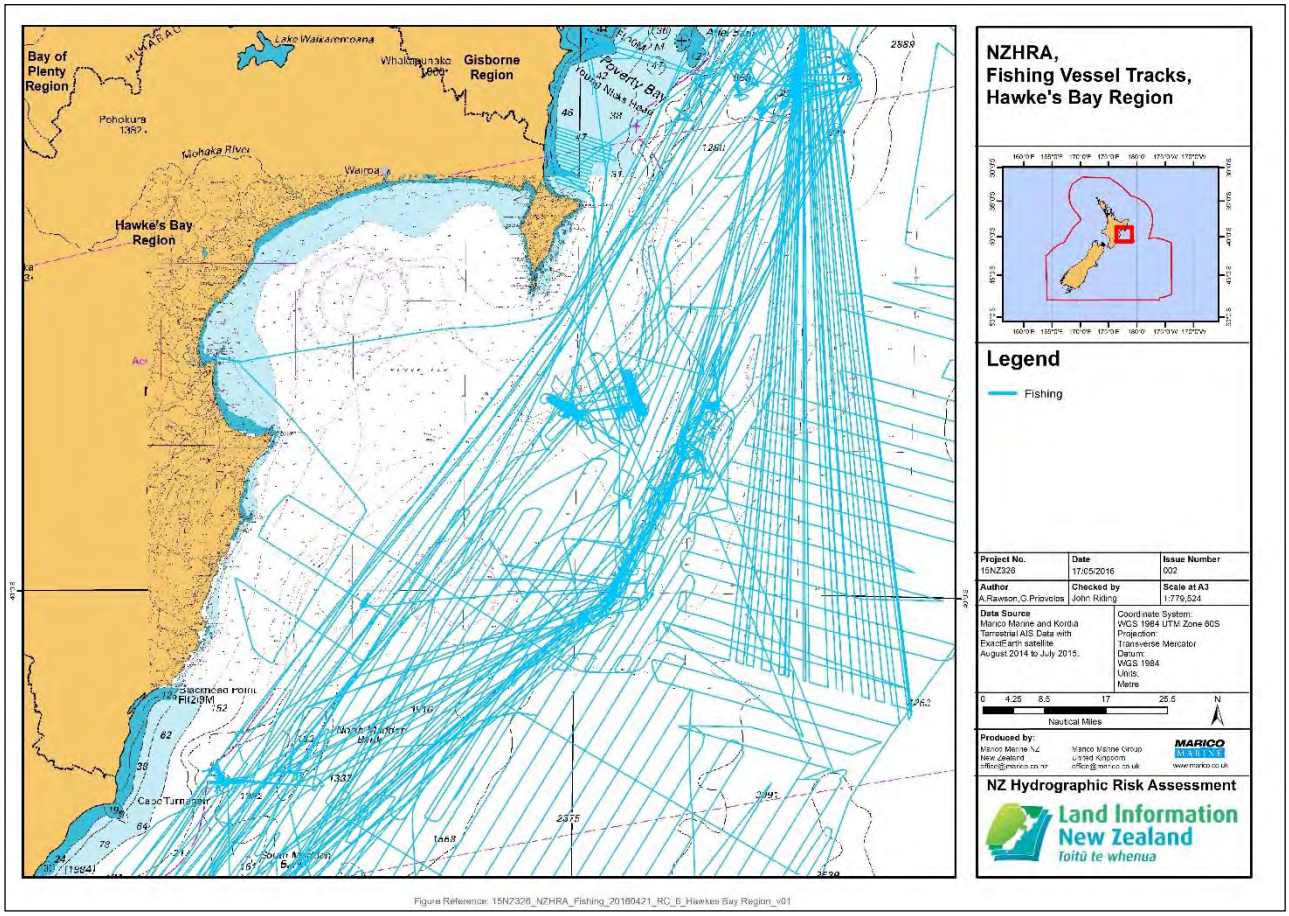


Figure 75 : Fishing Vessel Record (AIS) – Hawkes Bay Region

7.2.7 RECREATIONAL FISHING VESSELS - HAWKE'S BAY REGION

Recreational fishing is a popular recreational activity in Hawke's Bay, with an active charter market in evidence. No recreational vessels appeared in the record operating out of Napier.

7.2.8 RECREATIONAL CRAFT IN GENERAL - HAWKE'S BAY REGION

There are few large recreational vessels based in Napier; most of the recreational craft are trailer boats, with the exception of the marina-based vessels, many of which are sailboats.

7.3 HYDROGRAPHIC RISK – HAWKES BAY REGION

The most frequently used routes into and out of Napier have been surveyed within the last 12 years (2004) however the areas commonly used by cargo vessels to anchor were surveyed in 1980. Data

on the type of sea bed is scarce here and these areas show heightened risk, partly due to the focus of traffic routes in the region. There are several areas marked 'un-surveyed' along the coast around Cape Kidnappers and Clifton on the Approaches to Napier chart NZ561, and large areas of this chart were last surveyed in 1954.

The main cargo routes along coastal Hawke's Bay are low to medium risk.

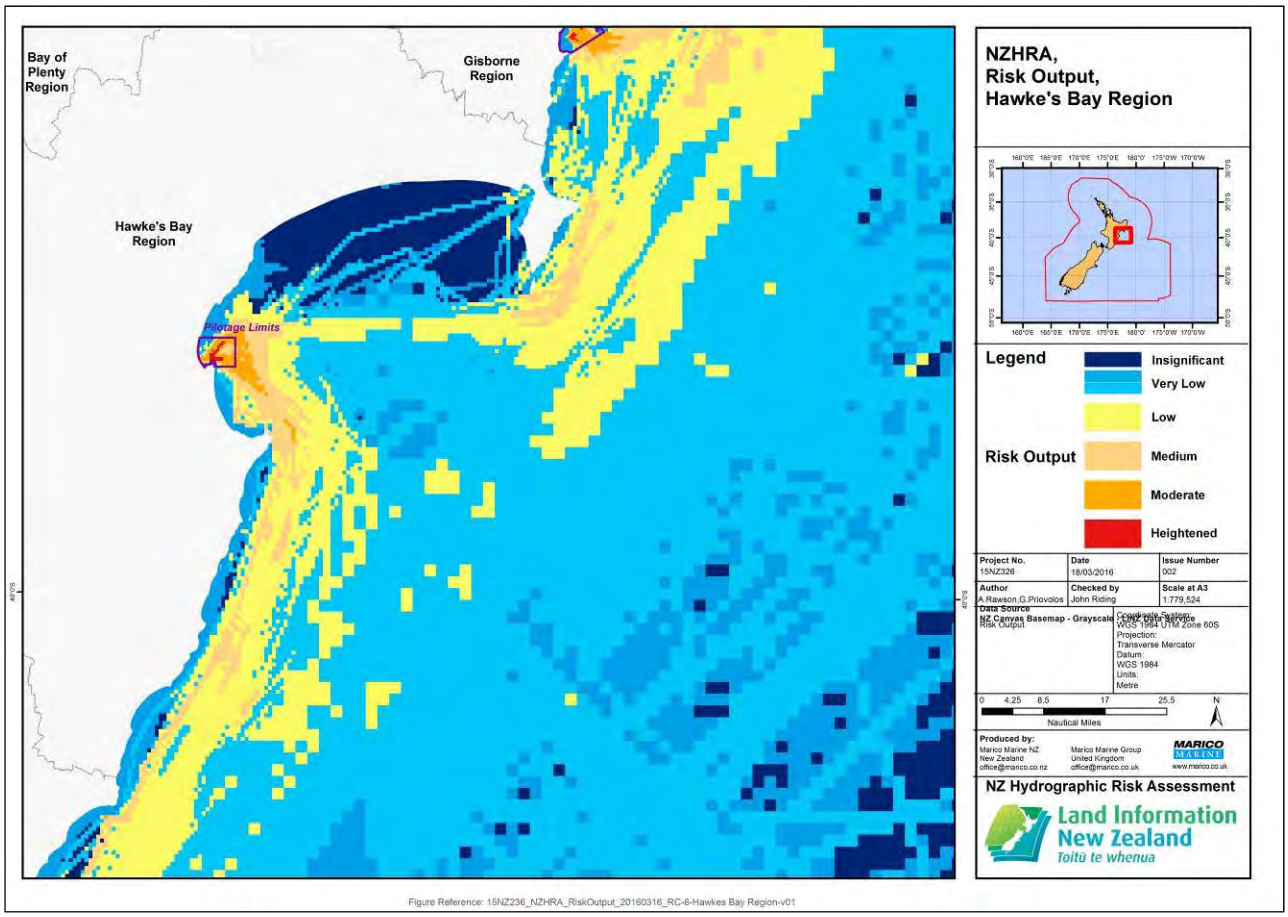


Figure 76 : Hydrographic Risk – Hawke's Bay Region

Hydrographic risk in the Hawkes Bay region varies; in part this is because of the characteristics of the traffic pattern. The port approaches show a rise in risk to the pilotage limit, with an area of heightened hydrographic risk into the harbour itself (**Figure 77**).

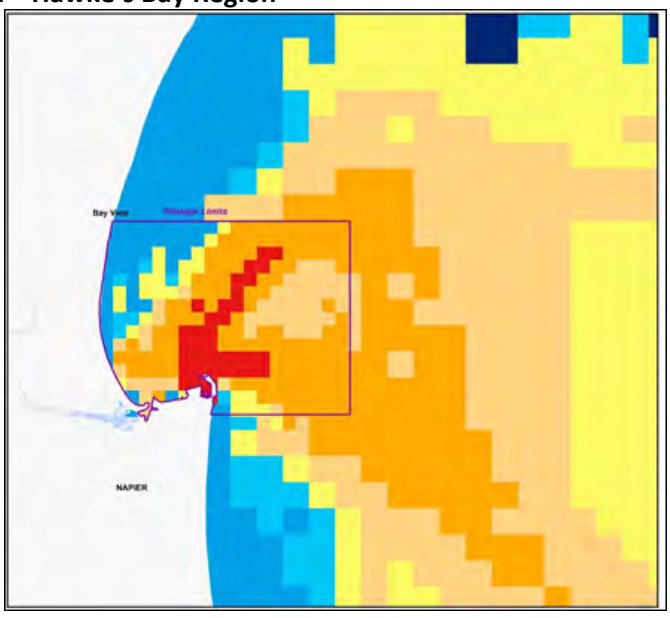


Figure 77 : Napier Harbour and Approaches – Heightened Risk

7.3.1 CHARTING BENEFIT – HAWKES BAY REGION

The southern coastal area of the southern part of Hawkes Bay region shows a moderate charting benefit result, in areas where traffic transits provide focus. A coastal route east of Mahia Peninsula, outside the SL4 shipping route surveyed by LINZ, also shows moderate benefit. The port andassociated approaches provide further areas for review. Elsewhere in the region the benefit is marginal to negative.

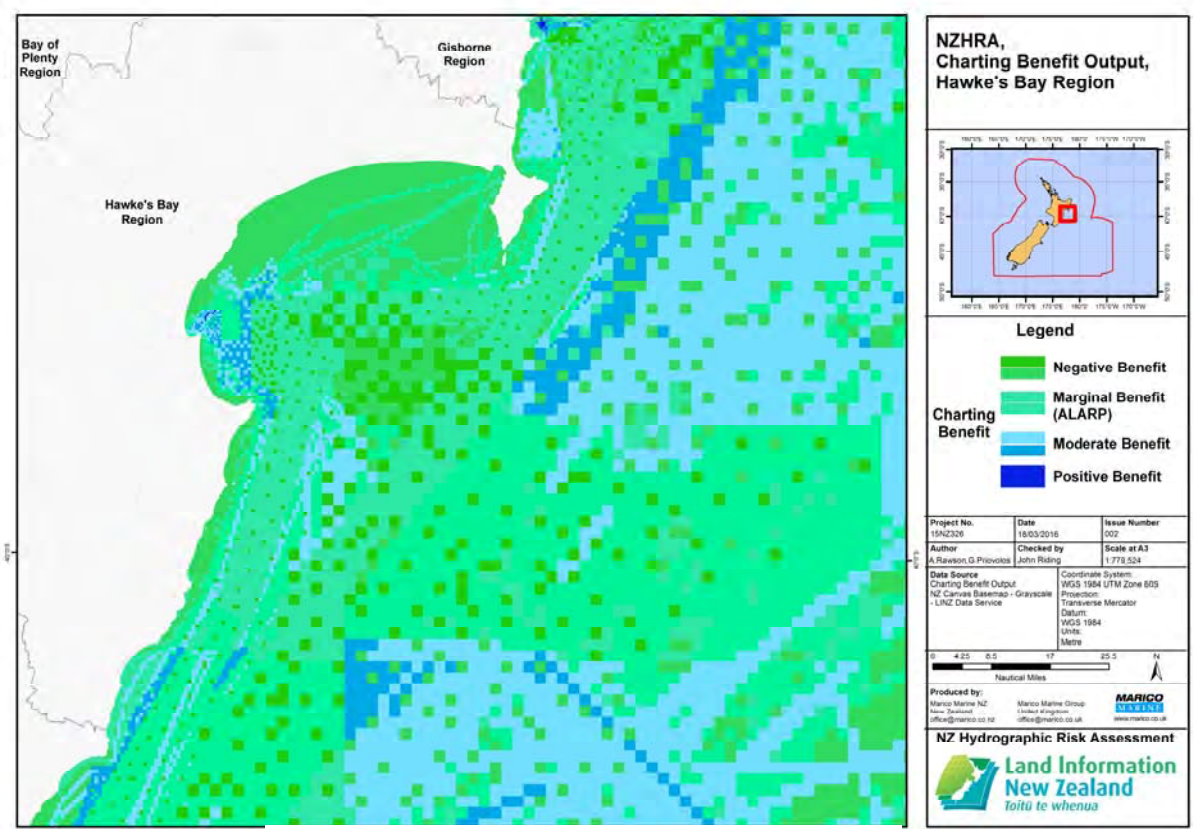


Figure 78 : Charting Benefit – Hawkes Bay Region

7.3.2 CHARTING BENEFIT – NAPIER HARBOUR

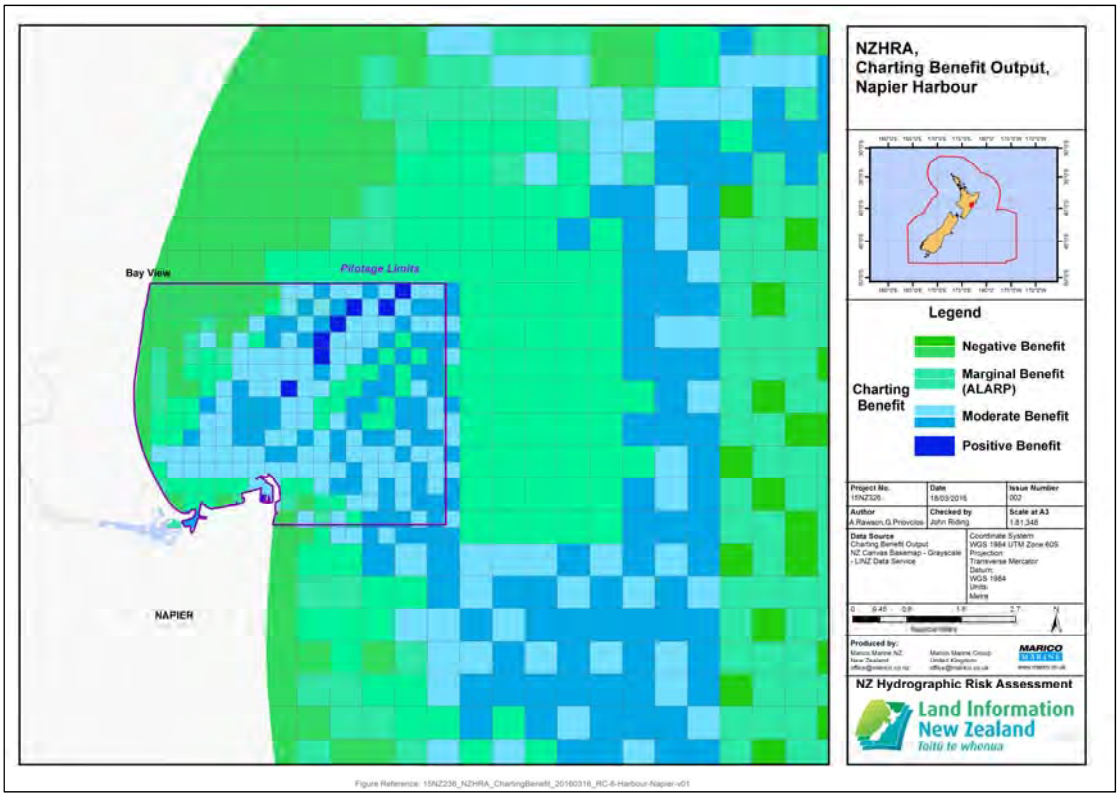


Figure 79 : Charting Benefit - Napier Harbour

Areas of positive benefit show in the approaches to Napier in the high traffic areas to the north and south of Pania Reef with moderate benefit showing in the ship anchorage areas and offshore reflecting the chart source survey data age.

8 HYDROGRAPHIC RISK RESULTS - MANAWATU-WANGANUI REGION

8.1 INTRODUCTION

Manawatu-Wanganui is a region whose main population centres are the cities of Palmerston North and Wanganui. It is administered by the Manawatu-Wanganui Regional Council, which for trading purposes is known as Horizons Regional Council.

Located on the South Taranaki Bight, Wanganui (or Whanganui) lies on the north-western bank of the Whanganui River, the longest navigable river in New Zealand, covering 290km from Mount Tongariro to the Tasman Sea.

The Wanganui Port, once a centre of transport remains with some vessel traffic across the bar entrance. The river is prone to flooding after heavy rain in the catchment.

8.1.1 ECONOMIC – VESSEL CONSTRUCTION AND REPAIR

The Q-West boat building operation is based at the port, specialising in aluminium construction. The company is engaged in building two 34m passenger ferries for Auckland ferry company Fullers. Q-West have recently built the new pilot boat for Tauranga and constructed two vessels for the NZ Police.

8.1.2 WANGANUI PORT

Wanganui's Port facilities are located at the mouth of the Whanganui River and are managed by Wanganui Port (2010). The port is operated by a joint venture between Tupoho Whanau Trust and the Wanganui District Council.

The Port provides wharves and docking facilities for small coastal freight vessels and commercial boats. The facility includes 580 lineal metres of wharf space and three warehouse buildings for storage use. There is also a city wharf for mooring pleasure craft, sited further up the Whanganui River.

8.1.3 CHARTING INFORMATION OBSERVATIONS – DATA GATHERING

Wanganui and approaches were last surveyed in 1993. The location and depth of the deepest water in the approaches changes after adverse weather and the leads may be altered to reflect these changes. Local knowledge is recommended for using this entrance.

8.2 TRAFFIC ANALYSIS – MANAWATU-WANGANUI REGION

The types of commercial vessels using the Port of Wanganui include: Small General / Break-bulk Coastal; Locally Built Q-West Vessels; Fishing Vessels

8.2.1 TRAFFIC ROUTES WEST MANAWATU-WANGANUI AND WANGANUI REGION

All vessels using the Port of Wanganui have to cross a shallow bar at the river entrance, restricting the draught of vessels that can enter here. The research vessel *Ikatere* which was built at Q-West in Wanganui, made one trip into the harbour to berth at Castlecliff during the project year.

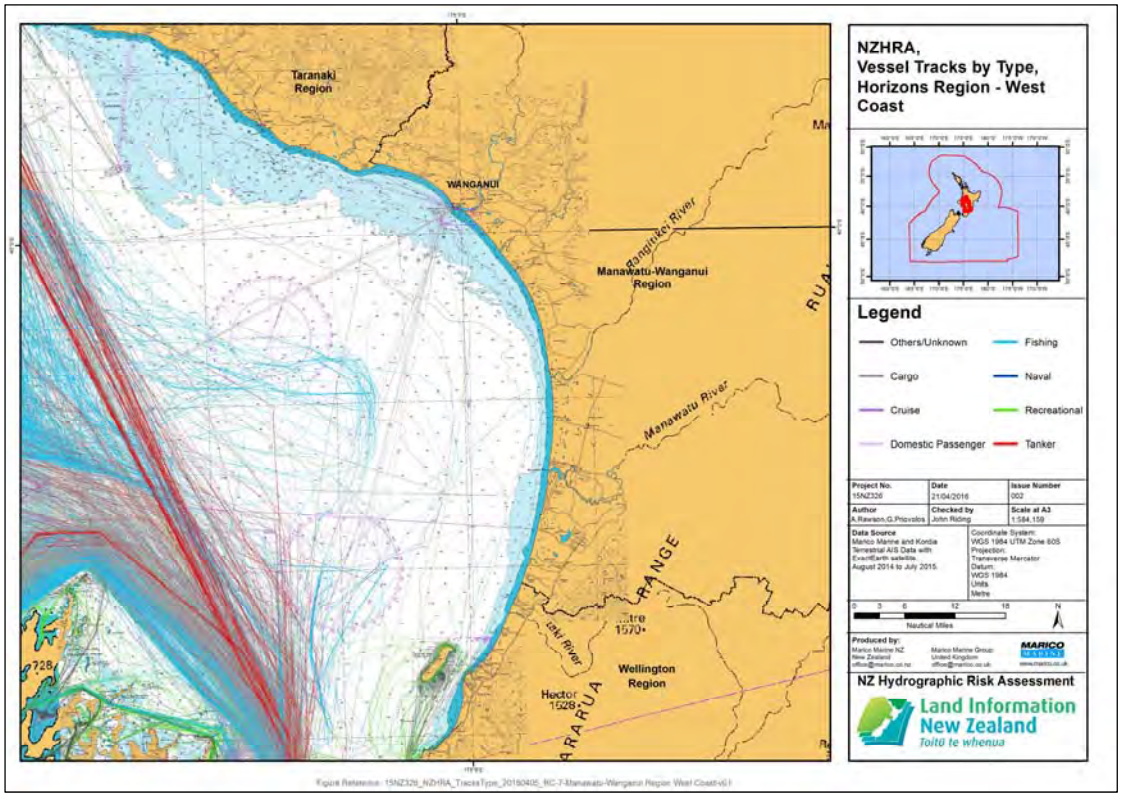
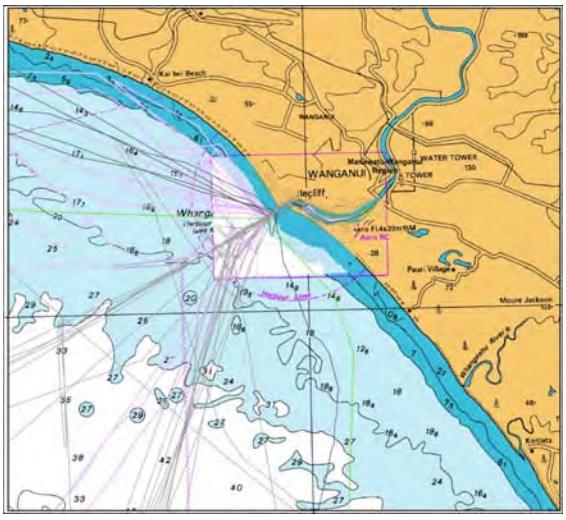


Figure 80 : Vessel Traffic Overall – Manawatu-Wanganui Region.



