Appendix

Contents

1. Governance

1.1 Consensus working group

There are 16 members on the Consensus Working Group (CWG); twelve members from stakeholder organisations and four represent mana whenua. The members were selected from within the larger reference group (RG). Further information on CWG members and the independent chair is detailed below.

The role of the CWG is to:

- engage with the reference group
- finalise and agree the scope of the study that will direct consultant work
- provide direction decisions as required and receive the final study report
- make recommendations to Auckland Council about the future of the port.

Independent Chair | Rick Boven
Dr Rick Boven is the independent chair of both the RG and the CWG. He has significant commercial experience, including leading projects for transport and infrastructure companies in New Zealand and internationally.

Nathan Kennedy
Nathan Kennedy is a long-time environmental and Māori rights advocate. He has been the environment officer for Ngāti Whanaunga for 15 years.

Tony Gibson
Tony Gibson joined Ports of Auckland as Chief Executive Officer in early 2011. He joined the Company with 30 years of experience in shipping and logistics.

Shane Vuletich
Shane Vuletich is Managing Director of The Fresh Information Company which specialises in strategy, measurement, evaluation and forecasting.

Michael Barnett
Michael Barnett is the Chief Executive of the Auckland Regional Chamber of Commerce and Industry. He holds a New Zealand Order of Merit for services to business.

Alan McDonald
Alan McDonald is the Policy Director of the Employers and Manufacturers Association (EMA). The EMA represents the interests of businesses in the area.

Jenni Goulding
Jenni Goulding is an independent Resource Management consultant. Her practice is currently undertaking development feasibility and project management.

Karen Wilson
Karen Wilson is of Te Ākitai Waiohua, Ngāti Te Ata, Ngāti Pikiao and Ngāti Hau descent and is a representative of the Mana Whenua group - Waiohua - Tāmaki Alliance.

Ngarimu Blair
Ngarimu Blair is the Deputy Chair of the Ngāti Whātua Ōrākei Trust and is involved in Treaty and Māori Heritage management issues in Tamaki Makaurau.

Greg McKeown
Greg McKeown is a previous chair of the Auckland City Council transport committee with a broad knowledge and strong interest in transport, port and city centre issues.

Rangimarie Hunia
Rangimarie Hunia is with Ngāti Whātua Ōrākei Whai Rawa, who have interests across the Tamaki Isthmus and are land owners of Quay Park.

Julie Stout
Julie Stout is an Auckland architect and Chair of Urban Auckland (Society for the Protection of Auckland City and Waterfront). She is representing groups associated with the built-environment, plus recreational harbour users.

Luke Christensen

Luke Christensen is the Auckland Policy Director of youth led organisation Generation Zero, which focuses on ensuring youth have a say in New Zealand's future.

Richard Didsbury

Richard Didsbury graduated in Engineering and is a director of Kiwi Property and Auckland Airport. He chairs the Committee for Auckland.

Maxine Moana-Tuwhangai

Maxine Moana-Tuwhangai has extensive management and accounting experience in previous roles at Tainui Group Holdings, Environment Waikato and Te Wānanga o Aotearoa.

Noel Coom

Noel Coom is the General Manager, New Zealand of ANL Container Line and is based in Auckland. He is currently Chair of the International Container Lines Committee.

Annabel Young

Annabel Young is the Executive Director at The New Zealand Shipping Federation, which represents the ship operators working around New Zealand.

1.2 Reference group

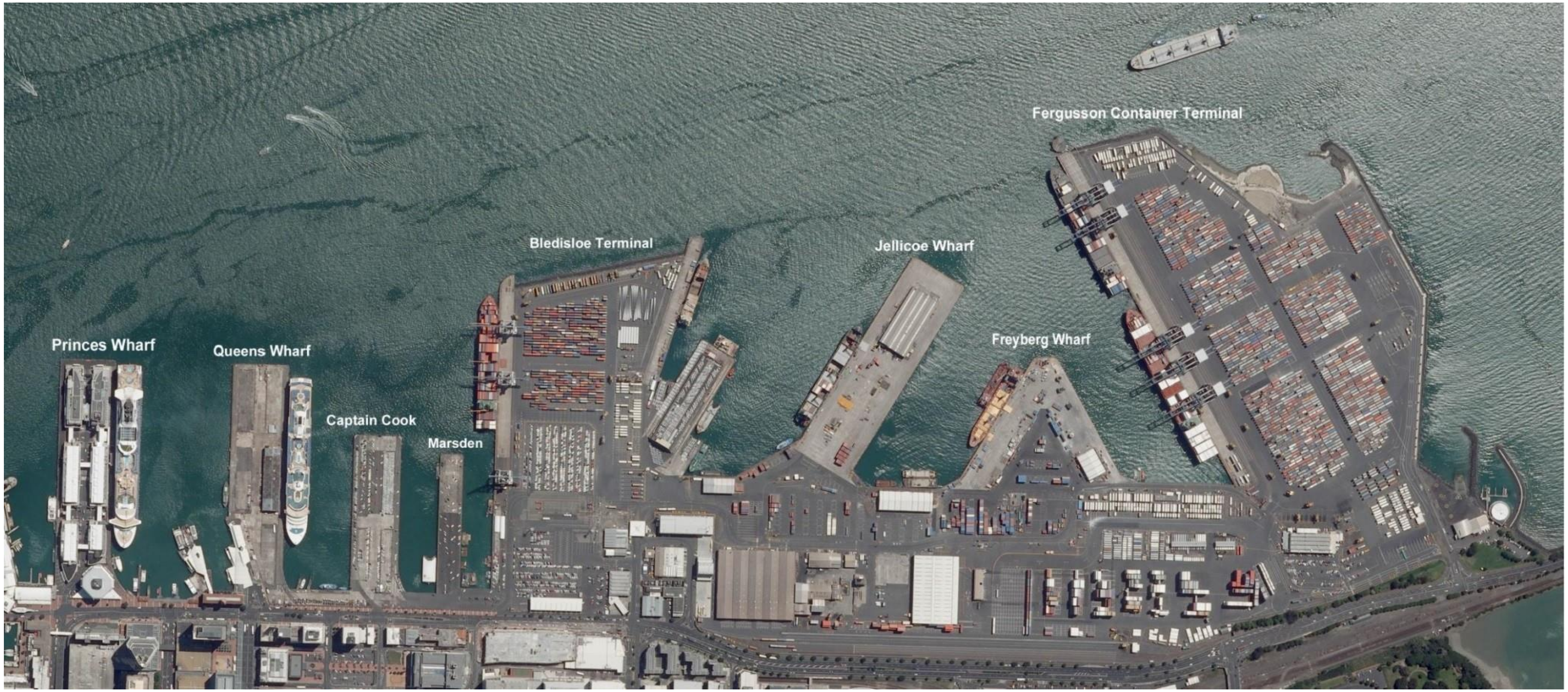
The reference group (RG) is made up of many community and business stakeholder organisations as well as the 13 mana whenua of the Tāmaki Collective and Waikato-Tainui. The purpose of this group is to:

- represent stakeholder organisations on the study and communicate updates to their representative sectors
- receive updates from the CWG
- engage with and provide feedback to the CWG
- undertake work requested by CWG.

The following organisations make up the RG:

Auckland Architecture Association	Devonport Heritage	Manukau Harbour Restoration Society	Ports of Auckland
Auckland Business Forum	Devonport Yacht Club	Maritime Union NZ	Renaissance Tours
Auckland CBD Residents' Advisory Group Inc (RAG)	Forest & Bird	Ngāti Whātua Ōrākei Whai Rawa Limited	Richmond Yacht Club
Babcocks NZ	Federated Farmers	NZ Council for Infrastructure Development (NZCID)	Society for the protection of Auckland harbours
Bayswater Community Committee	Generation Zero	NZ Institute of Architects	StoltHaven Limited
Britomart Group Ltd	Heart of the City	NZ Merchant Service Guild Inc	Stop Stealing Our Harbour
Cargo Service Ltd	Heritage NZ	Oceanbridge	Tainui Group Holdings Ltd
Chartered Institute of Logistics and Transport (CILT)	Holcim NZ Ltd	Onehunga Business Association	Torbay Sailing Club
Chelsea Refining	Imported Motor Vehicle Association (IMVIA)	Parnell Community Committee NZ	Wiri Business Association
Committee for Auckland	International Container Lines Committee (ICLC)	Parnell Inc	
Cruise NZ	Institute Landscape Architects (NZILA)	Parnell Community Committee NZ	
Devonport Business Association	Kotahi Ltd	PortPro Union	

2. Port of Auckland Layout



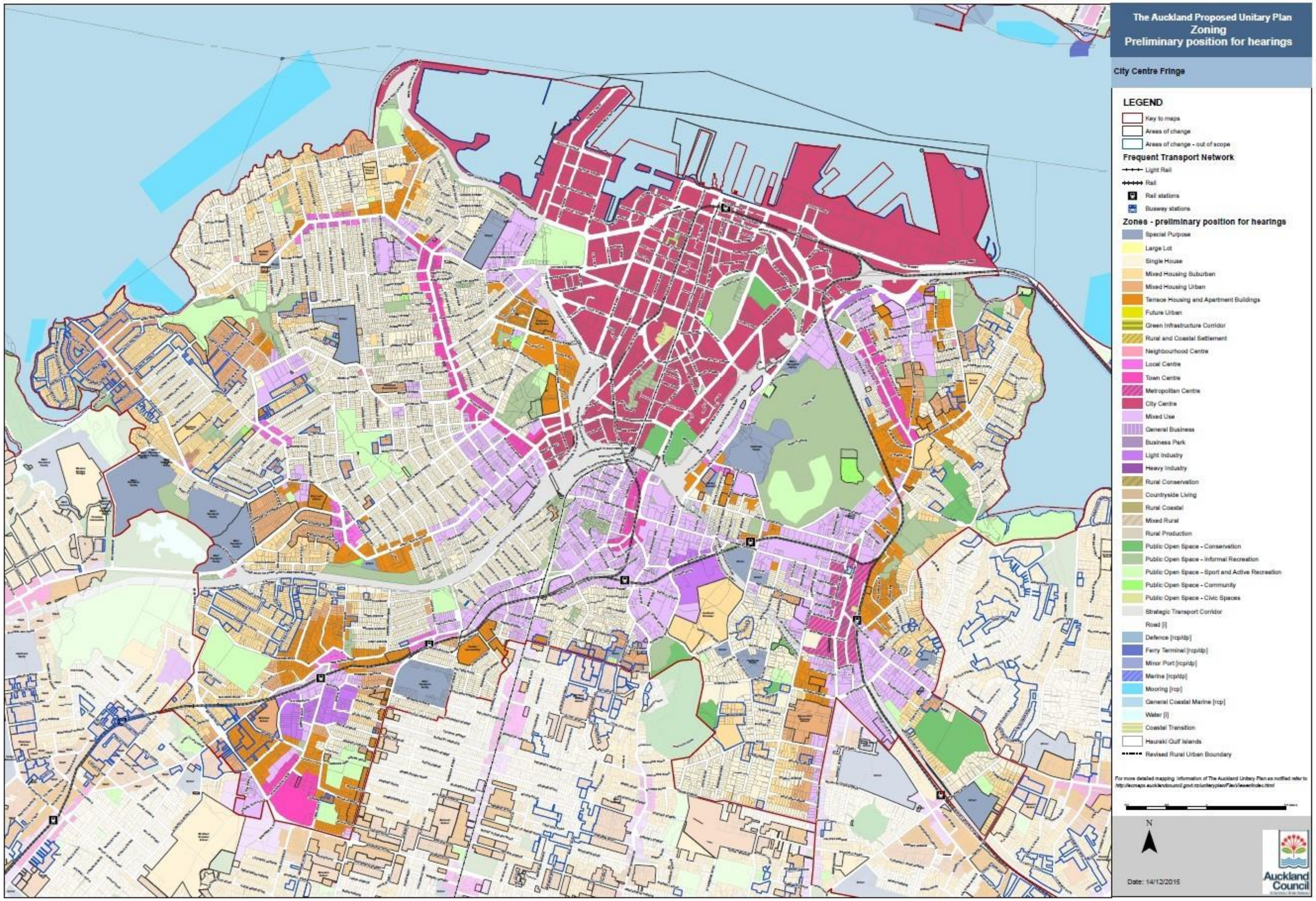
Source: Port of Auckland

3. Location of Wider POAL Infrastructure

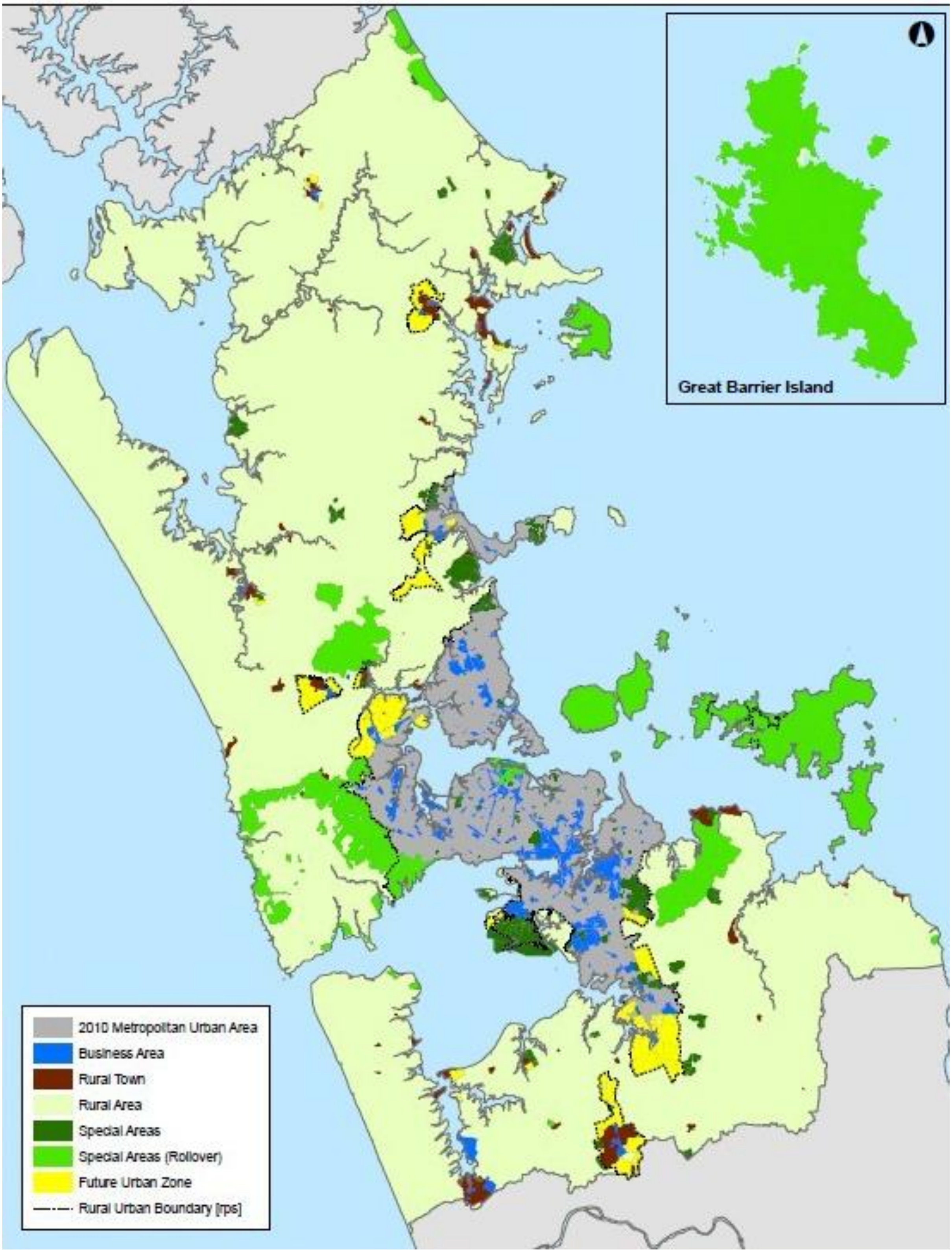
4. Historic Relinquishment/Sale of Land

5. Auckland Business Land Zoning

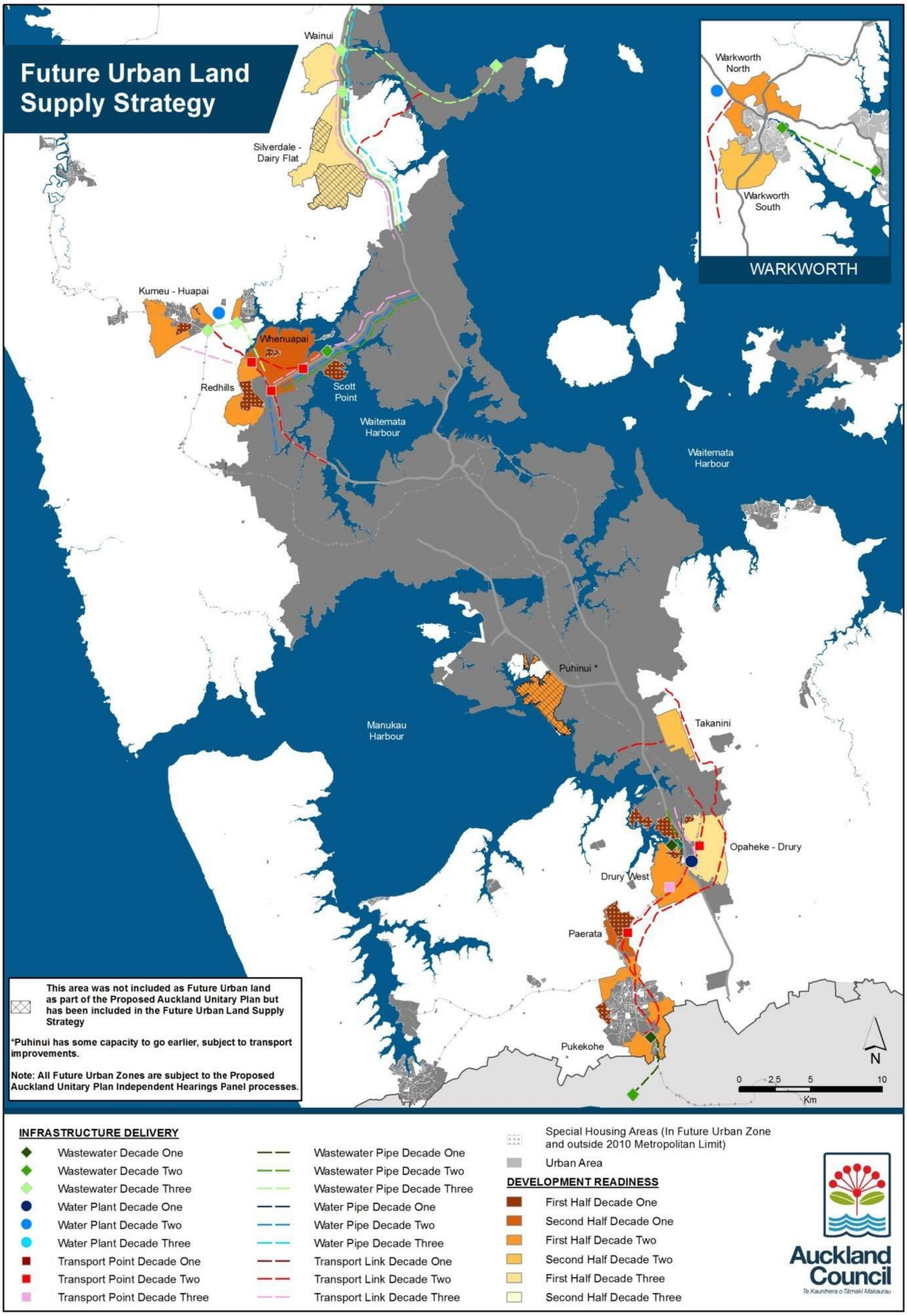
5.1 City centre fringe zoning



5.2 Geographic location of different land use typologies



6. Future Land Release Strategy to 2041



6.1 Future urban zones outside the 2010 Metropolitan Urban Limit (MUL)

Stage 3: Greenfields Areas of Investigation

25_ Three major greenfield cluster areas will provide capacity for approximately 90,000 new dwellings over the next 30 years. The three clusters are shown on Map 1 below.

MAP 1: Greenfield areas of investigation

1 Northern Cluster	**2 North-western Cluster**	**3 Southern Cluster**
Warkworth	Whenuapai	Pukekohe
Silverdale	Kumeu / Huapai	Paerata
		Drury / South Karaka

Source: Auckland Council, http://www.aucklandcouncil.govt.nz/EN/planspoliciesprojects/plansstrategies/unitaryplan/Documents/unitaryplanaddendumrub.pdf

7. Supporting Plans Summary

Type	Name	Description
Resource management and development	The Auckland Unitary Plan	The Auckland Unitary Plan is currently in the process of being completed. The Auckland Unitary Plan is the resource management plan, which will guide the development and quality of the city's built and natural environment. The Auckland Unitary Plan will be the principal regulatory tool to implement the Auckland Plan that regulates resource, land use and development.
Place based plans	The City Centre Master Plan	The City Centre Master Plan is a 20-year vision focusing on Auckland's city centre. It identifies opportunities for development. The plan is a non-statutory supporting document to the Auckland Plan and an input to the Unitary Plan. The City Centre Master Plan focuses on eight key initiatives, which include: ▶ Harbour edge stitch - uniting the waterfront with the city centre ▶ The east-west stitch - connecting the western edge of the city to the centre ▶ The engine room - Queen Street valley, the CBD and retail district ▶ Innovation cradle - nurturing the innovation and learning cradle ▶ City Rail Link - new public transport stations and development opportunities at Karangahape Road, Newton and Aotea Quarter ▶ The green link - connecting Victoria Park, Albert Park and the Domain as part of a blue-green park network ▶ City to the villages - connecting the city and the fringe ▶ A water city - revitalising the waterfront.
	Integrated Transport Programme – AT	Auckland's Integrated Transport Programme sets out the 30-year investment programme to meet the transport priorities of the Auckland Plan. It is developed by Auckland Transport and the New Zealand Transport Agency. The ITP provides a consolidated transport investment programme across the transport system over the next 30 years. The programme covers state highways and local roads, railways, buses, ferries, footpaths, cycle ways, intermodal transport facilities and supporting facilities such as parking and park-and-ride.
	The Waterfront Plan	The Waterfront Plan 2012 sets out the vision and goals for the waterfront and a range of short, medium and long-term initiatives that include a 20km promenade and cycleway along the edge of the waterfront, an innovation precinct at Wynyard Quarter, a 4.5 hectare park on Wynyard Point, and a light rail system from the Wynyard Quarter to St Heliers.
	Sea Change - Tai Timu Taoi Pari	Sea Change – Tai Timu Tai Pari is about improving the Gulf – its ecology, its economy and the health and wellbeing of its communities. The Sea Change – Tai Timu Tai Pari Hauraki Gulf Marine Spatial Plan will not be a legally binding document but it will guide the regulatory authorities who manage Gulf and its catchments. It will be then be for these authorities to reflect on the recommendations from the plan when undertaking their statutory processes. It will also provide guidance and recommendations for voluntary action from communities, interest groups and industry. The plan will ultimately inform how the Hauraki Gulf is shared, used and safeguarded, now and for future generations. Currently the plan is in draft, the Marine spatial planning initiative is designed to produce a Marine Spatial Plan to safeguard the Hauraki Gulf area.

Type	Name	Description
Local plans	Local Board Plans	Local Board Plans are three-year plans that set out the aspirations and priorities for a particular community. They guide the decisions that the local board will make for the area over the next three years and beyond. They inform and influence the development of the Auckland Council's Long-Term Plan.
	Local Board Agreements	Local board agreements are negotiated with the council and determine a local board's budget and funding for local activities for each financial year.
	Area Plans	Area plans are long-term (30-year) plans based on the same geographic areas as local boards. Currently in development, they will help to implement the directions and outcomes of the Auckland Plan at a local level.
Core strategies	Auckland's Economic Development Strategy	Auckland's Economic Development Strategy focuses on driving greater investment and cooperation by business, industry, government and community organisations. It provides guidance on Auckland's economic development and the council's planning and investment decisions over the next 10 years.
	Future Urban Land Supply Strategy	The primary purpose of the Future Urban Land Supply Strategy is to identify the sequencing and timing of future urban land for development readiness over 30 years.
	Low Carbon Auckland	The plan sets out a 30-year pathway and a 10-year plan of action to transform towards a greener, more prosperous, liveable, low carbon city, powered by efficient, affordable, clean energy and using resources sustainably.
Budgetary focus	The Long Term Plan	Produced every three years, the Long-term Plan puts the Auckland Plan in motion and sets out the council's projects and budget for the next 10 years.
	Annual Plan	Auckland Council is required to have an annual plan focusing on priority activities and projects, service levels, funding information and financial policies for the upcoming year.
Other relevant plans	Cruise Action Plan – ATEED	This action plan identifies opportunities to increase the regional economic benefits from the cruise industry and its contribution to the visitor economy by: ▶ Identifying growth and industry development trends and opportunities; ▶ Ensuring that opportunities to develop the cruise industry integrate with other key initiatives, including the Major Events Strategy, and initiatives to improve and develop visitor attractions across the region; ▶ Identifying opportunities to develop the value chain associated with the cruise industry, with visitor attractions and provisioning a key focus; and ▶ Identifying the potential partners for a range of cruise-specific initiatives with key industry players including Waterfront Auckland (WA), Ports of Auckland Limited (POAL) and the cruise industry
	Auckland Visitor Plan – ATEED	This Visitor Plan presents a clear aspiration for the contribution tourism makes to Auckland, supported by an investment road map and a tangible set of actions to align thinking, identify opportunities, and direct public and private sector investment in tourism-related initiatives over the next decade.
	Tourism 2025 – Tourism Industry Association	Tourism 2025 is not a detailed strategic plan but a shared vision and commitment to growing value by working together for the long-term benefit of New Zealand tourism and the wider economy. It is about the industry aligning for growth to improve our competitiveness

National Strategies Plans Summary

Agency/ Ministry	Document	Description
Ministry of Transport	Connecting New Zealand	This is a summary of the government's broad policy direction for transport over the next decade. These include the National Infrastructure Plan, the Government Policy Statement, the KiwiRail Turnaround Plan and Safer Journeys: New Zealand's Road Safety Strategy.
	Government policy statement on Land Transport 2015	This is the policy and regulatory framework it sets out the government's priorities for expenditure from the National Land Transport Fund over the next 10 years.
	Strategic Policy Programme	The Ministry is currently undertaking two strategic policy projects, looking at how transport might be regulated in 2025 and the public transport system in 2045. The three questions the Ministry looked at were: 1. How will New Zealand's economy perform in the future, and what are the implications for transport? 2. How could or should the transport system evolve in order to support mobility in the future? 3. How could or should New Zealand fund the transport system in the future?
	The Regulation 2025	The Regulation 2025 project is considering how the need for regulation might be different in 2025, and what tools will be available to shape behaviour. The project is considering 'regulation' in its broadest sense, including legislation, rules, education and social norms, and is examining all transport modes (road, rail, aviation, maritime and active transport).
	The Public Transport 2045	The Public Transport 2045 project will look at where new technologies and business models are likely to take us as a society, and the implications for public transport.
KiwiRail	Kiwi rail turnaround plan	A 10 year program for the rail business. The plan aims to increase rail traffic volumes and revenue, increase productivity, modernise assets and separate out the commercial elements of the business. However, it should be noted that this plan will be replaced by Kiwi Rail's new 30 year plan 'Project 2045'. Project 2045 is a 30 year plan intended to provide the basis for a long-term strategy to build long term certainty for the business.
Ministry of Business Innovation and Employment	New Zealand Energy Strategy 2011- 2021 New Zealand Energy Efficiency and conservation strategy 2011-2016	The New Zealand Energy Efficiency and Conservation Strategy (NZEECS), guides Energy Efficiency and Conservation Authority's work on energy efficiency, conservation and renewable energy. The plan works in tandem with the government energy strategy, which is advised by the Ministry of Business, Innovation and Employment. The strategies address energy consumptions such as oil, of which the transport sector is the primary user of this energy. One of the NZEECS goals is in relation to transport to have a more energy efficient transport system that uses more diverse fuels and technologies.

Agency/ Ministry	Document	Description
New Zealand Transport Agency	Safer journeys Action Plan 2013-2015	Action plan to : • advance the Safe System approach (accounts for human error and adapted to the physical tolerance of road users, eg sets the speed limit to avoid death and serious injuries). • address speed as a cause of road death and serious injury • improve roads and roadsides • improve the safety of the New Zealand vehicle fleet • reduce crashes caused by impaired road users
	The National Land Transport Programme (NLTP) for 2015-18	This contains all the land transport activities, including public transport, road maintenance and improvement, and walking and cycling activities, that the New Zealand Transport Agency anticipates funding for over the next three years.

8. Investment Logic Mapping

8.1 Overview[1]

8.1.1 Background

ILM was developed by the State Government of Victoria, Department of Treasury and Finance (DTF) in Australia in 2003, to screen budget bids. It was formally introduced to New Zealand by the State Services Commission (SSC) in July 2008, following successful pilots by the Ministry of Health. It is being increasingly used by New Zealand Government agencies and is included in the New Zealand Treasury's guidelines for Public Sector Business Cases. Although its origins are in the public sector it has proved an equally valuable technique when used in the private sector.

8.1.2 What is an ILM?

Investment logic mapping (ILM) is a series of structured workshops that bring together key stakeholders to ensure that there is early agreement on problems, outcomes and benefits before any investment decisions are made or a specific solution is identified.

8.1.3 What is it for?

ILM workshops put the emphasis on gaining a clear understanding of the problem (or opportunity), the consequence of the problem and the desired benefits – before looking at possible solutions. The output of an ILM is usually a one-page investment story that sets out the problems and benefits in straightforward language that all stakeholders can understand.

8.1.4 When is it used?

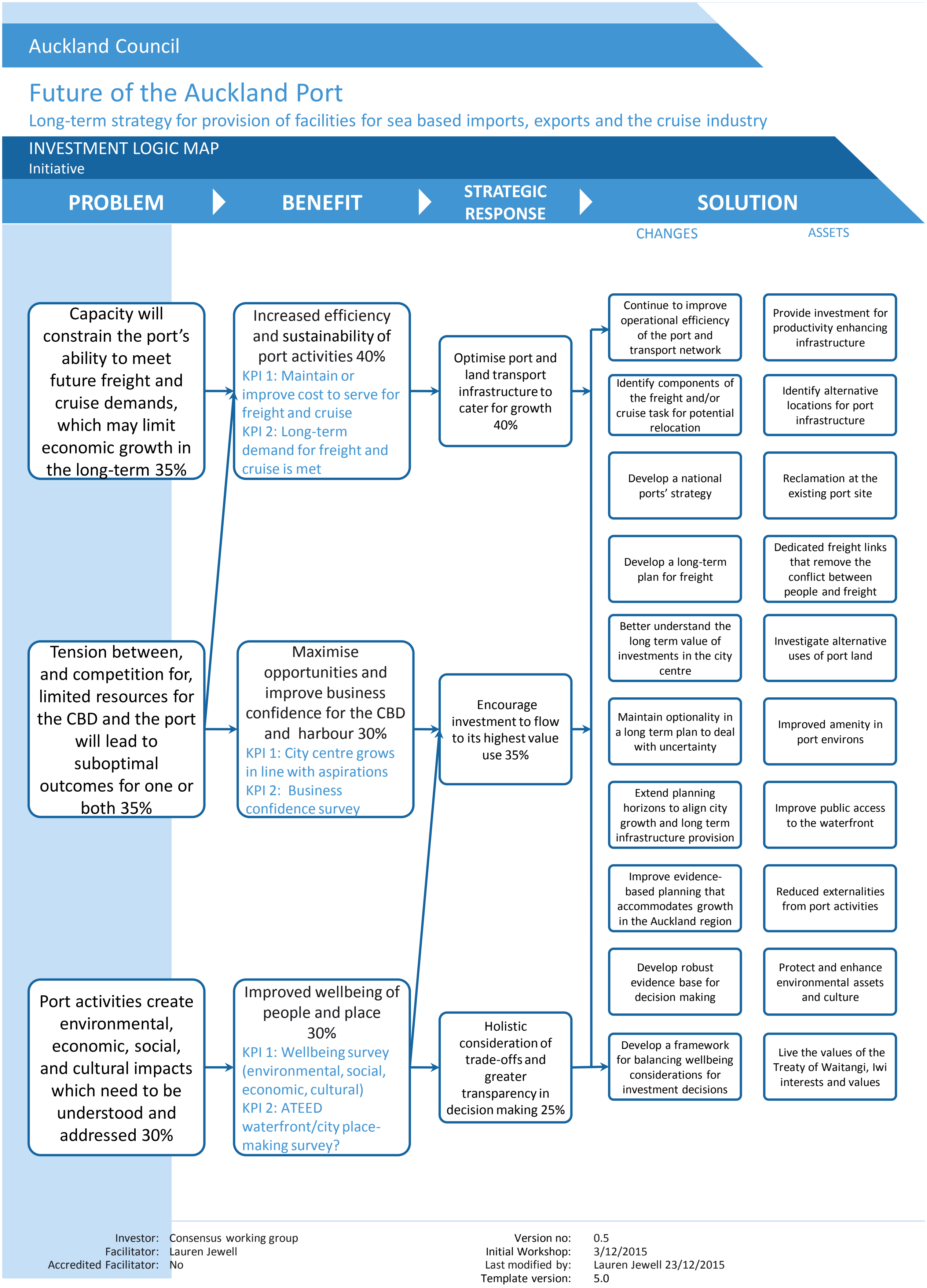
ILM workshops are normally carried out at the beginning of the development of the strategic case, and less formally, at the beginning of the development of the indicative business case as a scoping exercise to inform the IBC. There may also be other points during the project development lifecycle when the facilitated workshop techniques of the ILM process may be of use. The basis of this is that group can then determine whether an investment is warranted.