The insert shows a traffic image of Wanganui port.

8.2.2 TRAFFIC ROUTES EAST MANAWATU-WANGANUI AND WANGANUI

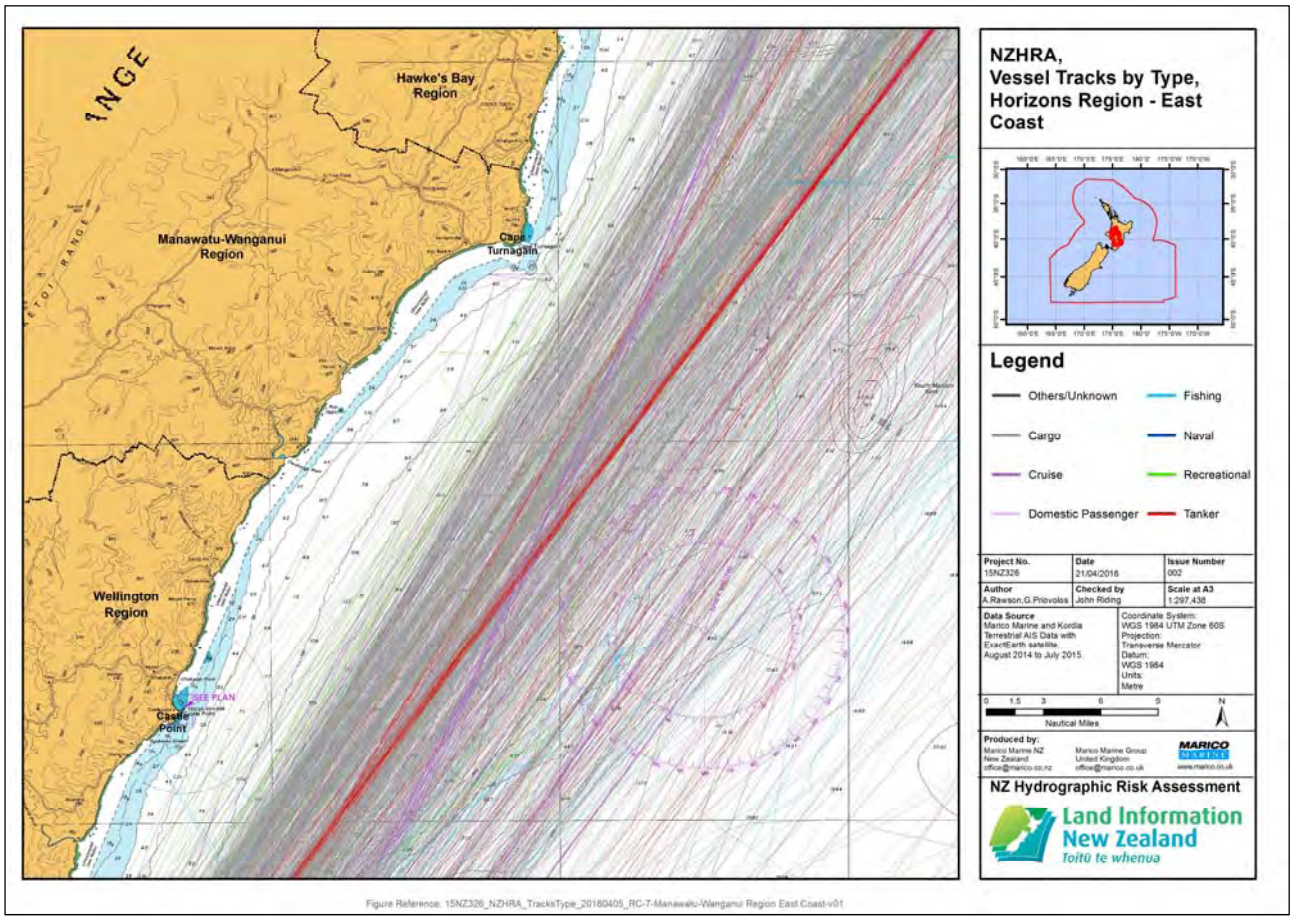


Figure 81 : Traffic Profile – East Manawatu-Wanganui Region

This is an area of costal transit traffic with most traffic a suitable distance offshore. The regional council coastal area on the East Coast is limited, but mostly remote.

8.2.3 TRAFFIC DENSITY – MANAWATU-WANGANUI REGION

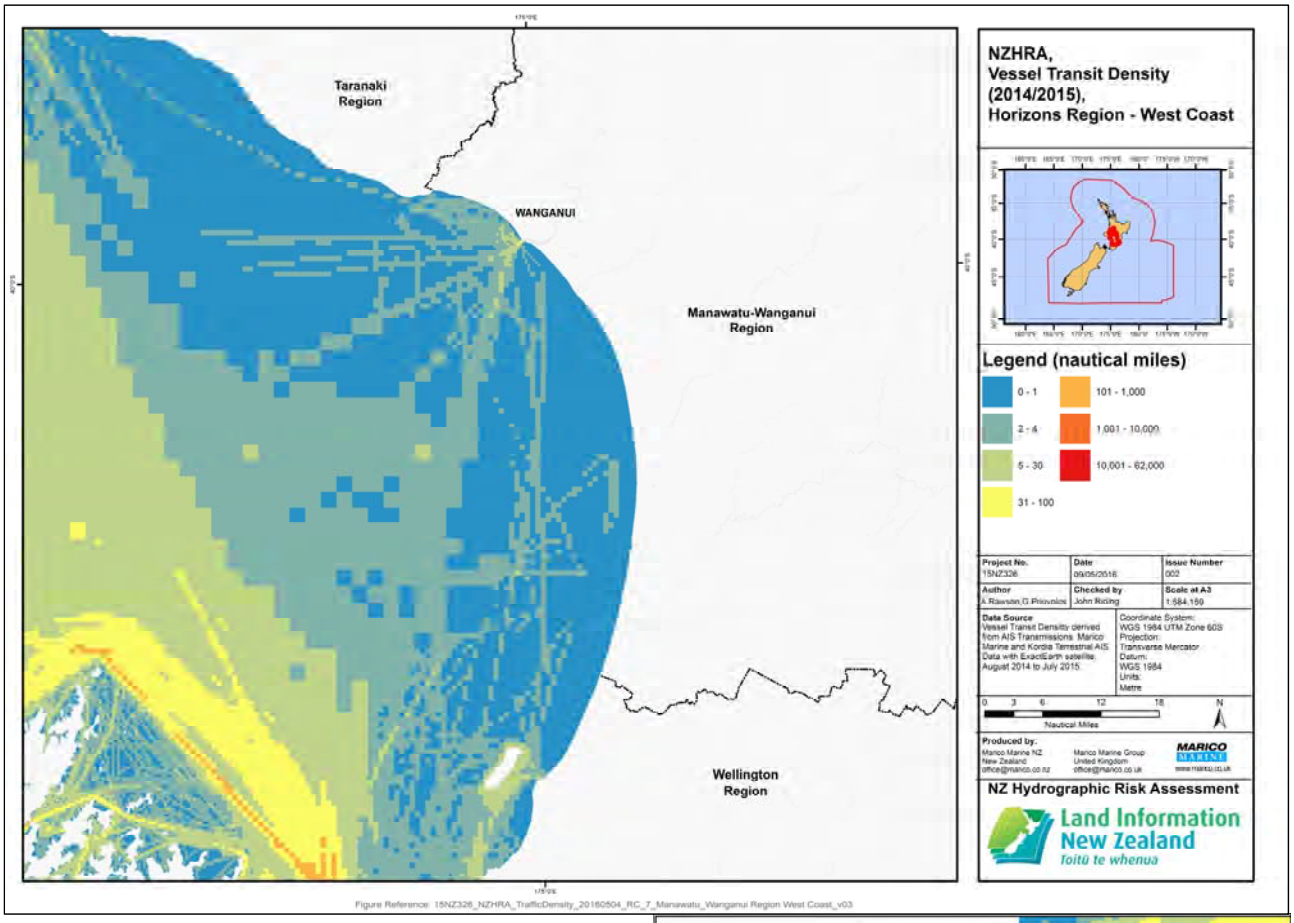
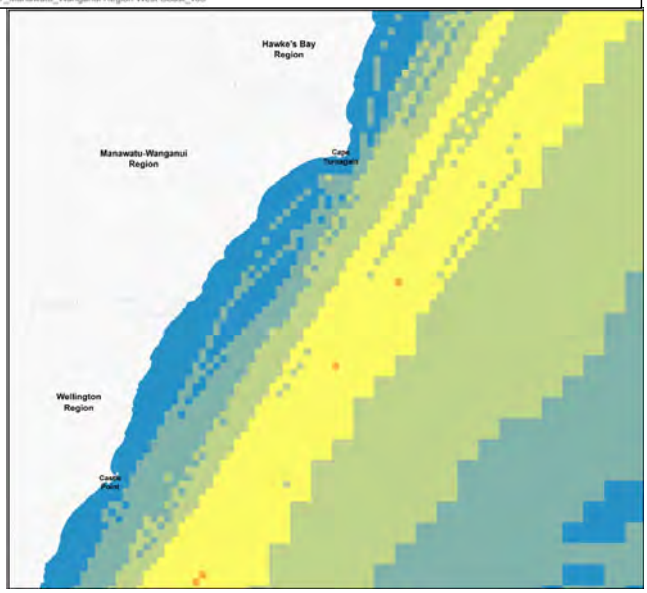


Figure 82 : Traffic Density Manawatu Wanganui



Traffic Density through this Region's waters is generally low.

8.2.4 CARGO VESSELS – MANAWATU WANGANUI

The 51m bulk carrier *Anatoki* made 11 trips across the Wanganui bar to Castlecliff Wharf. The vessel's loaded draught (4.2m) enables access to Wanganui, Westport and Greymouth. No other cargo vessels used the port.

On the East Side of the Manawatu-Wanganui region, along the Wairarapa Coast, all coastal cargo vessels passed 2nm or more off Cape Turnagain. This is a natural point where transiting traffic close onto the coastline.

8.2.5 DOMESTIC PASSENGER VESSELS - WANGANUI

Te Kotuku, a 334-passenger ferry and one of the biggest builds from Q-West boat builders, headed over the bar and into the Tasman Sea on its maiden voyage for engine commissioning and sea trials during the project year. The vessel then sailed to the Hauraki Gulf, to join other Fullers ferries.

Ten Seventy, an 18m high speed survey craft with adjustable foil amidships, built at Q West and capable of carrying six passengers, also launched during the project year and made trips across the bar for commissioning and sea trials before delivery to Auckland.

8.2.6 TANKER TRAFFIC – MANAWATU-WANGANUI

There was no tanker traffic into Wanganui during the year. The direct route between Cook Strait and Taranaki across the South Taranaki Bight took tankers around 50nm off Wanganui. On Manawatu-Wanganui's east coast, tankers transited along the rugged Wairarapa Coast 12-25nm offshore.

8.2.7 COMMERCIAL FISHING VESSELS

Two small paua / crayfish vessels call Wanganui their home port. Neither of these is fitted with AIS. Other fishing vessels occasionally call in here to discharge, including crayfish, gill-net and inshore trawlers, none of which were recorded on AIS. On the region's eastern shores, the Wairarapa Coast is home to 20 or more small crayfish and paua boats, all trailer-launched off the rocky and inhospitable shore. The majority of larger fishing vessels stayed more than 15nm off the Wanganui coast and more than 6nm off the Wairarapa Coast.

8.2.8 RECREATIONAL CRAFT IN GENERAL

Wanganui harbour contains a trailer boat ramp and trailer park where, on a good day, more than 150 recreational boats launch to head out to sea to catch fish. Rowing on the river is strongly supported, but there are few other types of recreational craft. On Wanganui-Manawatu's eastern coast, there is no shelter and there are few recreational boats.

8.3 HYDROGRAPHIC RISK – WEST MANAWATU-WANGANUI

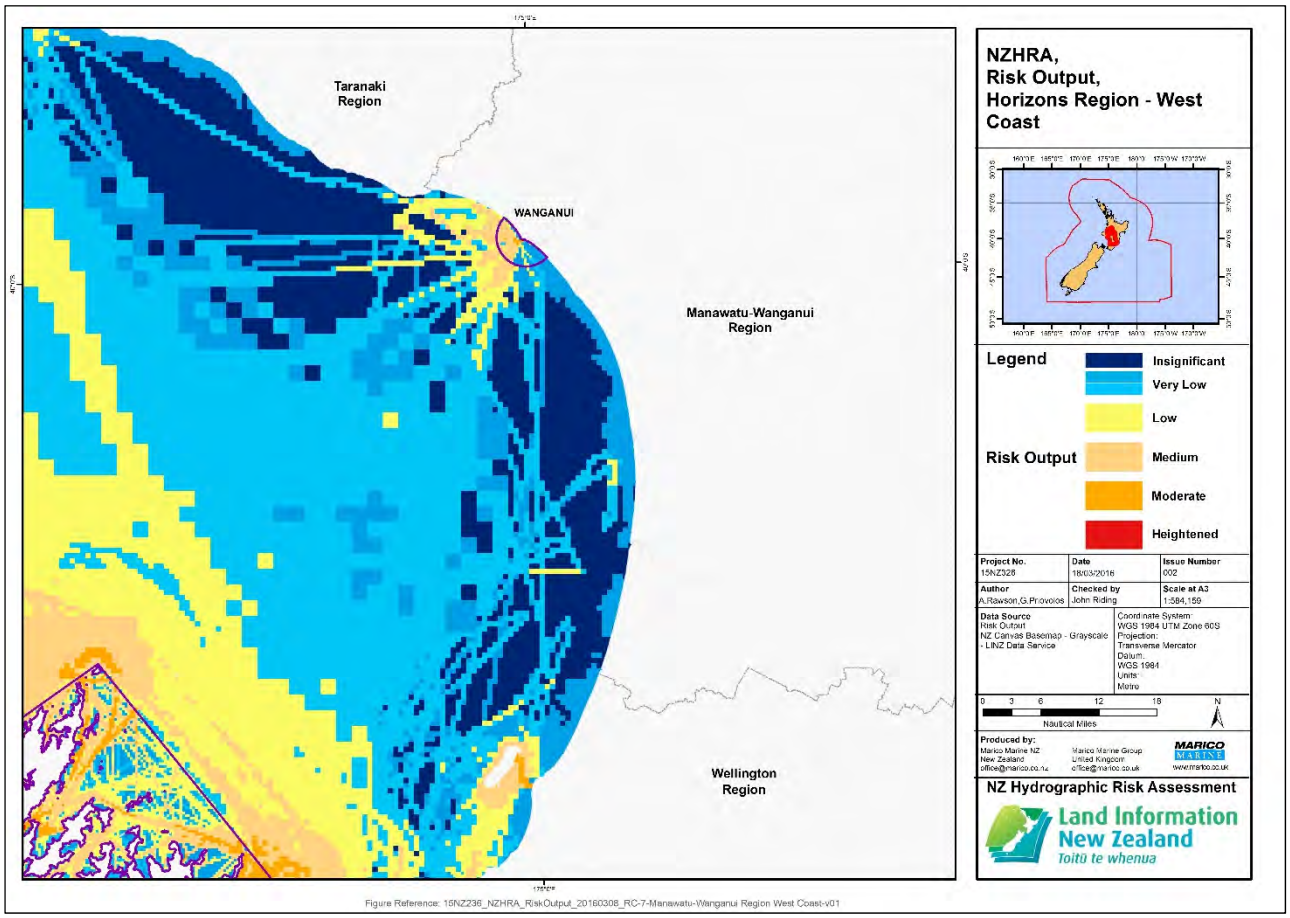
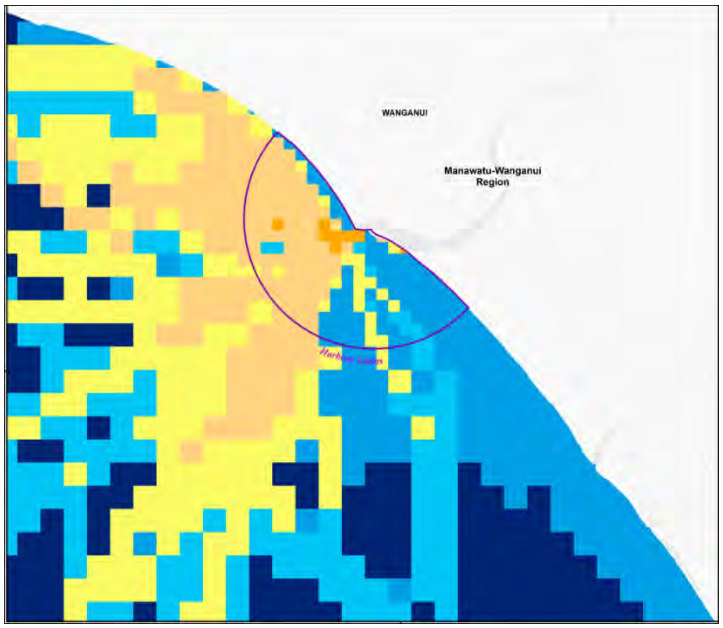


Figure 83 : Hydrographic Risk - West Manawatu – Wanganui



The West Manawatu-Wanganui Region has a very low to insignificant risk result overall, with an area of medium and a few cells of moderate risk at the approaches to Wanganui and at the bar entrance to the port of Wanganui.

8.4 HYDROGRAPHIC RISK – EAST MANAWATU

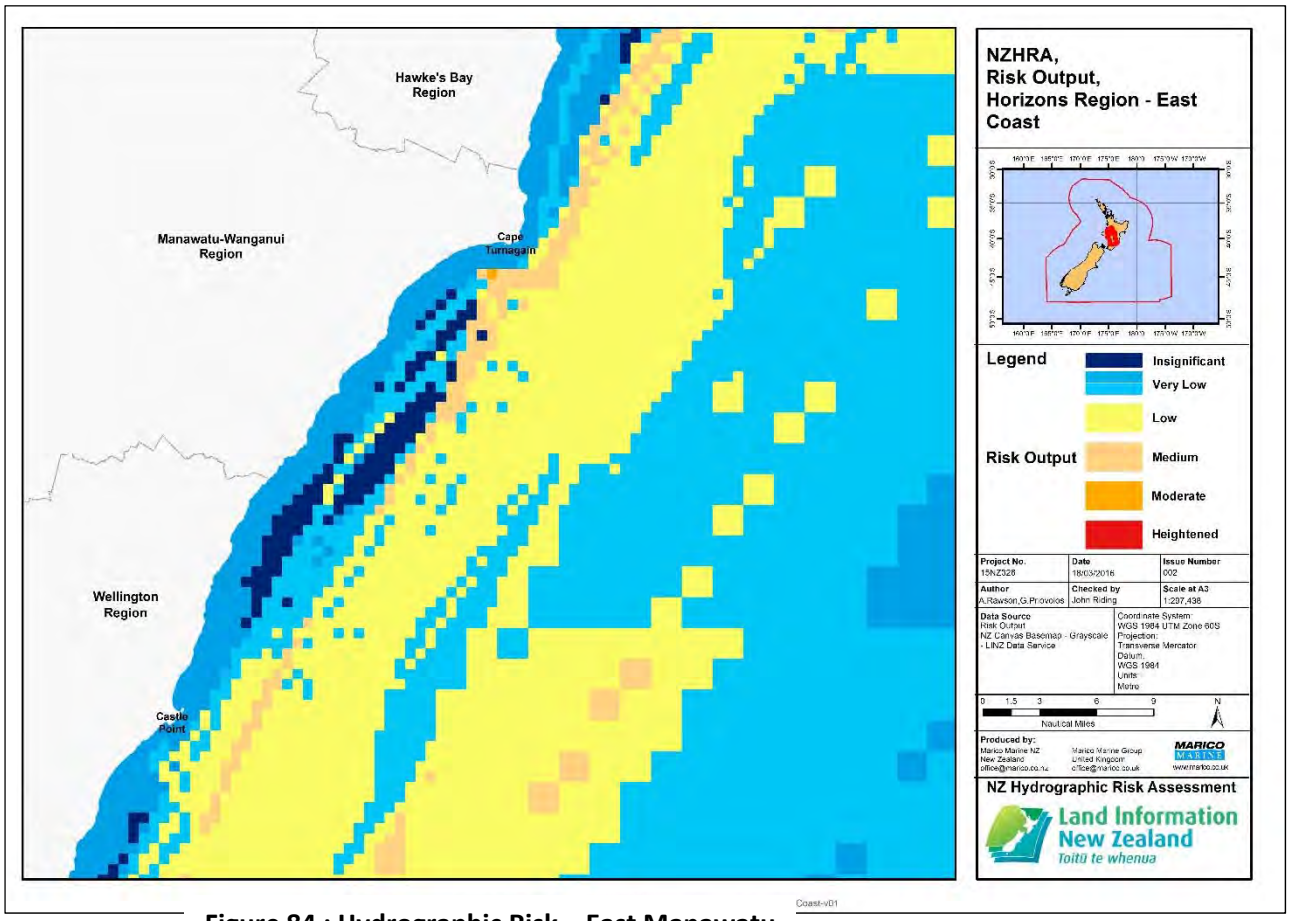


Figure 84 : Hydrographic Risk – East Manawatu

The short coastal stretch of Wairarapa Coast that falls into the Manawatu-Wanganui Region shows a low to insignificant hydrographic risk with a medium risk along the most frequented coastal vessel routes, last surveyed in 1953-55. The Medium risk area closes with the shore near Cape Turnagain where cruise vessels have paused near the cape, possibly for shelter, adjacent to the near-shore area marked on chart NZ57 as 'Unsurveyed.'

8.5 CHARTING BENEFIT– WEST MANAWATU-WANGANUI

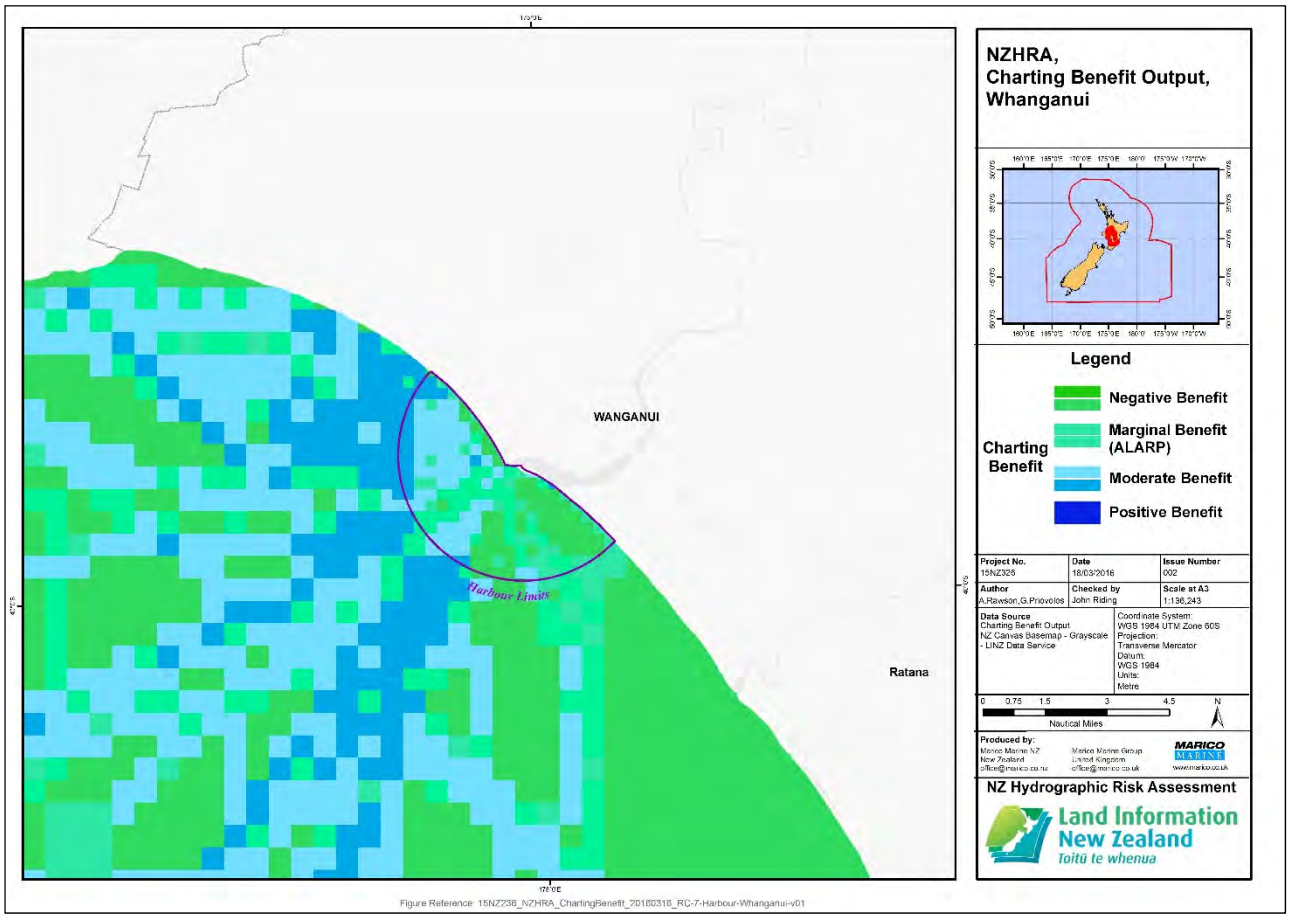


Figure 85 : Charting Benefit – Wanganui Harbour

On the western coast of the Manawatu-Wanganui Region, the charting benefit shows areas of moderate benefit following the converging vessel tracks into the port with the survey date of 1993 contributing, and showing negative and marginal benefit elsewhere.

8.6 CHARTING BENEFIT– EAST MANAWATU

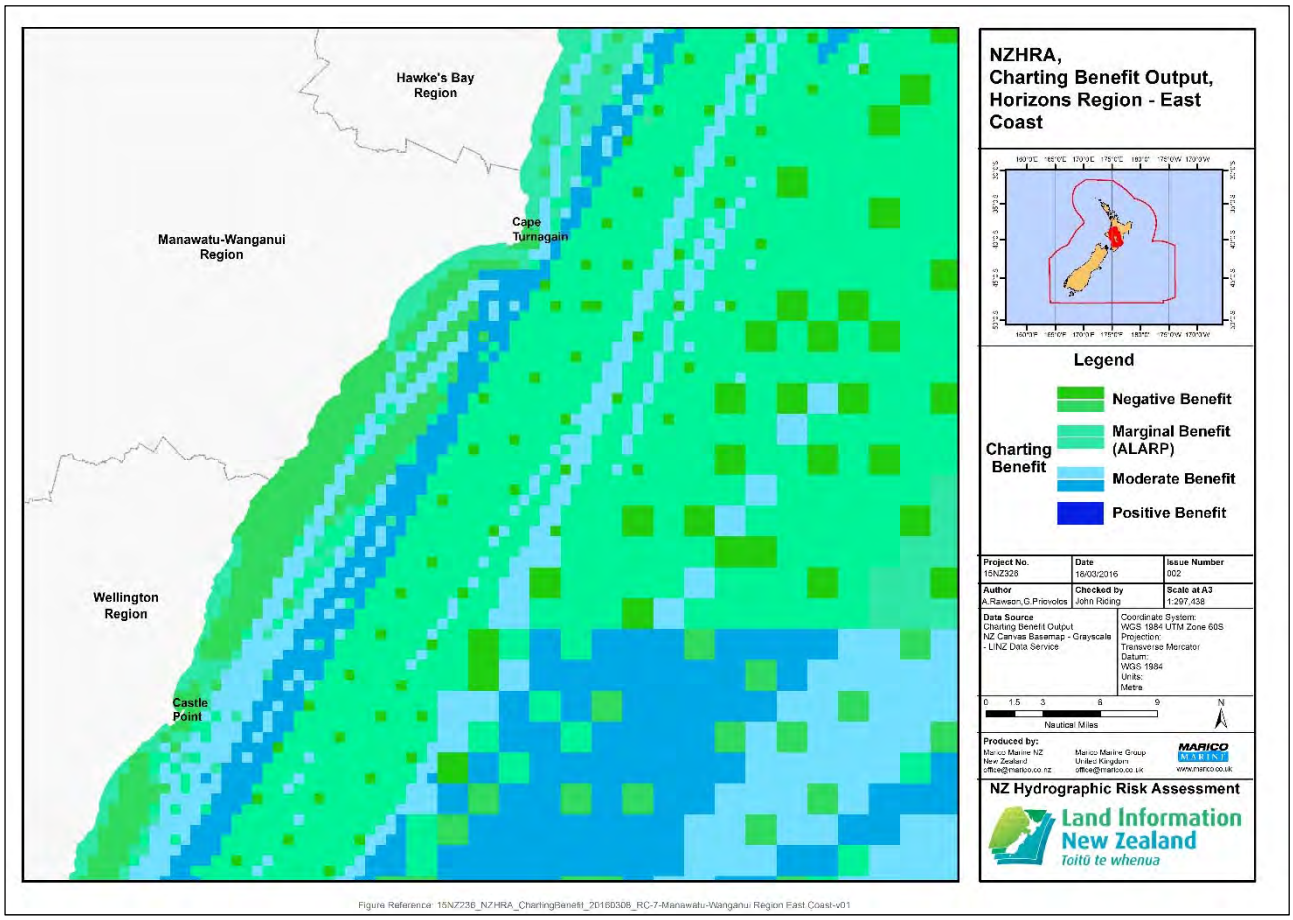


Figure 86 : Charting Benefit – Wairarapa Coast

The charting benefit along the East Manawatu's section of the Wairarapa Coast shows moderate benefit along the most frequented coastal vessel routes, due to the survey dates here. Offshore in deep water from Castle Point a large area of Moderate benefit reflects the poor survey quality. Elsewhere on this Region's stretch of coast there is a negative to marginal charting benefit.

9 HYDROGRAPHIC RISK RESULTS – GREATER WELLINGTON REGION

9.1 INTRODUCTION - WELLINGTON REGION

The narrow entrance to Wellington Harbour lies eastward of the Miramar Peninsula, and faces south to the Cook Strait. The harbour entrance contains the dangerous shallows of Barrett Reef, where many ships have been wrecked (notably the inter-island ferry *Wahine* in 1968). Barrett Reef, much of which is exposed at high tide, is located on the western side of the Wellington Harbour entrance channel. Due to the channelling effect of Cook Strait, the currents at the entrance are strong and unpredictable at times; gales are common. Currents in the harbour approaches are further influenced by the prevailing wind direction.

A significant volume of traffic uses the Cook Strait and harbour entrance channel. Three pilot boarding areas are located roughly west of Baring Head, with a fourth pilot boarding area 'Delta' inside the entrance, east of Steeple Rock, reserved for use when safe pilot boarding is not possible outside the harbour.

Wellington tops the mean wind speed comparisons for New Zealand with the notable exception of the Chatham Islands, and ranks number 3 behind Kaikoura and Scott Base, Antarctica for the number of gale force days. Wellington averages 173 days a year with wind gusts greater than about 60 km/h (32 knots) and gales in the Wellington region regularly measure gusts over 140 km/h (75 knots).

The entire harbour is relatively safe for large and small ships, with few rocks, good depths in almost every part, and a tidal range of no more than 1.5m (excluding springs). The harbour has three islands: Somes (Matiu), Ward (Mākaro) and little Mokopuna Island.

The signal station at Beacon Hill is fitted with modern vessel tracking equipment and monitors Wellington Harbour traffic 24/7. For communication, Beacon Hill operates on VHF channels 16 and 14.

9.1.1 ALL TRAFFIC ROUTES - WELLINGTON REGION

Large Vessel traffic in Wellington region is dominated by the inter-island ferry traffic. Five ferries operate the 50 nm route, taking around three hours to complete the crossing and carrying over 1.3M passengers per year as well as vehicles and livestock, between Wellington and Picton. There are also regular harbour passenger commuter services, with growing passenger numbers.

Commercial vessels approaching Wellington Harbour from the west and intending to use the leading line must join the leading line at least 2nm south of Barrett Reef buoy. Recommended tracks for

vessels of 18m or more in length are detailed in Schedule 6 of the Wellington Region Navigation and Safety Bylaws.

As Wellington Harbour has only one narrow entrance less than 800m wide, all vessels use the same approach between Barrett Reef and Pencarrow Head. Small vessels tend to keep to the sides of the main channel, especially if a ferry or other commercial traffic is transiting at the same time. Once inside past Steeple Rock, small vessels frequently pass over the Falcon Shoals. The outbound commercial vessel course passes close to the east of Falcon Shoals and Falcon Shoal light beacon.

9.1.2 PORIRUA HARBOUR – WELLINGTON REGION

Porirua Harbour is mostly used by small boats, although catamaran ferry services have operated out of Mana in the past. It has a busy marina and the Harbour provides an anchorage for a number of recreational craft. Mana Marina, with 305 berths, is located near the entrance to Porirua Harbour and the Pauatahanui Estuary.

9.1.3 COOK STRAIT – WELLINGTON REGION

Cook Strait lies between the North and South Islands of New Zealand. It connects the Tasman Sea on the northwest with the South Pacific Ocean on the southeast. It is 11.3 nm wide at its narrowest point, and is considered by mariners to be one of the most dangerous and unpredictable waters in the world.

The strait often experiences rough water and heavy swells from strong winds, especially from the south. New Zealand's position directly athwart the roaring forties means that the strait funnels westerly winds through the strait, deflecting them into northerlies.

The waters of Cook Strait are dominated by strong tidal flows. The tidal flow through Cook Strait is unusual in that the tidal elevation at each ends of the strait are almost exactly out of phase with one another, so high water on one side meets low water on the other. Strong currents result, with almost zero tidal height change in the centre of the strait. Although the tidal surge should theoretically flow in one direction for six hours and then the reverse direction for six hours, a particular surge might last eight or ten hours with the reverse surge depleted. In especially boisterous weather conditions the reverse surge can be negated altogether, and the flow can remain in the same direction through three surge periods or longer. This anomaly is indicated on marine charts for the region. Maximum tidal flows may exceed 5 knots at spring tides.

Furthermore, the submarine ridges running off from the coast complicate the ocean flow and turbulence. Strong currents around Karori Rock form the Karori Rip, extending up to 2.75 nm

offshore, where currents may also exceed 5 knots. In a spring tide mid ebb and southerly storm conditions, wind over tide conditions produce steep and dangerous seas in this area.

The seafloor topography is particularly irregular around the coast of the South Island where the presence of islands, underwater rocks, and the entrances to the sounds, create violent eddies. As a result of the severe wind and sea conditions, ferry sailings are regularly suspended.

Submarine power cables cross Cook Strait between Oteranga Bay in the North Island and Fighting Bay in the South Island as part of the HVDC Inter-Island electricity link between Benmore in the South Island and Haywards in the North Island. The cables are laid on the seabed within a legally defined zone called the cable protection zone (CPZ). The CPZ is about 3.8 nm wide for most of its length, narrowing where it nears the terminals on each shore. Fibre optic cables are also laid on the seabed within the CPZ. These carry national telecommunications across Cook Strait. Fishing activities and anchoring of boats are prohibited within the CPZ.

9.1.4 CentrePort Limited

CentrePort is 76.4% owned by Greater Wellington Regional Council via subsidiary holdings and 23.6% owned by Horizons Regional Council (via MWRC Holdings Limited). Approximately 10.5M tonnes of cargo is handled by the port in the year, including interisland volumes, worth around $3.5b. Centreport is rising in importance economically and the harbour offers deep water for the larger vessels entering all cargo trades. Deepening of the entrance channel is planned, where the seafloor rises gently to form a stable bar.

9.1.5 Charting Information Observations – Data Gathering

The main shipping channel in the narrow entrance to Wellington Harbour is charted as being surveyed in 2014 and 2008, however outside the main leads the area between Barrett Reef and Steeple Rock has source data dating from 1976 – 1977.

9.1.6 Economic Summary – Wellington Region

The Wellington region is by a margin the wealthiest region in the country. Estimates for regional GDP prepared by the Ministry for Economic Development put it at $17.5b in the year to March 2004, $36,700 per capita, 19% more than the Auckland Region ($30,750).

Tourism is a major contributor to the region's economy, injecting approximately NZ$1.3b into the Wellington region annually.

9.1.7 AREAS OF RISK ASSESSMENT SIGNIFICANCE – RESERVES, ECOLOGICAL, CULTURAL

Inside Wellington Harbour, the three islands of Somes (Matiu), Ward (Makoro) and Mokopuna are all protected as Nature Reserves. Landing on Mokopuna is prohibited.

Taputeranga Marine Reserve, an 854 ha area extending approximately 2.3 km offshore, stretches along Wellington's south coast from Lyall Bay to past Owhiro Bay. Divers can explore the wreck of the F69 Wellington frigate, which was scuttled in 2005 east of Taputeranga Island.

Further reserves spread along Wellington's south coast: Red Rocks Scientific Reserve, Te Kopahau Reserve, and at nearby Sinclair Head, there is a New Zealand fur seal colony.

A number of coastal reserves are also located along the west coast of the region, for example there are significant coastal reserves at Makara, Pauatahanui, Waikanae and Kapiti.

Two areas of sea either side of Kapiti Island make up the 2,000 ha Kapiti Marine Reserve where all marine life, habitats, objects and structures are protected. The Kapiti Marine Reserve is a nationally significant ecological and scientific resource containing impressive underwater scenery.

Mana Island is a sanctuary for lizards, birds and native plants after a successful mice eradication project.

Pauatahanui estuary near Paremata is the largest and least modified estuarine area in the southern North Island and the only large area of salt-marsh and seagrass in the Wellington Region. There are coastal reserves east of Wellington, at Castlepoint and Cape Palliser.

Cook Strait is an important habitat for many cetacean species. Several dolphin species (bottlenose, common, dusky) frequent the area along with killer whales and the endemic Hector's dolphins.

9.2 TRAFFIC ANALYSIS – WELLINGTON REGION

Approximately 4,200 ships call into CentrePort on an annual basis, with around 3,600 of these ship calls being attributable to inter-island ferries.

Types of vessels using the Port of Wellington include

- Container
- General and Break-bulk, especially log ships
- Tankers, including Cement
- Passenger cruise
- Passenger and vehicular ferries
- Car Carriers
- High Speed Passenger; Charter boats and Water taxis
- Tugs and workboats
- Military

A plot of traffic in this area, broken down by type is shown below. Wellington Harbour shows distinct traffic routes associated with passenger routes (commuter and interisland).

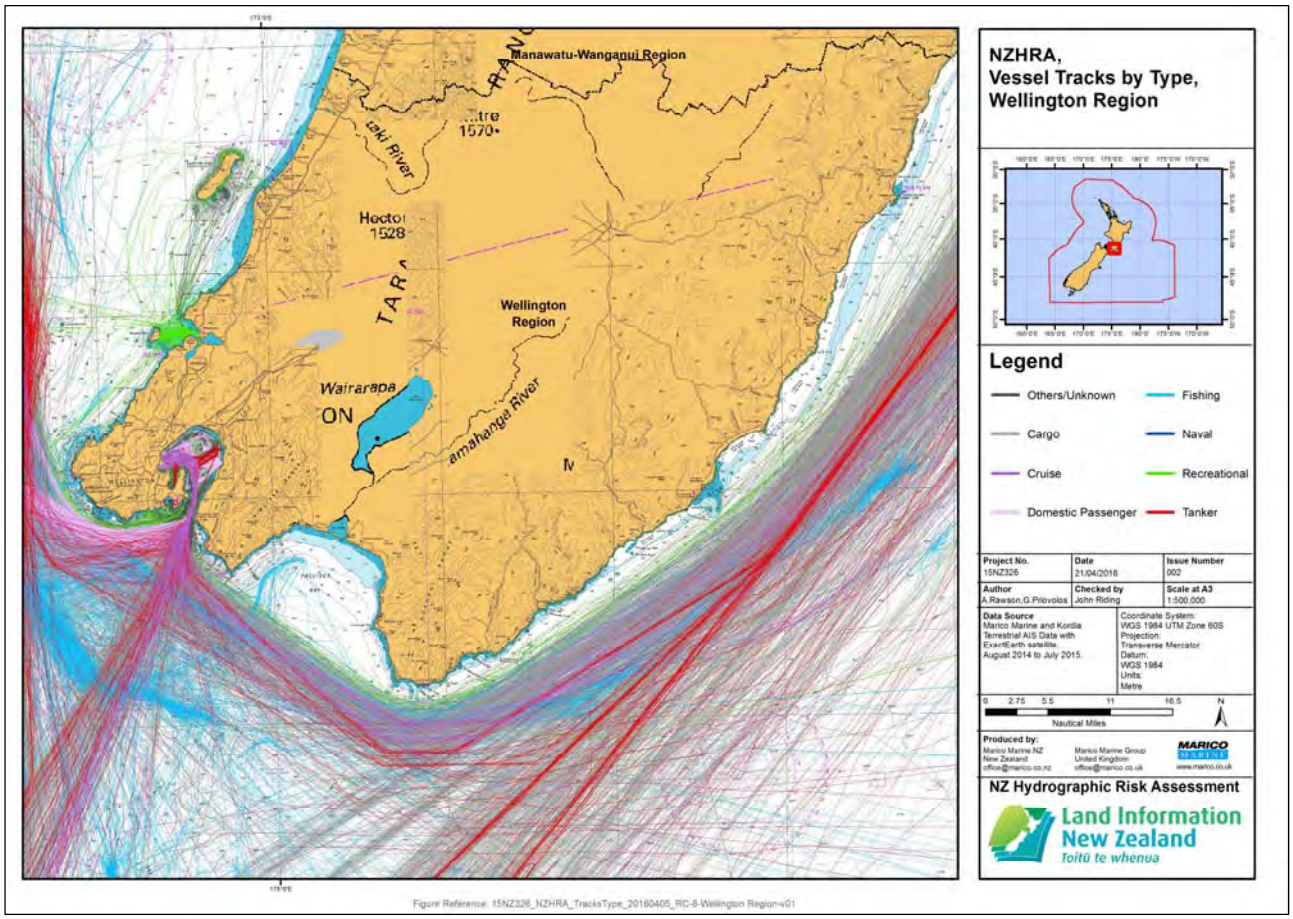
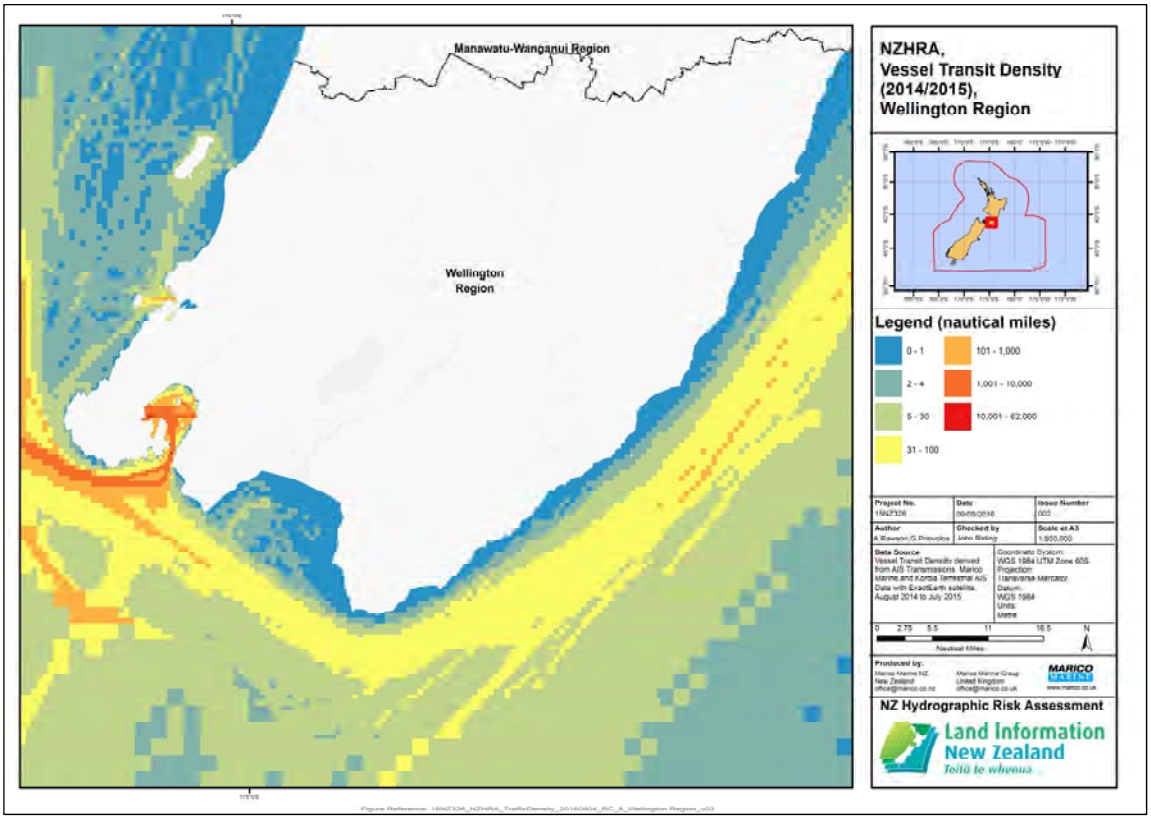


Figure 87 : Traffic Breakdown by Type – Wellington Region

The Wellington Region overall is busy with shipping traffic both using the port and transiting either south or on international voyages through the waters of Cook Strait. Large vessel of all types are represented in the traffic profile, which in the timescale of a year is significant.