[1] Source: NZTA http://hip.nzta.govt.nz/processes/project-development/strategic-case/ilm-guidance

8.1.5 What are the outputs?

The main outputs from the investment logic mapping process are the investment logic map and benefits map. Both are simple single-page flowcharts that tell the story of an investment and expose its underpinning logic. They are both in plain English and designed to answer many of the key questions required to make an investment decision.

8.2 CWG ILM workshop output



9. Case Studies of Port Redevelopments

Sydney

Situation

- Prior to 1960, Sydney's international shipping facilities were exclusively located in Port Jackson (the main harbour, containing Sydney Harbour Bridge), with bulk and break bulk docks at Darling Harbour and Walsh Bay, and bulk and ro-ro docks at Glebe Island and White Bay.
- With the advent of containerisation in the late 1950s it became clear that Sydney would require additional port facilities to cater for new cargo types. In the 1960s the government agency responsible for ports, the NSW Maritime Services Board, recommended that a new port complex be developed in the northern part of Botany Bay adjacent to Sydney Airport. The New South Wales Government endorsed the proposal in 1969 and work commenced in 1971.
- As a result of this re-location, port and other related industrial land gradually became available for redevelopment immediately adjacent to central Sydney, which over the last few decades has been progressively been developed for high density urban environments including Darling Harbour, and the current Barangaroo re-development proposal.

Darling Harbour (approximately 40 hectares) was formerly railway marshalling yards, and was first redeveloped in the late 1980's into a large tourist and leisure precinct, including a maritime museum and international convention centre. Work is still on-going to provide a new convention centre, apartments, student accommodation, retail and office space, and further public open space.

Barangaroo is a 22 hectare site (formerly a container port) that is now comprised of three unique areas: Barangaroo Point, Central Barangaroo and Barangaroo South. The site will provide around 3,500 homes and accommodate 24,000 employees. Barangaroo Point offers 5.7 hectares of harbour park (50% of Barangaroo will be public open space). There is 7.8 hectares of mixed-use commercial space, including sky-high office towers, luxury residential apartments, a landmark international hotel plus a variety of boutiques, shops, cafes and fine-dining restaurants. Construction of Barangaroo will create up to 3,000 jobs onsite and 8,000 offsite. Barangaroo is expected to bring in 12 million visitors each year (33,000 people visiting a day).

Europe

Marseille

The Euromediterranee is the largest urban renewal project in southern Europe, and commenced in 1995, which has upgraded the former port side district of La Joliette in Marseille into a business district. The award winning project spans across 480 hectares, and has seen the renovation of docks into offices, a 16,000m^2 former granary known as *Le Silo* into a theatre, and the upgrade and refurbishment of the 14 metre waterfront promenade called *boulevard du Littoral*, at a cost of 35 million euro. It includes a creative project called Terrasses du Port, which offers passenger reception facilities, a shopping centre, and scenic views of the port. On the 23,000 m² ground floor, the entrance to the shopping mall coexists with various port functions related to the cruise ship terminal (passenger boarding areas, vehicle storage, etc.).

London Docklands

Docklands is a 22 square kilometre riverfront development centred on the boroughs of Tower Hamlets, Newham, Southwark, Lewisham and Greenwich and was previously derelict land. The development has occurred largely from 1981 onwards, comprising a combination of development across housing, commercial, retail, educational and leisure facilities as well as, significant investment in transport infrastructure, lines and stations. It made great social, environmental and economic improvements for the area, by increasing number of jobs through new office facilities, increasing living populations through new housing and increasing the amount of public open space available through reclamation and design transformations on derelict or underutilised land.

Hamburg – Hafen City

HafenCity, Hamburg is a brownfield urban regeneration project located on the former site of old port warehouses. As European Union Free Trade has diminished the economic importance of the port, the land required has been reduced and given over to residential and commercial development, including shops, offices and hotels.

The area of HafenCity is approximately 220 hectares, and at completion (between 2020 - 2030) is projected to host 40,000 office workers and be home to 12,000 residents.

10. Unpicking the cargo growth forecasts – futurist thinking

There have been significant changes to what and how we consume products. The World Trade Organisation stated that it is unlikely that revolutionary events such as the explosion of communication and interactive facilities could have been predicted 20 years ago with any degree of precision.[2] Despite future forecasts being dependent on extrapolating current trends, it still provides valuable insights by identifying challenges from changes that we are likely to face.[3] The following sections discuss historic trends in trade since the 1980s, which help us contextualize the Ports of Auckland future freight task.

10.1 Detailed future state projection assumptions

General limitations to forecasting

- There is always an inherent risk in forecasting data and assumptions this is due to the pure nature of forecasting, such as the risk of random and other unforeseen events. Consideration to the limitations of forecasting should be considered when reading this report and other assumptions should be used as an indication only.

GDP Projections

- Obtained from OECD and NZ Treasury. These were available to 2060 and we have made no adjustments to these forecasts.

World Trade

- Obtained from Oxford Economics who ultimately use the International Monetary Fund (IMF) data. These projections were available to 2035. To project out to 2060 we have extended the same growth rate at 2035 out to 2060.
- To calculate the growth rate to apply we calculated the CAGR of this and applied to our forecast of containers and multi-cargo.

Containers

- We have assumed that the 2015 TEU's provide the base for our projections and thus applied our growth rates to this.
- This assumed that the mix of containerised cargo remains the same throughput the forecast period.
- Historical growth rates have been calculated as the CAGR over the period 2010-2015.
- NZ Treasury trade rate is average growth rate for combined imports and exports by value.

Multi-cargo

- We have assumed that the 2015 multi-cargo weights provide the base for our projections and thus applied our growth rates to this.
- This assumes that the mix of multi-cargo in 2015 will remain the same throughout the forecast period.
- We have not used historical growth rates as a driver of growth as the growth rates in multi-cargo has been quite volatile recently.

Vehicles

- Lower band projection – Historical vehicle imports as a percentage of population4 were analysed over a nine year period.
- This percentage was then applied over a 42 year time horizon for population forecasts resulting in a CAGR of 0.06%.
- Mid-range projection - As mentioned above, New Zealand imports majority of its new and used vehicles from Japan. As this source market is the biggest driver of vehicle imports, EY have utilised the CAGR of 1.86% from the Oxford economics forecast out to 2035 and applied this forecast, to vehicle import numbers to 2060. Please note: This forecast was using a dollar value projection and we have applied the CAGR to forecast future units. However, the CAGR utilised is not drastically dissimilar from other sources and our other calculations.
- Upper band projection – Historical vehicle imports as a percentage of GDP 5 were analysed over a nine year period. This percentage was then applied over a 45 year time horizon for GDP forecasts resulting in a CAGR of 2.3%.

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[2] World Trade Organisation (2013) World Trade Report 2013. Accessed from https://www.wto.org/english/res_e/booksp_e/world_trade_report13_e.pdf

[3] Ibid

[4] Statistics New Zealand

[5] Statistics New Zealand, OECD data

Vehicle forecast assumptions and sources of data.

Data	Source	Forecast period (yrs.)	Start point	Forecast period	Estimated ($US m.) at 2035	CAGR (%)
Imports into NZ from Japan	Oxford economics	20	2015	2035	$3,572	1.86%

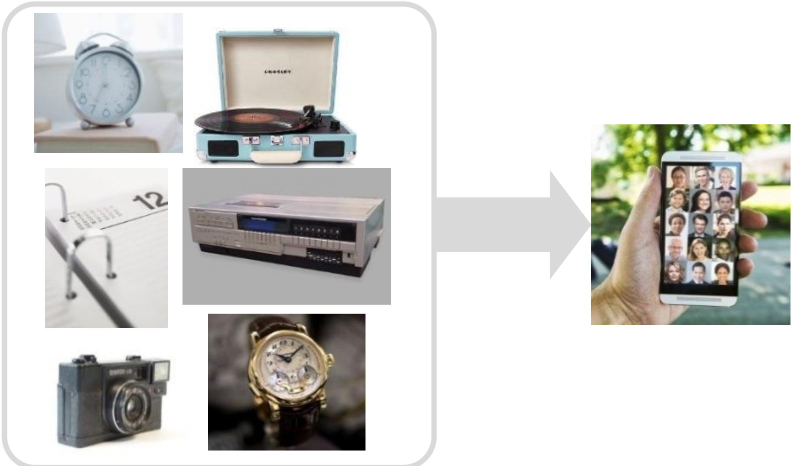
Other notes:

- PwC considers their forecast conservative given Statistics NZ has forecast population to increase to 27% in the same timeframe.
- Vehicle imports in recent years have already exceeded the PwC forecast.[6]
- We used the graph values to estimate the CAGR so the calculated CAGR is an approximation of value.
- The NZIER econometric model used the follows assumptions to determine their upper and lower bonds in their growth forecast.
- Other key considerations include:
  - Ageing average age of New Zealand's vehicles
  - Population growth
  - Propensity of different age cohorts to purchase vehicles
  - The effect of increasing incomes due to increases in GDP
  - City density and public transport use
  - Technology changes in motor vehicles.

10.1.1 Some trends in products 1980-2015

This looks at how complex our import and export mix is in terms of assessing the potential for things to change over time. In particular:

Technology has led to cases of many consumer items being consolidated



[6] NZIER, 2014

We consume products in totally different ways

Digitisation of movies, music and a range of other consumables see us import far less of these products than we used to.

We now use products that didn't exist as consumer products 30 years ago

But….some products have changed very little in size or haven't changed at all since the 1980s

Our domestic industry has also changed significantly

Over the last 30 years, we have lost almost all of our domestic mass-produced vehicle assembly industry. Other manufacturing including whiteware and clothing has also been off-shored, but been replaced by increasing focus on digital, tourism, foreign education and film and television.

10.2 Putting the disruption of the last 30 years into context

Summarising the trends above, there is an apparent headline trend to smaller, lighter, and more digital than ever. Even when looking at motor vehicle manufacturing, the fact we were importing the components means that all other things being equal, the shift from domestic to offshore production should have at least been neutral in terms of volume. This doesn't account for the plant and equipment needing to be imported to allow us to produce cars.

Despite massive changes in product mix, size and weight our TEU's per person have continued to increase:

Year	POAL TEU	Auckland Population	TEU per Capita
1995	381,000	1,115,800	0.34
2005	644,306	1,348,900	0.48
2015	972,434	1,569,900	0.62

Source: Statistics NZ, POAL annual Reports, EY analysis

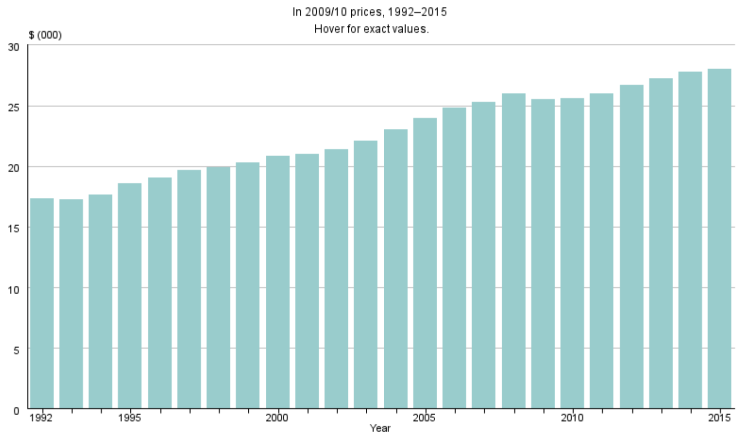
We have consciously picked 1995 as a benchmark date as this comes after the most significant reorientations of the New Zealand economy, particularly the largest impacts on the domestic manufacturing sector.

Consumption is king

The critical driver of this trend is overall consumption of volume of goods is effectively outstripping the smaller, lighter, digital trend.

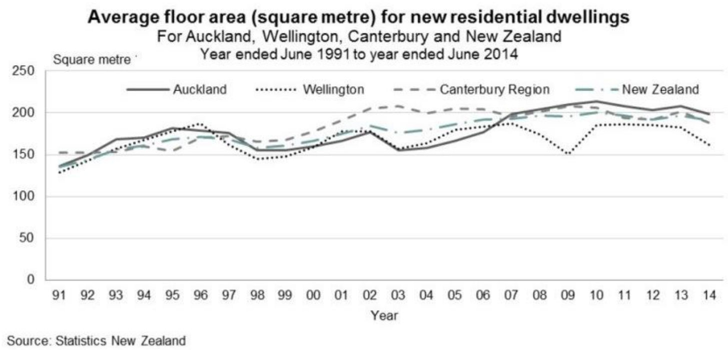
On average, household consumption rates across New Zealand have been increasing since 1990 (other than the period directly following the Global Financial Crisis).

Real household consumption expenditure per person



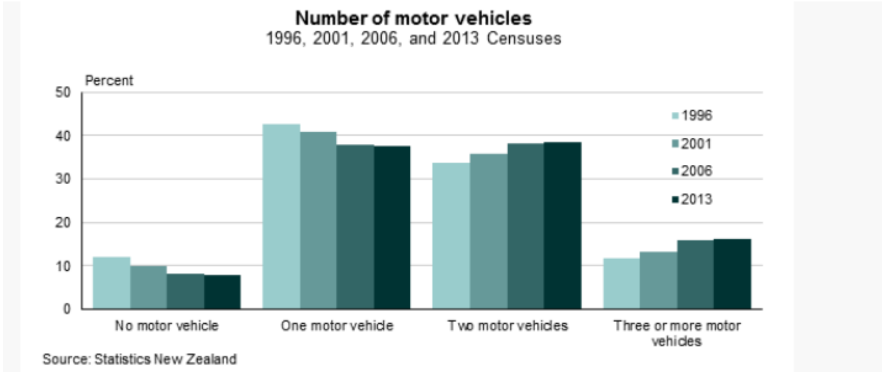
Source: Statistics New Zealand

In essence, modern lifestyles, and the accessibility of products (and their price), continues to drive physical consumption. For example, our houses are getting bigger:



This is despite the average household occupancy in Auckland (which has the highest birth rates in New Zealand and the largest proportion of large families) remaining constant at three people per dwelling between 2001 and 2015 (Auckland Council). Larger houses require more building products and more fixtures and fittings.

Motor vehicles also provide an indication of this trend as price, accessibility and market segmentation (e.g. the marketing of multiple vehicle types to meet a household's lifestyle needs) push household car ownership higher:



Again, the 1996 date is critical as a base date as it is three years after the de-regulation of used car imports in New Zealand. It's also critical to note that family size is not necessarily an indicator of number of vehicles, with academics such as Jose Viegas pointing to an increasing incidence in Europe of more than one vehicle per adult member of a household.

10.3 Testing the future freight forecasts

"I do believe in the horse. The automobile is no more than a transitory phenomenon." - Wilhelm II (German Emperor until 1918)

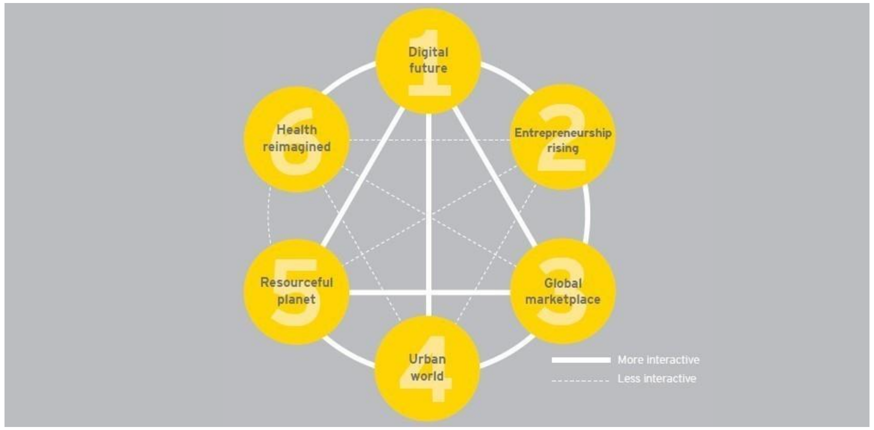
The Future Port Study forecasts are underpinned by an assumption that New Zealand will follow international trends towards 1 TEU per person over time. In the previous sections we have showed that despite a 30 year period of disruption in types of imports, the movement towards 1 TEU per person has held. In looking ahead, two questions need to be asked:

1. Whether there is a finite limit towards our propensity to consume more given reductions in price and increases in accessibility of goods?
2. Whether future disruptive forces will fundamentally change the need to import in a way we have not previously seen?

In order to answer these questions we have used the concept of ***megatrends*** to assess whether future changes will provide more demand for imports or less demand for imports based on our central scenario.

Megatrends are major drivers of social, economic or environmental transformation with formative influence on the underlying structure, ways of life and value systems of a society. The number of megatrends and what is in, and out of each), but general consensus on their categorisation. There are multiple views on what the specific current megatrends

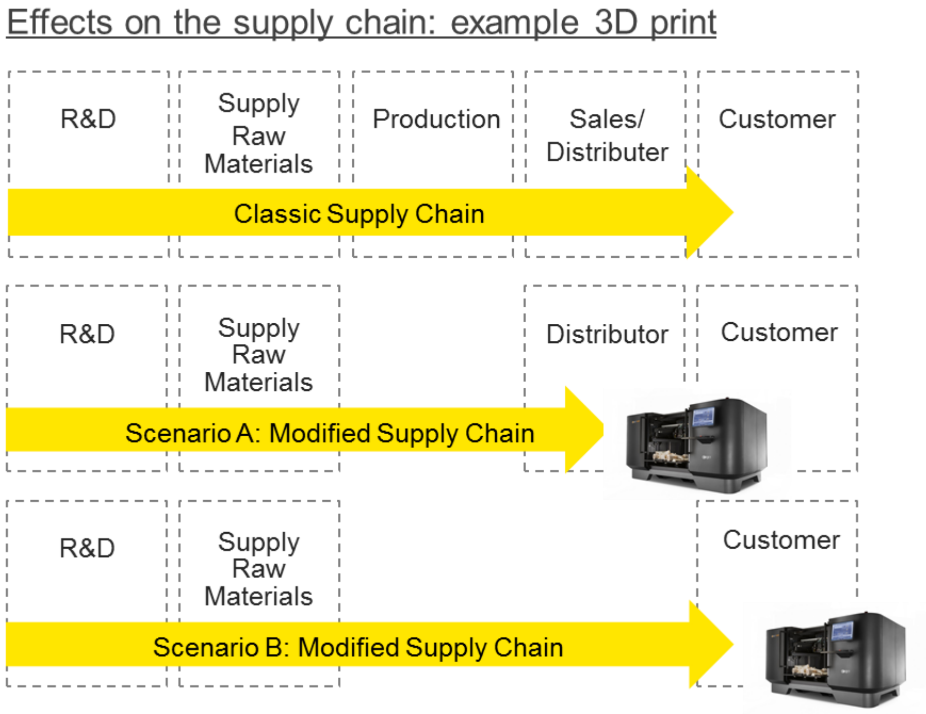
The megatrends we use in this paper are as follows:



10.4 Digital future – negative pressure, but not as much as you'd expect

The digital future megatrend encompasses things such as digitisation of product (e.g. films, music, books etc) as well as digitally based production techniques such as 3D printing. It can also cover areas such as robotics and autonomous drones and vehicles.

On the face of it, we would expect this megatrend to drastically reduce the amount of manufactured product we import, but what is important to consider here is the disruptive change a digital future places on the way we do things throughout the production process. This is shown in the 3D printing example:



The first critical point is that the supply of raw materials exists throughout even the most modified of the supply chains. The nature of these materials is critical to the view of:

1. Whether it is economically viable to 3D print at all – for example, while it is possible to 3D print paint, the volume of materials required to do so renders customer-based production non-economic.
2. Whether the benefits of "on-shore" production result in a superior product. Effectively this is the vehicle assembly debate re-imagined where we import components to assemble domestically. In some cases this will make sense. In others it will not.

Compounding this mixed view are some of the clear benefits of 3D printing. In particular, 3D printing allows for faster product testing and prototyping. In essence, they significantly reduce the costs of R&D and provide an overarching trend of more products-faster.

3D printing also represents a reduction in production costs of manufactures across the board. In many respects we would expect the general rule that economies of scale will continue to deliver cheaper products compared to small-scale production – particularly when distribution and retail is managed through digital channels.

Our digital world megatrend sees increased productivity and reduced prices of the things we consume. It feeds the consumption trend.

We consider that products that can be consumed digitally by the consumer will be the primary driver in reducing imports, but note that most of these are already happening.

10.5 Entrepreneurship rising – more imports, more exports

This trend feeds into what we see above, namely more people doing more things differently. Diversification of products and offering leads to increased market segmentation and specialisation.

This is supported by diversification of financing including higher incidences of crowdfunding and peer to peer funding allowing entrepreneurs' greater opportunity. Effectively we are looking at more products at market.

Even current trends can be counterintuitive. While the smart phone has replaced many traditional items, initially downsizing the home, device proliferation, driven by the need to sell products has become a second-order trend.

In addition, product lifecycles driven by innovation have also driven consumption. While the smart phone replaced the alarm clock, the camera, the stereo and the video player, the redundancy of software sees multiple smart phones being used over the course of one lifecycle of a an analogue product.

10.6 Global marketplace – more imports, more exports

Accessibility of products and the diversification of supply chains is a driver of more imports and exports. Consumers are no longer reliant on agents such as domestic retailers and importers to access products. They can do so digitally. Other factors that can increase trade are the increasing stimulation of trade from national governments; these include trade arrangements, such as free trade agreements.

10.7 Urban world – marginally more imports

The world is increasingly becoming urbanised, and there is a proven correlation between urbanisation and rates of consumption. It is critical to note that New Zealand, by international definitions is already highly urbanised, and as such, we expect this impact on our TEU forecasts to not be as pronounced as it would be in other countries.

10.8 Resourceful planet – neutral

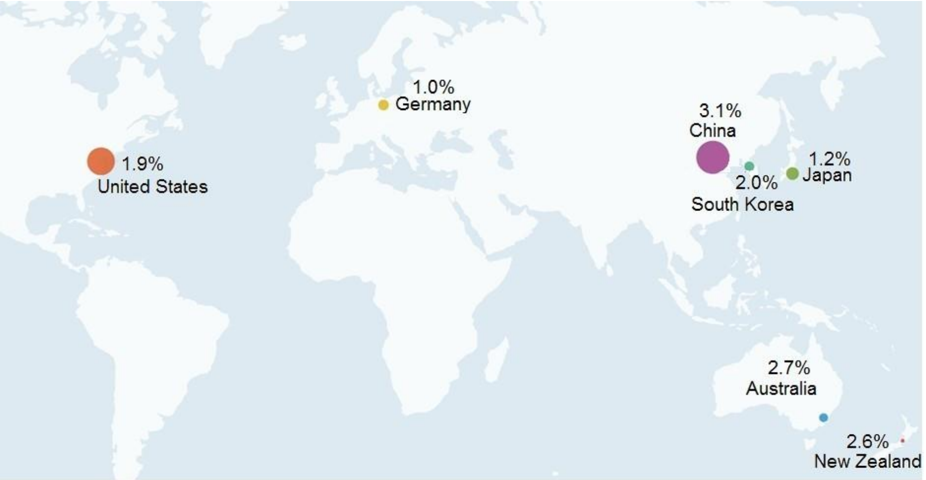
The need for, and use of resources is phenomenally difficult to assess from an import and export mix. Less than 10 years ago, peak oil was considered a major trend, but with different production techniques, concerns have abated.

User-driven power generation is another good example; the reduction of cost of photovoltaic cells, combined with innovations in home storage (e.g. the Tesla battery units) is fundamentally disrupting conventional resource models. However, this example sees New Zealand move away from periodic importation of large-scale plant and equipment, towards consistent importation of consumer-based products

10.9 Health reimagined – marginally more imports

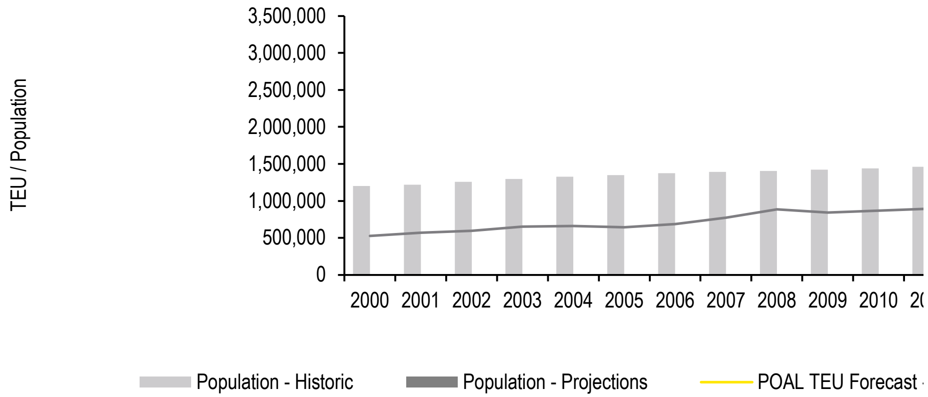
This is an interesting megatrend that against sees a more diversified approach to life and living. For example, more people living longer is likely to result in the proliferation of products to support older lifestyles, many of which have not yet reached development for consumer markets. As an example, the use of consumer robotics to aid in mobility represents the type of complex manufacture that is not currently imported, but can reasonably be expected to add to the import task.

New Zealand major trading partners' nominal GDP forecasts (2015); CAGR %pa (2016 to 2060).



Source: OECD

10.10 Forecast of historic TEU per capita and forecast TEU



Statistics New Zealand forecast's Auckland's population grow at an average rate of 1.34% p.a. (forecast range is up to 2043).

By extrapolating this population growth trend, and keeping TEU per capita constant at 0.62, 2 million TEU is reached in 53 years (2068/long term), or 3 million TEU by 83 years (2098/long term)

Increasing TEU per capita to 0.7, 2 million TEU is reached in 44 years (2059/medium term) or 3 million TEU by 74 years (2089/long term).

TEU	Population growth (0.62 TEU per capita)	Population growth (0.70 TEU per capita)	Population growth (1.00 TEU per capita)
2 million	53 years (2068) Long-term	44 years (2059) Medium-term	18 years (2033) Short-term
3 million	83 years (2098) Long-term	74 years (2089) Long-term	48 years (2063) Medium-term
4 million	106 years (2121) Long-term	104 years (2111) Long-term	69 years (2084) Long-term

11. Examples of container yard technology

The following table sections outline the characteristics of yard systems currently available. It should be noted that there are other system variants available, but these are the most widely adopted systems around the world. In addition, hybrids which use combinations of different systems are also widely used, but are not included in this analysis.

Reach Stacker

Description	► Rubber tyred, single container reach-lift system. ► Largely superseded in terminal operations other than minor regional ports ► Still sometimes used in transfer zones and particularly for side on rail loading ► Tailored between empty lifters and full lifter
Performance	► Low performance system used predominately for low-density areas. ► Stacking approximately 15 moves per hour ► Yard density approximately 500 TEU per hectare (3 high)
Deployment	► Minor localised ports ► Developing areas ► Rail terminals ► Intermodal and distribution centres

Straddle (Manual)

Description	► Rubber tyred single container mobile straddle vehicle ► Manually operated ► Represent approximately 20% of global ports (manual and auto) ► Second most popular system currently behind RTGs ► Highly manoeuvrable ► Current POAL yard system
Performance	► Can stack containers up to 4 high ► Varying configurations including (1 over 2) and (1 over 3) ► Can lift up to 60 tonnes (2 full containers) ► Designed for single or twinlift operation ► Yard density - 500 and 750 TEU per hectare (3 high) ► Stacking approximately 15 to 20 containers per hour
Deployment	► Medium to large size terminals

Examples	▶ Auckland – 900,000 TEU approximately ▶ APM Terminal, Gothenburg – 870,000 TEU approximately ▶ Port of Tacoma – 2 million TEU approximately ▶ Burchardkai Terminal Hamburg ▶ Melbourne ▶ Port Chalmers ▶ Southampton	

Straddle (Auto)

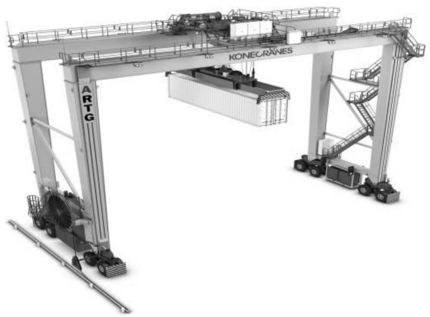
Description	▶ Rubber tyred single container mobile straddle vehicle ▶ Automated ▶ Automation can be applied to a manual straddle carrier over time ▶ Represent approximately 20% of global ports (manual and auto). ▶ Second most popular system currently behind RTGs ▶ Highly manoeuvrable	
Performance	▶ Can stack containers up to 4 high. ▶ Varying configurations including (1 over 2) and (1 over 3) ▶ Can lift up to 60 tonnes (2 full containers) ▶ Designed for single or twinlift operation ▶ Yard density - 500 and 750 TEU per hectare (3 high) ▶ Stacking approximately 15 to 20 containers per hour ▶ Improved cost outlay over manual straddles due to reduced downtime, fuel costs, inefficiencies etc.	
Deployment	▶ Medium to large size terminals	
Examples	▶ Patrick Brisbane ▶ Port Botany	

RTG (Manual)

Description	▸ Rubber tyred mobile gantry ▸ Manually operated ▸ Often work on fixed stacks however can be moved around the terminal ▸ High capacity stacking capability and highly manoeuvrable ▸ The most popular system in the world used in approximately 60% of the world's container ports ▸ Most RTG terminals are currently in Asia
Performance	▸ Relatively low cost to purchase and operate ▸ Highly flexible and manoeuvrable ▸ Yard density - Up to 1,000 TEU per hectare (4 to 7 containers high) ▸ 20 to 40 moves per hour ▸ An RTG can handle 50,000 TEU per year approximately ▸ Higher purchase costs than straddles, but lower operational costs
Deployment	▸ Medium to Large size Terminals
Examples	▸ Across Asia

RTG (Automated)

Performance	▸ Significant performance gains over a manual RTG system or straddle system ▸ Reduced labour and maintenance costs and increased efficiency ▸ General rule is that at least 6 Automated RTGs must be working together to realise any cost savings over time ▸ Suitable for the same terminal regimes as manual RTGs ▸ Highly flexible and manoeuvrable ▸ Yard density - 1,000 + TEU per hectare (4 to 7 containers high). ▸ 30 to 40 moves per hour
Deployment	▸ Generally large size container terminals
Examples	▸ Tobishima Terminal – Nagoya Japan



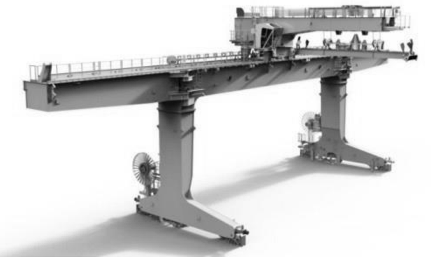
RMG (Manual)

Description	▶ Rail mounted fixed row gantry ▶ Manually operated	
Performance	▶ Generally only cost effective in large terminals ▶ Requires specific terminal planning and rail layouts ▶ Large reach up to 70 metres to maximise stack widths ▶ Environmentally friendly (electric) ▶ Various configurations including direct and cantilever sides ▶ Lifting capacity under spreader up to 65 tonnes ▶ Yard densities 900 TEU to 1,000 TEU per hectare (4 to 8 containers high) ▶ Single or twin-lift ▶ Increased yard capacity with wider and higher stacking	
Deployment	▶ Large size container terminals ▶ Rail terminals ▶ Becoming less popular as investment normally means that moving to full ASCs makes more financial sense	

RMG (Automated)

Description	▶ Rail mounted fixed row gantry ▶ Fully automated system	
Performance	▶ Only cost effective in large terminals and in symmetrical layouts ▶ Requires specific terminal planning and rail layouts ▶ Large reach up to 70 metres to maximise stack widths ▶ Environmentally friendly (electric) ▶ Various configurations including direct and cantilever sides ▶ Lifting capacity under spreader up to 65 tonnes ▶ Yard densities 1,100 TEU per hectare (4 to 8 containers high) ▶ Single or twin-lift ▶ Increased yard capacity with wider and higher stacking	
Deployment	▶ Most ASC systems are currently in Europe ▶ Large size container terminals ▶ Increasing market share	
Examples	▶ Hong Kong ▶ Pusan – South Korea ▶ Antwerp - Belgium	

Bridge Gantries

Description	► Rail mounted fixed row gantry ► Generally a fully automated system ► Multi stack spans	
Performance	► Only cost effective in large terminals and in symmetrical layouts ► Requires specific terminal planning and rail layouts ► Large reach up to 100 metres to maximise stack widths and cross stack operations ► Lifting capacity under spreader up to 100+ tonnes ► Yard densities 1,200 TEU + per hectare (8 containers + 1) ► Optimal yard capacity with wider and higher stacking	
Deployment	► Large terminals only	
Examples	► Singapore	

12. Container Terminal Future Technology – Discussion paper – Black Quay

In its 60 year history, containerisation has continued to increase its domination as the primary transport mechanism in shipping. Approximately 90% of global non-bulk cargo is now containerised and this continues to grow modestly.