9.2.1 TRAFFIC DENSITY – WELLINGTON REGION

The traffic density plot for Wellington Region shows the importance of the coastal traffic in this region. Although vessels are known to track sometimes too close to Cape Palliser, the density plot shows that coastal tracks do remain reasonable distributed here, as may be seen in the Wellington Harbour inset



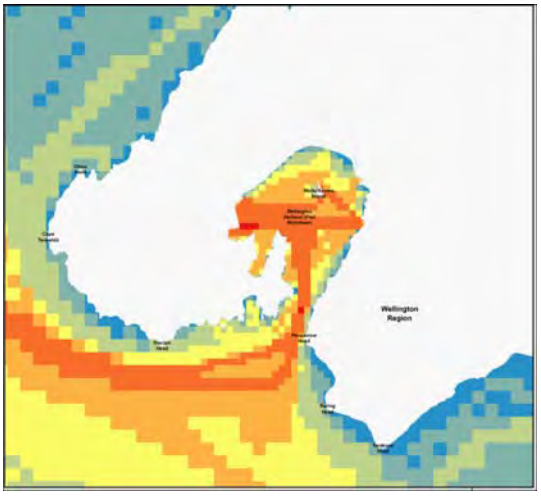


Figure 88 : Traffic Density – Wellington Region

9.2.1 TRAFFIC OVERALL – WELLINGTON HARBOUR

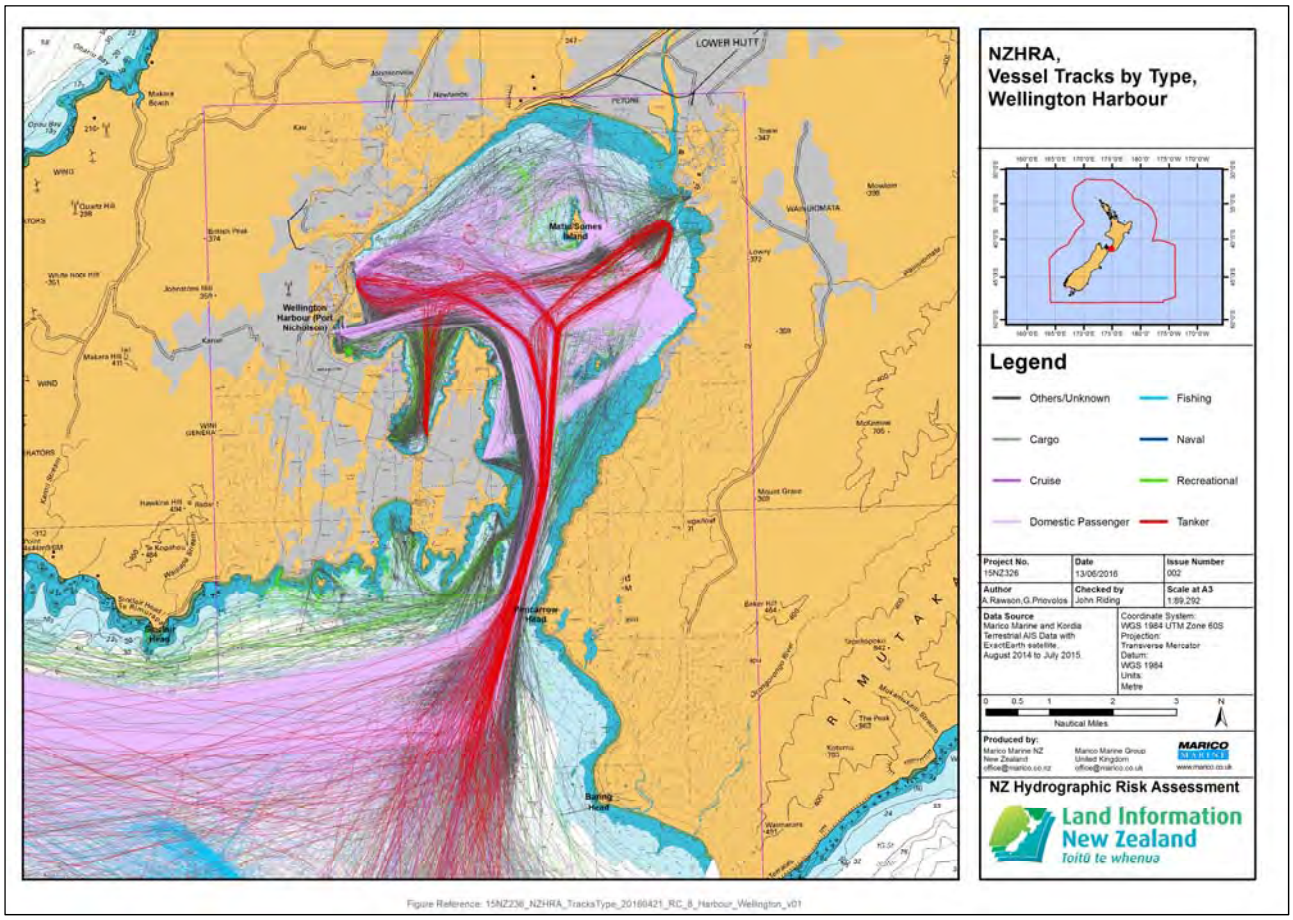


Figure 89 : Wellington Harbour Traffic by Vessel Type

Although the Cook Strait passenger RoRo services dominate Wellington Harbour traffic profile, traffic is considerable also by other vessel types. Wellington Harbour entrance channel is constrained by Barrett Reef and vessels need to align with entrance leads at an early stage in the inbound transit. The harbour has recommended routes to each of the berths or tanker terminals and these are clearly apparent from the plot, tanker outers especially. Although the Cook Strait passenger RoRo ferries are built to a SOLAS standard, they have been plotted (and analysed in the risk assessment) as domestic vessels.

9.2.2 CARGO VESSELS – WELLINGTON REGION

General cargo vessel usage of the Wellington Regional waters is significant. Traffic both into the harbour and through the Cook Strait is equally as busy as anywhere else in New Zealand.

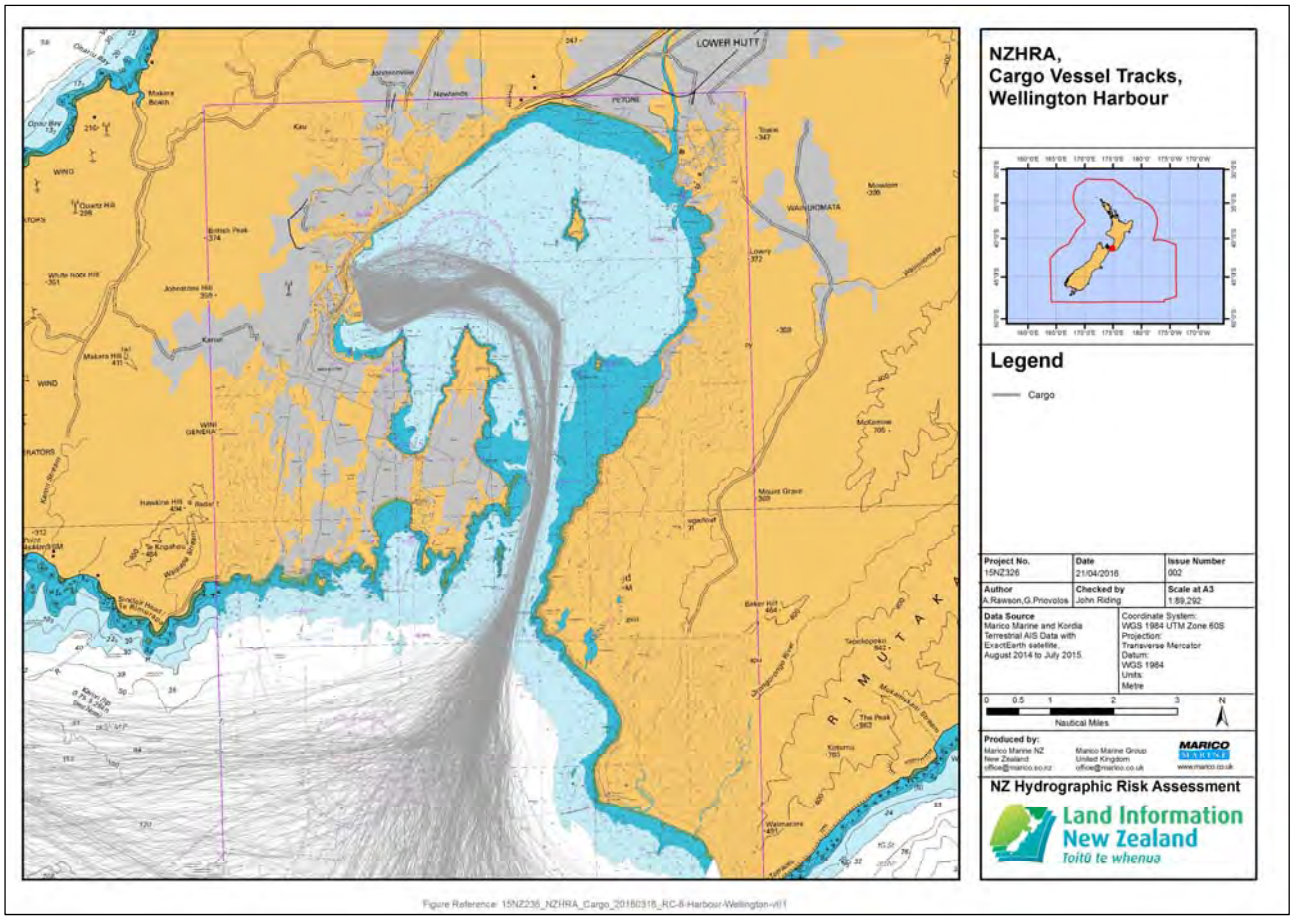
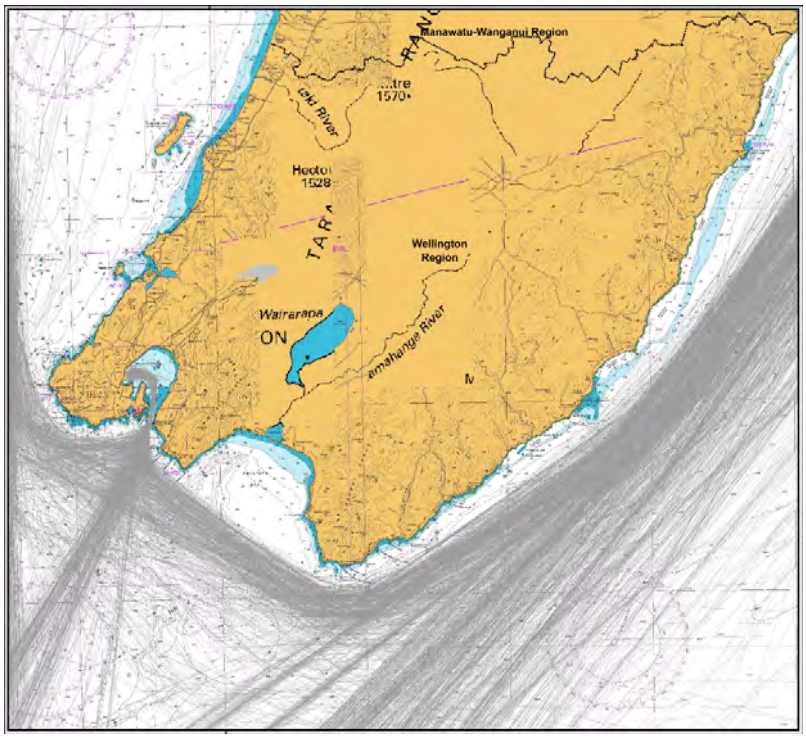
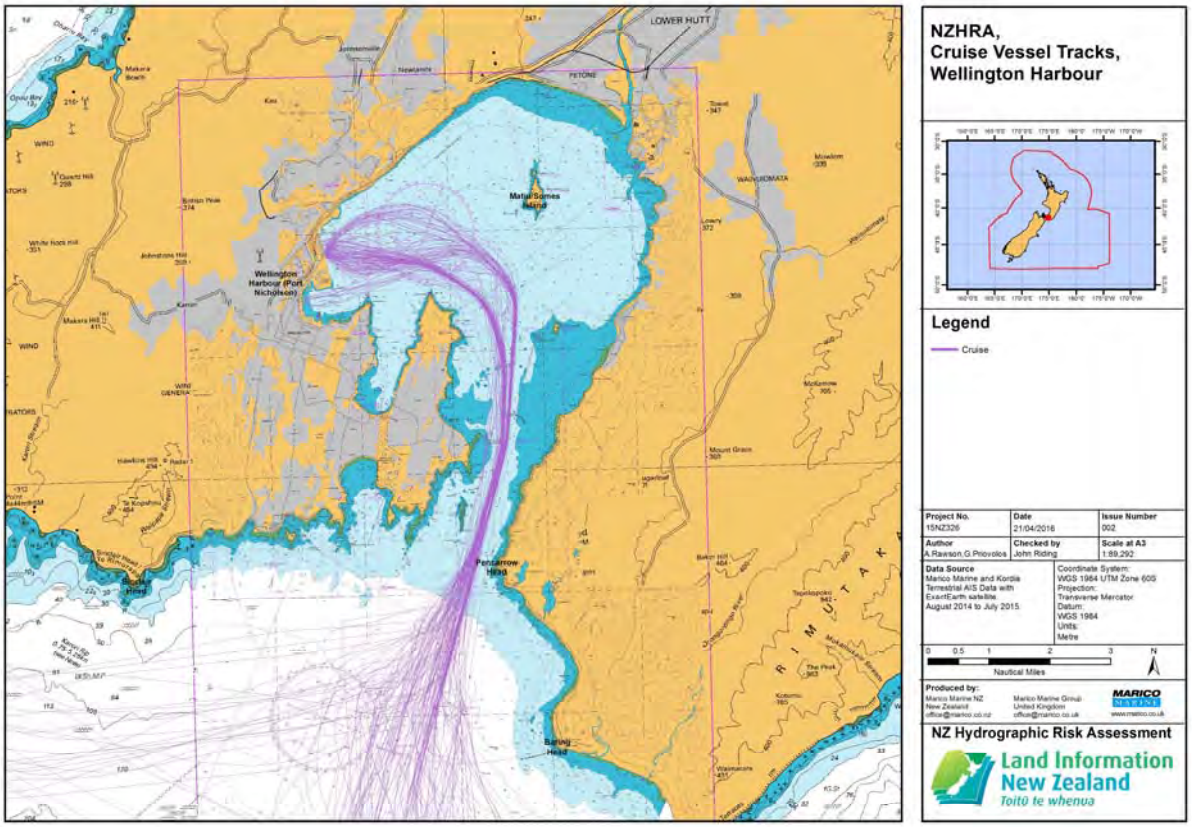


Figure 90 : General Cargo Vessels - Wellington



9.2.3 CRUISE VESSELS – WELLINGTON REGION

2014-2015 saw 76 cruise ship calls to Wellington, bringing more than 141,000 visitors to the city and contributing more than $30M to the economy. Cruise vessels berth at Aotea and Queens Wharf in Wellington Harbour.



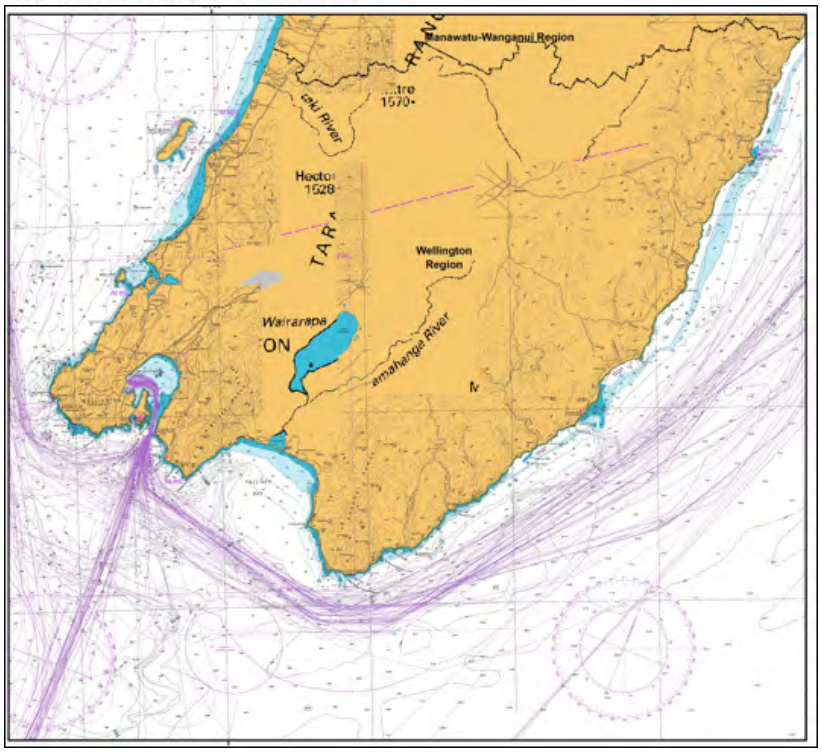
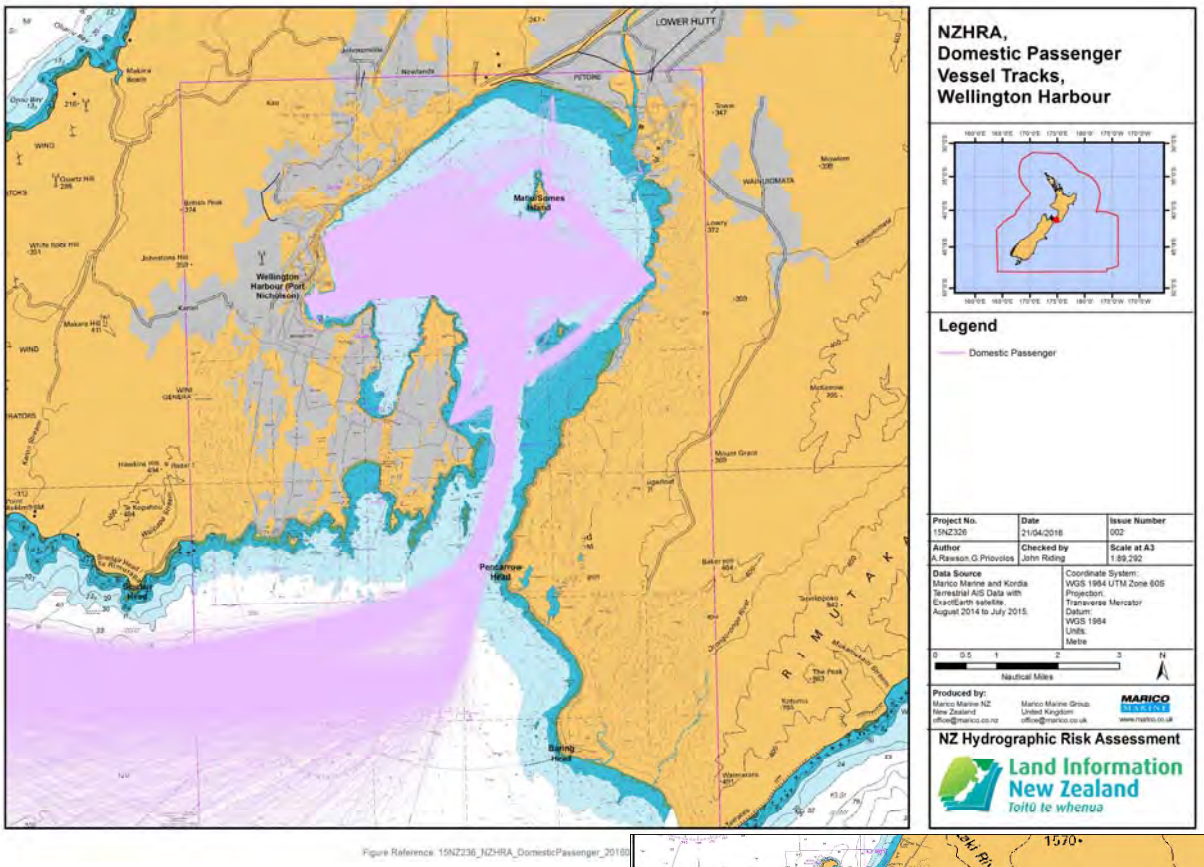


Figure 91 : Plot of Cruise Vessels Visiting Wellington Harbour (Regional Insert)

9.2.4 DOMESTIC PASSENGER SERVICES

A domestic ferry, East By West, carries commuters across Wellington Harbour with up to 16 sailings daily leaving Queens Wharf for Days Bay. Other destinations include Seatoun, Somes Island and Petone. When combined with the Cook Strait passenger RoRo record, the level of domestic traffic is significant, with the associated passenger volumes significant. On the western tip of the Wellington Region, a passenger service runs to Kapiti Island taking visitors for day trips, departing from Paraparaumu.