With global increases in volumes and larger vessels to carry it, there is increasing pressure on container terminals to handle the task. As such, there is a constant search on how to better performance and reduce inefficiencies.

Whilst it is essential that container terminals improve efficiencies, it is equally important that the wider supply chain equips itself to deal with the ever growing task and there is reliance on external parties outside the port gate to meet demand as much as there is at the port. This includes landside logistics.

The primary initiative to do this over the last 25 years on the port side is terminal automation. The amount of global ports that are automated is still relatively small, but this is expected to grow in the coming years.

The drive to innovate largely comes from the top end of the industry, and in particular, the world's largest trans-shipment ports. In addition to large scale increases in volumes, these ports must deal with the pressure associated with the largest vessels in operation, which are currently reaching 20,000 TEU per ship. Handling the sheer volumes and peaks associated with these primary hub ports has seen major investment and push into terminal automation.

Whilst it is the top end of the container port industry that drives innovation, there are growing examples of smaller secondary ports around the world looking to increase their productivity through innovation. The reasons for this are varied, but in essence, it's normally driven by a lack of terminal or berth space as well as their own individual pressures from growing trade tasks.

What must be made clear, however, is that whilst these smaller ports are pushing towards increased efficiency and increasingly doing so through some level of terminal automation, they do not drive the front face of port technology. Accordingly, we see these smaller ports that are investing in automation, doing so by using existing technologies that have been previously developed to serve the larger hub ports. Primary hub ports on the other hand continue to push new boundaries through investment in research and implementation of cutting edge technology.

Much of the reason for the continued move towards automation is the push for efficiency. Automated systems do not make mistakes that humans do and work at a continual, uniform and reliable rate. There is a clear distinction, however, between what are regarded as fully automated terminals and semi-automated terminals. Put simply, whilst a fully automated terminal removes labour requirement across the system, with the exception of operators in electronic driven control rooms, semi-automated terminals include only partial automation. For instance, a terminal might automate the yard handling system, whereas the gate etc. remains manually controlled. At this stage, semi-automated terminals are more common than fully automated ones.

To put Auckland into this context, it will not drive new technology to meet its long-term trade task, but rather, it will respond by using existing technology developed and derived at other ports, such as primary trans-shipment ports, and do this over time. Indeed, the technologies proposed by POAL currently, that being auto-strads and then eventual use of ASC's, are nothing new. ASC's for instance were first developed in the early 1990's.

As such, we should not consider Auckland to break boundaries in container terminal technology, but instead, use existing tried and tested systems. To put this into some perspective, POAL propose the use of ASC's in the long-term which have been in service in one form or another for almost 25 years. By the time it is implemented in Auckland, it would be at least 50 years old. This is not to say that ASC technology, as an example, will not have moved on. Naturally it will have progressed as it has done since its inception, and furthermore, there may be a new strand of this type of technology that will emerge over that timeframe that is deemed suitable for Auckland. From a planning and assessment perspective, however, the only sensible way to investigate Auckland is to consider today's leading edge performances from given technologies and apply these to Auckland.

Having said that, the following discussion provides an overview of container terminal technology drivers and expected future trends in order to provide some context.

12.1 Computerised terminal management

Terminal Operating Systems (TOS) are electronically based terminal management platforms that effectively reduce costs and increase productivity through reliable management of day-to-day operations such as terminal and vessel planning that were previously carried out manually.

In an automated terminal, TOS can receive and handle data from the quay cranes, instruct the terminal cranes and dispatch automated guidance vehicles (AGVs) as well as coordinate the yard layout management and vessel management. They develop optimal patterns for operations across the yard and keep track of individual container locations, thereby driving up efficiency and reliability.

TOS systems are not exclusive to automated terminals and can be used in both manual and semi-automated terminals as well. Indeed, POAL have already invested in a Navis TOS system to assist in the operation of their container terminal.

Generally speaking, improvements in the quality and efficiency of TOS systems is increasing with demand as throughput pressure increase at port around the world.

Terminal system productivity gains are beginning to stabilise as is discussed further below, and so there is increased focus on TOS to improve terminal performances through decision based initiatives such as optimal dispatching and equipment scheduling.

Electronic information such as truck weight data, optical character recognition (OCR) and Position Detection systems (PDS) can now be monitored electronically and in real time. The current push is to improve the availability and accuracy of this information and fee it directly to the TOS. There is also consideration of how to introduce quantum computing to TOS systems.

12.2 Ship to shore cranes

Technologies in ship to shore cranes has increased significantly, allowing much greater productivity than was previously possible. Transfer rates have increased from previous typical productivity numbers of around 25 containers per hour, to over 40 containers an hour at primary ports. This has been achieved through their ability to twin lift or quadruple lift from the ship amongst other factors.

The primary push for increased crane productivity now is to automate the quay cranes. To date, they are generally only semi-automated at best, restricted solely to manual operator assistance.

Fully automated quay cranes are already in development and are expected to interact electronically with the wider automation system including TOS and the yard equipment. They will also manage their own maintenance by tracking usage and intensity. It is expected that full automation of quay cranes could result in approximately a 15% improvement in crane productivity.

Primary global ports including Rotterdam and Jebel Ali are already implementing these quay crane systems.

12.3 Terminal systems

As alluded to earlier, there is some stabilisation of terminal system productivity as the primary systems reach some maturity. Having said this, technology improvements continue to be made across the transfer systems and yard handling technology.

The use of AGVs as wireless transfer mechanisms is expected to continue to grow. These systems are electronically guided by lasers, GPS and/or inbuilt transponders in the terminal pavement and are connected to the TOS. The auto-strad system being proposed by POAL can also provide this and produces increased efficiency of transfer operations.

There is currently some discussion of how magnetic levitation technology (Mag-Lev) could be used at ports to improve efficiency and cost outlay. Whilst the majority of this relates to using mag-lev in container transfer via rail out of an into the port terminal, there is also some research into using mag-lev as a replacement to AGV technology. This system would use mag-lev enabled rail to and from the quay. The consideration of mag-lev as a container transfer system is far behind the research to use it as a rail system alternative.

Whilst ASC's have been around for some time, they continue to improve modestly. Electronic link of the ASC system to the AGV's for instance improves productivity and safety. Two ASC's can work a stack in tandem without interference or downtime and can rearrange stacks to provide greater efficiency for pick up (or drop off). ASC's can also be wirelessly linked to the TOS.

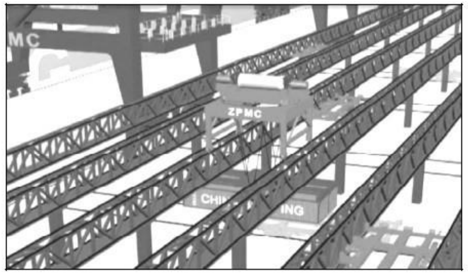
Aside from ASC systems, new theoretical terminal technologies are being investigated. These include but are not limited to automated storage and retrieval systems (AR/RS), overhead grid rail (GRAIL), Autocon, SpeedPort, Automated Container System (ACS) and linear motor conveyance system (LMCS). Whilst most of these are theoretical, some have been tested physically through early development of prototypes.

In essence, the majority of these theoretical systems use dedicated fixed route shuttles or continuous fixed bridge gantries across the terminal area to transfer containers. They are intended to improve turnaround times, increase terminal density and enable multi container lifting, all of which have improved since the inception of automated container terminal systems.

All the new systems run on electricity in an attempt to reduce running costs and emissions. They effectively operate by combining transfer, stacking and loading operations. All of these theoretical systems are likely to be extremely expensive to construct and to maintain and there are doubts around their flexibility given their fixed route nature, which could result in problems for the terminal at some stage.

As stated previously, if these systems were to emerge, they would do so only in the primary transshipment, large volume ports and not at secondary ports.

As a case study, the ACS system is summarised below:

System	Automated Container System (ACS)
Manufacturer	ZPMC (Shanghai Zhenhua Heavy Industry Co. Ltd)
Concept	An elevated fixed rail-guided transfer system designed to handle twin FEU containers. The elevated rail runs containers on buggies parallel to the wharf line and then perpendicular ground rails pick up containers to and from the quay cranes. These are transferred to and from RMG's in the yard.
Proposed Advantages/ Disadvantages	Increased efficiency in theory and reduced operating costs. However, there are some doubts around the system's ability to avoid bottlenecks with the buggy operations and it is considered to be a particularly expensive system.
Status	Under research/physical testing 

Source: ZPMC

Terminal gates are also becoming increasingly automated and the future is likely to see greater efficiency in moves to and from the port gate.

Much of this is expected to come from fully integrated customs and security operations at the port gate. An example of this would be the full integration of radiation portal monitoring (RPM) for each truck movement.

12.4 Container Security

With increased throughput and demand, there is increasing pressure on ports to ensure the security of containers.

The primary technology factors relating to container security are container tracking and tampering control. Radio frequency identification tags (RFID) are increasingly being used on containers to monitor their security from tampering.

In the future, it is expected that RFID will be combined with electronic positioning tracking using GPS, which will track containers right across the supply chain.

Currently labour intensive customs inspections are also expected to be increasingly replaced by non-invasive inspection. These systems use x-ray and gamma-ray technology to assess container contents and can share imaging wirelessly to the terminal operating system or to remote customs offices. This will have a continued positive effect on terminal efficiency.

12.5 Intelligent Containers

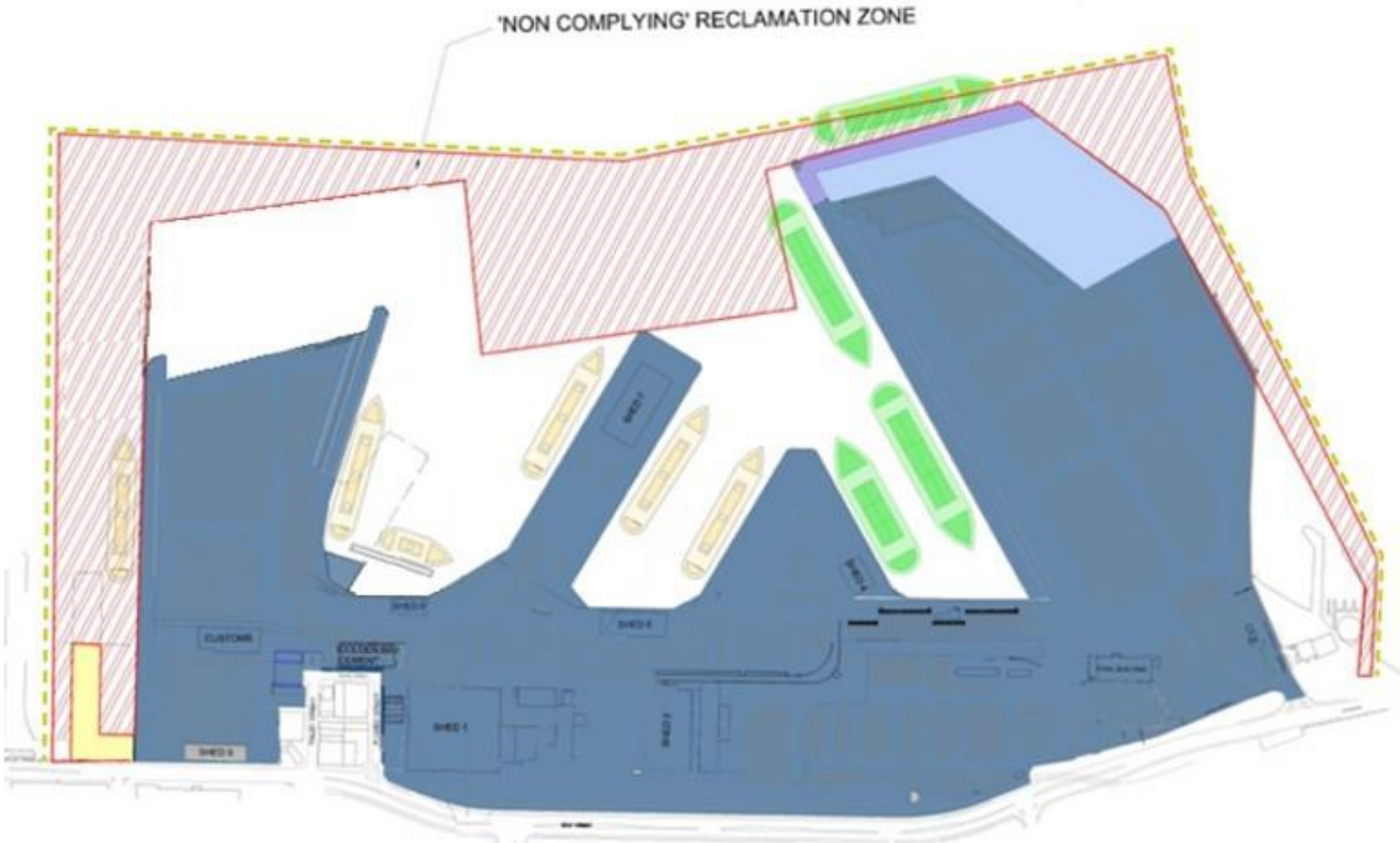
To some extent, containers are already becoming intelligent based on tracking systems and the like. However, there is potential for this to increase significantly including real time internet connectivity allowing comprehensive origin to destination tracking. Additionally, there is potential for container to talk to the goods they contain. This could be particularly relevant to temperature and humidity control in reefers and so on. They may also generate their own power to do so through the actual kinetic movement of the containers.

What does all this mean for Auckland's future container task?

Auckland will continue to benefit from technology change, but will not drive it as a secondary port. As planned by POAL, the port will utilise cascading technology over time from the primary ports where applicable and cost effective to do so.

In terms of projections, it is more reasonable to assume current technologies and associated productivities will become cost effective and realistic for Auckland in the longer term, but that this productivity will be based on the ports wider capability and capacity. Port of Auckland's layout means that it will never be able to utilise upper end terminal technologies for instance to the same degree as primary ports that are custom designed to accommodate and use them.

13. POAL areas of consent



Source: Ports of Auckland Development Proposals May 2013

13.1 Fergusson Container Terminal extension

Source: IBID

Consent to expand the Fergusson Container Terminal was obtained in 1998 and covers three major elements:

- **Reclamation:** There has been reclamation underway for over 15 years. This is approximately three hectares of reclamation remaining.
- **Wharf Extension:** A 50 metre wharf extension was consented northward of the main Fergusson Terminal Wharf and was completed in October 2015.
- **North Wharf:** the New Wharf will extend out 296 metres from the main Fergusson terminal. Application for building consent was lodged in July 2015.

14. Physical Viability Assessment Criteria

Physical viability	Explanation of assessment		
	Green	Amber	Red
Overall rating	Proceed	Investigate further	Stop
Shipping access	Excellent natural path of navigation in terms of a one way channel with no lateral land obstructions	Good natural path of path of navigation in terms of a one way channel with no lateral land obstructions but posing some engineering challenges	No natural path of path of navigation in terms of a one way channel due to lateral land obstructions or any other immovable obstructions
Natural depth	Excellent natural water depth of 13.5 metres or more with no natural obstructions	Good natural water depth of predominantly 12 metres or more but with potential to achieve 13.5 metres + through engineering undertakings but with some sporadic shallow areas and posing some engineering challenges	Insufficient natural water depth of 12 metres or below and / or major natural obstructions that cannot be addressed through engineering undertaking
Coastal processes	Excellent natural protection from coastal processes	Some natural protection from coastal processes and / or issues can be theoretically be dealt with through engineering undertakings	No natural protection, and issues cannot be dealt with through engineering undertakings
Natural land topography*	Excellent natural land layout across the coastal and landside area including relatively flat land, and no significant elevation at coastline	Reasonable natural land layout across the coastal and landside area, and no significant elevation at coastline	Poor natural land layout across the coastal and landside area, and / or significant elevation at coastline
Distance from existing primary land transport	Within 5km-10km from existing primary road and rail network	Within 10km-30km from existing primary road and rail network	Over 30km from existing primary road and rail network
Feasibility of land transport access	Excellent potential for connectivity to existing primary road and rail networks through engineering (Capital cost not considered yet)	Some potential for connectivity to existing primary road and rail networks through engineering (Capital cost not considered yet)	Poor potential for connectivity to existing primary road and rail networks due to significant natural or man-made restrictions (Capital cost not considered yet)
Distance from identified industrial concentration	Less than 30km from identified industrial concentration	Within 30-100km from identified industrial concentration	Over 100km from identified industrial concentration

**Availability of sufficient land for port and port related operation are not part of the initial physical viability considerations (however, sufficient space was assessed) and will form part of the following phase of work. In particular, it should be noted that some options related to generation of land through coastal reclamation or offshore reclamation*

14.1 Physical viability assessment – findings extract

Site 1 – Ports of Auckland (Current site)

Overview:

- This is based on using the existing site at Auckland
- This would be an automatic proceed to shortlisting as the port in question to enable further data

Key

G Proceed | A Further investigation | R Stop

Overall		G ▸ Automatic proceed
Physical Viability		**Comments**
Shipping access	A	✓ Very good but will become constrained
Natural depth	A	✓ Maintained 12.5m. Existing berth depths vary X Would require some dredging for the long term fleet but achievable
Coastal processes	A	✓ Potentially good subject to further study X Requires further study to assess impact of reclamation in harbour
Natural land topography	R	X Existing port but would require major rethink around current land allocations, including relocations to accommodate boxes and major wharf extensions/reclamations. No space for additional berths without major expansion into the harbour.
Distance from existing primary land transport	G	✓ Good. Established road and rail links
Feasibility of land transport access	A	✓ Good road network, the nearest state highway is situated about 2 km from the port. Carriageway needs regular maintenance and upgrade to accommodate increase in port activities X Rail connection to the existing port requires extensive upgrade.
Distance from identified industrial concentration	G	✓ Very good - 28km

Site 2 – Port of Tauranga

Overview:

- This is based on using the existing site at Port of Tauranga

Overall		A
Physical Viability		**Comments**
Shipping access	A	✓ Good but could become constrained in the long term
Natural depth	A	✓ Maximum draft is 13m X Would require dredging for future fleet based on visitation allowance
Coastal processes	A	✓ Potentially good with little new impacts on coastal processes expected. X Will likely require additional reclamation which requires future study
Natural land topography	A	X Will require further investigation but unlikely to be able to accommodate all of Auckland's trade growth as well as its own
Distance from existing primary land transport	G	✓ Good. Established road and rail links
Feasibility of land transport access	A	✓ Good access to road and rail connections. X Road to Auckland will require capacity upgrade.
Distance from identified industrial concentration	R	X Poor – 180km [from South Auckland] whilst recognising that it already services some Auckland trade X Poor– 150 km from Hamilton

Site 3 – Port Taranaki – South West Coast

Overview:

- This is based on using the existing site at Port Taranaki

Overall		R
Physical Viability		**Comments**
Shipping access	A	✓ Potentially good [needs to be tested for future fleet] X Whilst this is an existing port, it would likely require major reconfiguration to be able to accommodate future fleet
Natural depth	A	✓ Maintained 12.5m depth X Reasonably significant dredge required to accommodate future fleet
Coastal processes	A	✓ Potentially ok within the harbour environment X Existing breakwaters etc. would require relocation to make room for port in an exposed environment
Natural land topography	R	X Existing port but would require large scale reconstruction to supply port land. This would also require relocation of existing trade. X Might be possible to build within the existing footprint but will still require large scale reclamation
Distance from existing primary land transport	G	✓ Good access to SH3 and SH45.
Feasibility of land transport access	A	✓ Good. New road and rail not required, the existing port is well connected to road and rail networks but would require significant upgrades
Distance from identified industrial concentration	R	X Very Poor/Showstopper. 350km (4 hour trip min)

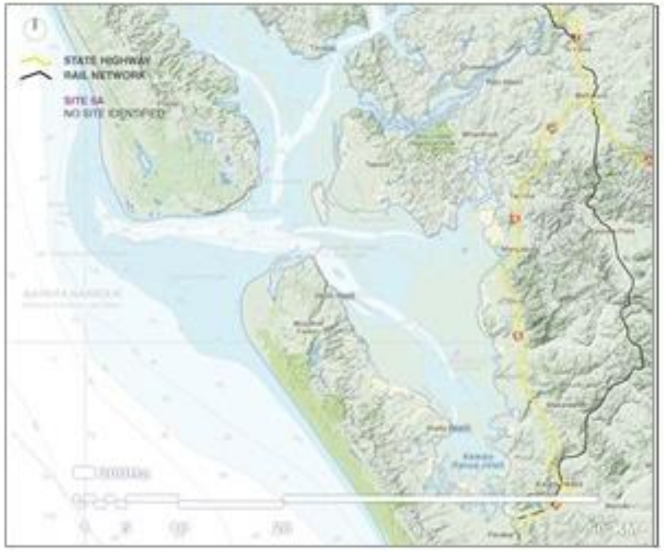
Site 4 – Northport

Overview:

- This is based on using the existing site at Marsden Point

Overall		A
Physical Viability		**Comments**
Shipping access	A	✓ Good but could be become constrained in the long term X Complexities expected with visitation of a long term fleet X Unlikely to be able to create enough berths for long-term task
Natural depth	A	✓ Maintained 12.5m to 14.5m (one berth) X Would require some dredging for the long term fleet X Would require major work for long term fleet
Coastal processes	G	✓ Inside sheltered harbour X Potential surging hazard
Natural land topography	A	X Existing port but would require large scale reclamations and relocations to accommodate the future container task X Town is also encroaching from the west X Will require further investigation but unlikely to be able to accommodate all of Auckland's trade growth as well as its own
Distance from existing primary land transport	A	✓ Good access to SH1 X Currently no rail access. Significant undertaking to connect to rail network
Feasibility of land transport access	A	X Would require major road and rail construction if port activities expand X New rail connection required, approximately 16 km to the nearest rail route X Current rail tunnels will not be able to cope with container sizes
Distance from identified industrial concentration	R	X Very poor – 160km

Site 5A – Kaipara Harbour – 1999,1989



Overview:

- The 1999 study did not identify any specific site or assess this location any further, other than to discount it as an alternative site due to navigational problems encountered in Harbour and any site within the area requiring longer transport links to the existing system.
- Note, sites in the Kaipara Harbour have been identified and assessed, whereas the previous work (1989/1999) did not identify any sites.

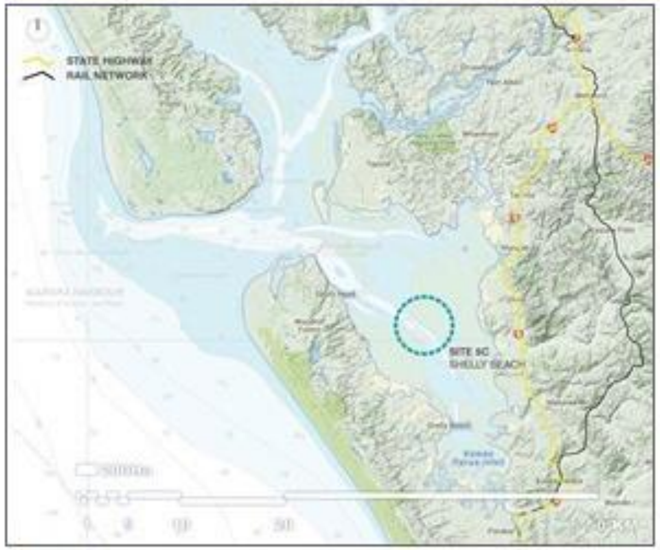
Site 5B – Tapora (Blue Sky)

Overview:

- Chosen as a primary testing site for Kaipara harbour
- Vessels could approach straight or turn so offers a multi face site
- Would require extensive reclamation to form out island or alternatively could build out south into the mud flats

Overall		R
Physical Viability		**Comments**
Shipping access	A	✓ Relatively complex but not unachievable
Natural depth	A	✓ Good natural depth well into main harbour X Spits and shoals at the entrance but dredging is feasible in principle X Likely major sediment transport issues X Accessible natural depth of 12m to 16m but sporadic
Coastal processes	R	X Likely major sediment transport issues X This is the landward end of a dynamic flood tidal delta. X Exposed to short period local swells of significant height. X Challenging ebb-tidal bar which is also dynamic X Long entrance channel to maintain in a high active system.
Natural land topography	A	✓ Flat plains towards Tapora
Distance from existing primary land transport	R	✓ Reasonably close to Run Road but this is a hilly windy country road at present X 25 km to main rail link.
Feasibility of land transport access	A	X Getting out of the plains to main road and rail is complex X New road will be complex and expensive X New rail required and complex with levels - the road needs upgrade and widening. The route is windy and steep. X The rail connection to nearest route (Helensville) would require significant investment. X Rail connection would require Southdown to Avondale link. X Freight traffic would have to travel through Auckland to get to inland ports and industrial areas
Distance from identified industrial concentration	R	X Poor - 127 km X Further from markets/inland ports and industrial areas of East Tamaki etc.

Site 5C – Shelly Beach (Blue Sky)



Overview:

- Chosen as a secondary testing site for Kaipara harbour
- Vessels would be required to navigate further along the Kaipara River. Very complex to get access which would be over the natural flats. Cant go further towards the inlet as there is not enough room to manoeuvre
- Would need to bridge out to this approximately 5km

Overall		R
Physical Viability		**Comments**
Shipping access	A	✓ Relatively complex but not unachievable
Natural depth	A	✓ Good natural depth well into main harbour X Spits and shoals at the entrance but dredging is feasible in principle X Likely major sediment transport issues X Accessible natural depth of 12m to 16m but sporadic
Coastal processes	R	X Likely major sediment transport issues X This is the landward end of a dynamic flood tidal delta. X Exposed to short period local swells of significant height. X Challenging ebb-tidal bar which is also dynamic X Long entrance channel to maintain in a high active system.
Natural topography	A	✓ Flat plains around Glorit but would need to be built offshore anyway
Distance from existing primary land transport	R	X Reasonably close to SH16 and village of Glorit but road would require significant upgrade X Over 25 km to rail access
Feasibility of land transport access	A	X New road will be complex and expensive X New rail required and complex with levels - the road needs upgrade and widening. The route is windy and steep. X The rail connection to nearest route (Helensville) would require significant investment. X Rail connection would require Southdown to Avondale link. X Freight traffic would have to travel through Auckland to get to inland ports and industrial areas
Distance from identified industrial concentration	A	X Average distance - 92 km

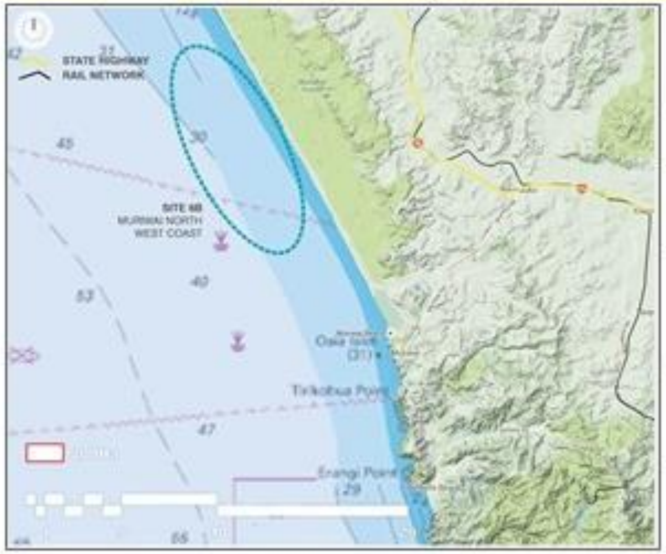
Site 6A – Muriwai Offshore Port (1999)

Overview:

- Site near Muriwai has been selected as representative of the coastal block
- Would be developed as an offshore port located 7km from Muriwai

1999 study comments		X Wave swells of up to four metres experienced frequently and extreme waves of up to 11 metres expected) X Road and rail access available - transport corridor can be built to connect to Main Trunk Railway and SH16 at Woodhill with relatively minor environmental impacts X Offshore port requires bridge access
Overall		A
Physical Viability		Comments
Shipping access	A	X Challenging coastal environment making shipping potentially difficult
Natural depth	A	✓ Water might be around 15m deep at 2km offshore X Probably relatively shallow up to 800m offshore
Coastal processes	A	X Highly exposed X Would require extensive protection infrastructure X High sediment transport, telecommunication cable landing site.
Natural land topography	R	X Extremely hilly right up to shore line and likely unsuitable X No supporting land
Distance from existing primary land transport	A	X Would have to go via Waimaku – some distance to primary infrastructure
Feasibility of land transport access	R	X Very poor – new road will be complex and would need to upgrade the main highway X New rail link required – the route has steep terrain with levels rising up to 125 m,
Distance from identified industrial concentration	A	X Average - 60 km

Site 6B – Muriwai (Blue Sky)



Overview:

- This is a previously identified location
- No bathymetries yet but it appears deep water is approximately 2km offshore where the small island is in the image
- Would require an offshore port

Overall		A
Physical Viability		Comments
Shipping access	A	X Challenging coastal environment making shipping potentially difficult
Natural depth	A	✓ Water might be around 15m deep at 2km offshore X Probably relatively shallow up to 800m offshore
Coastal processes	A	X Highly exposed X Would require extensive protection infrastructure X High sediment transport, telecommunication cable landing site.
Natural land topography	R	X High topography, but mostly dunes [check Aurecon] X Significant access issues, however considerably better than 6A
Distance from existing primary land transport	G	✓ Road and rail access available - transport corridor can be built to connect to Main Trunk Railway and SH16 at Woodhill
Feasibility of land transport access	A	X Complex access for new road, but considerably better than 6A X New rail required and complex with levels - the route has steep terrain with levels raising up to 125 metres but less distance than 6A
Distance from identified industrial concentration	A	✓ Average - 68km

Site 7A – Central Manukau Harbour (Blue Sky)

Overview:

- This requires access into the Manukau harbour system
- Would be a reclaimed island in the harbour
- Would need to take into account future flight paths from second runway

Overall		A
Physical Viability		**Comments**
Shipping access	A	✓ Complex but achievable ✓ Sandbar at the entrance must be dealt with through engineering undertakings
Natural depth	A	✓ Depth there though is around 12m to 15m X Some dredging required however to tidy up approach and turning zones. Harbour approach also requires dredging
Coastal processes	A	X Spring tidal currents up to 2.3 knots, and exposed to local wind-generated waves (would require some infrastructure). X Entrance channel through a dynamic bar on a highly exposed coast with high sediment transport rates - approx five km long entrance channel requires dredging and maintenance X Bypassing might be required
Natural land topography	G	✓ Creates isolated land and opportunity for expansion over time. ✓ Sand flats are at 0m approximately
Distance from existing primary land transport	A	✓ Close to motorway and rail corridors - able to leverage off significant current and planned infrastructure spend (Kirkbride, East West Connection) X Complex to reach shore with a bridge and roads to SH20 and SH1 will require upgrades X Railway connections complex
Feasibility of land transport access	A	X Requires significant bridge access infrastructure X New road and rail connections will be complex but achievable in order to connect to existing network ✓ AT is proposing to extend the rail network to Auckland Airport. ✓ Close proximity to major state highway network. ✓ Kirkbride interchange currently being constructed.
Distance from identified industrial concentration	G	✓ Excellent - 17km