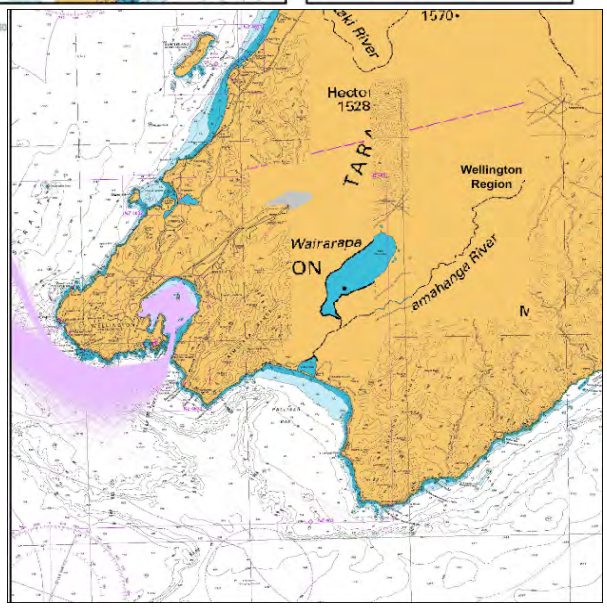


Figure 92 : Domestic Passenger Services – Wellington Harbour & Region

9.2.5 TANKER TRAFFIC – WELLINGTON REGION

Tanker traffic using Wellington regional waters is significant annually. Tankers approach Wellington from three main directions: from north through Cook Strait; from south along the Kaikoura coast; and from the east coast around Cape Palliser. A few tankers transited through the Cook Strait without stopping in New Zealand. Three tankers anchored inside Wellington harbour in the year. A tanker terminal at Seaview is one of two terminal destinations for tankers entering Wellington harbour. Tanker terminals at Evans Bay and Aotea Quay receive bulk oils, chemicals and LPG.

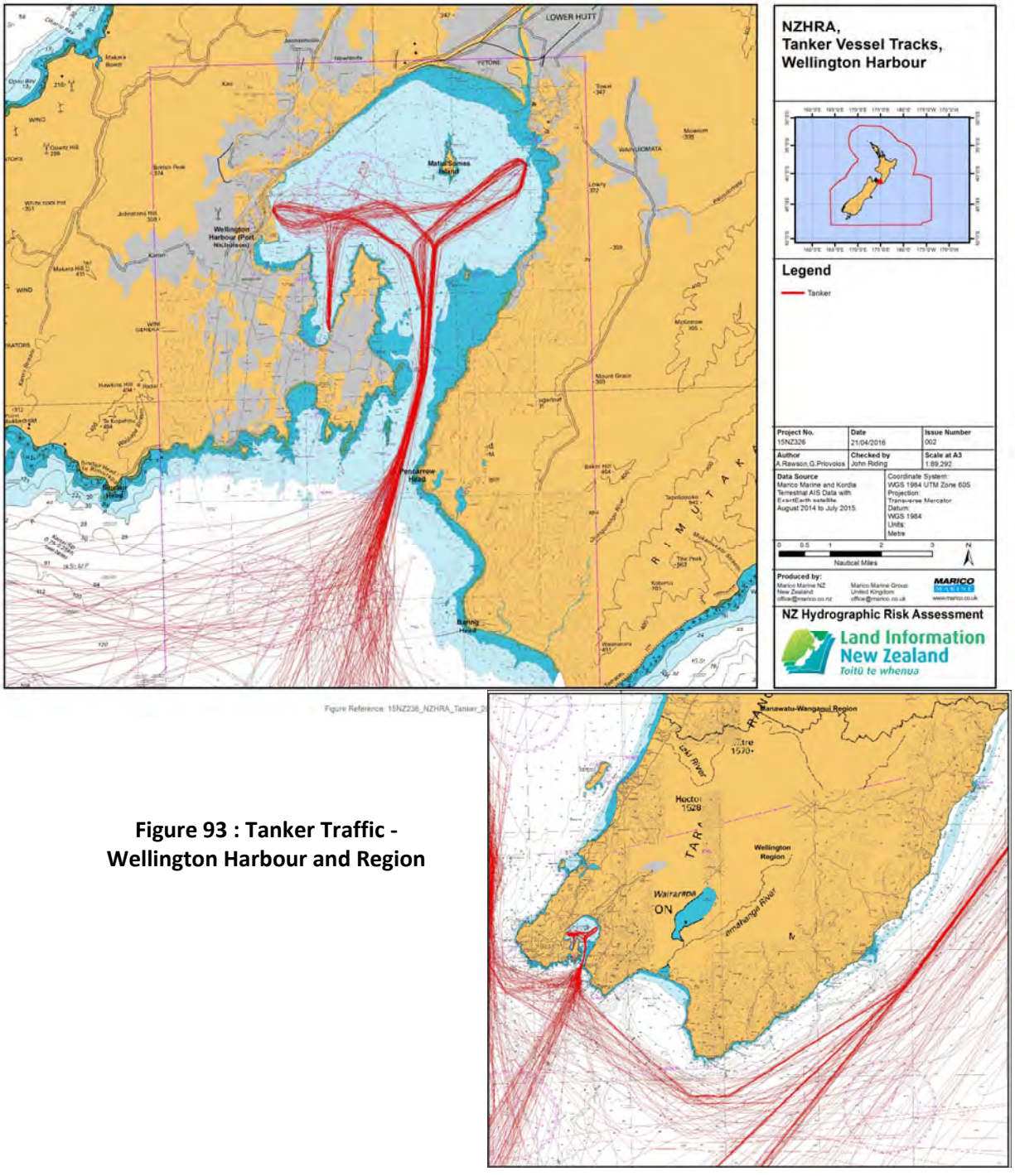


Figure 93 : Tanker Traffic - Wellington Harbour and Region

9.2.6 COMMERCIAL FISHING VESSELS – WELLINGTON REGION

A small fishing fleet including several trawlers, a few set-line boats, up to 6 down-line charter vessels and around 5 crayfish boats, are based mostly at Glasgow Wharf and on swing moorings at Island Bay. Fishing vessels mostly discharged at Aotea Quay. Including the Cook Strait, fishing activities in the region are dense over a 12 month period.

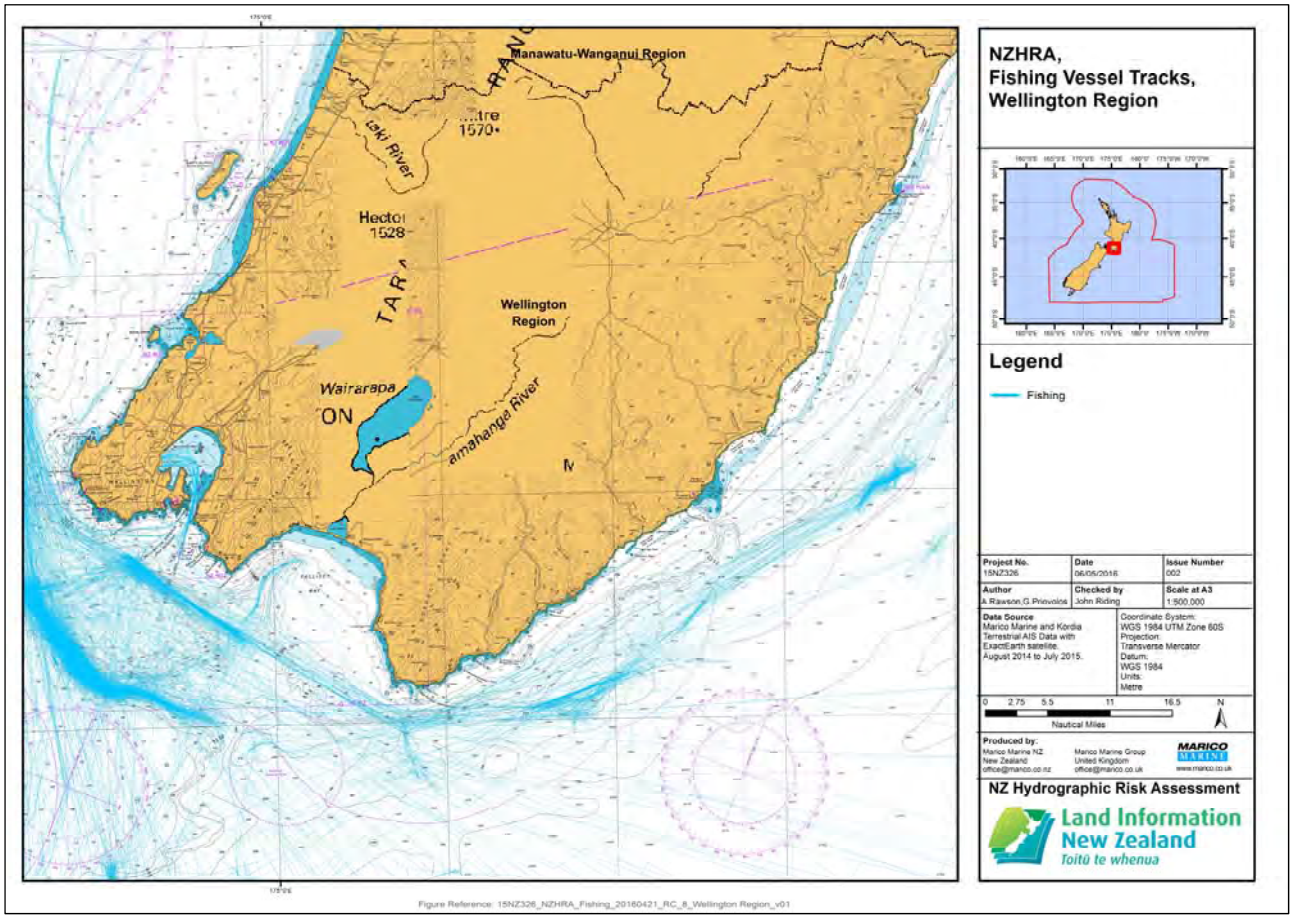


Figure 94 : Record of Fishing Vessel Activity – Wellington Region

9.2.7 RECREATIONAL FISHING VESSELS – WELLINGTON REGION

Recreational fishing vessels in Wellington region are mostly of the trailer type, recreational fishing activity overall is significant. A small number of recreational fishing boats are kept in the marinas or on the few moorings at Port Nicholson. These vessels are not fitted with AIS transponders.

9.2.8 RECREATIONAL CRAFT – WELLINGTON REGION

Twelve percent of NZ recreational boaters are said to be based in the Greater Wellington area[8]. There are three marinas in Wellington harbour: Chaffers; Evans Bay and Seaview Marinas, with additional fore and aft moorings at the Clyde Quay Boat Harbour. Outside Wellington Harbour, Mana marina has berthage for over 300 boats. Nearly 1,000 boats up to 20m length are berthed in these four marinas.

The Marlborough Sounds are popular destinations for recreational craft large enough to withstand the changeable conditions crossing Cook Strait, departing from both Wellington and Mana. Fishing is the most popular activity for recreational craft and there is good fishing along Wellington's south coast.

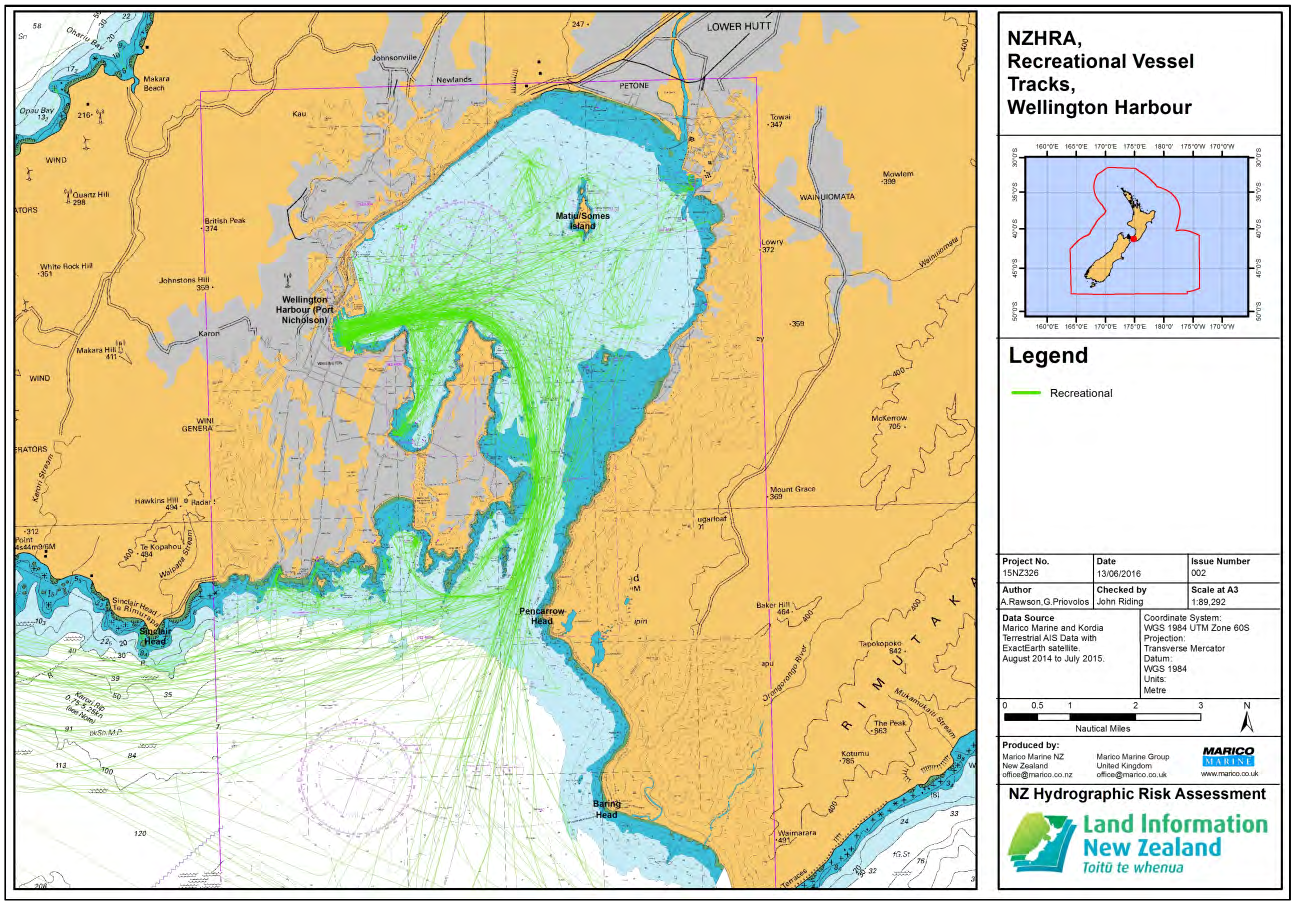


Figure 95 : Recreational Craft – Wellington Region

[8] *MNZ Research NZ 2014*

9.3 HYDROGRAPHIC RISK – WELLINGTON REGION

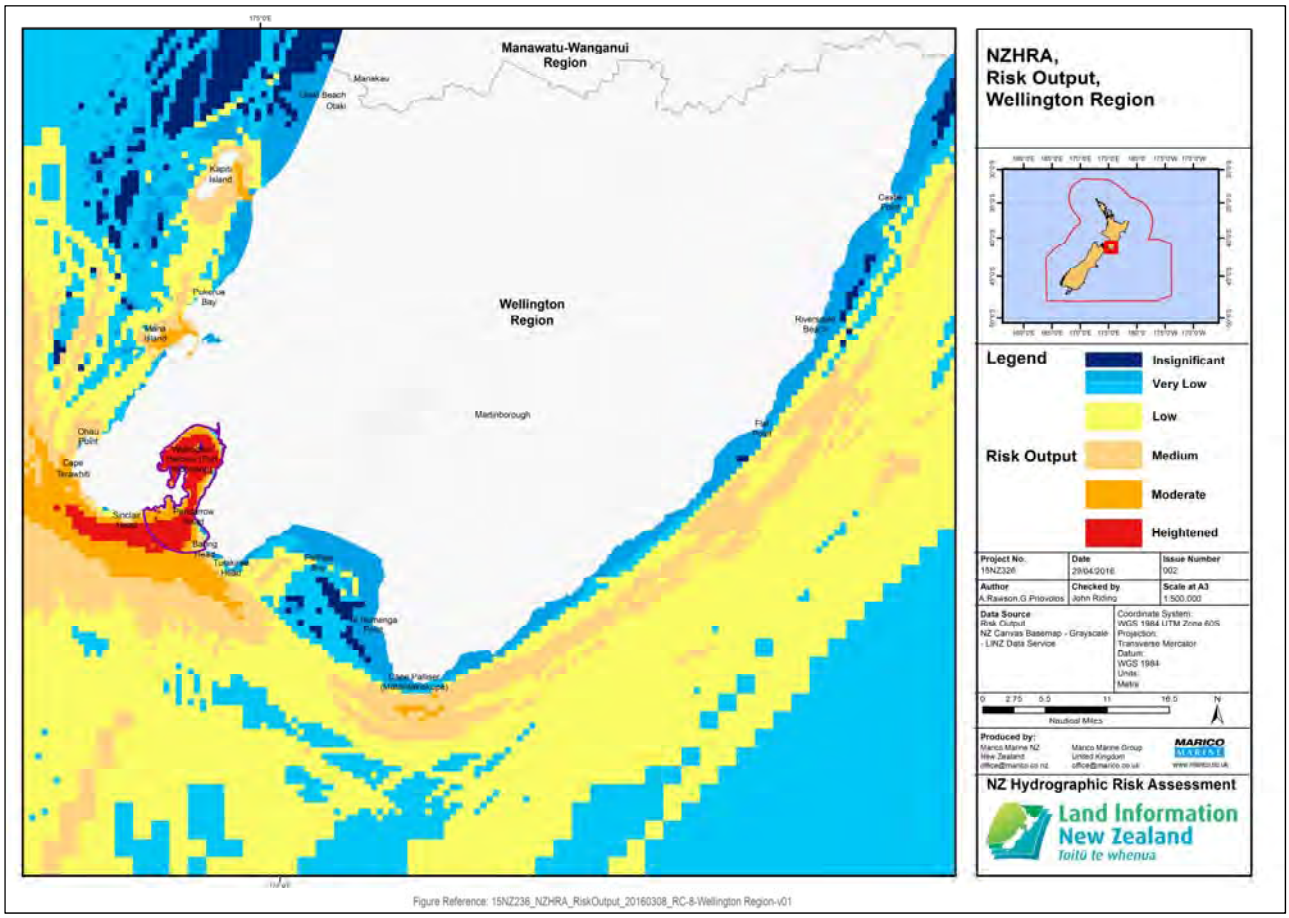


Figure 96 : Hydrographic Risk – Wellington Region

A heightened hydrographic risk shows clearly in the Wellington Harbour and approaches, along the Cook Strait ferry route. This extension of heightened risk into the Cook Strait waters reflects the waters of the Kaori Rip as well as the heavy traffic density and passenger volumes passing this area. Elsewhere in the region an extensive area of moderate hydrographic risk surrounds the highest risk areas. Medium risk follows the most commonly used vessel tracks around the coast, with low to very low risk further offshore.

9.3.1 HYDROGRAPHIC RISK - WELLINGTON HARBOUR & APPROACHES

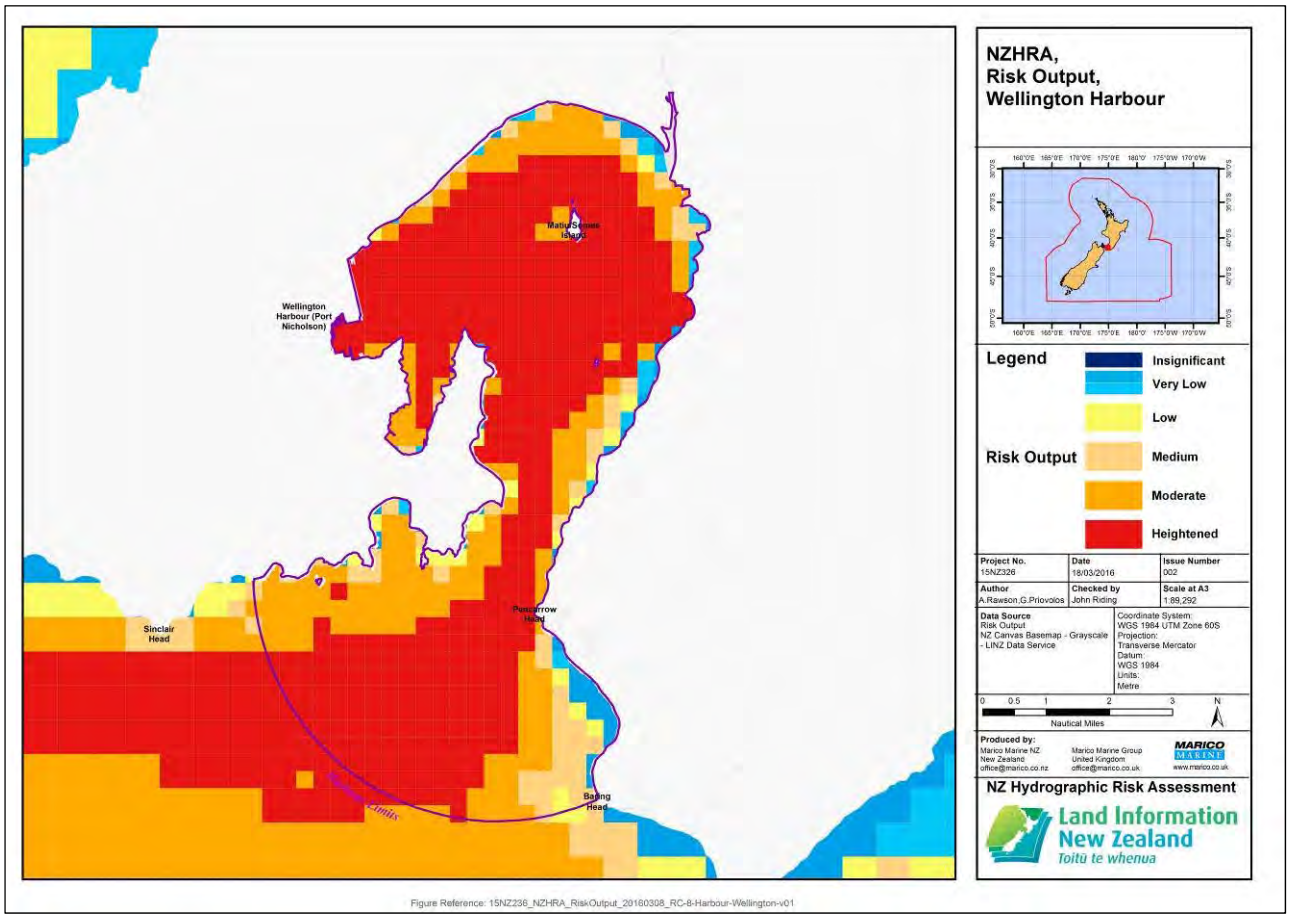


Figure 97 : Risk Output in Wellington Harbour and Approaches

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.

Further contributing to the heightened risk score in the Approaches are the parts of the busy approaches areas with last survey in 1985, with the critical approach channel adjacent to Barrett Reef using chart source data from 1976-1977. The change of chart scales from coastal into approach and then harbour scales does not follow the IHO recommendations.

All vessel types were observed to anchor in Wellington Harbour, including tankers, with the main portion of the harbour using charts with source data taken from 2007.

9.4 CHARTING BENEFIT – WELLINGTON REGION

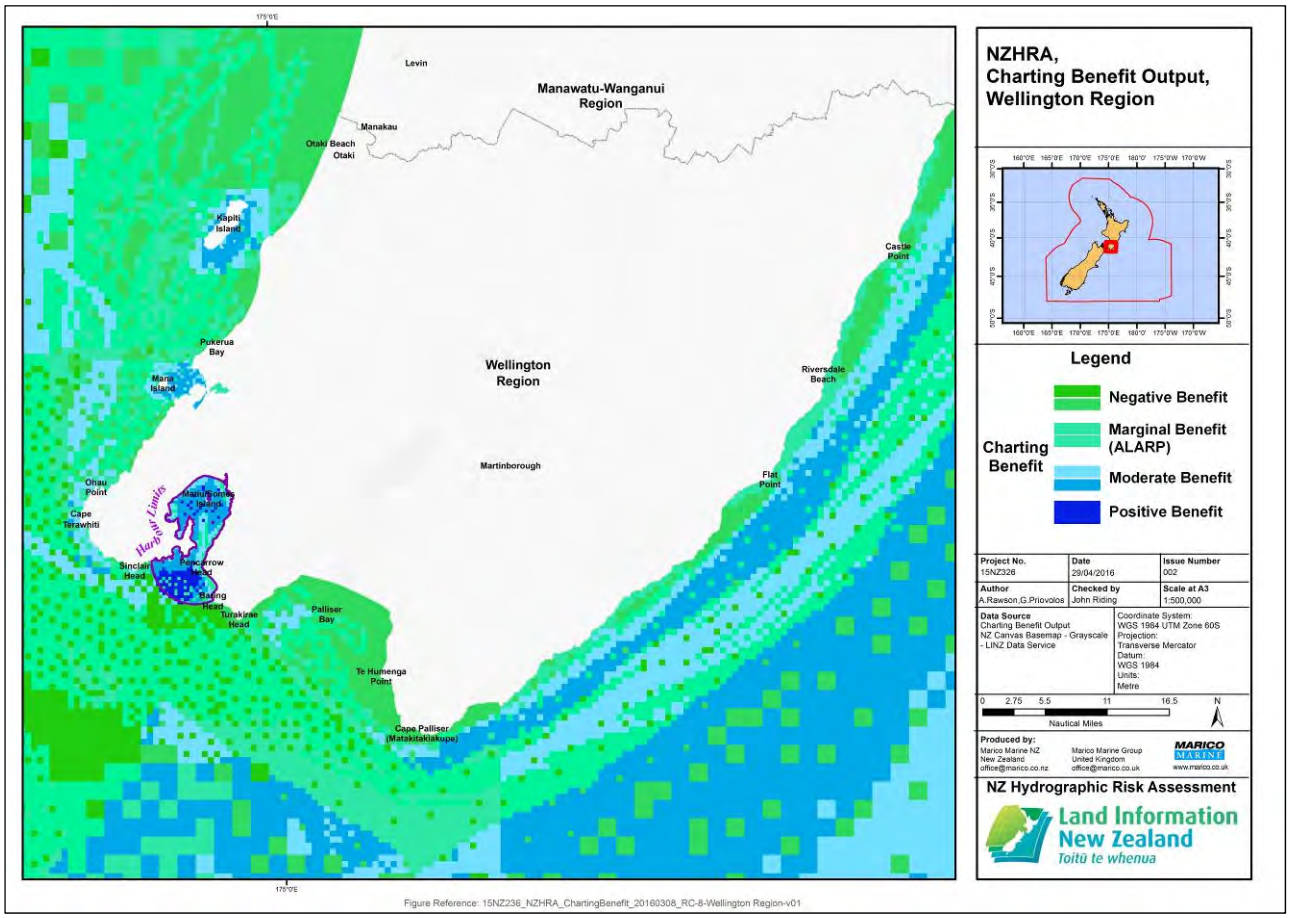


Figure 98 : Charting Benefit – Wellington Region

The offshore areas in the south of the region showing a moderate charting benefit reflect the chart survey ages here from the 1950's. The coastal route along the Wairarapa Coast shows a moderate charting benefit from the frequent use by all vessel types. It is interesting to note that the moderate area of charting benefit from Cape Palliser north is relatively close inshore and reflects the voting pattern of coastal transits by large vessels. Kapiti Island (where a marine reserve exists) also shows a moderate benefit, which is originating from the passenger volumes in this area and the age of charted data.

9.4.1 CHARTING BENEFIT – WELLINGTON HARBOUR & APPROACHES

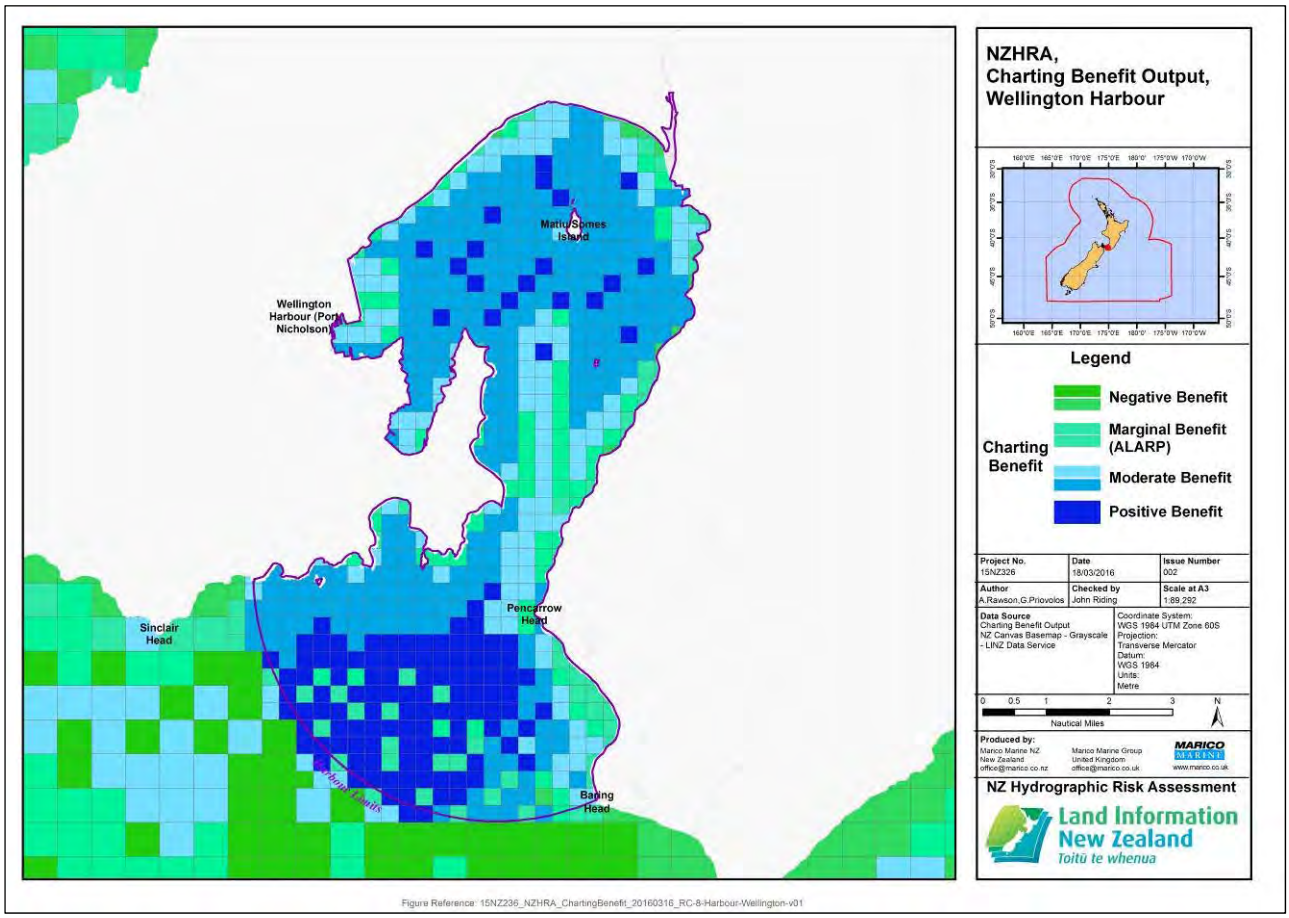


Figure 99 : Charting Benefit – Wellington Harbour and Approaches

Part of the Wellington Approaches showing a positive charting benefit was last surveyed in 1985 however the charting benefit inside harbour limits in the approaches reflects the high traffic density combined with the charting scale.

10 HYDROGRAPHIC RISK RESULTS - TARANAKI REGION

10.1 INTRODUCTION - TARANAKI REGION

Taranaki, on the west coast of the North Island, surrounds the volcanic peak of Mount Egmont (Taranaki), the second highest mountain in the North Island and the dominant feature of the region. The region is exceptionally fertile, with generous rainfall and rich volcanic soil. Dairy farming predominates, and there are significant oil and gas deposits in the region, both on- and off-shore.

The prevailing winds in these latitudes are westerly with a succession of high and low pressure systems dominating the meteorological conditions. Furthermore, New Zealand's topography, with unbroken mountain chains, produces considerable local accelerations and gusts that can produce localised swell, which is especially steep when wind is against tidal stream. When the prevailing conditions and tidal stream combine, these interact to produce heavy seas in offshore areas that can potentially lead to dangerous environmental conditions.

Swell prevails throughout the year and the port is susceptible to long period swell conditions which can cause considerable movement of vessels moored alongside in the harbour; this is due to the long fetch of sea extending deep into the Southern Ocean.

Taranaki is the focus region for New Zealand's oil and gas production. There are approximately 20 oil and gas fields in production in the Taranaki region, the key ones being Pohokura, Kupe, Maui, Maari, Turangi, Tui, Kowhai, Kapuni, and Mangahewa. The oil and gas industry is the most significant industry in the Taranaki region. The 250m long *Raroa II* floating processing, storage and offloading (FPSO) located in the South Taranaki Bight, and moored in a water depth of 100m, is designed to operate for 15 years. It processes and stores the oil before transporting it into shuttle tankers**.** Tugs and workboats that assist with FPSO hook-ups are based in Taranaki and Nelson.

There is no marina as such in New Plymouth but a single pier extending into the harbour can berth around 20 vessels.

10.1.1 PORT TARANAKI - TARANAKI REGION

Port Taranaki is the only deep water seaport on New Zealand's western seaboard. The port is owned by the Taranaki Regional Council. Port Taranaki handles mainly oil and other bulk liquid exports, with crude oil by far the most significant product transported through Port Taranaki, followed by methanol. The port handles a wide range of coastal and international cargoes, mostly relating to the farming, engineering and petrochemical industries. Port Taranaki is the third largest export port by

volume behind Tauranga and Lyttelton, and is the sixth largest exporter by value, behind Tauranga, Auckland, Lyttelton, Napier and Dunedin.

Port Taranaki accounts for 7.5% of all exports out of New Zealand by value. However, it accounts for 86% of all oil and gas exports by value.

The port also has an important role in servicing of the oil and gas rigs in the Taranaki basin.

Coastal trade is mainly in liquid bulk cargo, consisting of 82% of LPG throughput, 75% of petrol/fuel oil throughput, 9% of other liquid bulk throughput and 40% of crude oil throughput. All logs and cement through the port is for coastal destinations only. Container trade at the port is minimal but in contrast the port enjoys continued growth in its core bulk trades with total trade volume up to over 5M tonnes.

Due to surge movement in the harbour, vessels use shore moorings on Newton King Terminal and 'ShoreTension' on Blyde and Moturoa, supplied by Port Taranaki Ltd. Over the previous two years more than a dozen vessels per year were required to vacate a berth and long period waves were prevalent for approximately 6-7% of the time. The 'ShoreTension' technology now in use is said to be overcoming the impact of long period waves.

The port offers nine berths for a wide variety of cargoes and vessels. The maximum port draught is 12.5m, and for vessels in excess of 10m DUKC must be used.

Pilotage is compulsory for all vessels in excess of 100 GT. Three tugs are available of 28-40 tonnes bollard pull.

Anchorages are outside Port Limits and extreme caution is required in onshore wind conditions, as the seafloor is said to be of poor holding. Tidal streams are weak and erratic; currents may be strong in the offing and are much influenced by the winds. After prolonged south-westerly weather a current sets north-east at rates up to 1½kn; after prolonged easterly weather a current sets west at similar rates.

10.1.2 CHARTING INFORMATION OBSERVATIONS – DATA GATHERING

Most of the area from the shore to outside the breakwater was surveyed by the port in 2007. The harbour approaches were surveyed in 1998 and further out in 1989-90. A 'Precautionary Area' for vessels transiting through the oil field area is marked around the Taranaki Bight and oil and gas installations. Individual installations have the usual 500 metre self controlled zone around them.

10.1.3 AREAS OF RISK ASSESSMENT SIGNIFICANCE – RESERVES, ECOLOGICAL, CULTURAL

A marine protected area exists around the Sugar Loaf Island close to New Plymouth, with the 1,404 hectare Tapuae Marine Reserve adjoining it.

Pariokariwa is a 1,800 hectare offshore marine reserve located in the south-eastern most reaches of the North Taranaki Bight.

10.1.4 ECONOMIC SUMMARY - TARANAKI REGION

The port operation contributed $25.5M to regional GDP. Port Taranaki transports over 3.6M tonnes of goods annually, with a value of over $3.1b dollars.

10.2 TRAFFIC ANALYSIS – - TARANAKI REGION

Types of commercial vessels using Taranaki region include:

- Container
- General and Break-bulk
- Tankers
- Passenger cruise
- Offshore Tugs and workboats

10.2.1 ALL TRAFFIC ROUTES - TARANAKI REGION

Dominating the traffic routes for Taranaki region are tanker tracks. As Taranaki is the NZ Oil Port, with the location of offshore oil wells nearby, the dominance of tanker movements through these waters is unsurprising. Rig supply and offshore tug activity between the port and the offshore oil and gas rigs comprised most of the traffic visible under the category ‘Other’ with the harbour dredge and the port’s pilot boat making up most of the remainder of the plotted ‘Other’ tracks.

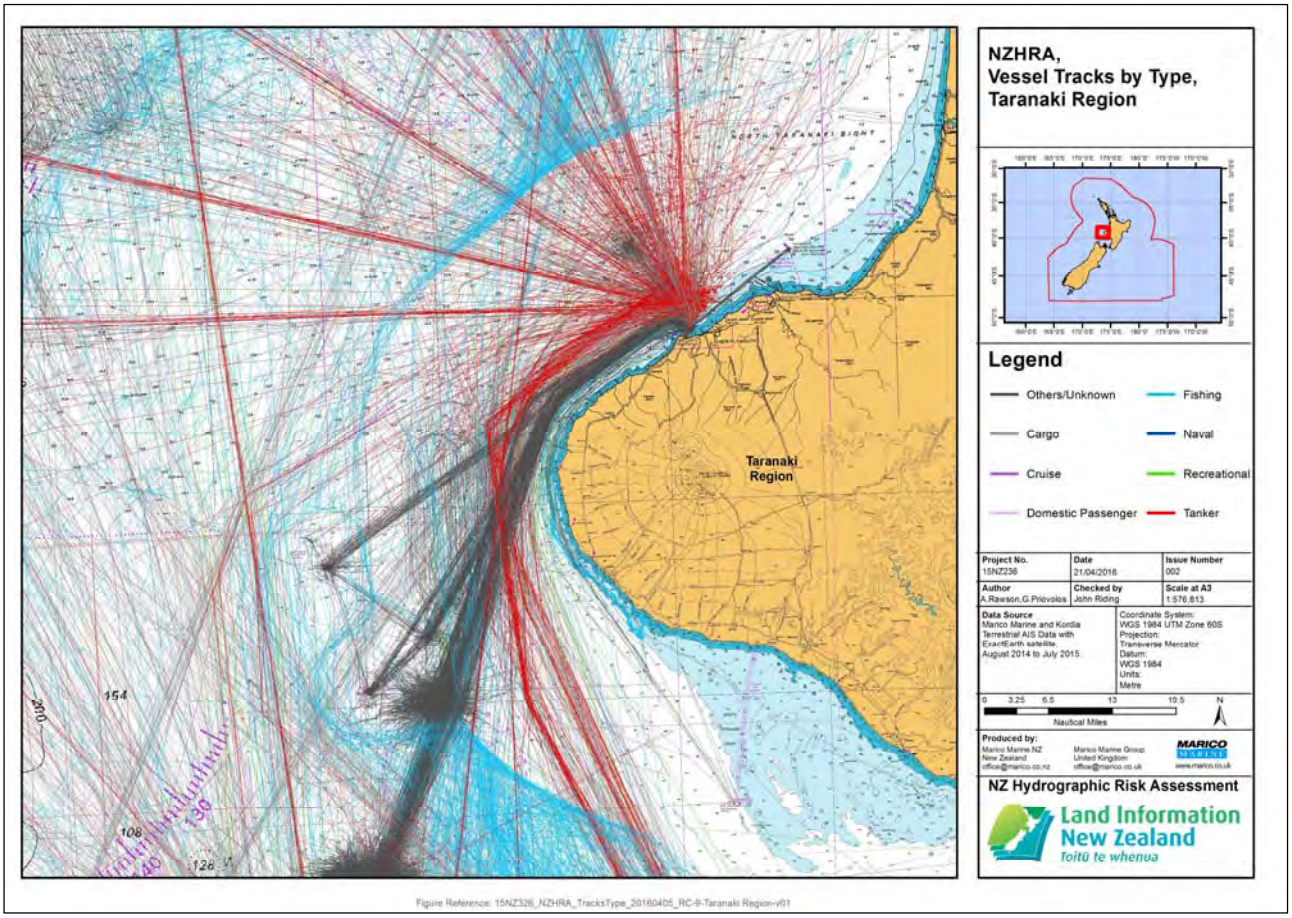


Figure 100 : Breakdown of Vessel Traffic by Type – Taranaki Region

10.2.2 TRAFFIC RECORD OVERALL - TARANAKI REGION

It is important to note the number of red circles in the offshore Taranaki waters. These represent Tankers anchoring offshore, which appear mostly to be either waiting for orders or planning to use the facilities at the Taranaki Port. These records are made regularly, by different Tankers, suggesting that the trade is exercising a custom and practice. The charting does not specify the type of the seafloor holding in the area and the area is an exposed coast. An anchor dragging event has occurred in the past.