Site 7B – Puhinui (1989,1999,2014, blue sky)

Overview:

- Located in the Manukau Harbour
- Puhinui was Identified in the 1989, 1999 and 2014 Studies
- The general area was then identified in the blue-sky list assessment from first principles

1989, 1999 and 2014 study comments		☒ Potential issue around harbour access due to sandbar. ☒ Would require significant maintenance dredging ☒ Difficult marine environment and high energy coastline ☒ Site could be exposed to extreme storms ☒ Potential issues with proximity to airport ✓ Excellent connectivity to all infrastructure ✓ Good proximity to existing industrial area
Overall		A
Physical Viability		Comments
Shipping access	A	☒ Complex and less viable than TA ☒ Sandbar at the entrance must be dealt with through engineering undertakings
Natural depth	R	☒ Depth there around 3m to 5m so would require extensive channel dredging ☒ Significant dredging required to create approach and turning zones compared to TA ☒ Harbour entrance faced with same issues as TA
Coastal processes	A	☒ Spring tidal currents up to 1.2 knots, and exposed to local wind-generated waves (would require some infrastructure). ☒ Entrance channel through a dynamic bar on a highly exposed coast with high sediment transport rates - approx. five km long entrance channel requires dredging and maintenance ☒ Bypassing might be required ☒ Potentially increased sediment issues in comparison to TA
Natural land topography	G	✓ Some availability of land, however likely more constrained than TA ☒ Land available encompasses reserve land means there may be negative effects regardless of reclamation around this
Distance from existing primary land transport	G	✓ Close to motorway and rail corridors - able to leverage off significant current and planned infrastructure spend (Kirkbride, East West Connection) ☒ Complex to reach shore with a bridge although less complex than TA ✓ Railway connections look complex but feasible
Feasibility of land transport access	G	☒ Requires bridge access infrastructure ☒ New road and rail connections will be less complex and likely achievable in order to connect to existing network compared to TA ✓ AT is proposing to extend the rail network to Auckland Airport. ✓ Close proximity to major state highway network. ☒ New road and rail required - freight movements may have an impact on the local traffic, SH20, and road safety. Requires alternative route (Hill Road) to connect to SH1 ✓ Good opportunity to take freight off before the Auckland motorway network (from the south).
Distance from identified industrial concentration	G	✓ Excellent - 10km

Site 7C – Hikihiki (Blue Sky)

Overview:

- This site is located against the Hikihiki bank. The location and orientation are indicative only to show the area.
- The intent is that it makes use of the channel basin although would require significant dredging
- The site would be offshore and would need to be accessed via a significant bridge. The bridge alignment is indicative only and may well run from the airport direction instead

Overall		A
Physical Viability		**Comments**
Shipping access	A	✗ Complex but achievable ✗ Sandbar at the entrance must be dealt with through engineering undertakings
Natural depth	A	✗ Significant effort required to reach the Papakura Channel over the flats ✗ The channel remains quite deep up to the site at around 13m but is narrow and would require substantial dredging all around to create turning and berthing widths ✗ Harbour approach also requires dredging
Coastal processes	A	✓ Spring tidal currents up to 1.6 knots ✗ Entrance channel through a dynamic bar on a highly exposed coast with high sediment transport rates - approx. five km long entrance channel requires dredging and maintenance ✗ Bypassing might be required
Natural land topography	G	✓ Creates isolated land and opportunity for expansion over time. ✓ Sand flats are at 0m approximately ✗ Would be more difficult to expand than Central Manukau Harbour
Distance from existing primary land transport	A	✓ Close to motorway and rail corridors - able to leverage off significant current and planned infrastructure spend (Kirkbride, East West Connection) ✓ Approximately 5 km to SH1 ✓ Railway connections look complex ✓ Complex to reach shore with a bridge and roads to SH20 and SH1 will require upgrade
Feasibility of land transport access	A	✗ Requires bridge access infrastructure ✗ New road and rail connections will be less complex and likely achievable in order to connect to existing network compared to 7A. Rail access would be more complex than 7B but possible ✓ AT is proposing to extend the rail network to Auckland Airport. ✓ Close proximity to major state highway network. ✗ New road and rail required - freight movements may have an impact on the local traffic, SH20, and road safety. Requires alternative route (Hill Road) to connect to SH1 ✓ Good opportunity to take freight off before the Auckland motorway network (from the south). ✓ Requires significant investment to connect to rail route due to housing density surrounding the rail corridor. (
Distance from identified industrial concentration	G	✓ Excellent - 14km

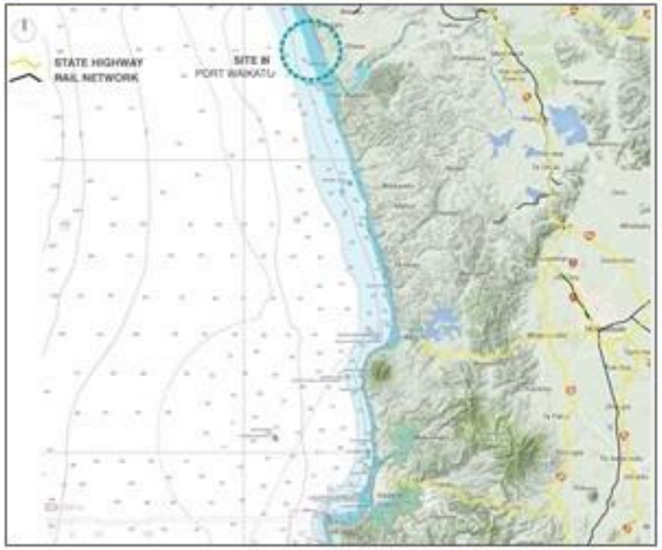
Site 7D – Manukau Island Port, Clarks Beach (2014)

Overview:

- The site selected is north-east of Clarks Beach. The port site is located approximately 1 kilometre off the coastline, outside the first order constraint CPA-1 zone on an inner harbour location on mudflats
- The port concept has two finger type reclamations 400 metres apart extending northwards with internal quays. The service area is located at the landward end of the fingers across the 400 metre basin width.

2014 study comments		✗ Expected significant technical issues with channel maintenance including high cost and volume. ✗ Anticipated negative effects associated with port construction in the harbour including on ecology. ✓ Strong location in terms of transport links ✗ Significant transport infrastructure required including new rail, road and bridge ✗ Excellent proximity to freight distribution centres
Overall		R
Physical Viability		Comments
Shipping access	A	✗ Complex and less viable than TA ✗ Sandbar at the entrance must be dealt with through engineering undertakings ✗ Significant undertaking to align new channel for large port
Natural depth	R	✗ Depth there around 3m to 5m approximately so would require extensive channel dredging ✗ Significant dredging required to create approach and turning zones compared to TA ✗ Harbour entrance faced with same issues as TA
Coastal processes	A	✗ Spring tidal currents up to 1.3 knots, and exposed to local wind-generated waves (would require some infrastructure). ✗ Entrance channel through a dynamic bar on a highly exposed coast with high sediment transport rates - approx. five km long entrance channel requires dredging and maintenance ✗ Bypassing might be required ✗ Potentially increased sediment issues in comparison to TA
Natural land topography	A	✓ Some availability of land, however likely more constrained than TA ✗ Lay of the land unlikely to be as feasible as TB
Distance from existing primary land transport	A	✓ Reasonable proximity to motorway and rail corridors ✗ Complex to reach shore with a bridge although less complex than TA ✓ Railway connections look complex but feasible
Feasibility of land transport access	A	✗ Requires bridge access infrastructure ✗ Significant new road and rail connections required and reasonably complex to connect
Distance from identified industrial concentration	A	✗ Average - 50km

Site 8 – Port Waikato (Blue Sky)



Overview:

- This site sits adjacent to the mouth of the river system to the north
- This would have to be an offshore port

1999 study comments		Southwestern coastline in general was assessed in 1999 X Coastal elevation makes access difficult and impractical X Sedimentation transport likely to be an issue X Subject to significant coastal erosion
Overall		R
Physical Viability		Comments
Shipping access	A	X Challenging coastal environment making shipping potentially difficult
Natural depth	R	✓ Water might be around 15m deep at 2km offshore X Probably relatively shallow up to 800m offshore
Coastal processes	R	X Highly wave exposed. X Would require extensive protection infrastructure X Actively adjusting coastline due to the Waikato River Flood control measures - the spit continues to grow north and the coast north of the spit continues to erode to the north
Natural land topography	R	X Surrounded by hills and constrained by river system
Distance from existing primary land transport	A	X Poor road system X No rail access X Complex access to main transport links
Feasibility of land transport access	A	✓ Possible road and rail access at Waiuku X New road will be expensive and complex X Major upgrades required.
Distance from identified industrial concentration	A	X Average – 69km

Site 9 – Kawhia Harbour (Blue Sky)

Overview:

- Using the natural harbour or surrounds at Kawhia

Overall		R
Physical Viability		**Comments**
Shipping access	R	X Challenging coastal environment making shipping potentially difficult X Access into the harbour for large shipping unlikely to be possible
Natural depth	R	X Very poor in harbour. would require large-scale dredging and reclamation project, making the site unfeasible
Coastal processes	R	X Extremely exposed to waves, high sediment transport and dynamic/shallow bar X Would require extensive infrastructure off or onshore X Would require 2.5 km dredged channel to be constructed as a minimum X Three knot currents
Natural land topography	R	X Extremely hilly right up to shore line and likely unsuitable X No supporting land
Distance from existing primary land transport	R	X Some local road connection but primitive but considerable distance from primary network X Would require new rail line
Feasibility of land transport access	R	X Hilly and difficult to access X The existing highway route is not suited for freight movements and require significant upgrade. SH3 is situated about 50 km from the site location. X Rail connection could be complex with the challenging topography.
Distance from identified industrial concentration	R	X Very poor -190km

Site 10 – Bream Bay area, Whangarei

Overview:

- Chosen as an alternative to expanding Marsden Point due to Marsden Point being constrained by the town
- Site is adjacent to the town of Ruakaka but position is reasonably flexible.
- Chosen as clearest point closest to deeper water contour. No decision as yet if this would be offshore or onshore - matter of cost vs benefit

Overall		A
Physical Viability		Comments
Shipping access	G	✓ Potentially good navigation lines ✓ Initial approach similar to Marsden Point
Natural depth	G	✓ Approximately 12 – 14 m natural depth some 900 m from shore
Coastal processes	A	X Semi-exposed, mostly small swell, but both long and short period swell (strong local winds and cyclonic swell) X Would require protective infrastructure, although relatively deep close to shore.
Natural land topography	A	✓ Localised levels appear to be reasonable X Would likely require significant reclamation. Main road constrains site to some extent but would not if reclaimed
Distance from existing primary land transport	A	✓ Site is adjacent to SH1 X The nearest rail route is about 15 km
Feasibility of land transport access	A	X Would require major road and rail construction X New rail connection required, approximately 25 km to the nearest rail route. Will be complex to construct. X Current rail tunnels will not be able to cope with container sizes ✓ Road connection reasonably straightforward
Distance from identified industrial concentration	R	X Very poor – 154 km

Site 11A – Te Haupa Island – Mahurangi (Blue Sky)

Overview:

- Chosen as an example of a developed natural island site
- Would require extensive expansion of the island footprint over time although perhaps not at first. More complex than a fully artificial island
- Access would be complex and unlikely to work as it would require bridging over the main channel entrance. Achievable but expensive. Bridge would be around 1.8km long

Overall		R
Physical Viability		Comments
Shipping access	A	X Technically feasible but particularly complex due to proximity to surrounding islands X Size and alignment of island makes creation of sufficient berth line unlikely
Natural depth	G	✓ Natural water depth up to the heads ✓ Accessible natural depth of 13m to 15m only for the outside coastline of the island
Coastal processes	A	X Semi-exposed to local winds (Southeast long fetch) X Would require extensive protection infrastructure X Significant sedimentation issues expected
Natural land topography	R	X Island makes available land restricted X Would require connection back to land
Distance from existing primary land transport	R	X SH1 is located approximately 10 km away. X Rail is approximately 20km away X Both road and rail access is complicated
Feasibility of land transport access	A	X Would need to use Mahurangi west road to access main road X No rail access. X New road and rail will be complex and expensive, with varying levels X Steep terrain, windy road, and partly gravel road.
Distance from identified industrial concentration	A	✓ Average - 79.5km

Site 11B – Mahurangi West (Blue Sky)

Overview:

- Location shown is indicative but generally the area could be developed as a separate island or reclamation from land. Most likely a combination of both.
- Would require extensive reclamation either way
- A small bridge would be required if developed as a near shore island.

Overall		A
Physical Viability		**Comments**
Shipping access	G	✓ Potentially good navigation lines
Natural depth	A	X Approximately 1km to deep water which is feasible if site is reclaimed or could be potentially bridged X Depth is approximately 10m to 11m, 1 km offshore, meaning that some localised dredging is required
Coastal processes	A	X Highly exposed X Semi-exposed to local winds (Southeast long fetch) X Would require extensive protection infrastructure X Significant sedimentation issues expected
Natural topography	A	✓ Complex site with varying levels
Distance from existing primary land transport	A	X Rail is approximately 20 km away X Both road and rail access is complicated ✓ Immediate road is approximately 1 km away
Feasibility of land transport access	A	X Both road and rail will be complex due to varying terrain ✓ Would need to use Hibiscus Coast Highway to access main road (SH1)
Distance from identified industrial concentration	A	✓ Average – 69.3km

Site 12A – Karepiro Bay (1999)

Overview:

- Situated between the Weiti River and the Okura River just south of the Whangaparoa Peninsula
- The Weiti river is an important environmental area, a commercial waterway, and has a mooring for several hundred recreational boats. The Okura River is a small tidal estuary, and its intertidal flats are important wildlife feeding areas.
- The southern shoreline of the area also extends near the residential areas of North Shore City.

1999 study		• Significant approach channel required • Significant sedimentation issues expected • Tidal flows issue expected due to reclamation • Sheltered marine environment • Forest and bush environment • Significant road and rail connectivity issues
Overall		R
Physical Viability		Comments
Shipping access	R	X Difficult to impossible for a large scale port X Unlikely to have any capacity to create sufficient berthage
Natural depth	R	X Depth in harbour is shallow and insufficient and would require large-scale dredging even if access was possible
Coastal processes	R	✓ Relatively sheltered in a harbour environment X Significant sedimentation issues expected
Natural land topography	R	X Relatively hilly and complex local environment
Distance from existing primary land transport	A	X Considerable distance from both road and rail with over 20 km to rail
Feasibility of land transport access	R	X Particularly complex road and rail connections required, including potential tunneling
Distance from identified industrial concentration	A	X Average – 55.9km

Site 12B – Long Bay (Blue Sky)

Overview:

- Location is shown as a reclamation that would require access dredging. Alternative wold be to build out an extra 600m approximately.
- Would require extensive reclamation either way
- Another alternative would be to dredge into the mouth of the Okura river and orientate the port east to west but this would likely have serious effects

Overall		A
Physical Viability		**Comments**
Shipping access	G	✓ Potentially good navigation lines
Natural depth	A	X Approximately 650m out to 11m depth X Would require significant localised dredging unless going out further
Coastal processes	A	X Semi-sheltered X Would require extensive protection infrastructure
Natural land topography	G	✓ Reasonably flat land available ✓ Topography allows potential for onshore or offshore port
Distance from existing primary land transport	A	✓ The port's internal road could be connected to Vaughans Road to the north, approximately 1 km from the site location X Would need to possibly build a new road west towards SH1 which is roughly about 4km away but complex land X No rail access and considerable distance to the rail network, approximately 20-30 km away
Feasibility of land transport access	R	✓ Access could be gained from Torbay direction which is close but this would not be feasible from a traffic perspective and roads would require major upgrades X Particularly complex road and rail connections required, including potential tunnelling
Distance from identified industrial concentration	A	X Average - 50km

Site 13A – Upper Harbour Port Island (1989)

Overview:

- Port island established off the Whau River
- Harbour bridge precludes any development of general cargo/container berths
- Despite show stopping nature of the bridge, assessment has been provided in the interest of completeness
- The early assessment of this site does not include factors relating to the land side transport network relation to Auckland. The reality is that, to some extent, connectivity through the western city creates similar issues to that faced at Auckland Port.

1989 study comments		X Presence of the harbour bridge eliminates all options for a major port
Overall		R
Physical Viability		Comments
Shipping access	R	X Harbour bridge eliminates any potential for modern shipping access X Without harbour bridge, navigation lines would be reasonable
Natural depth	R	X Localised natural depth is poor and would require substantial dredging to accommodate the modern fleet
Coastal processes	A	- Further analysis required
Natural land topography	A	✓ Reasonably level area X Localised land use constrains the potential footprint of the port
Distance from existing primary land transport	A	✓ Reasonably close to SH16 ✓ Reasonably close to primary rail network at Henderson X Transport access through relatively built up area
Feasibility of land transport access	A	X Relatively complex connectivity for both road and rail given nature of surrounding land use
Distance from identified industrial concentration	A	X Average – 30.5 km

Site 13B – Upper Waitemata Harbour (1999)

Overview:

- Upper Waitemata Harbour considered unsuitable as a port site as modern container vessels (> 2000+ TEUEQ capacity) which visit the Ports of Auckland site cannot pass under the existing Harbour Bridge. Not considered further in the report because of the above reason.
- Despite show stopping nature of the bridge, assessment has been provided in the interest of completeness
- The early assessment of this site does not include factors relating to the land side transport network relation to Auckland. The reality is that, to some extent, connectivity through the western city creates similar issues to that faced at Auckland Port.

1999 study comments		X Presence of the harbour bridge eliminates all options for a major port
Overall		R
Physical Viability		Comments
Shipping access	R	X Harbour bridge eliminates any potential for modern shipping access X Without harbour bridge, navigation lines would be reasonable up to the port area but complex around the port area X Width around the port area unlikely to accommodate modern marine operations
Natural depth	A	X Some natural depth through the localised channel, however considerable dredging required around the site to accommodate the port
Coastal processes	A	- Further analysis required
Natural land topography	A	✓ Reasonably level area X Localised land use constrains the potential footprint of the port
Distance from existing primary land transport	A	X 12 km away from rail ✓ 2 km away from road X Road access reasonably close however, connectivity to rail is complex
Feasibility of land transport access	A	X Road connectivity expected to be reasonably straightforward although will require significant localised upgrade X Rail connectivity expected to be complex given city fringe location
Distance from identified industrial concentration	A	X Average – 42.7 km

Site 14A – Wairoa Bay (1999)

Overview:

- Coastal block contains Waiheke Island and the coastline between the Tamaki River and the Wairoa River

1999 study comments		
1999 study comments		✓ Proposed sea access through Waiheke Channel X Would require significant dredging across Tamaki Strait ✓ Some localised protection from waves X Expected significant sedimentation issues X Substantial distance for road and rail connectivity
Overall		R
Physical Viability		**Comments**
Shipping access	R	X Shipping through Tamaki Strait is complex and unlikely
Natural depth	R	X No natural depth in this area and would require large-scale dredging
Coastal processes	A	X Sedimentation build up likely to be significant
Natural land topography	G	✓ Reasonably flat in localised area
Distance from existing primary land transport	A	X Approximately 25 km from both road and rail
Feasibility of land transport access	A	X Road upgrades and new rail, although long, would potentially be reasonably straightforward to construct
Distance from identified industrial concentration	A	X Average - 31 km

Site 14B – Ponui Island (1999 and 2014)

Overview:

- Located on the south-eastern coast, Ponui Island is a privately owned island that is isolated, contains areas of pasture, native bush and unspoilt coastline.
- Port would be nestled into the south-eastern corner of Ponui Island
- The site selected is approximately 2 kilometres offshore, south-east from Ponui Island in water depth between -8 metres and -12 metres CD. This port location was selected to be clear of the outstanding natural landscape areas on the mainland and Ponui Island, shown as red first order "no go" constraints.

1999 and 2014 study comments		X Anticipated large-scale dredging required X Relatively exposed site and required protection infrastructure X Significant infrastructure required to access the island X Road and rail complexity issues due to current land uses and topography
Overall		R
Physical Viability		Comments
Shipping access	G	✓ Relatively good lines of navigation
Natural depth	A	✓ Localised natural depth of 14 – 20 m X Would require significant localised dredging or reclamation to reach deep water
Coastal processes	A	X The alignment of the berths would be vulnerable to prevailing winds and would require significant protection infrastructure
Natural land topography	R	X Highly complex topography and island layout X Ability to create large-scale future port questionable
Distance from existing primary land transport	R	X Approximately 30 km from both road and rail X Significantly more challenging than 14A due to island environment
Feasibility of land transport access	A	X New road and rail required, including complex bridge connection to island of over 6 km
Distance from identified industrial concentration	A	X Average - 37 km

Site 14C – Kawakawa Bay (incorporating previous Ponui Offshore Port) (1999 & Blue Sky)

Overview:

- This site sits almost opposite Chamberlain Island
- Would have to be an offshore port
- Established that Kawakawa bay is the same site as the previously identified Ponui Offshore Port, therefore both have been combined, however, note previous assessment comments from 1999 above

1999 study comments		✓ No dredging required X Will require substantial protection infrastructure X 6 km bridge required for connectivity X Road and rail complexity issues due to current land uses and topography
Overall		A
Physical Viability		Comments
Shipping access	G	✓ Relatively good lines of navigation
Natural depth	A	X Natural depth of up to 12 m, approximately 3 km offshore X Approximately 4 km offshore to reach 13-14 m depth X Options to construct further out to sea or combine some localised dredging
Coastal processes	A	✓ Semi-sheltered ✓ Low sediment transport rates. X Would require extensive protection infrastructure
Natural land topography	A	X Complex local topography, hilly and varied X Less relevant as this option is an offshore port but will be difficult to generate suitable land backing
Distance from existing primary land transport	R	X The nearest state highway and rail route is approximately 30 km. X No substantial road system between Orere point and Kawakawa bay roads out to SH1 X No rail access
Feasibility of land transport access	A	X Would require substantial new road and rail which would be complex to construct
Distance from identified industrial concentration	A	X Average – 40km

Site 15A – Waimangu Point (Blue Sky)

Overview:

- This site sits further into the firth and makes use of the closest deep water in the area
- Bathymetry is complex in this area but there is good potential to access via the east of Chamberlain. Access through the straight will not be possible.
- Might be reclaimed from coastline or separated as an island
- Would have to be an offshore port

Overall		A
Physical Viability		Comments
Shipping access	G	✓ Relatively good lines of navigation
Natural depth	G	✓ Depth there is around 11m to 13.5 m X It is some distance out to deep water at approximately 1km
Coastal processes	A	X Would require extensive protection infrastructure X Open to northerly wind and swell
Natural land topography	A	X Complex land topography X Site may move north or south to gain better access to land, however this affects access to water depth
Distance from existing primary land transport	R	X The nearest state highway and rail route is approximately 47 km. X No substantial road system between Orere point and Kawakawa Bay roads out to southern motorway X No rail access
Feasibility of land transport access	R	X New road and rail will be extensive and complex and may require tunnelling
Distance from identified industrial concentration	A	X Average - 50km

Site 15B – Kaiaua Land Port (2014)

Overview:

- Site selection in this sector is largely dictated by the northern-most flat land area and nearest access to deeper water. The site selected is north of Kaiaua Township on the coast, between the settlements of Wharekawa and Whakatiwa

2014 study comments		X Major dredging required X Substantial maintenance dredging expected X Significant ecological blockers including RAMSAR site status X Transport links extensive and complex
Overall		A
Physical Viability		Comments
Shipping access	A	X If substantial channel and basin were created, then navigation lines are reasonable
Natural depth	R	X Poor natural depth as this is beyond the deep water zone X Major dredging required to gain access
Coastal processes	A	X Would require extensive protection infrastructure X Open to northerly wind and swell X effect of large-scale channel dredging unknown
Natural land topography	A	✓ Some availability of supporting land ✓ Reasonably level topography in localised area
Distance from existing primary land transport	A	X 23 km road connection to SH2 required X 13 km rail connection required
Feasibility of land transport access	A	X Significant construction and upgrade of road and rail network required X Potential duplication of transport connection required
Distance from identified industrial concentration	A	X Average – 66.6km

Site 16 – Tauranga II

Overview:

- This would be effectively a new port in the Tauranga general vicinity to cater for long term and complete box trade
- May be Matakana Island but unlikely
- Offshore port required

Overall		A
Physical Viability		Comments
Shipping access	G	✓ Relatively good lines of navigation
Natural depth	G	✓ 11m to 17m, approximately 1.5km offshore
Coastal processes	A	X Would require substantial potential infrastructure. X Exposed to significant swells
Natural land topography	A	X Highly constrained in the long term context at land site due to existing port and town X Potential availability of support land at existing port
Distance from existing primary land transport	G	✓ Established road and rail networks due to existing port
Feasibility of land transport access	A	X Significant road and rail upgrades required.
Distance from identified industrial concentration	R	X Poor - 180km

Site 17 – Whakatane

Overview:

- This is based on a new port in or around the Whakatene Harbour
- Likely to be offshore

Overall		R
Physical Viability		**Comments**
Shipping access	G	✓ Relatively good lines of navigation
Natural depth	G	✓ 11m to 17m, approximately 1.5km offshore
Coastal processes	A	X Would require substantial potential infrastructure. X Exposed to significant swells
Natural land topography	R	X Highly constrained natural topography – hilly terrain surrounding area
Distance from existing primary land transport	R	X The nearest state highway and rail route is approximately 47 km away
Feasibility of land transport access	R	X Major road and rail construction required
Distance from identified industrial concentration	R	X Very poor – 273km

15. Physical Viability - Red Sites - Reasons for Disqualification

Site	RED - Physical Viability Findings
Site 3: Port of Taranaki	Port of Taranaki is an existing regional port. To accommodate Auckland trade, the existing port at Taranaki would require large scale reconstruction including sizable reclamation as there would be insufficient space to handle the trade. This would also require relocation of existing trade. More importantly for Taranaki from an operational perspective, the port is 350km from the industrial concentrations around Auckland (4 hour trip minimum) resulting in this site not being viable site to take Auckland's trade.
Site 5B: Tapora, Kaipara Harbour	The Tapora site was identified from first principles and was intended to test the viability of access to and from the Kaipara Harbour, both in terms of landside and waterside. The site would effectively be formed by reclamation of the existing sand island which would then be bridged back to the plains. Although shipping access into the harbour is theoretically possible, the channel would require considerable dredging in places and it is expected that sediment build up in the channel would be prohibitive given the nature of the harbour. In addition, the harbour is subject to a challenging dynamic ebb tidal bar. From a landside perspective, accessing the plains is complex and likely costly. This is true for both road and rail and is due to undulating terrain, levels and the fact that little existing infrastructure exists. The rail line connection to the nearest route (Helensville) would require significant investment and would also require a Southdown to Avondale link. In summary, this is a poor site from a technical perspective.
Site 5C: Shelly Beach, Kaipara Harbour	The Shelly Beach site was identified from first principles and was intended to test the viability of access to and from the Kaipara Harbour, both in terms of landside and waterside. The site is a nearshore island built in the Kaipara Harbour that would be accessed by a bridge to its east. Although shipping access into the harbour is theoretically possible, the channel would require considerable dredging, much more than the Tapora option. It is also expected that sediment build up in the channel would be prohibitive given the nature of the harbour. In addition, the harbour is subject to a challenging dynamic ebb tidal bar and this location is at the landward end of the dynamic flood tidal delta. It is also exposed to short period local swells of significant height. From a landside perspective, the site is reasonably close to SH16 and village of Glorit but the road would require significant upgrade and is expected to be complex. Both road and rail will be complex and expensive due to undulating terrain, levels and the fact that little existing infrastructure exists. The rail line connection to the nearest route (Helensville) would require significant investment and would also require a Southdown to Avondale link. In summary, this is a poor site from a technical perspective.

Site	RED - Physical Viability Findings
Site 7D: Manukau Island Port, Clarks Beach	In addition to the new potential locations identified in the Manukau Harbour, Clarks Beach was previously highlighted as a potential site during previous studies. The site was re-examined as part of this study. As it is understood, this was intended to be an island port option within the harbour adjacent to Clark's Beach (1km to the north east). This site was poorly chosen from a number of perspectives resulting in it being deemed unsuitable, certainly in comparison to other Manukau Harbour options. There is no natural depth at the location given it is positioned away from the main deep water channels and would require extensive dredging from the channel to the extent that this would be prohibitive. Ongoing sediment build up is also expected to be prohibitive. The reclamation requirement would be expected to be similar to the other Manukau Harbour options. The limitation posed by the sandbar at the harbour entrance is not expected to be a showstopper and the amount required to be dredged to allow access for large ships would be modest. Additionally, sediment build-up is expected to fall within moderate maintenance volumes. Additionally, the site's location is much less attractive than the other Manukau options from a landside logistical perspective and would require extensive transport infrastructure development. Having said this, should the Manukau Harbour area be proven as feasible to accommodate a new port, additional studies would be expected to consider the entire harbour in more detail.
Site 8B: Port Waikato, West Coast	The Port Waikato site was identified from first principles as a potential site from a pure technical perspective. Generally speaking the site is unsuitable from a number of perspectives. Although the site was identified as a possible offshore island site, the nearshore depths in the area are relatively shallow. Deeper water exists further offshore but at some distance. As an area with high wave exposure, it is unlikely to be suitable, unless moved further out of the breaking zone. Even then, this site would be highly exposed and would require mass infrastructure at the island to protect it, driving up development costs significantly. In addition, the area is an actively adjusting coastline due to the Waikato River Flood control measures. From a landside perspective, the topography at the coastline is reasonable, but is sporadic further inland. The existing road network in the area is poor and there is no rail access. Developing both to connect to the main network would be complex and particularly expensive.
Site 9: Kawhia Harbour, West Coast	Kawhia Harbour was identified from first principles as a potential site from a pure technical perspective and around the notion of testing all natural harbours in the North Island region. Generally speaking the site is unsuitable from a number of perspectives. The harbour in its natural state is not suitable for receival of shipping and has no natural depth. To access the harbour would require large scale dredging. In addition, to build a port there would require significant reclamation in order to form land close to berthing areas. Both these factors are likely prohibitive. Shipping access would be difficult in any case, although not impossible. From a landside perspective, the topography at the coastline is complex and undulating making development difficult and expensive. The existing road network in the area is poor and rail access is expected to be difficult due to topography. Developing both to connect to the main network would be complex and particularly expensive. Finally, the distance of this site to the Auckland industrial concentrations is prohibitive at 190km.

Site	RED - Physical Viability Findings
Site 11A: Te Haupa Island, Mahurangi	The Te Haupa Island site was identified to test the technical viability of developing a natural offshore island port. The island itself would not be large enough to accommodate the size of the potential new port being contemplated, meaning that the island footprint would have to be extended artificially. The expanded island would require bridging to the mainland. The fact that this site makes use of the island is, in this case, a negative as the island would require extensive levelling which is expected to be more expensive per hectare than a new island. This is in addition to the need to reclaim. The area is expected to suffer from heavy sedimentation build up although natural depth in the area is reasonably good. The site is also semi-exposed to winds. From a landside perspective, transport access for both rail and road access is complex. Although SH1 is 10km away and rail is approximately 20km away, the terrain is steep, and existing infrastructure is poor. In addition, shipping access is complex due to proximity to surrounding islands and the size and alignment of the islands makes creation of sufficient berth line unlikely.
Site 12A: Karepiro Bay (Northeastern Coastline)	Karepiro Bay was previously identified as a potential site and was noted again during first principle analysis of the coastline as part of this study. There is a key difference however in the areas assessed originally and the site identified on this occasion. That being that the original study examined the use of the bay itself, whereas this was discounted quickly during this study as it is entirely unsuitable for shipping. Instead this study examined the potential to build a port outside the bay zone further south as a nearshore/ onshore development. Even outside the constrained harbour, there is insufficient land available to build a port with the capacity to handle the long-term trade task. Whilst there is some potential for the port to be built offshore, other restrictive factors would render this unfeasible, such as the shallow and insufficient immediate water depth which would require extensive dredging. It is also unlikely to have any capacity to create sufficient berthage. The site is also expected to suffer from ongoing and prohibitive sedimentation issues. From a landside perspective, the area is hilly and complex and development of transport infrastructure would be particularly costly. This includes both rail and road and may involve tunneling. As a northern site, it is expected to put greater pressure on the transport network given freight will have to move across the city.
Site 13A: Upper Harbour: Port Island	The Upper Harbour Site was identified in previous studies. The area was not considered from first principles as part of this study primarily because the Auckland Harbour Bridge restricts modern large scale shipping accessing it. Whilst there might be an argument to remove the bridge if the port was deemed optimal, this is a moot point. The requirement to reach the north shore at this location will remain and even if the bridge was replaced by a tunnel, the dredging requirement for a channel would impact on the tunnel depths that are thought to be unfeasible.