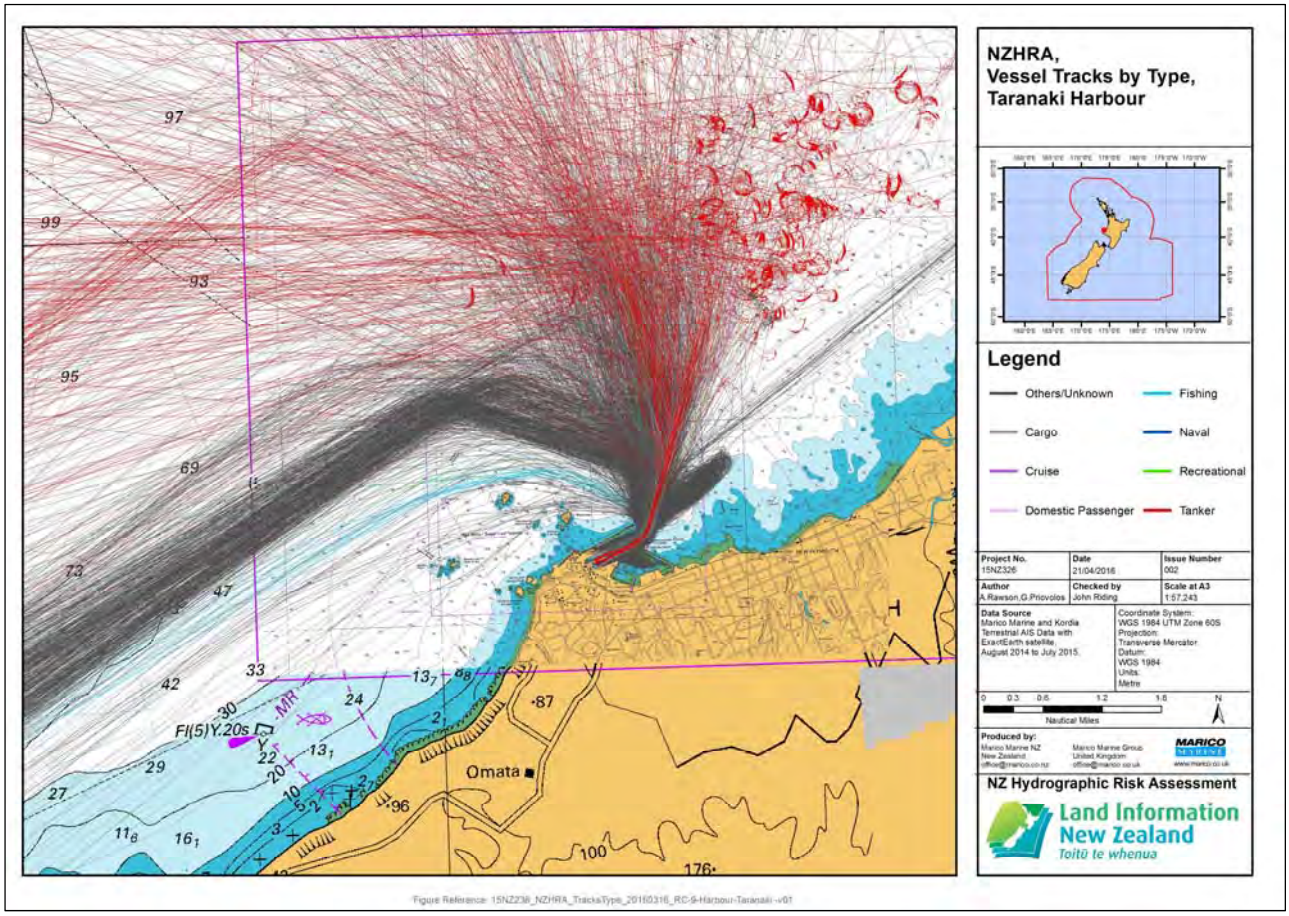


Figure 101 : Traffic Breakdown by Ship Type – Taranaki Approaches

Taranaki has a considerable volume of traffic in any 12 month period. Apart from tankers, much of the remaining traffic is small and services the oil industry.

10.2.3 TRAFFIC DENSITY – TARANAKI REGION

Traffic density through the Taranaki waters is low overall, even with the effect of traffic to the oilfields. However, there is an area of increased density (medium) for traffic aligning with the Mount Taranaki coastline. This traffic is dominated by oil field service vessels servicing the offshore production facilities, mostly from Port Taranaki.

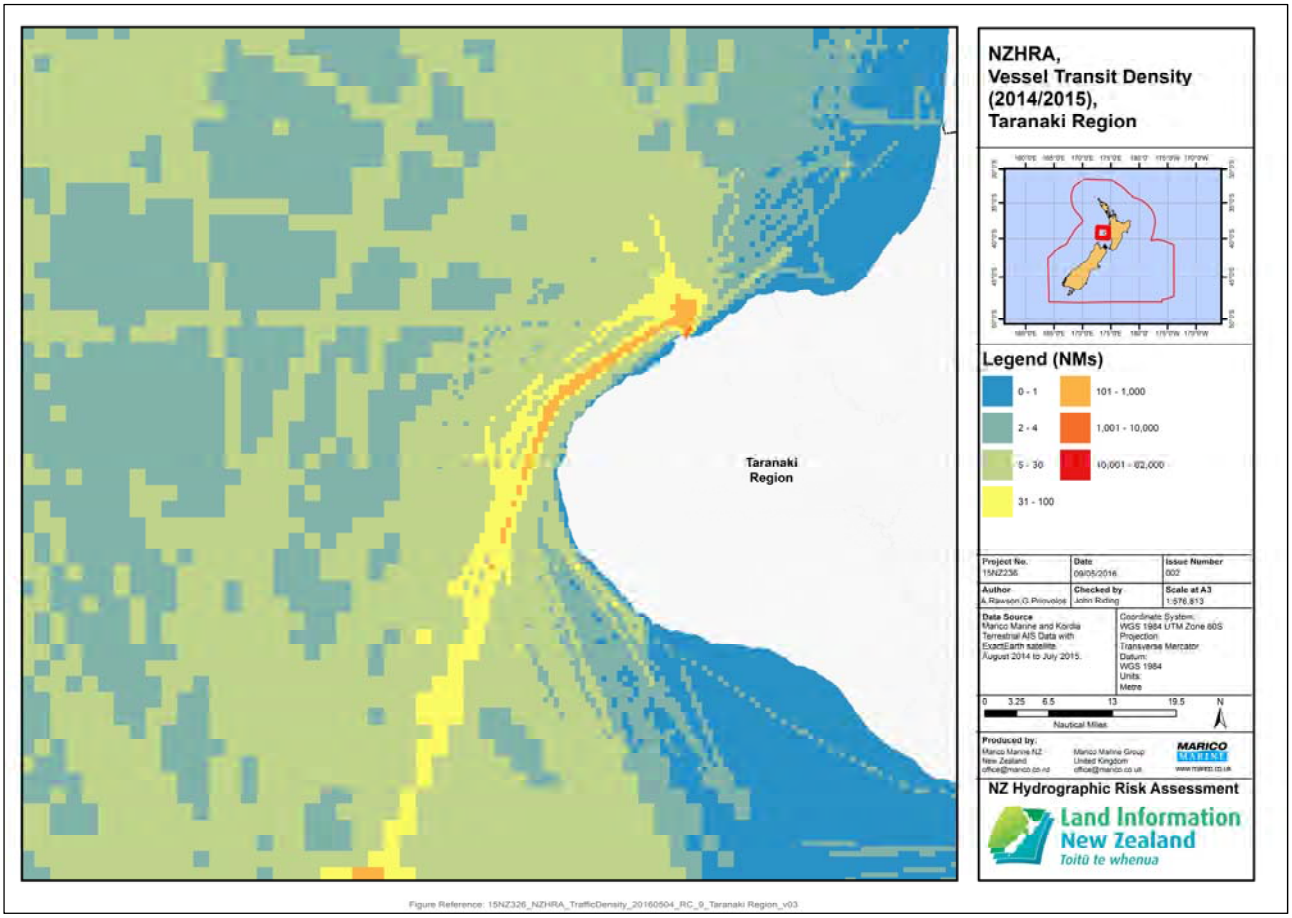


Figure 102 : Traffic Density – Taranaki Region

10.2.4 CARGO VESSELS – TARANAKI REGION

Cargo ships transit between most Australian ports and Port Taranaki, while common domestic routes are around North Cape and through Cook Strait to other coastal destinations, with a lesser number of cargo vessels tracking between Nelson and Taranaki.

The majority of vessels that transit along the New Zealand coast to or from Port Taranaki, tend to navigate several miles off and parallel to the shoreline. A small number of cargo vessels bypass Taranaki, heading between North Cape and Nelson.

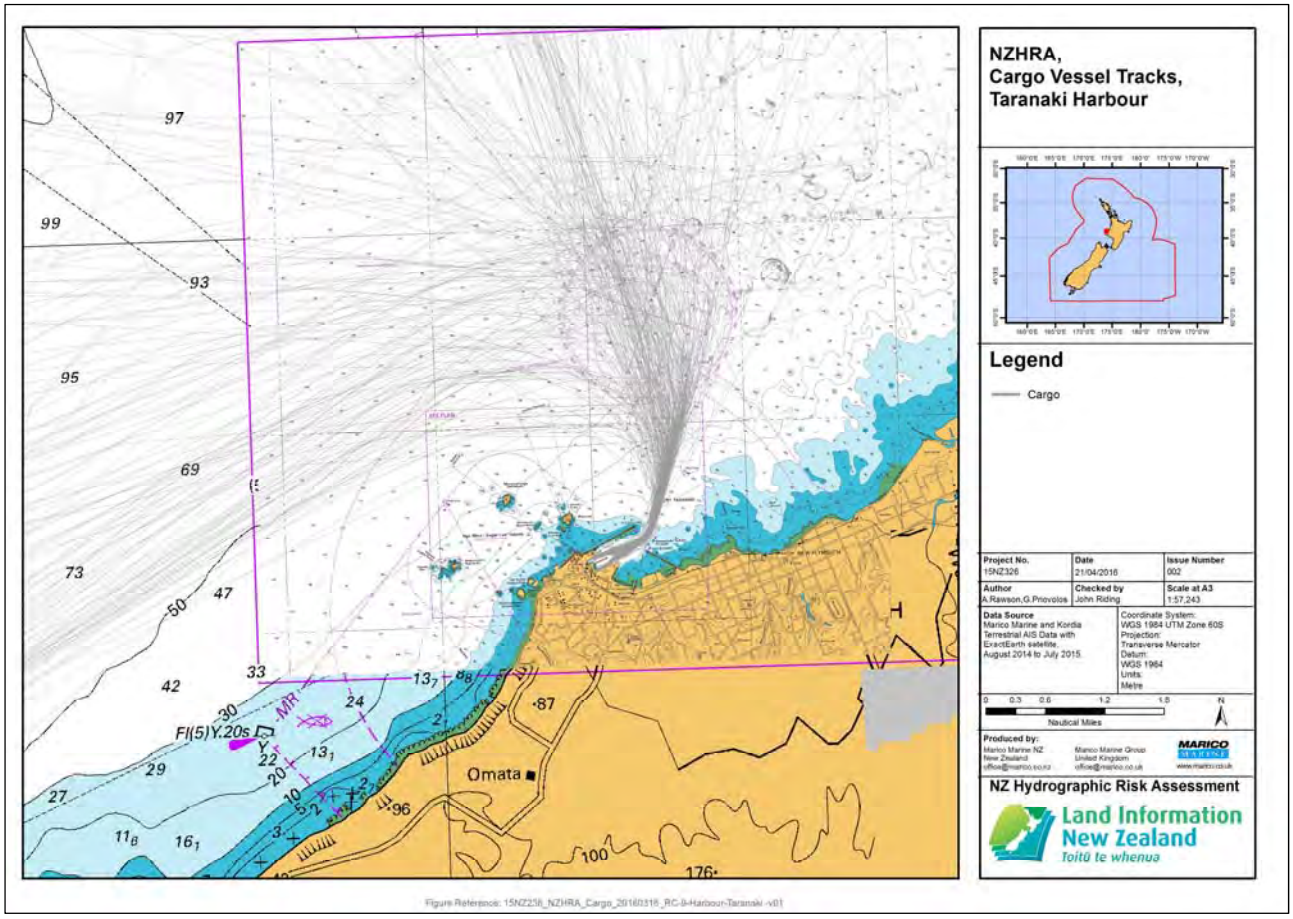


Figure 103 : Cargo Vessels – Taranaki Harbour and Approaches

10.2.5 CRUISE VESSELS – TARANAKI REGION

One passenger cruise vessel visited Port Taranaki, with cruise vessels seldom transiting the west coast of the North Island. The plot shows some transiting through the waters, but this area is not of importance to cruise operations. A single domestic Fullers passenger vessel called into Port Taranaki in the year of the data record, possibly on a delivery voyage from Key West builders.

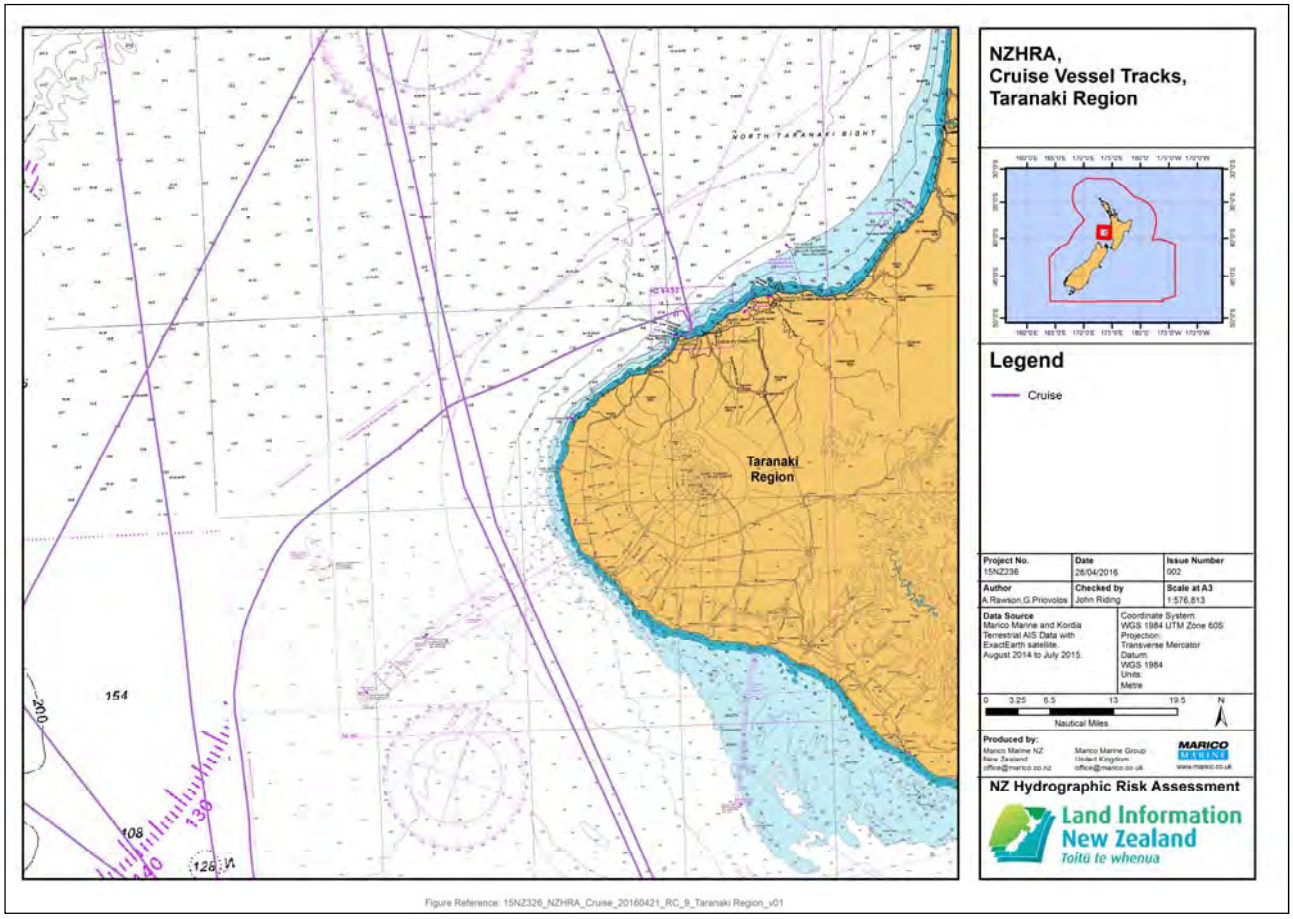


Figure 104 : Cruise Vessel Traffic – Taranaki Region

10.2.6 TANKER TRAFFIC - TARANAKI REGION

There is a large amount of tanker traffic, as expected for a port that services the oil fields nearby. A significant number of tankers anchored offshore in the 12 month period of data, north and north-east of the port.

Tankers transited south around Cape Egmont within 3-8nm off the coast. Tanker tracks diverged from Port Taranaki in every direction, indicating that Port Taranaki is the first or last New Zealand port for many tankers. Several tankers 'stooged' back and forth in the North Taranaki Bight, either sheltering or awaiting a berth or cargo.

Bulk ship calls to Taranaki numbered 881 and LPG, oil and chemical tankers are frequent visitors to the port, often anchoring outside the harbour.

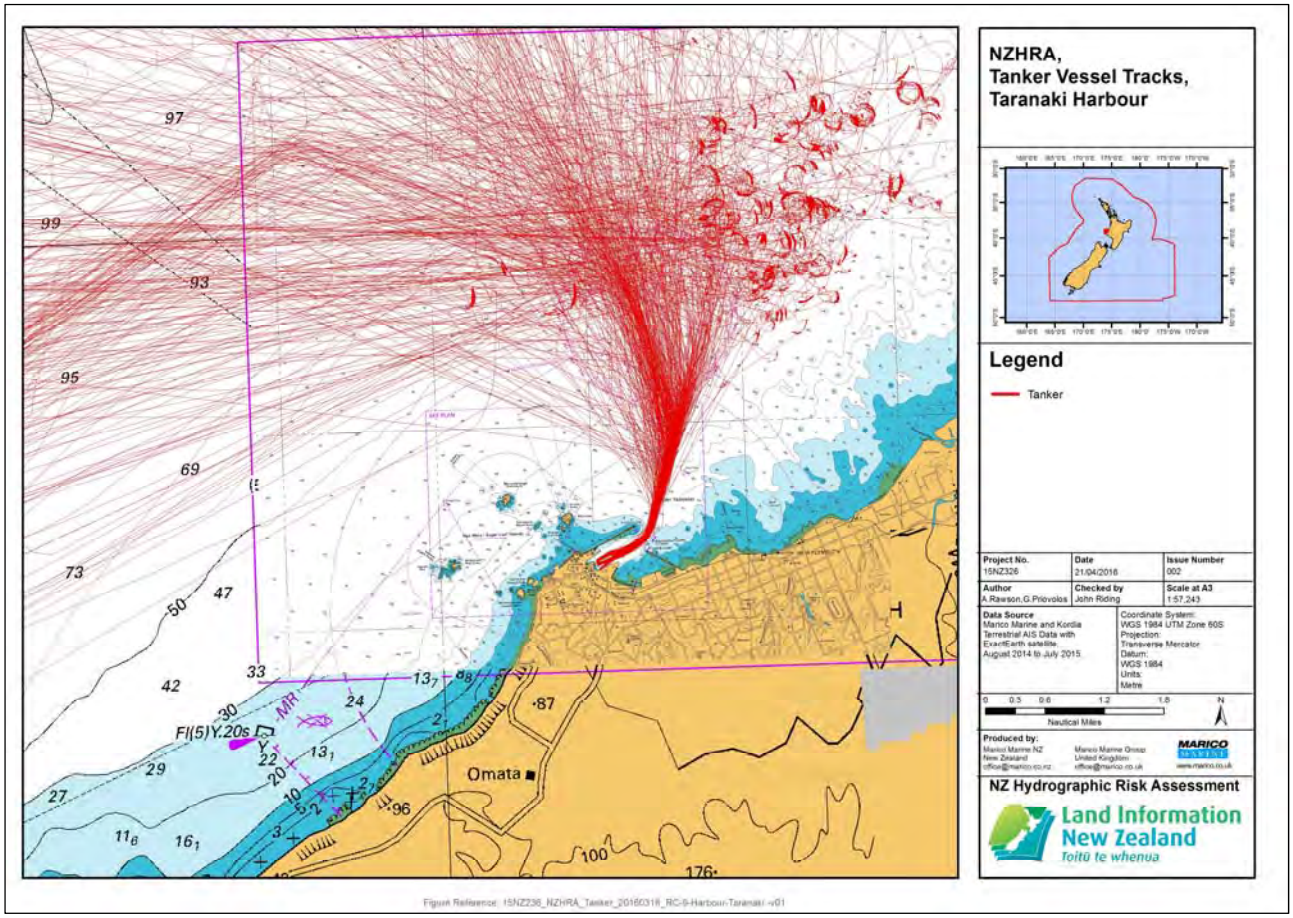


Figure 105 : Tanker Traffic – Taranaki Region

10.2.7 COMMERCIAL FISHING VESSELS - TARANAKI REGION

The fishing and seafood processing industry within the inshore waters of the Taranaki Region is relatively small. However, outside the 24m Contiguous Zone large trawlers operate in significant numbers, with a concentration of fishing activity notable in the centre of the Taranaki Bight. Only nine fishing vessels are registered as having their home port in Taranaki. The majority of fishing activity is seen during the summer months. Several charter companies run day fishing trips and tours.