Site	RED - Physical Viability Findings
Site 13B: Upper Harbour	The second Upper Harbour Site was identified in previous studies. The area was not considered from first principles as part of this study primarily because the Auckland Harbour Bridge restricts modern large scale shipping from accessing it. Whilst there might be an argument to remove the bridge, if the port was deemed optimal, this is a moot point. The requirement to reach the north shore at this location will remain and even if the bridge was replaced by a tunnel, the dredging requirement for a channel would impact on the tunnel depths that are thought to be unfeasible.
Site 14A: Wairoa Bay (Central Eastern Coastline)	This area was considered as part of previous studies and has been claimed by some external parties as the optimal location for a new port. It was considered as part of the early technical work in this study but discounted due to a number of primary factors. The area is a shallow water zone that extends across the entire Tamaki Strait with depths ranging from 6m to 0m. For shipping to access this site, mass dredging would be required through the Strait to an extent deemed prohibitive. Any argument to take shipping through the Waiheke Channel is also poorly based. The channel widths and proximities to the islands are not suitable for large shipping and would require some dredging anyway before accessing the Strait. The Strait would then still require mass dredging to access the site. It is also likely that sediment movement along the Strait would be prohibitive to port development. Although there is a reasonable topography from the site to Papakura and the distance to the South Auckland area is good, the extent of both road and rail infrastructure to service the port would be large due to the distance of new infrastructure given the lack of existing infrastructure.
Site 14B: Ponui island port (1999 & 2014)	The Ponui Island site was identified in previous studies including the most recent in 2014. Although it was examined from first principles as part of this study, it was deemed unfeasible from a basic technical perspective. Although shipping access to the site is expected to be reasonably good, the ability for the island to cater for a large port from a size perspective is unlikely. Although the island is large, its topography effectively restricts port development to the south-east side which is not sufficiently large based on the long term trade task/s. Additionally, access to the island via a bridge would be particularly complex and more so than could be expected with a customised location for an artificial island. From a landside perspective, transport access, including both road and rail is expected to be particularly complex and costly due to current land uses and topography.
Site 17: Whakatāne, Whakatāne	Whakatāne was chosen as a potential site from a technical perspective as it has good natural water depth and is reasonably accessible by ship; however the area is exposed to large natural swells. As an offshore island site, it would require substantial infrastructure to withstand the coastal conditions and would need to be positioned far out enough to avoid the breaking zone. Despite the costs of this expected to be high, it is landside factors that deem this site unfeasible, in particular the show stopping nature of the distance to Auckland at 279km. The topography in the area is complex and hilly, meaning support land for the port would be limited and the cost of road and rail infrastructure high. The red flag issue for Whakatāne however is its distance from Auckland and the primary industrial concentrations at 273km.

16. Amber and Green sites – Physical viability findings and Multiple Criteria Analysis Findings

	Physical/Operational Capacity	Economic/Cost	Liveable City	Cultural	Environmental
Constrain the port to its current footprint (Do Minimum Option)	As the existing port, Auckland has sufficient capacity to deal with its own short term trade task. Its capacity and capability to handle the long term task on its current footprint, based on 4 million TEU +, appears unlikely. It would appear that both berth capacity and yard capacity will become an issue without land increase, even with significant technological improvements.	Given the port already exists; the costs of development are expected to be relatively modest compared to new sites. However, the capital costs associated with maximising the port's capacity (which is unlikely to meet the long term task due to its size limitation) is likely to be high and may not represent the best scenario for the land use and for the city, as well as sufficient security in accommodating the long term trade task. The port's location is considered good as it is close to the primary markets which it serves.	If Auckland port remains in the long term, the highest value for the land is unlikely to be realised given that it is located on a prime city waterfront area that is already largely gentrified. There will also be a negative impact on the quality of urban form and design for Auckland as a growing city that has emphasis around its waterfront. Staying in place is also expected to prevent commercial growth opportunities outside of port related industry	Negative impact on iwi values across all criteria. While this option could be seen as the least intrusive the way in which the Port came into existence failed to recognize the underlying interests and relationships of mana whenua iwi.	No ecological significance. No impact on coastal processes. The environmental impact of the port remaining on its current footprint would be less than other new port options. Notwithstanding increased impact associated with intensified operations within the existing footprint. Good proximity to SH1 and Wiri. No change in current carbon footprint. Should a preferred option(s) be carried forward following the short list evaluation a more detailed assessment of the environmental effects will be required including an assessment against the statutory consent tests of the Resource Management Act 1991.

	Physical/Operational Capacity	Economic/Cost	Liveable City	Cultural	Environmental
Site 2: Port of Tauranga	A broad assessment of the Port of Tauranga (PoT) and its potential to accommodate Auckland's trade task on top of its own projected task indicated that it could only accommodate a small proportion of Auckland's spill over trade task. This assessment considered the expansion plans for Tauranga container terminal as advised by PoT. Accordingly, it does not represent a solution in its own right, but may form part of the long term strategy, subject to further assessment. Whilst there is the theoretical potential for PoT's Mt Maunganui terminal to be adapted into a container terminal and provide more capacity, this scenario is thought to be unlikely as the timber industry uses this land and would be difficult to relocate given its export nature for the locality.	Putting capacity constraints aside, if Tauranga did expand its container terminal to its full potential, the costs would be similar to that at Auckland. That being substantial but significantly less than a new port option. Major economic and financial costs would be expected outside the port gate including transport infrastructure development to access the Auckland region, and the time/cost to market would be comparatively high.	There is expected to be a positive impact for Auckland city if the port land was gentrified. This would be enabled if Tauranga was able to take the entire Auckland trade task (which it cannot). This would allow Auckland to maximise highest value land use for the waterfront land, and provide commercial growth opportunities. Having increased waterfront land would potentially make Auckland more attractive to visitors and have a positive impact on the quality of urban form and design for Auckland. Having said this, there would be an associated negative impact on Tauranga due to an increase in port related activity on land use and additional burden on the localised transport network.	Unlikely that any Tauranga moana iwi would participate economically in an increased Port Tauranga. They have invested significant amounts in unsuccessful litigation against widening and deepening channels. Moana-centric people with an enduring thousand year association with Tauranga Moana that is fundamental to their identity and wellbeing, culturally and materially. Previous dredging by Port Tauranga to widen and deepen the shipping channels was legally opposed by all Tauranga moana iwi. Potential offset by an improvement for Auckland as the mana whenua from this area would benefit from an environmental perspective. Overall an improvement for Auckland mana whenua - but displacement will create whakawhanaungatanga tensions. Further specific site assessment required should this option progress to feasibility study.	Little new impact on coastal processes. Bypass dredging disposal would need to be assessed. Effects predominantly confined to increased intensified port operations within the existing footprint and increased land transport activity along existing network corridors. Increased carbon footprint for Auckland market. Should a preferred option(s) be carried forward following the short list evaluation a more detailed assessment of the environmental effects will be required including an assessment against the statutory consent tests of the Resource Management Act 1991.

	Physical/Operational Capacity	Economic/Cost	Liveable City	Cultural	Environmental
Site 4: Northport (accommodating Auckland's long term trade task)	Northport is unlikely to be able to accommodate Auckland's container task in any significant way. This is due to both an insufficient amount of terminal land or berth length. Enabling this would require large scale construction that would have an unfeasible impact on surrounding public land. Decommissioning of the existing oil terminal is unlikely to present a suitable solution given depth restrictions in that area, although in theory this could be dredged further. There does however appear to be sufficient space and planning to accommodate at least some of Auckland's general cargo task	The distance from Northport to the primary markets in the Auckland region is particularly large (160km) and this would inevitably result in negative time/cost to market. The financial cost of landside transport infrastructure upgrades is also likely to be particularly high.	There is expected to be a positive impact for Auckland city if the port land was gentrified. This would be enabled if Northport was able to take the entire Auckland trade task (which it cannot). This would allow Auckland to maximise highest value land use for the waterfront land, and provide commercial growth opportunities. Having increased waterfront land would potentially make Auckland more attractive to visitors and have a positive impact on the quality of urban form and design for Auckland. Having said this, there would be an associated negative impact on Northport due to an increase in port related activity on land use and additional burden on the localised transport network.	Mana whenua iwi includes Ngāti Wai, Ngāti Whātua, and Ngāpuhi. Most iwi with interests to this area are pre settlement (with the exception Ngāti Whātua and Iwi commercial fishing and aquaculture interests). Ngāti Whātua support economic development in the north and increasing the trade role of Northport. Ngāti Patuharakeke, claim Marsden Point Oil Refinery and expansion, Portcorp Deepwater Port and reclamation and the Hopper Marina Development have all had a significant effect on the natural environment and the ability of Patuharakeke to exercise their traditional practices and negated the impact of mana whenua, mana moana and mana takutaimoana Further specific site assessment required should the site progress to feasibility study.	No substantial change in coastal processes. Located inside sheltered harbour. Potential surging hazard from Tsunami Additional reclamation would substantially increase the port footprint. Additional effects associated with increased intensity of use at the port and along transport corridors. Increased carbon footprint for Auckland market. Should a preferred option(s) be carried forward following the short list evaluation a more detailed assessment of the environmental effects will be required including an assessment against the statutory consent tests of the Resource Management Act 1991.

	Physical/Operational Capacity	Economic/Cost	Liveable City	Cultural	Environmental
Site 6A: Muriwai Offshore Port (Northwestern Coastline)	This option is based on development of an offshore island that is accessed by bridge. Accordingly, its ability to accommodate the trade task is a matter of building sufficient footprint, which is virtually unlimited from a physical perspective. If the island is adequately positioned offshore, the water depth is suitable for large deep draft vessels. The wave climate along the shoreline is not suitable for shipping; however this might be mitigated providing the port is positioned far enough from the breaking zone. The port would require extensive sea protection in the form of built in breakwaters. The links to the land transport networks is undeveloped other than a minor road to the area, which would require substantial and expensive upgrades	As a new site for port development, the cost would be high. The cost to develop landside transport links would also be high despite the relatively short distances involved. This is due to a lack of development in the area as well as topography. The freight transport distances to the site would be average (65 km), however as the site sits north of Auckland, this would mean that freight would need to move across the city which is not ideal. There are little positives from an economic perspective with this site.	There is expected to be a positive impact for Auckland city if the port land was gentrified. This would be enabled if Muriwai was developed to be able to take the entire Auckland trade task. This would allow Auckland to maximise highest value land use for the waterfront land, and provide commercial growth opportunities. Having increased waterfront land would potentially make Auckland more attractive to visitors and have a positive impact on the quality of urban form and design for Auckland. There would be a localised negative impact on the Muriwai area which needs to be taken into account but the impact on Auckland liveability is positive	Ngāti Whātua o Kaipara and Te Kawerau a Maki have settled their respective historical claims in relation to the area that includes Muriwai. The development of a new port will need to take cognisance of these Settlements. Given the location of this site it is unlikely that there would be significant mana whenua investment into any proposed Port development. There are a number of mana whenua archeological sites in the Muriwai area and sites of cultural significance. Further specific site assessment required should the site progress to feasibility study.	Site of two regionally significant surf breaks and regionally significant ecology. High energy wave environment making site determination difficult. Substantial landside impacts associated with establishment of new road and rail connections and upgrades to existing corridor infrastructure. A new port footprint would potentially impact identified significant ecological areas within the coastal marine area. The landside connections would impact outstanding natural landscapes along the Coastal Marina Area/land interface. The entire coastline is identified as an Outstanding Coastal Natural Character Area and Outstanding Natural Landscape. Increased carbon footprint for Auckland market. Should a preferred option(s) be carried forward following the short list evaluation a more detailed assessment of the environmental effects will be required including an assessment against the statutory consent tests of the Resource Management Act 1991.

	Physical/Operational Capacity	Economic/Cost	Liveable City	Cultural	Environmental
Site 6B: Muriwai, North West Coast	This option is based on development of an offshore island that is accessed by bridge. It is a similar option to site 6A although positioned further north. Accordingly, its ability to accommodate the trade task is a matter of building sufficient footprint, which is virtually unlimited from a physical perspective. Providing the island is adequately positioned offshore, the water depth is suitable for large deep draft vessels. The wave climate along the shoreline is not suitable for shipping; however this might be mitigated providing the port is positioned far enough from the breaking zone. The port would require extensive sea protection in the form of built in breakwaters. The links to the land transport networks is less developed than site 6A; however the land at the shoreline is considerably flatter, making development more realistic (recognising that the area is a national park). The cost of developing new road and rail would still be expensive although comparatively less than site 6A.	As a new site for port development, the cost would be high. The cost to develop landside transport links would also be high with average distance (64 km). This is due to a lack of development in the area as well as topography. The costs are expected to be lower than site 6A however. The freight transport distances to the site would be moderate; however, as the site sits north of Auckland, this would mean that freight would need to move across the city which is not ideal. There are little positives from an economic perspective with this site.	There is expected to be a positive impact for Auckland city if the port land was gentrified. This would be enabled if Muriwai was developed to be able to take the entire Auckland trade task. This would allow Auckland to maximise highest value land use for the waterfront land, and provide commercial growth opportunities. Having increased waterfront land would potentially make Auckland more attractive to visitors and have a positive impact on the quality of urban form and design for Auckland. There would be a localised negative impact on the Muriwai area which needs to be taken into account but the impact on Auckland liveability is positive.	Ngāti Whātua o Kaipara and Te Kawerau a Maki have settled their respective historical claims in relation to the area that includes Muriwai. The development of a new port will need to take cognisance of these Settlements. Given the location of this site it is unlikely that there would be significant mana whenua investment into any proposed Port development. There are a number of mana whenua archeological sites in the Muriwai area and sites of cultural significance. Further specific site assessment required should the site progress to feasibility study.	Site of two regionally significant surf breaks and regionally significant ecology. High energy wave environment making site determination difficult. Substantial landside impacts associated with establishment of new road and rail connections and upgrades to existing corridor infrastructure. A new port footprint would potentially impact identified significant ecological areas within the coastal marine area. The landside connections would impact outstanding natural landscapes along the Coastal Marina Area/land interface. The entire coastline is identified as an Outstanding Coastal Natural Character Area and Outstanding Natural Landscape. Moderate increase in carbon footprint for Auckland market. Should a preferred option(s) be carried forward following the short list evaluation a more detailed assessment of the environmental effects will be required including an assessment against the statutory consent tests of the Resource Management Act 1991.

	Physical/Operational Capacity	Economic/Cost	Liveable City	Cultural	Environmental
Site 7A: Central Manukau Harbour	The central Manukau site was chosen based on several natural features that were not explored previously. Although a central harbour site might appear unusual, development costs here are expected to be substantially less than for other potential offshore solutions identified. This includes relatively high bed levels, reducing reclamation costs potentially, and a deep channel immediately adjacent. The port could also be substantially expanded over time. The limitation posed by the sandbar at the harbour entrance is not expected to be a showstopper and the amount required to be dredged to allow access for large ships would be modest. Additionally, sediment build-up is expected to fall within moderate maintenance volumes. Very little dredging within the harbour would be required. Although the site would require construction of a long bridge-way to meet it, the costs of bridge development would be modest from an overall scheme perspective.	Although the cost of developing the port would still be high, it is likely that these would be offset by the fact that the port is in an optimal position to service Auckland's primary industrial areas reducing time to market costs significantly. The relative cost of landside transport infrastructure is also low given its proximity to the existing network. The large population close to the port location provides potential wider economic activity and benefits	There is expected to be a positive impact for Auckland city if the port land was gentrified. This would be enabled if Central Manukau Harbour was developed to be able to take the entire Auckland trade task. This would allow Auckland to maximise highest value land use for the waterfront land, and provide commercial growth opportunities. Having increased waterfront land would potentially make Auckland more attractive to visitors and have a positive impact on the quality of urban form and design for Auckland. There would be a localised negative impact on the Manukau Harbour area which needs to be taken into account but the impact on Auckland liveability is positive	Auckland Council identifies at least 17 Mana Whenua groups with interests in the Manukau harbour. Historically poor interactions between mana whenua and public infra-structure in the Manukau harbour. Pollution badly affected the harbour environment, food sources and mana whenua interests and relationship with their areas. Potential for co-ownership or co-investment provided other cultural imperatives are resolved. Potential co-governance harbour Settlement framework will increase mana whenua involvement in harbor co-management decisions. Anticipate a change in Manukau harbour governance arrangements post Manukau harbour settlement.	Requires substantial entrance channel dredging both capital and maintenance dredging. The landside effects of the road and rail networks are expected to be less substantial given the proximity to established road and rail corridors and proximity to Wiri. The nearby coastal communities of Awhitu Peninsula, Cornwalis and Laingholm will notice an environmental change associated with coastal occupation but will not be directly impacted by new transport corridors. The new transport corridors will pass through predominantly rural coastal land in Mangere. There are identified significant ecological areas both marine and landside along the new corridor and causeway route will be impacted by the port and associated infrastructure. The port structure is no located within an identified significant marine ecological areas although the marine environment is inferred as being of high ecological diversity.

	Physical/Operational Capacity	Economic/Cost	Liveable City	Cultural	Environmental
				Multiple sites of significance around the Manukau. Importance of the Manukau harbour as a historical and contemporary fishing and food gathering resource, plus contemporary cultural interactions. Further specific site assessment required should the site progress to feasibility study.	Potential ecological effects associated with disturbance, change in water quality, alteration to tropical functioning, loss of habitat and movement restrictions. Relatively small increase in carbon footprint. Should a preferred option(s) be carried forward following the short list evaluation a more detailed assessment of the environmental effects will be required including an assessment against the statutory consent tests of the Resource Management Act 1991.
Site 7B: Manukau Harbour: Puhinui (1989, 1999, 2014, Blue Sky)	The Puhinui option was investigated previously but was identified from first principles during this study. The position of a potential site was unclear during previous studies, so a general area close to the airport was identified. This is a near-shore island development to avoid the nearby sanctuary. Under further investigation, it may be possible to locate it closer to the shoreline.	The cost of developing this port would be particularly high given its dredge cost and in comparison to other new port sites. However, its position to primary industrial areas is likely optimal which might offset some of these development costs significantly. The relative cost of landside transport infrastructure is also low given its proximity to the existing network.	There is expected to be a positive impact for Auckland city if the port land was gentrified. This would be enabled if Puhinui was developed to be able to take the entire Auckland trade task. This would allow Auckland to maximise highest value land use for the waterfront land, and provide commercial growth opportunities.	Auckland Council identifies at least 19 Mana Whenua groups with interests in the Manukau harbour. Historically poor interactions between mana whenua and public infra-structure in the Manukau harbour. Pollution badly affected the harbour environment, food sources and mana whenua interests and relationship with their areas. Discharge of freshwater into the Puhinui area together with other environmental changes leads to stagnant water.	Requires substantial entrance channel dredging both capital and maintenance dredging. The landside effects of the rail and road networks are expected to be less substantial given the proximity to established road and rail corridors and proximity to Wiri. The coastal residential community of Manurewa and coastal Karaka will notice an environmental change around coastal occupation.

	Physical/Operational Capacity	Economic/Cost	Liveable City	Cultural	Environmental
	As an island, there is ample space for it to accommodate the trade task from a port perspective. The limitation posed by the sandbar at the harbour entrance is not expected to be a showstopper and the amount required to be dredged to allow access for large ships would be modest. Additionally, sediment build-up is expected to fall within moderate maintenance volumes. However, the site is significantly shallower than the other Manukau options identified and the cost implications of dredging access there are likely to be particularly high. Its location close to the primary road and rail network is excellent.	The large population close to the port location provides potential wider economic activity and benefits.	Having increased waterfront land would potentially make Auckland more attractive to visitors and have a positive impact on the quality of urban form and design for Auckland. There would be a localised negative impact on the Manukau Harbour area which needs to be taken into account but the impact on Auckland liveability is positive.	Pukaki stream and other areas which are already under environmental pressure are being actively worked on by mana whenua. Potential for co-ownership or co-investment provided other cultural imperatives are resolved. Potential co-governance harbour Settlement framework will increase mana whenua involvement in harbor co-management decisions. Anticipate a change in Manukau harbour governance arrangements post Manukau harbour settlement. Multiple sites of significance around the Manukau. Importance of the Manukau harbour as a historical and contemporary fishing and food gathering resource, plus contemporary cultural interactions. Further specific site assessment required should the site progress to feasibility study.	There will be some impact on significant ecological areas both marine and landside. The new port is located entirely within an identified significant marine ecological area. Relatively small increase in carbon footprint. Should a preferred option(s) be carried forward following the short list evaluation a more detailed assessment of the environmental effects will be required including an assessment against the statutory consent tests of the Resource Management Act 1991.

	Physical/Operational Capacity	Economic/Cost	Liveable City	Cultural	Environmental
Site 7C: Hikihiki, Manukau Harbour	Similar to the Central Manukau site, the Hikihiki site was chosen based on several natural features that appear not to have been explored previously. The site has similar positive characteristics to the central site but not quite to the same extent. This still includes relatively high bed levels, reducing reclamation costs potentially, and a deep channel immediately adjacent, albeit with additional localised dredging and reclamation volumes. The port could also be substantially expanded over time. The limitation posed by the sandbar at the harbour entrance is not expected to be a showstopper and the amount required to be dredged to allow access for large ships would be modest. Additionally, sediment build-up is expected to fall within moderate maintenance volumes. Very little dredging within the harbour would be required. The bridge-way would be shorter than the central site although still significant.	Although the cost of developing the port would be high (higher than the central site most likely), it is possible that these would be offset by the fact that the port is in an optimal position to service Auckland's primary industrial areas reducing time to market costs significantly. The relative cost of landside transport infrastructure is also low given its proximity to the existing network. The large population close to the port location provides potential wider economic activity and benefits	There is expected to be a positive impact for Auckland city if the port land was gentrified. This would be enabled if Hikihiki was developed to be able to take the entire Auckland trade task. This would allow Auckland to maximise highest value land use for the waterfront land, and provide commercial growth opportunities. Having increased waterfront land would potentially make Auckland more attractive to visitors and have a positive impact on the quality of urban form and design for Auckland. There would be a localised negative impact on the Manukau harbour area which needs to be taken into account but the impact on Auckland liveability is positive.	Auckland Council identifies at least 17 Mana Whenua groups with interests in the Manukau harbour. Historically poor interactions between mana whenua and public infra-structure in the Manukau harbour. Pollution badly affected the harbour environment, food sources and mana whenua interests and relationship with their areas. Potential for co-ownership or co-investment provided other cultural imperatives are resolved. Potential co-governance harbour Settlement framework will increase mana whenua involvement in harbor co-management decisions. Anticipate a change in Manukau harbour governance arrangements post Manukau harbour settlement. Multiple sites of significance around the Manukau. Importance of the Manukau harbour as a historical and contemporary fishing and food gathering resource, plus contemporary cultural interactions. Further specific site assessment required should the site progress to feasibility study.	Requires substantial entrance channel dredging both capital and maintenance dredging. The landside effects are expected to be less substantial given the proximity to established road and rail corridors and proximity to Wiri. The coastal residential community of Manurewa will notice an environmental change around coastal occupation. There will be some impact on identified significant ecological areas both marine and landside. The new port is located entirely within an identified significant marine ecological area. There will be substantial dredging at the harbour entrance. Relatively small increase in carbon footprint. Should a preferred option(s) be carried forward following the short list evaluation a more detailed assessment of the environmental effects will be required including an assessment against the statutory consent tests of the Resource Management Act 1991.

	Physical/Operational Capacity	Economic/Cost	Liveable City	Cultural	Environmental
Site 10: Bream Bay area (previously Ruakaka) Whangarei	This site is effectively a new site close to Northport and the town of Ruakaka. The area has good localised deep water although conditions are expected to be reasonably hazardous for shipping so would require extensive sea protection. The port would be an offshore island. Although the proximity to existing landside transport networks is reasonably good, the networks themselves would require large scale upgrades and over particularly long lengths given it must be linked with Auckland	The distance from Bream Bay to the primary markets in the Auckland region is particularly large (154km) and this would inevitably result in negative time/cost to market. The financial cost of landside transport infrastructure upgrades is also likely to be particularly high.	There is expected to be a positive impact for Auckland city if the port land was gentrified. This would be enabled if Bream Bay was developed to be able to take the entire Auckland trade task. This would allow Auckland to maximise highest value land use for the waterfront land, and provide commercial growth opportunities. Having increased waterfront land would potentially make Auckland more attractive to visitors and have a positive impact on the quality of urban form and design for Auckland. There would be a localised negative impact on the lower Whangarei area which needs to be taken into account but the impact on Auckland liveability is positive.	Mana whenua iwi includes Ngāti Wai, Ngāti Whātua, Ngati Manuhiri and Ngāpuhi. Most iwi with interests to this area are pre settlement (with the exception Ngāti Whātua and Iwi commercial fishing and aquaculture interests). Ngāti Whātua support economic development in the north and increasing the trade role of Northport. Ngāti Patuharakeke, claim Marsden Point Oil Refinery and expansion, Portcorp Deepwater Port and reclamation and the Hopper Marina Development have all had a significant effect on the natural environment and the ability of Patuharakeke to exercise their traditional practices and negated the impact of mana whenua, mana moana and mana takutaimoana. Further specific site assessment required should the site progress to feasibility study.	Would require protective infrastructure, although relatively deep close to shore. Sediment bypassing would be required to the north and south. Increased carbon footprint for Auckland market. Should a preferred option(s) be carried forward following the short list evaluation a more detailed assessment of the environmental effects will be required including an assessment against the statutory consent tests of the Resource Management Act 1991.

	Physical/Operational Capacity	Economic/Cost	Liveable City	Cultural	Environmental
Site 11B: Mahurangi West, Mahurangi	The Mahurangi West site provides reasonably good access for shipping from a linear perspective. However, depth in the area is variable and not sufficient to cater for larger vessels. Therefore, significant dredging would be required. In addition, the coastal environment there is quite severe. The site would be developed partially offshore and partially onshore, however it is theoretically possible to build it all offshore. This would not fully address all its technical issues. The site is a considerable distance from the industrial centres of Auckland and the links to the primary transport network are poor.	The distance to this site from Auckland is significantly large (76km) and as a northern site, it would mean freight moving across Auckland city, putting additional burden on the localised transport network. The cost/time to market is expected to be high accordingly. The capital cost to develop the site is also expected to be prohibitive given the extent of dredging required whilst building offshore.	There is expected to be a positive impact for Auckland city if the port land was gentrified. This would be enabled if Mahurangi West was developed to be able to take the entire Auckland trade task. This would allow Auckland to maximise highest value land use for the waterfront land, and provide commercial growth opportunities. Having increased waterfront land would potentially make Auckland more attractive to visitors and have a positive impact on the quality of urban form and design for Auckland. There would be a localised negative impact on the Mahurangi area which needs to be taken into account but the impact on Auckland liveability is positive.	Mana whenua includes Ngati Whatua, Te Kawerau a Maki, Ngati Manuhiri and Marutuahu. Natural resources and strategic position of this area have attracted Māori for hundreds of years. The Puhoi and Waiwera Rivers gave canoe access inland to the walking tracks over to the west coast and Waiwerawera hot springs close by. Mahurangi shark fishing grounds provided sharks for drying as a winter food. A number of historical sites in the area. Further specific site assessment required should the site progress to feasibility study.	Would require infrastructure for protection, although minimal dredging required. High sediment load from Mahurangi Estuary. An area of regionally significant marine ecology. Also requires a dredged channel of up to 2km. Increased carbon footprint for Auckland market. Should a preferred option(s) be carried forward following the short list evaluation a more detailed assessment of the environmental effects will be required including an assessment against the statutory consent tests of the Resource Management Act 1991.

	Physical/Operational Capacity	Economic/Cost	Liveable City	Cultural	Environmental
Site 12B: Long Bay, Long Bay	Long Bay is a well-developed part of the city; however it was identified as a potential site purely based on its technical merits. It provides potentially good access to shipping, however depth there would not be sufficient for larger vessels, resulting in the need to dredge, which would be considerable. The site would be an offshore island. The landside transport connections are unlikely to be suitable. Although development is technically possible, it is expected that costs would be high and impact directly on public areas.	The distance to this site from Auckland is significantly large and as a northern site, it would mean freight moving across the city. The cost/time to market is expected to be high accordingly. The capital cost to develop the site is also expected to be prohibitive given the extent of dredging required whilst building offshore and taking into account the cost of landside transport links.	There is expected to be a positive impact for Auckland city if the port land was gentrified. This would be enabled if Long Bay was developed to be able to take the entire Auckland trade task. This would allow Auckland to maximise highest value land use for the waterfront land, and provide commercial growth opportunities. Having increased waterfront land would potentially make Auckland more attractive to visitors and have a positive impact on the quality of urban form and design for Auckland. Having said this, Long Bay is effectively part of Auckland (although not part of the city centre) and accordingly the overall impact would not be particularly positive. Certainly so when compared to other potential options.	Mana whenua includes Ngati Whatua, Te Kawerau a Maki, Ngati Manuhiri and Marutuahu. Proposed site falls within the Okura Long Bay marine reserve. Many sites of significance. Long Bay Restaurant redevelopment was cancelled following discovery of koiwi (human remains). The area is believed to be a burial site and potential place of past occupation and conflict. Further specific site assessment required should the site progress to feasibility study.	Sheltered anchorage along the southern shore of the Whangaparoa Peninsula. Up to 1km entrance channel required.

	Physical/Operational Capacity	Economic/Cost	Liveable City	Cultural	Environmental
Site 14C: Kawakawa Bay (incorporating previous Ponui Offshore Port) (1999 & Blue Sky)	The Kawakawa site was identified from first principles, however largely corresponds to a previously identified option (Ponui). It is an offshore island solution. Although shipping access would potentially be good, considerable localised dredging would be required on top of the large scale reclamation. The landside area is hilly and complex and would present difficulties and costs in developing transport infrastructure. Whilst the distance to the main industrial areas of Auckland is average, the cost of infrastructure to access it would be high and most likely prohibitive. The bridgeway to access the site would also be substantial.	The distance to this site from Auckland is reasonably short, however the cost to develop infrastructure to service it is likely high The cost/time to market is expected to be relatively good, with a distance of 40km and may offset some of the development costs but unlikely to offset all of them. Localised dredging and reclamation costs are also expected to be high	There is expected to be a positive impact for Auckland city if the port land was gentrified. This would be enabled if Kawakawa Bay was developed to be able to take the entire Auckland trade task. This would allow Auckland to maximise highest value land use for the waterfront land, and provide commercial growth opportunities. Having increased waterfront land would potentially make Auckland more attractive to visitors and have a positive impact on the quality of urban form and design for Auckland. There would be a localised negative impact on the Kawakawa Bay area which needs to be taken into account but the impact on Auckland liveability is positive	Mana whenua includes members of the Hauraki Collective and Waikato Tainui. Hauraki Gulf and its islands are matters of national significance (section 7 - Hauraki Gulf Marine Park Act 2000). Presumption that any negative environmental impact would adversely affect national significance of the Gulf. Hauraki Gulf Forum established to recognise the historic, traditional, cultural, and spiritual relationship of tangata whenua with the Hauraki Gulf, its islands, and, where appropriate, its catchments (section 15 - Hauraki Gulf Marine Park Act 2000). No Deed of Settlement has been executed with the Hauraki Collective yet. Indications are that negotiations will recommence this year having previously been placed on hold by the Minister of Treaty Settlements.	Requires extensive infrastructure. Currents up to 1.5 m (E-W) during spring tides. Potential impact on a regionally significant surf break (Orere Point). Substantial landside impacts associated with establishment of new road and rail connections. A new port footprint would potentially impact identified significant ecological areas within the coastal marine area. The landside connections would impact existing significant ecological areas along the transport route. The communities of kawakawa Bay, Clevedon, the rural coastal area immediately adjacent the site and others along the transport corridor would experience environmental change as a result of the port and corridor construction and operation. The coastal area immediately adjacent the site is identified as an Outstanding Coastal Natural Character Area.