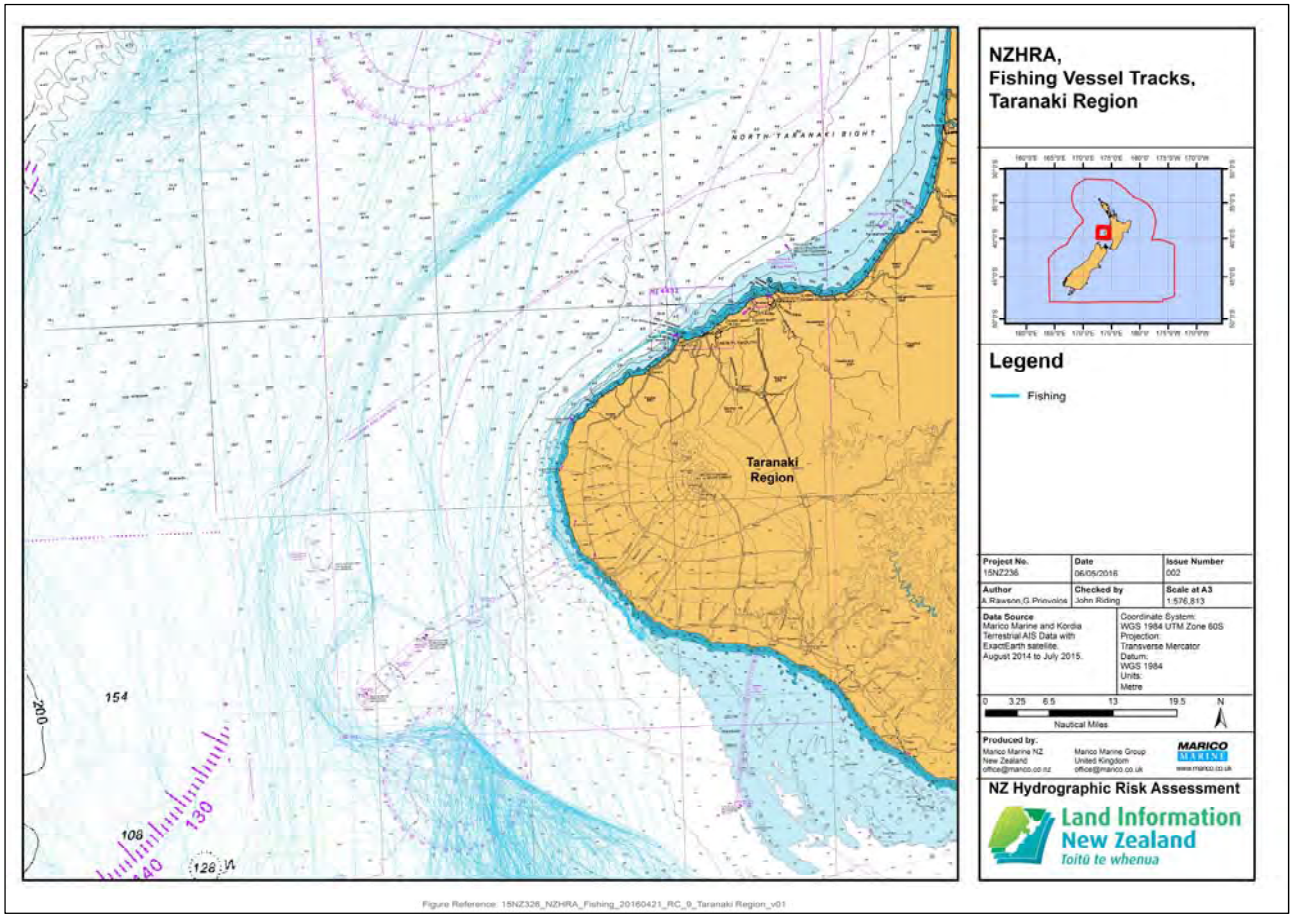


Figure 106 : Fishing Vessel Activity – Taranaki Region

10.2.8 RECREATIONAL FISHING VESSELS - TARANAKI REGION

The small number of recreational fishing vessels operating out of Taranaki are mostly trailer boats, launching into the harbour from the boat ramp. There is no marina as such in New Plymouth but a single pier extending into the harbour can berth around 20 vessels.

10.2.9 RECREATIONAL CRAFT IN GENERAL - TARANAKI REGION

There are 35 swing moorings inside the harbour for boats up to 10m in length. A yacht club operates within the harbour.

10.3 ANCHORAGE ANALYSIS – TARANAKI APPROACHES

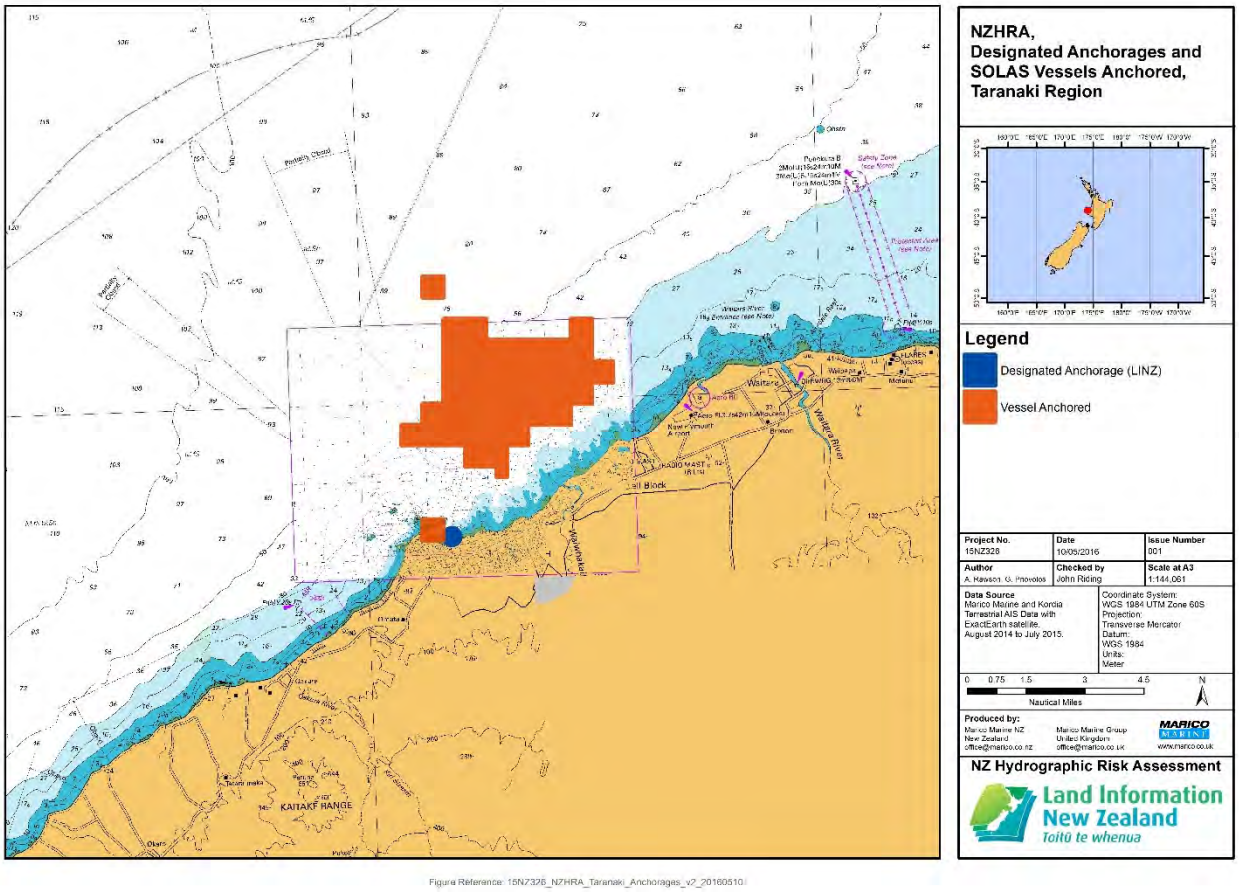


Figure 107 : Taranaki Approaches – Informal Anchorage Locations

Given the record of a considerable number of tankers anchoring offshore in the year of the data period (2014-15), analysis of these locations has been included. Traffic plots show numerous tankers anchored in informal anchorage areas outside the harbour limits over a large area, mostly in 20-30m water depth, 2 – 6 nm north-north-east of the port. This shows an area where monitoring by the region could be readily achieved, but advice to mariners may be a first step, including charting and regulatory navigational management. Chart source data in the area is from 1989-1990; this being for large areas outside harbour limits and all of ship anchorages. Advice to mariners of any poor holding for anchoring in the area is not available.

Vessels are not permitted to anchor within Harbour Limits, unless under pilotage.

10.4 HYDROGRAPHIC RISK - TARANAKI REGION

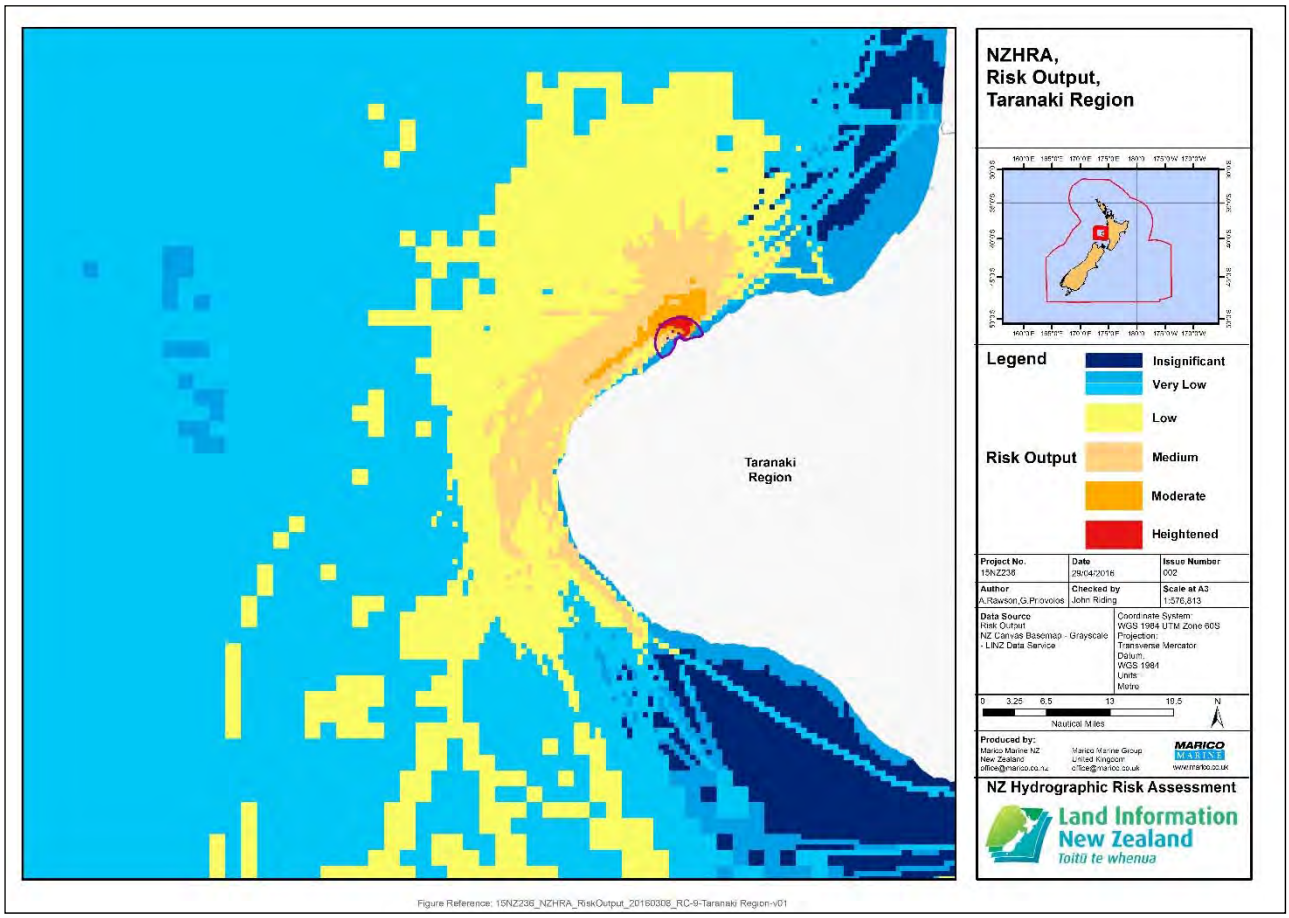
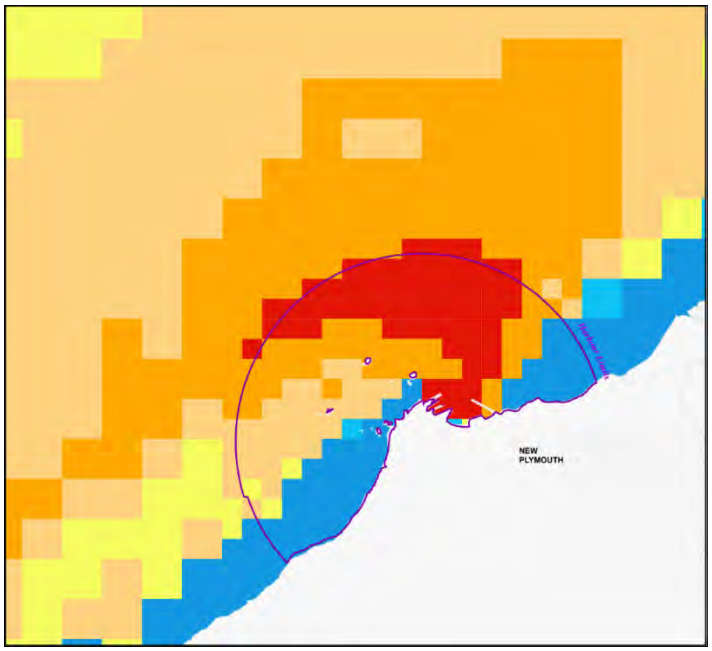


Figure 108 : Hydrographic Risk – Taranaki Region

The Taranaki coast shows a risk result of low to medium overall. The Taranaki Bight shows low/very low to insignificant. The approaches to Port Taranaki as well as its harbour areas provide moderate and heightened levels of risk. This is as much related to the fact that Taranaki is an oil services port as it is related to traffic levels (see insert).



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 approach scale chart in the vicinity of the anchorage relating to the seafloor type.

10.5 CHARTING BENEFIT - TARANAKI REGION

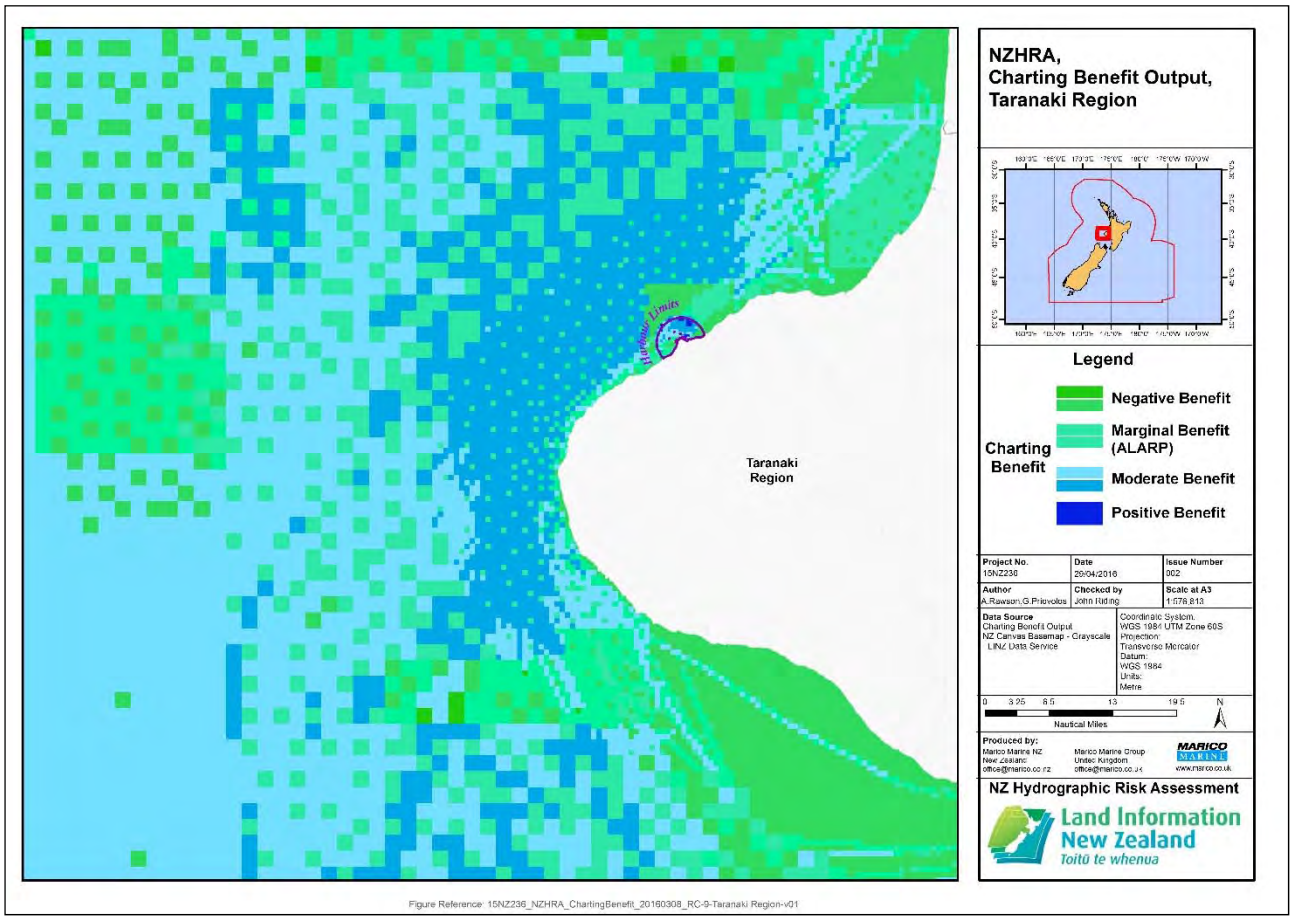
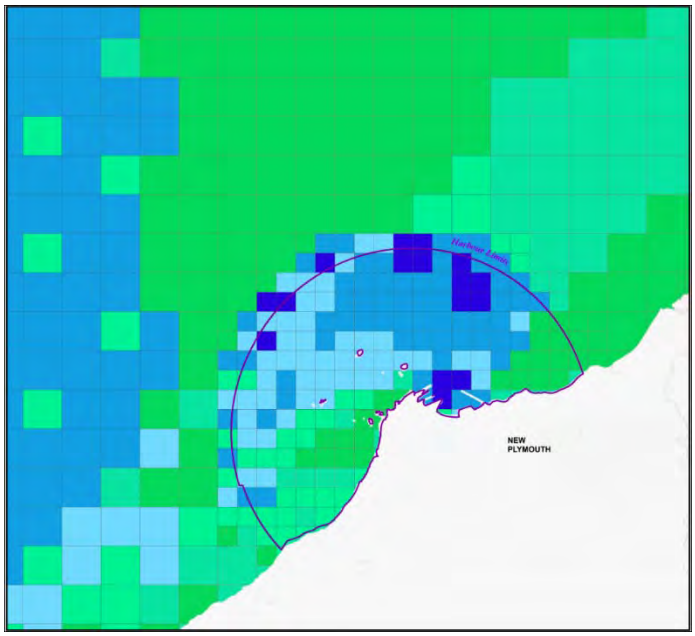


Figure 109 : Chart Benefit – Taranaki Region



The positive charting benefit inside the harbour limits reflects the heightened risk score here. A contributing factor to the positive charting benefit for the harbour area may result from the chart notation of dredged depths with no seafloor point-sounding data.

Although its harbour enclosure is small in size, Taranaki has a considerable volume of traffic in any 12 month period. This is, in part, related to the nature of the oil industry and its supply/support system. Apart from the dominant tanker traffic, much of the remaining traffic is small and services the oil industry.

11 DISCUSSION – NORTH ISLAND

The Overview Document (15NZ236A) should be consulted for the NZ National results, which provide a necessary overview. This work allows LINZ to develop a work programme to be delivered over a number of years, the content and scope of which only LINZ can decide as part of its function as Charting Authority for NZ Waters. As such, this report cannot come to conclusions other than what is presented in each Regional Council area.

1. The North Island presents a good result for Hydrographic Risk overall.
2. Although the project has provided some challenge to deliver a Hydrographic Risk Analysis for the whole of the New Zealand EEZ, a charting benefit assessment of the navigable waters by Hydrographic Risk has been achieved. A charting benefit model, 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 indication of charting benefit that allows a survey and charting updating plan to be developed.
3. The project has been able to identify areas, e.g. Wellington Harbour Approaches, where a Charting Reorganisation (in terms of scale and/or extents) would be of benefit to navigation. It has also identified areas where improvements could be made to the navigational safety management of vessels using coastal waters; examples include numerous tankers anchoring outside Taranaki Harbour waters in an exposed area, and inshore coastal transits in areas of significant current (e.g. Colville Channel).
4. LINZ has policy to add the MQual Charting Quality CATZOC rating to its charts and has done this to almost all of its coastal charting series. The CATZOC rating is of help to the navigator using ECDIS and it is also a key input into a Hydrographic Risk Assessment. The rollout of CATZOC has to date extended into the Coastal Chart portfolio, but not into the offshore series of charts. Therefore, it is worthwhile LINZ considering extension into all of the LINZ portfolio within the NZ EEZ, so that the LINZ macro scale international charts are given a rating reflecting their seafloor coverage and quality overall. This will assist in a future review of the GIS based risk model. As this is offshore deep water, there is little or no reputational risk posed to LINZ by adding MQual CATZOC to all of its Official Nautical Charting portfolio.
5. It is practically impossible to update all of the source data used in a chart at one time. This produces some scattering of charting benefit result in the plots. In the LINZ portfolio, there is chart source data in parts of some charts dating back to 1939. These areas will provide limited seafloor coverage information. Where charting benefit results are also positive it makes sense to have policy to prioritise these areas over others.

6. The updating of charting in the areas of maintained channels within harbour areas was a subject of feedback during data gathering. In some cases source data for maintained channels may not be updated for 10-15 years, e.g. Port of Tauranga which is charted as last dredged to various depths in 1996, although in practice maintenance dredging occurs annually. Whilst piloted vessels do not necessarily need to rely on official nautical charts (Pilots have access to local survey results), those navigating pilot exempt vessels do not. As the risk assessment methodology also shows these areas as providing benefit from Charting Upgrade, setting policy for charting update in this area would be of help to planning.

7. There are some informal anchorages in use around the NZ Coast, for example in the approaches to Gisborne and Taranaki. Hydrographic survey seafloor coverage may not always meet the standard recommended by the IHO in such areas; this may need pointing out to Mariners. However, it may be useful to consider seafloor conditions in such areas, in conjunction with the local navigational safety authority.

8. Changes to Harbour responsibility in New Zealand Harbour Waters occurred in the 1990s. This has resulted in navigational responsibilities being delivered through regional council systems, who do take 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.

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