	Physical/Operational Capacity	Economic/Cost	Liveable City	Cultural	Environmental
				Potential Foreshore and Seabed applications could be raised in Settlement negotiations or under the Marine and Coastal Area (Takutai Moana) Act 2011. Further specific site assessment required should the site progress to feasibility study.	Should a preferred option(s) be carried forward following the short list evaluation a more detailed assessment of the environmental effects will be required including an assessment against the statutory consent tests of the Resource Management Act 1991.
Site 15A: Waimango Point, Firth of Thames	The Waimango Point site was identified from technical first principles. It is an offshore island port accessed via a bridgeway. The exact area remains flexible subject to more detailed analysis, but it's likely that distance to substantial deep-water is moderate. As an offshore port, capacity of the port is expected to be almost limitless. The landside transport links are complex and likely to be particularly costly, and the site's distance to Auckland's industrial area is relatively long (50 km).	The distance to this site from Auckland is reasonably moderate, however the cost to develop infrastructure to service it is likely high The cost/time to market is expected to be relatively good and may offset some of the development costs but unlikely all of them. There might be some requirement for some localised dredging and reclamation costs are also expected to be high. The site has a poor ability to capitalise on wider economic opportunities due to lower population in surrounding areas.	There is expected to be a positive impact for Auckland city if the port land was gentrified. This would be enabled if Waimango Point was developed to be able to take the entire Auckland trade task. This would allow Auckland to maximise highest value land use for the waterfront land, and provide commercial growth opportunities. Having increased waterfront land would potentially make Auckland more attractive to visitors and have a positive impact on the quality of urban form and design for Auckland. There would be a localised negative impact on the Waimango Point area which needs to be taken into account but the impact on Auckland liveability is positive.	Mana whenua includes members of the Hauraki Collective and Waikato Tainui. Hauraki Gulf and its islands are matters of national significance (section 7 - Hauraki Gulf Marine Park Act 2000). Presumption that any negative environmental impact would adversely affect national significance of the Gulf. This site is close to areas of importance to mana whenua and areas of Māori land. Hauraki Gulf Forum established to recognise the historic, traditional, cultural, and spiritual relationship of tangata whenua with the Hauraki Gulf, its islands, and, where appropriate, its catchments (section 15 - Hauraki Gulf Marine Park Act 2000).	Low sediment transport rates. Would require extensive infrastructure, although short dredged entrance channel. Substantial landside impacts associated with establishment of new road and rail corridor. A new port footprint would potentially impact identified significant ecological areas within the coastal marine area. The landside connections would impact existing significant ecological areas along the transport route.

	Physical/Operational Capacity	Economic/Cost	Liveable City	Cultural	Environmental
				No Deed of Settlement has been executed with the Hauraki Collective yet. Indications are that negotiations will recommence this year having previously been placed on hold by the Minister of Treaty Settlements. Potential Foreshore and Seabed applications could be raised in Settlement negotiations or under the Marine and Coastal Area (Takutai Moana) Act 2011. Further specific site assessment required should the site progress to feasibility study.	The communities of Kawakawa Bay, Clevedon, the rural coastal area immediately adjacent the site and others along the transport corridor would experience environmental change as a result of the port and corridor construction and operation. The coastal area immediately adjacent the site is identified as an Outstanding Coastal Natural Character Area. Should a preferred option(s) be carried forward following the short list evaluation a more detailed assessment of the environmental effects will be required including an assessment against the statutory consent tests of the Resource Management Act 1991.

	Physical/Operational Capacity	Economic/Cost	Liveable City	Cultural	Environmental
Site 15B: Kaiaua Land Port (Firth of Thames – western shore north of Kaiaua	The Kaiaua site was identified from technical first principles. It is an onshore port, however an offshore island port accessed via a bridgeway was also explored, similar to Waimango Point. The exact area remains flexible subject to more detailed analysis, but it's likely that distance to substantial deep-water is moderate. As an offshore port, capacity of the port is expected to be almost limitless. This would not be the case with an onshore port. The landside transport links are complex and likely to be particularly costly, and the site's distance to Auckland's industrial area is relatively long.	The distance to this site from Auckland is reasonably moderate, however the cost to develop infrastructure to service it is likely high The cost/time to market is expected to be relatively good and may offset some of the development costs but unlikely all of them. There might be some requirement for some localised dredging and reclamation costs are also expected to be high. The site has a poor ability to capitalise on wider economic opportunities due to lower population in surrounding areas	There is expected to be a positive impact for Auckland city if the port land was gentrified. This would be enabled if Kaiaua was developed to be able to take the entire Auckland trade task. This would allow Auckland to maximise highest value land use for the waterfront land, and provide commercial growth opportunities. Having increased waterfront land would potentially make Auckland more attractive to visitors and have a positive impact on the quality of urban form and design for Auckland. There would be a localised negative impact on the Kaiaua area which needs to be taken into account but the impact on Auckland liveability is positive.	Mana whenua includes members of the Hauraki Collective and Waikato Tainui. Hauraki Gulf and its islands are matters of national significance (section 7 - Hauraki Gulf Marine Park Act 2000). Presumption that any negative environmental impact would adversely affect national significance of the Gulf. Hauraki Gulf Forum established to recognise the historic, traditional, cultural, and spiritual relationship of tangata whenua with the Hauraki Gulf, its islands, and, where appropriate, its catchments (section 15 - Hauraki Gulf Marine Park Act 2000). No Deed of Settlement has been executed with the Hauraki Collective yet. Indications are that negotiations will recommence this year having previously been placed on hold by the Minister of Treaty Settlements. Potential Foreshore and Seabed applications could be raised in Settlement negotiations or under the Marine and Coastal Area (Takutai Moana) Act 2011. Further specific site assessment required should the site progress to feasibility study.	Low sediment transport rates. Potential negative effects from the dredging, disposal of dredged material, and reclamation. Requires approximately 10 km entrance channel. Substantial landside impacts associated with establishment of new road and rail corridor. A new port footprint would potentially impact identified significant ecological areas within the coastal marine area. The landside connections would impact existing significant ecological areas along the transport route.

	Physical/Operational Capacity	Economic/Cost	Liveable City	Cultural	Environmental
Site 16: Tauranga II, Tauranga	This option is effectively a new offshore port built outside the Tauranga Harbour. Although the technical factors for this site are reasonably positive, its transport links and distance from Auckland are prohibitive.	Major economic and financial costs would be expected outside the port gate including transport infrastructure development to access the Auckland region, and the time/cost to market would be comparatively high.	There is expected to be a positive impact for Auckland city if the port land was gentrified. This would be enabled if Tauranga was able to take the entire Auckland trade task. This would allow Auckland to maximise highest value land use for the waterfront land, and provide commercial growth opportunities. Having increased waterfront land would potentially make Auckland more attractive to visitors and have a positive impact on the quality of urban form and design for Auckland. Having said this, there would be an associated negative impact on Tauranga due to an increase in port related activity on land use and additional burden on the localised transport network	Unlikely that any Tauranga moana iwi would participate economically in an increased Port Tauranga. They have invested significant amounts in unsuccessful litigation against widening and deepening channels. Moana-centric people with an enduring thousand year association with Tauranga Moana that is fundamental to their identity and wellbeing, culturally and materially. Previous dredging by Port Tauranga to widen and deepen the shipping channels was legally opposed by all Tauranga moana iwi. Potential offset by an improvement for Auckland as the mana whenua from this area would benefit from an environmental perspective. Overall an improvement for Auckland mana whenua - but displacement will create whakawhanaungatanga tensions. Further specific site assessment required should this option progress to feasibility study.	Would require substantial infrastructure. Semi-exposed, although very exposed to tropical cyclone swells, regionally/nationally significant surfing breaks (Matakana Island). Very dynamic ebb-tidal delta and entrance channel (de Lange, 2015), which is very large and any offshore port would likely have large impacts on Matakana Island and the harbour entrance. High sediment transport rates, 200,000-300,000 m3/yr. New substantial environmental footprint within the harbour. Should a preferred option(s) be carried forward following the short list evaluation a more detailed assessment of the environmental effects will be required including an assessment against the statutory consent tests of the Resource Management Act 1991.

17. MCA Results

17.1 Multi Criteria Analysis, Weighting and Scoring

Criteria	Weighting	-2	-1	0	1	2	Comment
Berth capacity to meet forecast trade volumes	6.67%	900-1,500	1,500-2,000	2000-3000	3000-4000	4000+	TEUs as a proxy for length and depth
Land-side/yard capacity ability to meet trade volumes (on site or with access to inland port)	6.67%	0 - 50	50 - 100	100 - 150	150 - 200	200 +	Hectares
Accessible depth (includes potential to dredge to required long term depth (14m to 15m +)	6.67%	< 11.5m	11.5 - 13m	13-14m	14-15m	>15m	Approach depth,
Navigable feasibility	6.67%	very poor	poor	average	good	excellent	
Physical/geographical/topography constraints	3.33%	very poor	poor	average	good	excellent	
Ability to accommodate forecast cruise vessels	0.00%	very poor	poor	average	good	excellent	Size, Throughput, long term
Indicative whole-of-life port cost [land acquisition/land reclamation/capital/maintenance/operations - affordability/fundability]	1.25%	very high	high	moderate	Low	very low	$bn values tbd, includes port site and water side up to gate
Indicative cost of transport network infrastructure required to support long-term port operations	3.00%	very high	high	moderate	Low	very low	$bn values tbd, includes land side up to gate
Time/cost to market	4.00%	very poor	poor	average	good	excellent	Import, export, consumer, supply chain, (distance and scale)
Ability to capitalise and catalyse agglomeration benefits and wider economic opportunities	1.75%	very low	Low	moderate	high	very high	Direct, indirect, and induced economic effects (scale cf do minimum)
Access to service infrastructure (electricity, water, stormwater etc.)	0.00%	very low	Low	moderate	high	very high	
Ability of iwi, communities and people to interact with the Waitematā, waterfront, city and port environs	5.00%	very poor	poor	average	good	excellent	

Criteria	Weighting	-2	-1	0	1	2	Comment
Ability for Auckland city centre to expand its waterfront footprint and accommodate alternative land use maximise highest value land use	5.00%	very poor	poor	average	good	excellent	
Impact of freight on land use capacity and development (immediate port environs)	4.00%	very poor	poor	average	good	excellent	Immediate port environs and along transport corridors
Growth opportunities of the city centre and it's supply chains	6.00%	very poor	poor	average	good	excellent	
Achieving highest value land use	0.00%	very low	Low	moderate	high	very high	$/sqm (Current site alternative use if applicable)
Attractiveness of Auckland for visitors, residents, businesses, users of waterways, users of urban transport networks	4.00%	very poor	poor	average	good	excellent	
Impact and quality of urban form and design for Auckland	3.00%	very poor	poor	average	good	excellent	
Significance of sites (Waitematā harbour, Hauraki Gulf etc)	3.00%	very high	high	moderate	low	very low	Revisit wrt cultural, environmental considerations
Impact on iwi values - economic - whanake putea	2.00%	very poor	poor	average	good	excellent	Economic, social, cultural and environmental values, and iwi inter-generational outcomes; to align with Kaitiakitanga; Cognisant of, and compliant with, the Treaty of Waitangi and relevant Treaty Settlements.
Impact on iwi values - spiritual - mana whenua	2.00%	very poor	poor	average	good	excellent	
Impact on iwi values - environmental - kaitiakitanga	2.00%	very poor	poor	average	good	excellent	
Impact on iwi values - cultural - tikanga-a-iwi	2.00%	very poor	poor	average	good	excellent	
Impact on iwi values - Social	2.00%	very poor	poor	average	good	excellent	
Cognisant and compliant with Treaty and relevant Settlements	0.00%	very poor	poor	average	good	excellent	
Environmental impact on site sea-side	10.00%	very high	high	moderate	low	very low	Change to marine/biological/ecological footprint, coastal processes (sediment transport, hydrodynamics), Sensitivity of marine environment/locality to adverse events (ie spill), water and sediment quality, operational discharge and emissions
Environmental impact on site landside	10.00%	very high	high	moderate	low	very low	Noise, light, carbon emissions, operational discharge and emissions, air quality

Criteria	Weighting	-2	-1	0	1	2	Comment
Accessibility to labour markets	0.00%	very poor	poor	average	good	excellent	
Requirement for, or complexity of arrangements with, interdependent parties to achieve outcomes (e.g. AT, Kiwirail, NZTA, AC, ATEED, Port, iwi)	0.00%	very poor	poor	average	good	excellent	
Extent of legislative and planning change and/or consents required	0.00%	very high	high	moderate	low	very low	
Health and Safety impacts of port operations	0.00%	very poor	poor	average	good	excellent	
Requirement for change in governance/ownership	0.00%	very poor	poor	average	good	excellent	No weighting, comment on the impact
Attractiveness to private investment (NZ, FDI)	0.00%	very poor	poor	average	good	excellent	
Visual impacts on Auckland	0.00%	very poor	poor	average	good	excellent	
Visual impact on new site	0.00%	very poor	poor	average	good	excellent	
Impact on heritage values	0.00%	very poor	poor	average	good	excellent	

Note: those criteria with no weighting are second order criteria

17.2 MCA Results – Unweighted

Future Ports Study

Step 2 - MCA (Unweighted)

Step 2 - MCA (Unweighted)	Evaluation Criteria Weighting	Option 1: Constrain the port to it's current footprint (Do Minimum Option)	Option 5: Site 2: Port of Tauranga	Site 3: Port of Taranaki	Site 4: Northport	Site 5B: Tapora, Kaipara Harbour	Site 5C: Shelly Beach, Kaipara Harbour	Site 6A: Muriwai Offshore Port (Northwestern Coastline)	Site 6B: Muriwai, North West Coast	Site 7A: Central Manukau Harbour	Site 7B: Manukau Harbour: Puhinui (1989, 1999, 2014, Blue Sky)	Site 7C: Hikihiki, Manukau Harbour	Site 7D: Manukau Island Port, Clarks Beach
Overall Physical Viability rating		G	A	R	A	R	R	A	A	A	A	A	R
Only Proceed if Amber or Green		1	1	-	1	-	-	1	1	1	1	1	-
Physical / operational capacity	30.0%	3	4	-	-	-	-	7	8	8	2	7	-
Economic / Cost	10.0%	6	1	-	3	-	-	4	4	6	7	6	-
Liveable City	30.0%	7	10	-	11	-	-	12	12	13	13	13	-
Iwi	10.0%	5	3	-	1	-	-	3	3	-	-	-	-
Environmental	20.0%	-	2	-	2	-	-	3	2	2	3	2	-
Other (Non Weighted)	0.0%	6	1	-	1	-	-	2	2	-	1	-	-
Total Score	100.0%	3.0	1.0	-	4.0	-	-	11.0	13.0	25.0	20.0	24.0	-
Overall MCA Rank		30	29	-	12	-	-	5	4	1	3	2	-
MCA Evaluation Criteria													
Check:	100.0%	ok											
Berth capacity to meet forecast trade volumes	6.7%	-2	-2	-2	-1	2	2	2	2	2	1	2	1
Land-side/yard capacity ability to meet trade volumes (on site or with access to inland port)	6.7%	-1	-1	-2	1	2	2	2	2	2	1	2	2
Accessible depth (includes potential to dredge to required long term depth (14m to 15m +)	6.7%	-1	-1	-1	-1	0	-1	2	2	2	-1	1	-1
Navigable feasibility	6.7%	0	-1	-1	-1	1	-1	1	1	1	0	1	-1
Physical/geographical/topography constraints	3.3%	1	1	1	2	-1	-1	0	1	1	1	1	1
Ability to accommodate forecast cruise vessels	0.0%	0	0	0	0	0	0	0	0	0	0	0	0
Indicative whole-of-life port cost [land acquisition/land reclamation/capital/maintenance/operations - affordability/fundability]	1.3%	2	0	0	0	-2	-2	-2	-2	-2	-1	-2	-2
Indicative cost of transport network infrastructure required to support long-term port operations	3.0%	1	-1	RF	-2	-1	-1	0	0	2	2	2	-1
Time/cost to market	4.0%	1	-1	RF	-2	-1	-1	0	0	2	2	2	0
Ability to capitalise and catalyse agglomeration benefits and wider economic opportunities	1.8%	0	-1	-1	-1	-2	-2	-1	-1	2	2	2	0
Access to service infrastructure (electricity, water, stormwater etc)	0.0%	2	2	2	2	-2	-2	-1	-1	2	2	2	-1
Ability of iwi, communities and people to interact with the Waitemata, waterfront, city and port environs	5.0%	0	2	2	2	2	2	2	2	2	2	2	2
Ability for Auckland city centre to maximise highest value land use	5.0%	-2	2	2	2	2	2	2	2	2	2	2	2
Impact of freight on land use capacity and development (immediate port environs)	4.0%	-1	-2	-2	-1	-2	-2	0	0	1	1	1	-1
Growth opportunities of the city centre and it's supply chains	6.0%	-1	2	2	2	2	2	2	2	2	2	2	2
Attractiveness of Auckland for visitors, residents, businesses, users of waterways, users of urban transport networks	4.0%	0	2	2	2	1	1	2	2	2	2	2	2
Impact and quality of urban form and design for Auckland	3.0%	-1	2	2	2	2	2	2	2	2	2	2	2
Significance of sites (Waitemata harbour, Hauraki Gulf etc)	3.0%	0	0	0	0	0	0	0	0	0	0	0	0
Impact on iwi values - economic - whanake putea	2.0%	-1	0	1	1	1	1	0	0	2	2	2	2
Impact on iwi values - spiritual - mana whenua	2.0%	-1	0	0	0	0	0	0	0	0	0	0	0
Impact on iwi values - environmental - kaitiakitanga	2.0%	-1	-1	2	-1	-1	-1	-1	-1	-1	-1	-1	-1
Impact on iwi values - cultural - tikanga-a-iwi	2.0%	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
Impact on iwi values - Social	2.0%	-1	-1	-1	0	-1	-1	-1	-1	0	0	0	0
Environmental impact on site sea-side	10.0%	0	-1	-1	-1	-2	-2	-1	-1	-2	-2	-2	-2
Environmental impact on site landside	10.0%	0	-1	-1	-1	-2	-2	-2	-1	0	-1	0	-1
Accessibility to labour markets	0.0%	2	2	2	2	0	0	1	1	2	2	2	1
Requirement for, or complexity of arrangements with, interdependent parties to achieve outcomes (e.g. AT, Kiwirail, NZTA, AC, ATEED, Port, iwi)	0.0%	2	1	-1	1	-1	0	0	0	-1	-1	-1	-1
Extent of legislative and planning change and/or consents required	0.0%	2	-1	-1	-1	-2	-2	-2	-2	-2	-2	-2	-2
Health and Safety impacts of port operations	0.0%	0	0	0	0	0	0	0	0	0	0	0	0
Requirement for change in governance/ownership [reconsider when it comes to weightings]	0.0%	2	-2	-2	-2	0	0	0	0	0	0	0	0
Attractiveness to private investment (NZ, FDI)	0.0%	-2	-2	-2	-2	1	1	1	1	1	1	1	1
Visual impacts on Auckland	0.0%	0	2	2	2	2	2	2	2	2	2	2	2
Visual impact on new site	0.0%	NA	-1	-1	-1	-2	-2	0	0	-2	-1	-2	-1
Impact on heritage values	0.0%	0	0	0	0	-1	0	0	0	0	0	0	0

Future Ports Study

Step 2 - MCA (Unweighted)

Step 2 - MCA (Unweighted)	Evaluation Criteria Weighting	Site 8B: Port Waikato, West Coast	Site 9: Kawhia Harbour, West Coast	Site 10: Bream Bay area (previously Ruakaka) Whangarei	Site 11A: Te Haupa Island, Mahurangi	Site 11B: Mahurangi West, Mahurangi	Site 12A: Karepiro Bay (Northeastern Coastline)	Site 12B: Long Bay, Long Bay	Site 13A: Upper Harbour: Port Island	Site 13B: Upper Waitemata Harbour	Site 14A: Wairoa Bay (Central Eastern Coastline)	Site 14B: Ponui Island port (1999 & 2014)	Site 14C: Kawakawa Bay (Incorporating previous Ponui Offshore Port) (1999 & Blue Sky)	Site 15A: Waimangu Point, Firth of Thames	Site 15B: Kaiaua Land Port (Firth of Thames – western shore north of Kaiaua)	Site 16: Tauranga II, Tauranga	Site 17: Whakatane, Whakatane
Overall Physical Viability rating		R	R	A	R	A	R	A	R	R	R	R	A	A	A	A	R
Only Proceed if Amber or Green		-	-	1	-	1	-	1	-	-	-	-	1	1	1	1	-
Physical / operational capacity	30.0%	-	-	9	-	6	-	6	-	-	-	-	6	7	6	6	-
Economic / Cost	10.0%	-	-	4	-	2	-	1	-	-	-	-	4	4	5	3	-
Liveable City	30.0%	-	-	11	NA	12	-	11	-	-	-	-	11	12	12	10	-
Iwi	10.0%	-	-	3	NA	2	-	3	-	-	-	-	1	1	1	2	-
Environmental	20.0%	-	-	4	-	4	-	4	-	-	-	-	3	3	2	3	-
Other (Non Weighted)	0.0%	-	-	-	-	-	-	3	-	-	-	-	2	2	2	1	-
Total Score	100.0%	-	-	9.0	-	10.0	-	6.0	-	-	-	-	7.0	9.0	RF	9.0	-
Overall MCA Rank		-	-	7	-	6	-	11	-	-	-	-	10	7	-	7	-
MCA Evaluation Criteria																	
Check:	100.0%																
Berth capacity to meet forecast trade volumes	6.7%	2	-2	2	1	1	-2	2	0	0	-1	-1	2	2	2	2	2
Land-side/yard capacity ability to meet trade volumes (on site or with access to inland port)	6.7%	2	-2	1	1	2	-2	1	0	0	1	-1	2	2	2	2	2
Accessible depth (includes potential to dredge to required long term depth (14m to 15m +)	6.7%	2	-2	2	2	0	-2	0	0	0	-2	2	1	2	-1	2	2
Navigable feasibility	6.7%	1	-2	2	-1	2	-1	2	0	0	-2	2	2	2	2	2	2
Physical/geographical/topography constraints	3.3%	0	-1	2	-1	1	0	1	0	0	2	-2	-1	-1	1	-2	-2
Ability to accommodate forecast cruise vessels	0.0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Indicative whole-of-life port cost [land acquisition/land reclamation/capital/maintenance/operations - affordability/fundability]	1.3%	-2	-2	-1	-1	-1	-1	-1	0	0	-1	-1	-2	-1	-2	-2	-2
Indicative cost of transport network infrastructure required to support long-term port operations	3.0%	-1	1	-2	-1	0	0	0	0	0	-1	-1	-1	-2	-1	-2	-2
Time/cost to market	4.0%	0	-2	-2	-1	-1	-1	-1	0	0	1	1	1	1	0	-2	-2
Ability to capitalise and catalyse agglomeration benefits and wider economic opportunities	1.8%	0	-1	-1	0	0	0	0	0	0	0	0	-1	-1	-1	1	-2
Access to service infrastructure (electricity, water, stormwater etc)	0.0%	-1	0	2	-2	0	0	1	0	0	0	-2	-1	-1	-1	2	0
Ability of iwi, communities and people to interact with the Waitemata, waterfront, city and port environs	5.0%	2	2	2	2	2	2	2	0	0	2	2	2	2	2	2	2
Ability for Auckland city centre to amaximise highest value land use	5.0%	2	2	2	2	2	2	2	0	0	2	2	2	2	2	2	2
Impact of freight on land use capacity and development (immediate port environs)	4.0%	-1	0	-1	-1	0	-1	-1	0	0	-1	-1	-1	0	0	-2	-2
Growth opportunities of the city centre and it's supply chains	6.0%	2	2	2	2	2	2	2	0	0	2	2	2	2	2	2	2
Attractiveness of Auckland for visitors, residents, businesses, users of waterways, users of urban transport networks	4.0%	2	2	2	2	2	2	2	0	0	2	2	2	2	2	2	2
Impact and quality of urban form and design for Auckland	3.0%	2	2	2	2	2	2	2	0	0	2	2	2	2	2	2	2
Significance of sites (Waitemata harbour, Hauraki Gulf etc)	3.0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Impact on iwi values - economic - whanake putea	2.0%	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0
Impact on iwi values - spiritual - mana whenua	2.0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Impact on iwi values - environmental - kaitiakitanga	2.0%	-2	-1	-1	0	-1	0	-1	0	0	-1	-1	-1	-1	-1	-1	0
Impact on iwi values - cultural - tikanga-a-iwi	2.0%	-2	0	-1	-1	-1	0	-1	0	0	0	0	0	0	0	-1	0
Impact on iwi values - Social	2.0%	-2	0	-1	0	0	0	-1	0	0	0	0	0	0	0	0	0
Environmental impact on site sea-side	10.0%	-2	-2	-2	-2	-2	-2	-2	0	0	-2	-2	-2	-2	-2	-2	-2
Environmental impact on site landside	10.0%	-1	-1	-2	1	-2	-2	-2	0	0	-2	-2	-1	-1	RF	-1	-2
Accessibility to labour markets	0.0%	1	1	2	1	1	1	1	0	0	1	0	-1	-1	-1	2	1
Requirement for, or complexity of arrangements with, interdependent parties to achieve outcomes (e.g. AT, Kiwirail, NZTA, AC, ATEED, Port, iwi)	0.0%	-1	-1	0	0	0	0	-2	0	0	0	0	0	0	0	-2	-2
Extent of legislative and planning change and/or consents required	0.0%	-2	-2	-2	-2	-2	-2	-2	0	0	-2	-2	-2	-2	-2	-2	-2
Health and Safety impacts of port operations	0.0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Requirement for change in governance/ownership [reconsider when it comes to weightings]	0.0%	0	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0
Attractiveness to private investment (NZ, FDI)	0.0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Visual impacts on Auckland	0.0%	2	2	2	2	2	2	2	0	0	2	2	2	2	2	2	2
Visual impact on new site	0.0%	0	-2	-1	1	-1	-1	-2	0	0	-1	2	-1	-1	-1	1	-1
Impact on heritage values	0.0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

17.3 MCA Results – Weighted

Future Ports Study

Step 3 - MCA (Weighted)

Step 3 - MCA (Weighted)	Evaluation Criteria Weighting	Constrain the port to it's current footprint (Do Minimum Option)	Downsize the port by shifting some of the operations to another location	Relocating some or all volume or activity of Auckland's port	Enabling growth of the port in it's current location	Site 2: Port of Tauranga	Site 3: Port of Taranaki	Site 4: Northport	Site 5B: Tapora, Kaipara Harbour	Site 5C: Shelly Beach, Kaipara Harbour	Site 6A: Muriwai Offshore Port (Northwestern Coastline)	Site 6B: Muriwai, North West Coast	Site 7A: Central Manukau Harbour	Site 7B: Manukau Harbour: Puhinui (1989, 1999, 2014, Blue Sky)	Site 7C: Hikihiki, Manukau Harbour	Site 7D: Manukau Island Port, Clarks Beach
		G				A	R	A	R	R	A	A	A	A	A	R
Only Proceed if Amber or Green		1	-	-	-	1	-	1	-	-	1	1	1	1	1	-
Physical / operational capacity	30.0%	0	-	-	-	0	-	0	-	-	0	1	1	0	0	-
Economic / Cost	10.0%	0	-	-	-	0	-	0	-	-	0	0	0	0	0	-
Liveable City	30.0%	0	-	-	-	0	-	0	-	-	0	0	1	1	1	-
Iwi	10.0%	0	-	-	-	0	-	0	-	-	0	0	-	-	-	-
Environmental	20.0%	-	-	-	-	0	-	0	-	-	0	0	0	0	0	-
Other (Non Weighted)	0.0%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Score	100.0%	0.5	-	-	-	0.3	-	0.0	-	-	0.5	0.7	1.0	0.5	0.9	-
Overall MCA Rank		30	-	-	-	29	-	28	-	-	5	3	1	7	2	-
	Weighting 100.0%															
Berth capacity to meet forecast trade volumes	6.7%	-0.13	0.00	0.00	0.00	-0.13	-0.13	-0.07	0.13	0.13	0.13	0.13	0.13	0.07	0.13	0.07
Land-side/yard capacity ability to meet trade volumes (on site or with access to inland port)	6.7%	-0.07	0.00	0.00	0.00	-0.07	-0.13	0.07	0.13	0.13	0.13	0.13	0.13	0.07	0.13	0.13
Accessible depth (includes potential to dredge to required long term depth (14m to 15m +)	6.7%	-0.07	0.00	0.00	0.00	-0.07	-0.07	-0.07	0.00	-0.07	0.13	0.13	0.13	-0.07	0.07	-0.07
Navigable feasibility	6.7%	0.00	0.00	0.00	0.00	-0.07	-0.07	-0.07	0.07	-0.07	0.07	0.07	0.07	0.00	0.07	-0.07
Physical/geographical/topography constraints	3.3%	0.03	0.00	0.00	0.00	0.03	0.03	0.07	-0.03	-0.03	0.00	0.03	0.03	0.03	0.03	0.03
Indicative whole-of-life port cost [land acquisition/land reclamation/capital/maintenance/operations - affordability/fundability]	1.3%	0.03	0.00	0.00	0.00	0.00	0.00	0.00	-0.03	-0.03	-0.03	-0.03	-0.03	-0.01	-0.03	-0.03
Indicative cost of transport network infrastructure required to support long-term port operations	3.0%	0.03	0.00	0.00	0.00	-0.03	RF	-0.06	-0.03	-0.03	0.00	0.00	0.06	0.06	0.06	-0.03
Time/cost to market	4.0%	0.04	0.00	0.00	0.00	-0.04	RF	-0.08	-0.04	-0.04	0.00	0.00	0.08	0.08	0.08	0.00
Ability to capitalise and catalyse agglomeration benefits and wider economic opportunities	1.8%	0.00	0.00	0.00	0.00	-0.02	-0.02	-0.02	-0.04	-0.04	-0.02	-0.02	0.04	0.04	0.04	0.00
Access to service infrastructure (electricity, water, stormwater etc)	0.0%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ability of iwi, communities and people to interact with the Waitemata, waterfront, city and port environs	5.0%	0.00	0.00	0.00	0.00	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Ability for Auckland city centre to emaximise highest value land use	5.0%	-0.10	0.00	0.00	0.00	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Impact of freight on land use capacity and development (immediate port environs)	4.0%	-0.04	0.00	0.00	0.00	-0.08	-0.08	-0.04	-0.08	-0.08	0.00	0.00	0.04	0.04	0.04	-0.04
Growth opportunities of the city centre and it's supply chains	6.0%	-0.06	0.00	-0.06	-0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12
Achieving highest value land use	0.0%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Attractiveness of Auckland for visitors, residents, businesses, users of waterways, users of urban transport networks	4.0%	0.00	0.00	0.00	0.00	0.08	0.08	0.08	0.04	0.04	0.08	0.08	0.08	0.08	0.08	0.08
Impact and quality of urban form and design for Auckland	3.0%	-0.03	0.00	0.00	0.00	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
Significance of sites (Waitemata harbour, Hauraki Gulf etc)	3.0%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Impact on iwi values - economic - whanake putea	2.0%	-0.02	0.00	0.00	0.00	0.00	0.02	0.02	0.02	0.02	0.00	0.00	0.04	0.04	0.04	0.04
Impact on iwi values - spiritual - mana whenua	2.0%	-0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Impact on iwi values - environmental - kaitiakitanga	2.0%	-0.02	0.00	0.00	0.00	-0.02	0.04	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Impact on iwi values - cultural - tikanga-a-iwi	2.0%	-0.02	0.00	0.00	0.00	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Impact on iwi values - Social	2.0%	-0.02	0.00	0.00	0.00	-0.02	-0.02	0.00	-0.02	-0.02	-0.02	-0.02	0.00	0.00	0.00	0.00
Cognisant and compliant with Treaty and relevant Settlements	0.0%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Environmental impact on site sea-side	10.0%	0.00	0.00	0.00	-0.10	-0.10	-0.10	-0.10	-0.20	-0.20	-0.10	-0.10	-0.20	-0.20	-0.20	-0.20
Environmental impact on site landside	10.0%	0.00	0.00	0.00	-0.10	-0.10	-0.10	-0.10	-0.20	-0.20	-0.20	-0.10	0.00	-0.10	0.00	-0.10
Accessibility to labour markets	0.0%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Requirement for, or complexity of arrangements with, interdependent parties to achieve outcomes (e.g. AT, Kiwirail, NZTA, AC, ATEED, Port, iwi)	0.0%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Extent of legislative and planning change and/or consents required	0.0%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Requirement for change in governance/ownership [reconsider when it comes to weightings]	0.0%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Attractiveness to private investment (NZ, FDI)	0.0%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Visual impacts on Auckland	0.0%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Visual impact on new site	0.0%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Impact on heritage values	0.0%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Future Ports Study

Step 3 - MCA (Weighted)

Step 3 - MCA (Weighted)	Evaluation Criteria Weighting	Site 8B: Port Waikato, West Coast	Site 9: Kawhia Harbour, West Coast	Site 10: Bream Bay area (previously Ruakaka) Whangarei	Site 11A: Te Haupa Island, Mahurangi	Site 11B: Mahurangi West, Mahurangi	Site 12A: Karepiro Bay (Northeastern Coastline)	Site 12B: Long Bay, Long Bay	Site 13A: Upper Harbour: Port Island	Site 13B: Upper Waitemata Harbour	Site 14A: Wairoa Bay (Central Eastern Coastline)	Site 14B: Ponui Island port (1999 & 2014)	Site 14C: Kawakawa Bay (incorporating previous Ponui Offshore Port) (1999 & Blue Sky)	Site 15A: Waimangu Point, Firth of Thames	Site 15B: Kaiaua Land Port (Firth of Thames – western shore north of Kaiaua	Site 16: Tauranga II, Tauranga	Site 17: Whakatane, Whakatane
		R	R	A	R	A	R	A	R	R	R	R	A	A	A	A	R
Only Proceed if Amber or Green		-	-	1	-	1	-	1	-	-	-	-	1	1	1	1	-
Physical / operational capacity	30.0%	-	-	1	-	0	-	0	-	-	-	-	0	1	0	0	-
Economic / Cost	10.0%	-	-	0	-	0	-	0	-	-	-	-	0	0	0	0	-
Liveable City	30.0%	-	-	0	-	0	-	0	-	-	-	-	0	0	0	0	-
Iwi	10.0%	-	-	0	-	0	-	0	-	-	-	-	0	0	0	0	-
Environmental	20.0%	-	-	0	-	0	-	0	-	-	-	-	0	0	0	0	-
Other (Non Weighted)	0.0%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Score	100.0%	-	-	0.3	-	0.3	-	0.3	-	-	-	-	0.5	0.6	RF	0.4	-
Overall MCA Rank		-	-	10	-	9	-	11	-	-	-	-	6	4	-	8	-
	Weighting																
	100.0%																
Berth capacity to meet forecast trade volumes	6.7%	0.13	-0.13	0.13	0.07	0.07	-0.13	0.13	~~0.00~~	~~0.00~~	-0.07	-0.07	0.13	0.13	0.13	0.13	0.13
Land-side/yard capacity ability to meet trade volumes (on site or with access to inland port)	6.7%	0.13	-0.13	0.07	0.07	0.13	-0.13	0.07	~~0.00~~	~~0.00~~	0.07	-0.07	0.13	0.13	0.13	0.13	0.13
Accessible depth (includes potential to dredge to required long term depth (14m to 15m +)	6.7%	0.13	-0.13	0.13	0.13	0.00	-0.13	0.00	~~0.00~~	~~0.00~~	-0.13	0.13	0.07	0.13	-0.07	0.13	0.13
Navigable feasibility	6.7%	0.07	-0.13	0.13	-0.07	0.13	-0.07	0.13	~~0.00~~	~~0.00~~	-0.13	0.13	0.13	0.13	0.13	0.13	0.13
Physical/geographical/topography constraints	3.3%	0.00	-0.03	0.07	-0.03	0.03	0.00	0.03	~~0.00~~	~~0.00~~	0.07	-0.07	-0.03	-0.03	0.03	-0.07	-0.07
Indicative whole-of-life port cost [land acquisition/land reclamation/capital/maintenance/operations - affordability/fundability]	1.3%	-0.03	-0.03	-0.01	-0.01	-0.01	-0.01	-0.01	~~0.00~~	~~0.00~~	-0.01	-0.01	-0.03	-0.01	-0.03	-0.03	-0.03
Indicative cost of transport network infrastructure required to support long-term port operations	3.0%	-0.03	0.03	-0.06	-0.03	0.00	0.00	0.00	~~0.00~~	~~0.00~~	-0.03	-0.03	-0.03	-0.06	-0.03	-0.06	-0.06
Time/cost to market	4.0%	0.00	-0.08	-0.08	-0.04	-0.04	-0.04	-0.04	~~0.00~~	~~0.00~~	0.04	0.04	0.04	0.04	0.00	-0.08	-0.08
Ability to capitalise and catalyse agglomeration benefits and wider economic opportunities	1.8%	0.00	-0.02	-0.02	0.00	0.00	0.00	0.00	~~0.00~~	~~0.00~~	0.00	0.00	-0.02	-0.02	-0.02	0.02	-0.04
Access to service infrastructure (electricity, water, stormwater etc)	0.0%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	~~0.00~~	~~0.00~~	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ability of iwi, communities and people to interact with the Waitemata, waterfront, city and port environs	5.0%	0.10	0.10	0.10	0.10	0.10	0.10	0.10	~~0.00~~	~~0.00~~	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Ability for Auckland city centre to emaximise highest value land use	5.0%	0.10	0.10	0.10	0.10	0.10	0.10	0.10	~~0.00~~	~~0.00~~	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Impact of freight on land use capacity and development (immediate port environs)	4.0%	-0.04	0.00	-0.04	-0.04	0.00	-0.04	-0.04	~~0.00~~	~~0.00~~	-0.04	-0.04	-0.04	0.00	0.00	-0.08	-0.08
Growth opportunities of the city centre and it's supply chains	6.0%	0.12	0.12	0.12	0.12	0.12	0.12	0.12	~~0.00~~	~~0.00~~	0.12	0.12	0.12	0.12	0.12	0.12	0.12
Achieving highest value land use	0.0%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	~~0.00~~	~~0.00~~	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Attractiveness of Auckland for visitors, residents, businesses, users of waterways, users of urban transport networks	4.0%	0.08	0.08	0.08	0.08	0.08	0.08	0.08	~~0.00~~	~~0.00~~	0.08	0.08	0.08	0.08	0.08	0.08	0.08
Impact and quality of urban form and design for Auckland	3.0%	0.06	0.06	0.06	0.06	0.06	0.06	0.06	~~0.00~~	~~0.00~~	0.06	0.06	0.06	0.06	0.06	0.06	0.06
Significance of sites (Waitemata harbour, Hauraki Gulf etc)	3.0%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	~~0.00~~	~~0.00~~	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Impact on iwi values - economic - whanake putea	2.0%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	~~0.00~~	~~0.00~~	0.02	0.02	0.00	0.00	0.00	0.00	0.00
Impact on iwi values - spiritual - mana whenua	2.0%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	~~0.00~~	~~0.00~~	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Impact on iwi values - environmental - kaitiakitanga	2.0%	-0.04	-0.02	-0.02	0.00	-0.02	0.00	-0.02	~~0.00~~	~~0.00~~	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	0.00
Impact on iwi values - cultural - tikanga-a-iwi	2.0%	-0.04	0.00	-0.02	-0.02	-0.02	0.00	-0.02	~~0.00~~	~~0.00~~	0.00	0.00	0.00	0.00	0.00	-0.02	0.00
Impact on iwi values - Social	2.0%	-0.04	0.00	-0.02	0.00	0.00	0.00	-0.02	~~0.00~~	~~0.00~~	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cognisant and compliant with Treaty and relevant Settlements	0.0%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Environmental impact on site sea-side	10.0%	-0.20	-0.20	-0.20	-0.20	-0.20	-0.20	-0.20	~~0.00~~	~~0.00~~	-0.20	-0.20	-0.20	-0.20	-0.20	-0.20	-0.20
Environmental impact on site landside	10.0%	-0.10	-0.10	-0.20	0.10	-0.20	-0.20	-0.20	~~0.00~~	~~0.00~~	-0.20	-0.20	-0.10	-0.10	RF	-0.10	-0.20
Accessibility to labour markets	0.0%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	~~0.00~~	~~0.00~~	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Requirement for, or complexity of arrangements with, interdependent parties to achieve outcomes (e.g. AT, Kiwirail, NZTA, AC, ATEED, Port, iwi)	0.0%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	~~0.00~~	~~0.00~~	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Extent of legislative and planning change and/or consents required	0.0%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	~~0.00~~	~~0.00~~	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Requirement for change in governance/ownership [reconsider when it comes to weightings]	0.0%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	~~0.00~~	~~0.00~~	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Attractiveness to private investment (NZ, FDI)	0.0%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	~~0.00~~	~~0.00~~	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Visual impacts on Auckland	0.0%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	~~0.00~~	~~0.00~~	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Visual impact on new site	0.0%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	~~0.00~~	~~0.00~~	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Impact on heritage values	0.0%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	~~0.00~~	~~0.00~~	0.00	0.00	0.00	0.00	0.00	0.00	0.00

17.4 MCA – Weighted (Rank)

Future Ports Study

Ranked Scores

Weighted			Score
1	Site 7A: Central Manukau Harbour		0.95
2	Site 7C: Hikihiki, Manukau Harbour		0.88
3	Site 6B: Muriwai, North West Coast		0.66
4	Site 15A: Waimangu Point, Firth of Thames		0.59
5	Site 6A: Muriwai Offshore Port (Northwestern Coastline)		0.52
6	Site 14C: Kawakawa Bay (incorporating previous Ponui Offshore Port) (1999 & Blue Sky)		0.50
7	Site 7B: Manukau Harbour: Puhinui (1989, 1999, 2014, Blue Sky)		0.46
8	Site 16: Tauranga II, Tauranga		0.36
9	Site 11B: Mahurangi West, Mahurangi		0.33
10	Site 10: Bream Bay area (previously Ruakaka) Whangarei		0.32
11	Site 12B: Long Bay, Long Bay		0.27
12	Site 4: Northport	-	0.02
13	Site 2: Port of Tauranga	-	0.27
14	Constrain the port to it's current footprint (Do Minimum Option)	-	0.47

17.5 MCA Unweighted scores (Rank)

Future Ports Study **Ranked Scores**		
Unweighted		Score
1	Site 7A: Central Manukau Harbour	25
2	Site 7C: Hikihiki, Manukau Harbour	24
3	Site 7B: Manukau Harbour: Puhinui (1989, 1999, 2014, Blue Sky)	20
4	Site 6B: Muriwai, North West Coast	13
5	Site 6A: Muriwai Offshore Port (Northwestern Coastline)	11
6	Site 11B: Mahurangi West, Mahurangi	10
7=	Site 10: Bream Bay area (previously Ruakaka) Whangarei	9
7=	Site 15A: Waimangu Point, Firth of Thames	9
7=	Site 16: Tauranga II, Tauranga	9
10	Site 14C: Kawakawa Bay (incorporating previous Ponui Offshore Port) (1999 & Blue Sky)	7
11	Site 12B: Long Bay, Long Bay	6
12	Site 4: Northport	4
13	Constrain the port to it's current footprint (Do Minimum Option) -	3

18. CBA – Transport Costs Description

Site location	General Comments
Option 1: Base case	Constraining growth in the port limits the growth in the landside domestic freight task. In terms of road corridors, assuming no change in the The existing port access connecting in to the strategic highway network takes most freight along The Strand, Stanley Street and to start of SH16 at Grafton Gully. SH16 at this location is a four lane road and carries around 45,000 vehicles per day with a corresponding heavy commercial vehicle proportion of approximately 8%. This section of road currently suffers from peak period congestion with commuter traffic using this link to access the strategic highway network to and from the eastern city area. As commuter traffic and congestion increase, the movement of freight to and from the port becomes less reliable during the day, necessitating an increase in capacity linking SH16 towards the port gate. Other sections on the strategic highway network will come under increasing pressure as traffic growth continues during the day. There are a number of freight efficiencies available to respond to this in the short to medium term including increasing the utilisation of trucks, increasing the load carried by each container and considering the mode share of domestic freight. In terms of rail, accommodating increased freight train paths on the Auckland passenger network will be challenging during the day. Given the on-going increase in patronage of the passenger services, following electrification (and ultimately following completion of the City Rail Link), this conflict could be a potential issue, and may bring forward the need for an additional freight line. There are a number options available to increase capacity in the medium term, including targeted capacity improvements on the network such as the third main between Wiri and Westfield junction, possible grade separation of Westfield and Wiri to reduce interaction of freight movement at this critical section of the rail network. Such investment in rail infrastructure to provide this passenger/freight separation would be an advantage to the city.
Option 4: Expand port footprint	This option assumes the network in the vicinity of the port would be required to accommodate 2 million TEU by approximately 2041, and up to a forecast 4 million TEU by around 2065, including trans-shipment. POAL has a longer term aim to accommodate up to 30% mode share by rail,[7] with the remainder of the domestic freight task being carried by road with an estimated 900,000 domestic road based TEU's by 2041. The existing port access connecting in to the strategic highway network takes most freight along The Strand, Stanley Street and to start of SH16 at Grafton Gully. SH16 at this location is a four lane road and carries around 45,000 vehicles per day with a corresponding heavy commercial vehicle proportion of approximately 8%. This section of road currently suffers from peak period congestion with commuter traffic using this link to access the strategic highway network to and from the eastern city area. It is considered likely that this link will be placed under increasing pressure as an alternative route to east/west movement through the CBD area seeing traffic re-routed on to the strategic road network, resulting in higher proportion of passenger car traffic on this section of the network in the future.

[7] Assuming 100-120 TEU per train, this equates to around 20-25 trains per day which equates around 2 trains per hour assuming 12 hours off peak running only. Source: www.kiwirail.co.nz

Site location	General Comments
	As commuter traffic and congestion increase, the movement of freight to and from the port becomes less reliable during the day. Based on analysis of freight distribution, approximately 70% of freight is destined for distribution in south Auckland or beyond, representing around 630,000 road based TEU movements to/from the Port utilising SH16 and ultimately SH1.[8] The remainder of freight is distributed in and around the Auckland region on various high capacity regional and national routes. There are a large number of contributing factors that add to the variability of road capacity including gradient, number of lanes, vertical and horizontal alignment, speed and vehicle utilisation. This makes it difficult to establish capacity constraints in the network without undertaking detailed traffic modelling. However, it is considered likely that, a combination of background traffic growth, increased number of TEU's being carried by truck and growth in bulk cargo transport requirements (such as vehicle imports) would see the need for capacity improvements between SH16 and the port entrance. It is likely that NZTA's Grafton Gully Stage Three project would be required to maintain journey time reliability for freight moving forward and would give a direct connection from the port to the strategic road network. The amenity impact will be a major consideration as freight volumes increase. The timing of the project and determining what proportion of the project need is attributable to freight only is based on a range of variables including proportion of trips by truck, future bulk cargo requirements, container load utilisation, and TEU's carried by each truck. In the long term, determining network impacts of the projected 4 million TEU's handled by the port in 2065 is significantly beyond current long term available network modelling forecasts. In terms of rail, the opening of the City Rail Link In the short term will allow a step change in the way passenger services operate in the Auckland commuter rail network. The frequency of passenger services on the Eastern and Southern lines will make the movement of freight during the day difficult. Whilst there may be opportunities to introduce additional freight services during the day moving forward, this is likely to be constrained depending on the all-day passenger service frequency. Short term improvements include Initiatives such as changes to signaling around the port entrance, the introduction of longer sidings at Wiri and the port and the introduction of faster, more utilised freight services. Accordingly, without any rail network upgrades (such as the 'third' main line between Westfield and Wiri), the ability to accommodate increased freight services on the existing rail network will be difficult. One option will be to run trains off peak,(this may increase port/inland port storage requirements) although it is noted this has corresponding environmental and network maintenance impacts. In the medium term, upgrades will be required to the network between the port and their Freight Hub at Wiri. There are a number options available to increase capacity in the medium term, including targeted capacity improvements on the network such as the third main between Wiri and Westfield junction, possible grade separation of Westfield and Wiri to reduce interaction of freight movement at this critical section of the rail network. A third main line between Sylvia Park and the Strand may be required should the growth in freight volumes be unconstrained. Beyond this, the continued expansion of the passenger train network through initiatives such as electrification of the network south of Papakura to Pukekohe and increases in the number of trains between Tauranga and Metro Port will continue to put pressure on the rail network. At feasibility stage, we would strongly recommend network modelling is undertaken to establish possible road and rail impacts of continued growth in the volume of freight moved through the port.[9]

[8] Based on 2041 volumes, for south Auckland and beyond and including rail and trans-shipped containers. Excluding bulk.
[9] Current traffic forecasts extend out to the 2040's which is similar to 2m TEU forecast. Longer term growth forecast here is beyond 2060.

Site location	General Comments
Option 5a: Central Manukau Harbour	The need to have direct freight connections into the road and rail network serving regional and national distribution networks. As previously discussed, around 70% of freight through the Ports of Auckland is destined for distribution centres in south Auckland, or beyond. The proximity of the Manukau Harbour options to the primary distribution centres in south Auckland and the proximity to existing transport infrastructure presents an opportunity to reduce the impact of moving fright from the port gate to the centroid of the distribution network in south Auckland. This option would require the construction of dedicated road and rail structures connecting the port location with the mainland, the structures and associated infrastructure of which would be subject to the constraints imposed by the height restrictions in the area surrounding Auckland International Airport. In terms of rail, the proposed connection to the NIMT would be located around Puhinui and would be on the western side of the currently proposed third main line for freight traffic, minimising impact for passenger trains at this location. However, the connection to the inland port at Wiri may have significant impact to the existing Wiri Junction, with the additional freight movement possibly disrupting passenger services.[10] Accordingly, upgrades to the Wiri junction may be required in support of this option. This option may encourage and bring forward the possibility of improved rail connections, including passenger rail, to the airport and surrounding environments.
Option 5b: Puhinui Manukau Harbour	
Option 5c: Hikihiki, Manukau Harbour	
Option 5d: Kawakawa Bay	Connecting a possible Firth of Thames port in to the strategic road and rail network would require the construction and upgrade of road and rail infrastructure to meet the immediate and longer term freight task. In terms of connection to the road network, a direct route from possible port areas located on the north eastern shores of the Firth of Thames could be via Kawakawa Bay, around Clevedon, connecting in to the strategic road and rail network between approximately Papakura and Takanini. Whilst the area from the port through Clevedon is not densely populated, significant alignment and capacity upgrades over approximately 25km would be required to the Clevedon-Kawakawa Road and beyond to the connection with SH1. State Highway 1 is a strategically important link and carries around 90,000 vehicles per day between Takanini interchange and Hill Road to the north[11]. With approximately 60% of freight destined for south Auckland, this option would remove the need for this proportion of the freight task to travel through Auckland, with a possible corresponding decrease in freight related traffic on SH16 and SH1 between the current port location and south Auckland. Noting significant growth expected in south Auckland where the population is forecast to increase by approximately 120,000 during the next 30 years, a range of transport interventions have been suggested for the south aimed at increasing transport choice, improving the resilience of the network and separating shorter distance trips from longer distance trips[12] . Determining the required capacity enhancements that are directly attributable to freight is difficult without network modelling being undertaken. However, given the growth in south Auckland, it is likely that capacity improvements to accommodate increased freight movement on SH1 would be required in the medium term to maintain journey time reliability for freight destined for the south Auckland distribution centres.
Option 5e: Waimango Point, Thames	

[10] Further demographic modelling will be needed to understand the extent of the disruption in terms of number of passengers affected and those travelling from that area.
[11] Source: NZTA State Highway traffic volumes, 2014.
[12] Source: https://at.govt.nz/projects-roadworks/transport-for-future-urban-growth/transport-for-growth-in-southern-auckland/

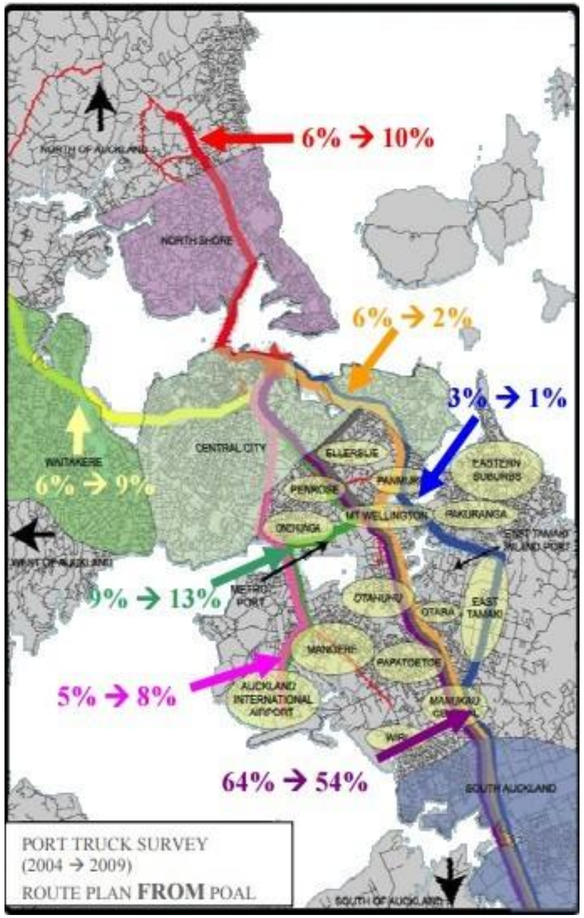
Site location	General Comments
	Strengthened east-west links would allow for the connection of the proposed freight route in to the strategic road network. Furthermore, our estimates indicate that between 20% and 30% of domestic TEU's are destined for central Auckland, and areas to the east, north and west. It is likely that these trips would make use of SH20 and SH1 to reach their destinations, possibly strengthening the need for projects such as East West Link, connecting SH20 with SH1 along the northern shores of the Manukau Harbour between Onehunga and Penrose. Other considerations include improving the resilience of the strategic network in south Auckland to provide for improved north-south movements. Such initiatives support proposed project such as the Mill Road improvement. In terms of rail, connecting to the nearest rail line at the NIMT will likely present vertical and horizontal alignment challenges, and may result in the need to tunnel a section for rail. The link could join the NIMT between the Papakura and Takanini Area. North from here, and to minimise possible conflict with passenger services connecting Papakura and Auckland, a third dedicated freight track may be required.
Option 5f: Muriwai Offshore	There are a number of challenges to overcome to enable the connection of a port located off Muriwai to the strategic road and rail network. Located north of Auckland, the port would require new or significantly upgraded road and rail links across the northern foothills of the Waitakere Ranges to connect in to the North Auckland Line (NAL) railway and SH16 around Waimauku. Our estimates indicate that around 10% of domestic freight movements are associated with destinations north of Auckland, with the majority heading to south Auckland and beyond and the Auckland region itself. Providing a connection north of Auckland results in the need for freight destined for this area to travel further to the existing distribution centres of south Auckland and necessitates the movement of all freight on road and rail through Auckland to the Freight Hub at Wiri and distribution centres. State Highway 16 is the main highway connecting Waimauku and the western ring route. From here, freight related traffic would continue down SH20, possibly on to the proposed East West Link project that connects SH20 and SH1 on the northern shore of the Manukau Harbour. SH16 carries around 20,000[13] vehicles per day, with approximately 4% commercial vehicles. The port currently generates in the region of 2,000 heavy vehicle movements per day, more than double the current volume on SH16 in the vicinity of Kumeu and Huapai.
Option 5g: Muriwai, North West Coast	This area is likely to see traffic growth as the development of the Northwest Transformation – the largest 'urbanisation' project in New Zealand continues. Including the Future Urban Zone around Kumeu and Huapai, the new urban areas in north west Auckland will result in a forecast increase in population of around 75,000. To support this growth, Auckland Transport are considering a range of transport interventions required[14] such as alternative highway corridor parallel to SH16, extension of commuter rail services to Huapai and provision of a bus priority to Kumeu/Huapai. The increase in road freight traffic along SH16 through Huapai and Kumeu would increase the case for a bypass in the medium term, with the existing route accommodating local urban traffic and the new higher capacity corridor catering for longer distance traffic and freight. Whilst the completion of the Western Ring Route will provide an increase in capacity on SH16 west of Westgate, the corridor is still likely to suffer from peak period congestion in the future. Reducing journey time reliability from the distribution centroid in south Auckland with the port at this location.

[13] Source: NZTA State Highway Volumes, 2014.
[14] Source: https://at.govt.nz/projects-roadworks/transport-for-future-urban-growth/transport-for-growth-in-north-west-auckland/#networks

Site location	General Comments
	In terms of rail, from the NAL connection in the vicinity of Waimauku, the proposed connection will link the NIMT via NAL between Penrose and Westfield, major south face junction work at Penrose will be required. (alternative route through existing NAL line via Newmarket junction is available but it's use for freight services may cause major conflict to passenger services). To support the efficient movement of freight through the Auckland passenger rail network, other infrastructure works may be required which including upgrades to the existing Waitakere tunnel, possible introduction of the Southdown line from Avondale, and improvements to the NIMT between Westfield and Wiri junctions. However, such improvements to the rail network could provide positive effects in terms of providing passenger rail to north-west Auckland, including to Helensville, which could represent significant growth opportunities in satellite settlements.

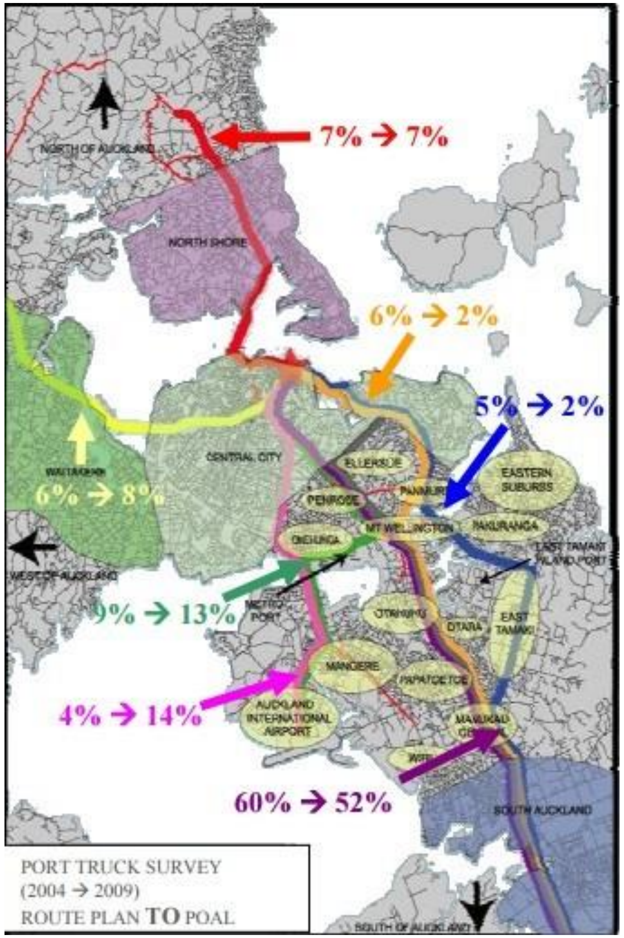
18.1 Freight Flows (Import and Export)

Truck Route Distribution leaving POAL



Source: Beca Truck Survey 2009

Truck Route Distribution arriving to POAL



Source: Beca Truck Survey 2009

19. CBA – Detailed Assumptions

Component	Option 1 Base Case – Do minimum	Option 4 Reclaim more		Option 5 Move to a new port location						
		EY	POAL	Option 5A Central Manukau Harbour	Option 5B Puhinui	Option 5C Hikihiki	Option 5D Firth of Thames – Kawakawa Bay	Option 5E Firth of Thames – Waimango Point	Option 5F Muriwai Offshore Port	Option 5E Muriwai North West Coast
Capacity / Port Productivity										
Maximum TEU Capacity	3 million	4 million	4 million	10 million	10 million	10 million	10 million	10 million	10 million	10 million
Infrastructure design – Capital expenditure										
Consulting and design	$30 million	$30 million	$30 million	$100 million	$100 million	$100 million	$100 million	$100 million	$100 million	$100 million
Approvals (including EIA)	$10 million	$10 million	$10 million	$50 million	$50 million	$50 million	$50 million	$50 million	$50 million	$50 million
Reclamation Cost ($/m³)	$60	$60	$60	$50	$50	$50	$50	$50	$50	$50
Reclamation Area	2.31 million m³	6.9 million m³	2.5 million m³	21 million m³	21 million m³	30 million m³	37 million m³	37 million m³	37 million m³	37 million m³
Caisson perimeter (reclamation infill) cost ($ / lin m)	$80,000	$80,000	$80,000	$200,000	$200,000	$200,000	$200,000	$200,000	$200,000	$200,000
Caisson perimeter area	1,410m	2,445m	1,740m	6,000m	6,000m	6,000m	12,500m	12,500m	12,500m	12,500m
Bridge(s) required – suspended concrete structures	Not applicable	Not applicable	Not applicable	2	2	2	2	2	2	2

Component	Option 1 Base Case – Do minimum	Option 4 Reclaim more		Option 5 Move to a new port location						
		EY	POAL	Option 5A Central Manukau Harbour	Option 5B Puhinui	Option 5C Hikihiki	Option 5D Firth of Thames – Kawakawa Bay	Option 5E Firth of Thames – Waimango Point	Option 5F Muriwai Offshore Port	Option 5E Muriwai North West Coast
Cost of bridge ($ / lin m)	Not applicable	Not applicable	Not applicable	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000
Bridge length	Not applicable	Not applicable	Not applicable	6,500m	700m	5,500m	3,500	3,500	3,500	3,500
Pavement (typical HD) cost ($/m²)	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200
Pavement area	220,000 m²	660,000 m²	335,000 m²	2 million m²	2 million m²	2 million m²	2.65 million m²	2.65 million m²	2.65 million m²	2.65 million m²
Dredging (mobilisation)	$1 million	$10 million	$10 million	$20 million	$20 million	$20 million	Not applicable	Not applicable	Not applicable	Not applicable
Dredging (works) ($/m³)	$60	$60	$60	$60	$60	$60	$60	$60	$60	$60
Dredging (works) area	1 million m³	1 million m³	1 million m³	4 million m³	35 million m³	4.37 million m³	0 million m³	0 million m³	0 million m³	0 million m³
Berth cost ($ / lin m)	$150,000	$150,000	$150,000	$150,000	$150,000	$150,000	$150,000	$150,000	$150,000	$150,000
Berth area	400m	1,330m	1,330m	2,200m	2,200m	2,200m	2,200m	2,200m	2,200m	2,200m
Terminal works (OOM)	$168 million	$1 billion	$1 billion	$1 billion	$1 billion	$1 billion	$1 billion	$1 billion	$1 billion	$1 billion
Transport infrastructure										
Distance to nearest road connection	Not available	Not available	Not available	26km	14km	24km	58km	69km	76km	62km
Distance to nearest rail connection	Not available	Not available	Not available	24km	7km	17km	43km	54km	24km	18km

Component	Option 1 Base Case – Do minimum	Option 4 Reclaim more		Option 5 Move to a new port location						
		EY	POAL	Option 5A Central Manukau Harbour	Option 5B Puhinui	Option 5C Hikihiki	Option 5D Firth of Thames – Kawakawa Bay	Option 5E Firth of Thames – Waimango Point	Option 5F Muriwai Offshore Port	Option 5E Muriwai North West Coast
Transport infrastructure – Construction $ per km										
General cut and fill	Not available	Not available	Not available	$1 million	$1 million	$1 million	$1 million	$1 million	$1 million	$1 million
Major Cut and fill	Not available	Not available	Not available	$5 million	$5 million	$5 million	$5 million	$5 million	$5 million	$5 million
Bridge	Not available	Not available	Not available	$22 million	$22 million	$22 million	$22 million	$22 million	$22 million	$22 million
Tunnel	Not available	Not available	Not available	$50 million	$50 million	$50 million	$50 million	$50 million	$50 million	$50 million
Pathway	Not available	Not available	Not available	$1.5 million	$1.5 million	$1.5 million	$1.5 million	$1.5 million	$1.5 million	$1.5 million
Corridor widening	Not available	Not available	Not available	$3 million	$3 million	$3 million	$3 million	$3 million	$3 million	$3 million
Construction Required (For the link)										
General Cut and fill (0 to 5m)	Not available	Not available	Not available	14km	5km	12km	29km	29km	10km	8km
Major cut and fill (5 to 20m)	Not available	Not available	Not available	Not applicable	Not applicable	Not applicable	5km	11km	7km	4km
Coastal / Elevated Structures	Not available	Not available	Not available	10km	4km	5km	7km	6km	2km	2km
Tunnel and Special Structures	Not available	Not available	Not available	Not applicable	Not applicable	Not applicable	2km	8km	5km	4km
Permanent Way (Track & Sign)	Not available	Not available	Not available	24km	7km	17km	43km	54km	24km	18km

Component	Option 1 Base Case – Do minimum	Option 4 Reclaim more		Option 5 Move to a new port location						
		EY	POAL	Option 5A Central Manukau Harbour	Option 5B Puhinui	Option 5C Hikihiki	Option 5D Firth of Thames – Kawakawa Bay	Option 5E Firth of Thames – Waimango Point	Option 5F Muriwai Offshore Port	Option 5E Muriwai North West Coast
Construction Required (Elsewhere)										
General Cut and fill (0 to 5m)	Not available	Not available	Not available	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	13km	13km
Major cut and fill (5 to 20m)	Not available	Not available	Not available	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	2km	2km
Coastal / Elevated Structures	Not available	Not available	Not available	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
Tunnel and Special Structures	Not available	Not available	Not available	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
Permanent Way (Track & Sign)	Not available	Not available	Not available	2km	Not applicable	Not applicable	Not applicable	Not applicable	15km	15km
Construction Required (Upgrade of existing track)										
Corridor widening	Not available	Not available	Not available	Not applicable	4km	4km	4km	4km	10km	10km
Coastal / Elevated Structures	Not available	Not available	Not available	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
Tunnel and Special Structures	Not available	Not available	Not available	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	2km	2km
Permanent Way (Track & Sign)	Not available	Not available	Not available	Not applicable	4km	4km	4km	4km	14km	14km

Component	Option 1 Base Case – Do minimum	Option 4 Reclaim more		Option 5 Move to a new port location						
		EY	POAL	Option 5A Central Manukau Harbour	Option 5B Puhinui	Option 5C Hikihiki	Option 5D Firth of Thames – Kawakawa Bay	Option 5E Firth of Thames – Waimango Point	Option 5F Muriwai Offshore Port	Option 5E Muriwai North West Coast
Average distance										
Port site to Albany	33km	33km	33km	44.9km	40.7km	50.3km	74.8km	85.6km	36.1km	39.8km
Port site to Te Atatu Peninsula	16.1km	16.1km	16.1km	34.7km	33.0km	42.5km	69.0km	79.7km	31.6km	38.0km
Port site to Howick	20.1km	20.1km	20.1km	32.8km	18.70km	26.97km	40.5km	51.3km	60.4km	63.5km
Port site to East Tamaki	20.9km	20.9km	20.9km	25.5km	12.7km	22.23km	41.95km	51.2km	64.5km	62.8km
Port site to Auckland CBD	2.83km	2.83km	2.83km	30.1km	24km	36.05km	59.7km	70.9km	42.4km	46.1km
Port site to Walmsley Road	9.27km	9.27km	9.27km	14.07km	8.3km	19.2km	49km	59.8km	49.4km	53.2km
Port site to Wiri	26.2km	26.2km	26.2km	17km	3.9km	14km	40km	50km	60km	68km
Port site to Takanini	33km	33km	33km	25.7km	11.95km	13.15km	34.03km	44.55km	66.85km	70.5km
Port site to Wellington	646km	646km	646km	642.5km	629.7km	668.5km	660.5km	652.5km	684.5km	687.5km
Land use										
Total Land Area at Ports of Auckland Site to be redeveloped	Not applicable	Not applicable	Not applicable	75 ha	75 ha	75 ha	75 ha	75 ha	75 ha	75 ha
Land yield	Not applicable	Not applicable	Not applicable	34.1 ha	34.1 ha	34.1 ha	34.1 ha	34.1 ha	34.1 ha	34.1 ha

20. Private Sector Involvement Case Study

International case study: Long term lease of Port of Darwin – Oct15

Transaction Structure

- Long term lease where the Government retained ownership of any land holdings with the leased port assets to return to the Government at the end of the lease period
- Ongoing capital development of the port is funded by the lessee
- Lessee incentivised to invest in the future growth and development of the port.

Lease Term

- 99 Years

Employees

- Maintain established workforce at the Port of Darwin with no forced redundancies during the term of the Enterprise Agreement (terminates June 2018).

Protecting economic regulatory regime

- The Territory will retain a range of oversight and regulatory functions including responsibility for price and access regulation.

Protecting the public sector

- The State will retain responsibility for key safety functions including Regional Harbourmaster Role
- Lessee will be required to maintain the port to agreed standards. Regulating via licensing of stevedores
- Lessee will be subject to key planning and environmental regulation as was previously the case under State ownership.

Price and Value

- Leased for AUD $506 million. 20% has been held by the Government with an intention to transfer to an Australian investor/s in time
- The Territory will receive a share of future revenue where it is better than expected trade performance
- The Lessee has committed to provide sponsorship to community initiatives.

21. Extract from Auckland Regional Council

International Ports and Freight Policies, Strategies and Action Plans discussion paper, June 2010

International challenges / issues	Government responses
• Lack of integration across the transport system and supply chain • Creating communication and dialogue amongst stakeholders • Lack of data for planning • Difficulty in forecasting future freight demand • Providing sufficient capacity to facilitate future freight growth and demand • Shipping consolidation, larger ships and the trend towards hubbing • Lack of coordination (policy, regulation and investment) • Duplication of resources and investments • Competition from foreign ports / risk of hubbing via other countries • Urban encroachment • Infrastructure / supply chain resilience • Lack of stability and certainty in policy that affects private investment • Funding - public and private • Economic viability and adequate financial returns • Destructive competition between domestic ports • Traffic congestion • Providing a level playing field for investors, operators and users • Technological changes • Customer demand for Just-in-time delivery methods • Shortage of skilled workers • Increased safety and security concerns • Environmental sustainability	• Information sharing and creation of a trade traffic database to inform policy • Long-term container capacity studies and demand forecasting at a national level • Ensure capacity and resilience of the supply chain • Implement a national policy/action plan • Communication and consultation with industry and the community • Co-ordination of Government and industry in decision making and investment • Developing published port plans detailing the future development of both ports and corresponding freight corridors to provide certainty for investment • Facilitate port consolidation • Setting aside of land banks and capacity planning • Working with ports and stakeholders to ensure long-term sustainable development • Assist in increasing the efficiency of ports • Development of multi-modal facilities • Improve regulations to decrease costs • Provide incentives for private sector investment • Develop performance indicators for ports • Enact a "super-hub port" strategy • Managing, maintaining and expanding sea access and hinterland connections • Funding for targeted freight-related infrastructure investment • Establish port development project appraisal and location criteria • Encourage and promote modal shift to rail and short-sea shipping

22. Implementation Roadmap

The Port Study has discussed the options available to accommodate the long-term trade forecast for Auckland. Determining the short and medium term path that will enable POAL to meet the long-term trade task is complicated. It will require detailed transitional strategy, high levels of co-ordination, and continual stakeholder consultation.

The Port Study does not make a recommendation about transition, as this decision rests with the CWG and Auckland Council. However a fundamental consideration will be the timing and nature of short-to-medium term decisions required to achieve the long-term strategy. As this Study cannot pre-empt the long-term strategy, we have identified advantages and disadvantages of different paths in the table below and have provided a procedural anchor to the 'actual' timing of decisions below.

As per this report, short-term is defined as from now to 2040, medium-term as 2040-2065, and long-term as beyond 2065. We have also considered two extra layers of decision making for this appendix: an 'immediate term' which considers those actions required over the next three years and those decisions to be made right now (regardless of the long-term strategy employed).

Figure 1 provides a conceptual overview of the immediate, short and medium-term steps that are required to achieve the long-term goal. Inherent in all of these decisions is choice. We also stress that these decisions are not mutually exclusive. For example, the CWG could agree there is merit in undertaking options at once.

Figure 1: Conceptual implementation roadmap

Timeframe	Actions required			
Next 6 months	✓ Consider the recommendations from the CWG	✓ Align decision making with national interests	✓ Protect Future Option(s)	✓ Formal engagement with mana whenua on next steps

Timeframe	Option A: Stay in current Port location		Option B: New Port location – Investment:	Option B: New Port location – Divestment:
Immediate Term (2016-2020)	Refer to table 1B	Potential decision to follow Option B →	✓ Refer to table 2a	✓ Refer to table 2a
Short Term (2020-2040)	Refer to table 1C	Potential decision to follow Option B →		
Medium Term (2040-2065)		Potential decision to follow Option B →		
Long Term (2065 +)	**Unlikely Port can meet trade requirements beyond three million TEU without major reclamation of the Waitematā** Refer to table 1D	Necessity to follow Option B →		

Protect Option

Option protection is good public policy. It is also particularly crucial in the case of this study where the preferred location for a new port development is in the Manukau; an area where development plans surrounding the proposed port sites could prove uneconomic in the future - in the absence of sufficient protection. We believe that the best way to protect Auckland's option is to undertake a Programme Business Case which determines the individual project requirements to build a new port. This will then be used as a primary input into considerations such as notice of requirements, designations and formal consideration in Regional Plans.

Actions to be done now

Regardless of the eventual decision around the future location of the port, there are a range of decisions/actions that should be undertaken now.

Table 1a: Indicative decision making – to be done regardless of decision

Timeframe	Description	Dependencies	Decision Maker(s)	Action(s)
Next six months	**Consider the recommendations from the CWG** Provide certainty to the community and the market about the future of the location of POAL. This will also help to support the ports license to operate.	▶ Consensus from CWG on recommendations.	▶ Auckland Development Committee (ADC) in consultation with CWG.	✓ ADC to communicate its official consideration of CWG recommendations.
	Invite a wider national discussion The Port Study has investigated how to meet Auckland's freight task; it has not considered what is in the best interests of New Zealand. It is prudent to consider whether other options (and potentially port locations) work better from a national perspective.	▶ Central government view ▶ Wider national community	▶ Auckland Development Committee in consultation with CWG. ▶ Central government	✓ Auckland Council to discuss the outcomes of this Study with central government. ✓ Auckland Council to initiate a Programme Business Case for the preferred port location (ideally) in partnership with central government – this will also help all understand what corridors need to be protected.
	Protect future option(s) Our conclusion is that POAL will not be able to stay in its current location indefinitely. Therefore, it is prudent to begin putting in place appropriate designations for eventual infrastructure as it will never be cheaper/easier than now to do so.	▶ Consensus from CWG on preferred alternative location(s) ▶ Programme Business Case for new port location.		
	Formal engagement with Mana whenua It will be important to continue the dialogue about next steps that has been started as part of this process.	▶ Consensus from CWG on recommendations.	▶ Auckland Council	✓ Auckland Council to continue dialogue with Mana whenua

Actions for a 'Stay scenario'

In the scenario where decision makers decide not to move the port, or make a commitment not to move the port in the short to medium term, the following decisions will need to be made which will both help sustain the port and help with an eventual transition.

Table 1b: Indicative decision making – 'Stay scenario' (immediate term)

Description	Dependencies	Decision Maker(s)	Action(s)
Immediate Term (2016 – 2020)			
Monitoring Regime Develop and implement a detailed monitoring regime to assess the freight and efficiency performance of POAL as well as metrics around trade growth, productive efficiencies in landside, berth and transport. Agree trigger points - such that if these are reached, decisions made about a new port location, port extension, or re-tasking of freight are brought forward.	▶ None. Should be done as a matter of priority.	▶ Auckland Council (ACIL) in consultation with POAL.	✓ ACIL to develop a monitoring regime for implementation and inclusion in POAL's next Statement of Intent.
Investment decision needed for multi-cargo (particularly vehicles) Multi-cargo is projected to reach capacity within the next 3 - 5 years. Decisions needs to be made about managing multi-cargo (i.e. re-tasking vs investment in vertical infrastructure) in the short term.	▶ Decision around future location of POAL ▶ Freight (actual and forecasts) for multi-cargo. ▶ Affordability of solution. ▶ Consenting process. ▶ Decision around Bledisloe extension(s).	▶ POAL in consultation with Auckland Council (ACIL).	✓ POAL to notify decision in their next Annual Report. ✓ POAL to undertake due consenting process.
Investment decision needed for Bledisloe A critical constraint for POAL is berth capacity. A decision on progression of the Bledisloe berth extension and/or reclamation needs to be made (including approach to associated consenting activity, any associated construction activity at Queen's wharf and any associated demolition activity at Marsden wharf) in the short term.	▶ Decision around future location of POAL ▶ Public support. ▶ Consenting process. ▶ Central Wharves Strategy. ▶ Affordability of solution. ▶ Disposal of blast material.	▶ POAL in consultation with Auckland Council (ACIL, ATEED, Panuku Development Auckland and Regional Facilities Auckland).	✓ POAL to communicate decision to the public as soon as possible. ✓ POAL to undertake stakeholder engagement. ✓ POAL to undertake due consenting process.
Mana Whenua formal engagement Formally engaging, resourcing and involving mana whenua iwi in this tranche of the forward work programme.	▶ Potential Treaty Settlements over relevant affected sites.	▶ Auckland Council ▶ POAL ▶ Mana whenua iwi settlement entities	✓ Mana whenua to be involved as a partner in future decision making processes.

Description	Dependencies	Decision Maker(s)	Action(s)
Bulk fuel leases A decision needs to be made, and communicated, about the long term future of bulk-fuel leases on Wynyard wharf. Investments will need to be made in alternative arrangements should these leases not be renewed.	▶ Long term future of port ▶ Expiry dates and contracts associated with bulk fuel terminal leases. ▶ Ability to serve cruise ships from alternate locations. ▶ Projected timing and nature of development of Wynyard Quarter.	▶ Auckland Council (PDA, ATEED) in consultation with POAL and oil companies.	✓ POAL to communicate decision to the public as soon as possible. ✓ Auckland Council to develop a plan to serve the cruise industry (and POAL) should these leases not be renewed.
Relationship between current/future needs and transport investment(s) POAL's future has a major bearing on future transport requirements – both for ongoing maintenance as well as capital expenditure. There is a pressing need to avoid the potential for significant stranded transport assets in the short to medium term. Continued communication of transport needs to transport planning processes is essential. This could be transport needs associated with remaining in current location or transport needs in respect to a new location.	▶ Decision around future location of POAL ▶ Monitoring of POAL freight task and efficiency performance. ▶ Timing of land transport funding cycle. ▶ Affordability of solution(s).	▶ Auckland Council (AT) in consultation with NZTA, Kiwirail and POAL.	✓ POAL to continue to input transportation requirements to relevant planning forums. ✓ JMAC to conduct ongoing transport modelling.
Decision around port automation To help manage projected capacity constraints, POAL have proposed the introduction of a hybrid terminal system that includes the use of automated straddle carriers (auto-strads). This decision needs to be confirmed, or rejected, to ensure appropriate capital expenditure.	▶ Decision around future location of POAL ▶ Programme Business Case for new port location. ▶ Affordability of solution ▶ Ability to transfer auto-strads to new port location.	▶ POAL in consultation with Auckland Council (ACIL).	✓ POAL to include decision in next Annual Report.
Decision to be made (or reconfirmed) about the long-term future of the port of Auckland Ongoing consideration of the long-term suitability of POAL remaining on the Waitematā if reclamation is not considered.	▶ Monitoring of POAL freight task and efficiency performance. ▶ Affordability of solution – and discussions around funding.	▶ Auckland Council (ACIL) in consultation with POAL.	✓ Auckland Council to communicate decision to public and then refer to actions identified in Table 2a as a starting point.

Table 1c: Indicative decision making – 'Stay scenario' (short - medium term)

Description	Dependencies	Decision Maker(s)	Action(s)
Short Term (2020-2040) and Medium Term (2040-2065)			
Ongoing monitoring and reporting The proposed monitoring framework should be continually examined to ensure that efficiency and performance metrics are being met. This monitoring will support built-in time buffers for decision making and will also enable subsequent decision to be robust.	▶ Agreement to develop a monitoring regime. ▶ Quality of information and the reporting metrics required to support the monitoring regime.	▶ Auckland Council (ACIL) in consultation with POAL.	✓ Auckland Council to report and communicate outcomes of monitoring framework to the community annually.
Mana Whenua formal engagement Formally engaging, resourcing and involving mana whenua iwi in this tranche of the forward work programme.	▶ Potential Treaty Settlements over relevant affected sites.	▶ Auckland Council ▶ POAL ▶ Mana whenua iwi settlement entities	✓ Mana whenua to be involved as a partner in future decision making processes.
Investment needed in transport An ability to accommodate an almost doubling of existing freight handling capacity will come with a concurrent need to invest in and maintain critical transport corridors. Early signalling of these needs will be required – remaining cognisant of the desire not to gold plate assets for a port that may not remain in the long term.	▶ Monitoring of POAL freight task and efficiency performance. ▶ Affordability of transport solutions. ▶ Densification of land use around corridors. ▶ NZTA/AT funding options. ▶ Timing of eventual long-term decision of port location.	▶ Auckland Council (AT) in consultation with NZTA, Kiwirail and POAL.	✓ POAL to input transportation requirements to relevant planning forums.
Decision to be made (or reconfirmed) about the long-term future of the port of Auckland Ongoing consideration of the long-term suitability of POAL remaining on the Waitematā if reclamation is not considered.	▶ Monitoring of POAL freight task and efficiency performance. ▶ Affordability of solution – and discussions around funding.	▶ Auckland Council (ACIL) in consultation with POAL.	✓ Auckland Council to communicate decision to public and then refer to actions identified in Table 2a as a starting point.

Table 1d: Indicative decision making – 'Stay scenario' (long term)

Description	Dependencies	Decision Maker(s)	Action(s)
Long Term (2065+)			
Transition to new location or expansion Our analysis suggests that POAL cannot meet trade requirements beyond three million TEU without major reclamation in the Waitematā. Therefore, a fundamental decision will need to be made before the long term to ensure that Auckland can continue to meet its requirements for freight.	► Outcome of monitoring regime. ► Outcome of Programme Business Case and supporting Indicative and Detailed Business Cases. ► Affordability of solution. ► Community consultation.	► Auckland Council in consultation with POAL.	✓ Auckland Council to communicate decision to public and then refer to actions identified in Table 2a as a starting point.

Actions for a 'Go scenario'

Once a decision is made to relocate port operations to a new location, the following steps can and should be considered when seeking to understand the investment requirements. We believe that a Programme Business Case would be the logical next step – supported by a range of indicative and detailed business cases. To frame the myriad of considerations that would go into a new port location decision we have adopted a business case categorisation approach.

Table 2a: Indicative decision making – 'Go scenario'

Consideration	Strategic	Economic	Financial and Commercial	Management
Identify preferred new site through a Programme Business Case and supporting Indicative and Detailed Business Cases	✓	✓	✓	✓
Designations to protect transport corridors and land uses	✓	✓		✓
Community engagement	✓	✓	✓	✓
Formal engagement, involvement and resourcing of mana whenua iwi	✓	✓	✓	✓
Environmental impact assessments and consents	✓	✓		✓
Consultation with transport agencies including New Zealand Transport Agency, KiwiRail and Auckland Transport	✓	✓	✓	✓
Funding discussions	✓	✓	✓	✓
Ownership and governance	✓	✓	✓	✓
Purchase and/or negotiate with land owners	✓	✓		✓
Procurement			✓	✓
Construction				✓
Consultation with shippers	✓			✓
Transition and implementation	✓	✓	✓	✓
Detailed Technical engineering work		✓		✓
Cost Benefit Analysis		✓		

Once a decision is made to relocate port operations to a new location, the following steps can and should be considered when seeking to understand the divestment requirements. To frame the myriad of considerations that would go into a new port location decision we have adopted a business case categorisation approach.

Table 2a: Indicative decision making – 'Go scenario'

Consideration	Strategic	Economic	Financial and Commercial	Management
Identify parcels of land for development	✓	✓	✓	✓
Assess the various development plans (including site utilisation and terms of lease/ownership arrangements).	✓	✓	✓	✓
Community communication and engagement	✓	✓		✓
Formal engagement, involvement and resourcing of mana whenua iwi	✓	✓	✓	✓
Construction of supporting infrastructure	✓	✓		✓
Alignment with existing strategies including – Central Wharves Strategy and Central City Management Plan.	✓	✓		✓
Timing of land release – considering relevant developments like Wynyard.	✓	✓	✓	✓
Sale and proceeds – consideration of ring-fenced proceeds.	✓	✓	✓	✓

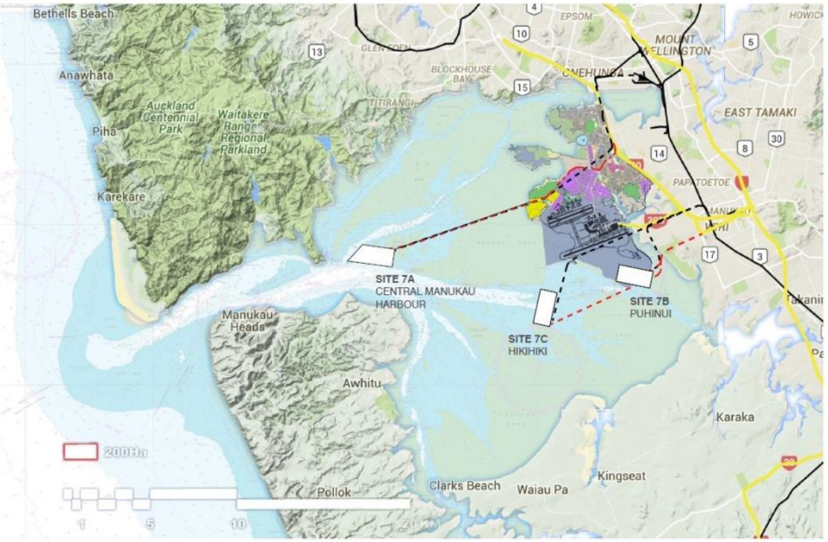
Option protection

Option protection is good public policy. It is also particularly crucial in the case of this study where the preferred location for a new port development is in the Manukau; an area where development plans in the areas surrounding the proposed port sites could prove uneconomic in the future – in the absence of sufficient protection.

We believe that the best way to protect Auckland's option is to undertake a Programme Business Case which determines the individual project requirements to build a new port. This consideration will then be used as the primary input into considerations such as notice of requirements, designations, land purchases and inclusion in Regional Plans.

Potential Port Sites

Manukau Sites



PROPOSED RAIL CONNECTION
PROPOSED CONNECTION TO LOCAL UPGRADED ROAD

Thames Sites

PROPOSED RAIL CONNECTION
PROPOSED CONNECTION TO LOCAL UPGRADED ROAD
PROPOSED TUNNEL

23.1 Coastal Processes

The coastal processes in relation to the entrance channel through the Manukau Heads are discussed below. Basic summaries of coastal processes for the Western Firth of Thames and Muriwai sites are also presented. In all cases, the descriptions and recommendations are based on the available information; detailed field data collection and numerical modelling are required to verify and quantify impacts and mitigation methods.

It has been assumed that the ports are constructed as solid reclamations, as well as the causeways (i.e. worst case scenarios), unless otherwise indicated. Impacts would be greatly reduced if piled structures are utilised, and will be necessary in some locations to mitigate impacts.

23.1.1 Manukau

Determination of the best location, orientation and sediment transport processes and volumes of sand that would likely be required to be dredge from the entrance channel, as well as the likely deposition patterns, will require an in depth fieldwork and numerical modelling programme. Mead et al., (2010) noted in their review of the West Coast's physical environment (from Taranaki to Dargaville) that "Only limited research into the hydrodynamics of the Manukau Heads has been conducted, possibly due to the adverse and often dangerous conditions that prevail across the Heads". However, there is sufficient data to consider the feasibility of an entrance channel dredged to 14.0m depth for access to a Manukau Harbour future Auckland port.

The Manukau Heads represents a highly dynamic environment with strong tidal currents associated with both ebb and flood tides. Additionally, with the Manukau Heads being situated on the west coast of New Zealand it is exposed to high wave energy. Considered together, the influence of tide and waves means that the surficial sediment in the vicinity of the Manukau Heads can be expected to be highly mobile and the possibility for bedforms of some description being formed is likely (Mead et al., 2010).

Sediment transport on Auckland's West Coast is dominantly from south to north, driven by the predominant wind and wave climate from the southwest – occasional reversals occur during northwest wind and wave conditions. Various estimates have been made with respect to the net sediment transport to the north that range from 175,000-275,000 m^3/yr (Gibb, 1989; McComb, 2001: Phillips, 2005).

Southward reversal of sediment transport during northwesterly events has been estimated at around 100,000m^3/yr, with total gross sediment transport rate across the harbour entrance (in both directions) is likely to be of the order of 275,000-375,000m^3/yr (Mead et al., 2010).

Although Port Taranaki in New Plymouth is relatively sheltered in comparison to the Manukau Harbour Entrance, due its orientation to the predominant swell direction, there is a high potential for sediment transport from the southwest to the northeast. Port Taranaki dredged 1.3m^3 of material from the entrance channel between 1989 and 1998, some 145,000m^3/yr (McComb and Black, 2000). While McComb (2001) calculated that sediment transport in the area was of the order of 220,000 m3/yr. Similarly, at Port Otago some 500,000 m^3/yr of gross sediment transport has been previously calculated, although around 200,000-250,000m^3 of entrance channel maintenance dredging will be required each year with the 14m deep entrance channel (P. McComb, pers. comm.). Thus, less material that transported across the channel is likely be require dredging.

With respect to entrance channels, there is the main channel (the ebb-tide channel) known as the southwest channel, and the secondary channel (the flood-tide channel) known as the south channel. The south channel is relatively shallow, and shore-parallel, and so does not lend itself well to a maintained entrance channel – it would also require at least 2x the length of dredging to develop. The southwest channel is the larger and deeper of the 2, and would experience higher currents (likely exceeding 3 knots in some conditions). Dredging would be required through the terminal lobe of the ebb-tidal bar, a distance of some 4km.

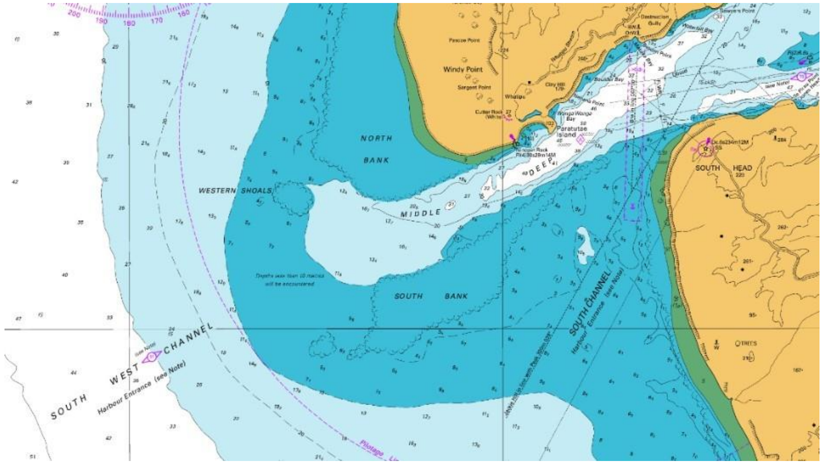
The wave climate driving the sediment transport on the west coast of the North Island is a high energy wave environment, open to the prevailing south westerly wind direction with long fetches across the Tasman Sea to the Southern Ocean. The consistent passage of weather systems across these water bodies results in dominant long period swells from the south westerly quarter.

Analysis of hindcast wave data has been undertaken at two offshore locations for the period 1997-2007. The two locations A (north) and B (south) are located at lat lon -37.98° 174.18° and -36.81° 174.00° respectively. Significant wave height and wave period roses for the two offshore locations are shown below. These highlight the dominant south westerly wave climate, and show the effect of wave refraction between the two data locations due the bathymetry north of Cape Egmont.

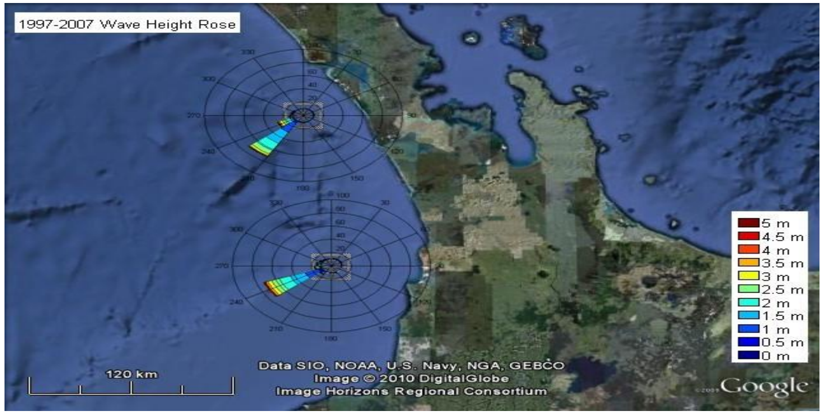
The mean significant wave height for both locations from 1997-2007 is 2.1m, with a mean period of 11-13 seconds. The maximum wave height from 1997-2007 is 7.2m and 6.7m for locations A and B respectively, with a maximum period of 18-19 seconds.

Approximate water depths in the MDI (Metocean Data Interface – our in-house data archive) locations are 300m. Nodder (1991) indicates that waves capable of suspending fine sand at 30m and 50m occur 67% and 20% of the time. The wave climate is subsequently a dominant force in sediment transport along the Taranaki shelf (Nodder, 1991).

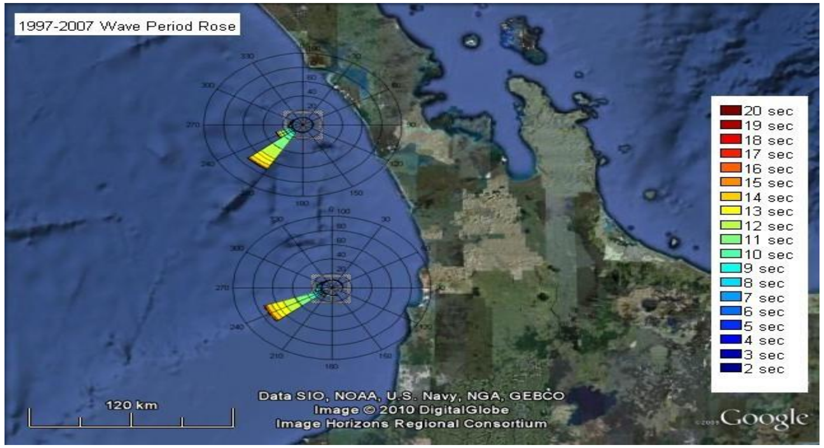
The Manukau Harbour Entrance[15]



Wave Height Roses[16]



Wave Period Roses[17]



[15] There are 2 channels, the ebb-tide channel (south west channel) and the flood-tide channel (south channel).

[16] Significant wave height roses for the period 1997-2007. Two locations A (north) and B (south) are located at lat lon -37.98° 174.18° and -36.81° 174.00° respectively.

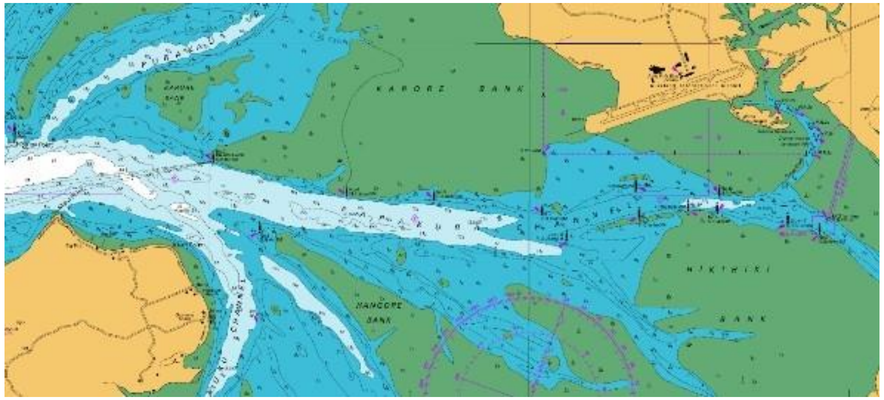
[17] Wave period roses for the period 1997-2007. Two locations A (north) and B (south) are located at lat lon -37.98° 174.18° and -36.81° 174.00°, respectively.

The strong currents of the ebb-tidal channel mean that sediment that is transported into the channel is likely to be spread out along the length of the dredged channel. Based on the only other entrance channel on the West Coast, and the dredging requirements of other New Zealand port entrance channels with similar sediment transport rates (Taranaki, Tauranga and Otago) this would likely require annual dredging. However, numerical modelling reviews of similar sites would be required to provide a better idea of the distribution of sediment and likely dredging regime. Due to the predominant south to north sediment transport regime, sediment bypassing would be required to ensure the health of the coastal sediment transport system (i.e. Auckland City's West Coast beaches). Dredged material would be deposited on the northern side of the entrance channel in a nearshore area where it would not be lost from the nearshore sediment transport system. Similar dredge disposal bypassing is undertaken at Port Taranaki. Identifying the location of deposition to best work with the existing sediment transport system will require targeted fieldwork and numerical modelling.

With respect to maximum wave heights within Manukau Harbour, Mead et al., (2008) modelled wind-generated waves at 1, 2, 5, 10, 20, 50 and 100 year return periods. The 100 year return period extreme wind event results in wave heights in excess of 2m during sustained winds of 30.5 m/s (Figure 6).

Current speeds during the highest spring tides exceed 2.3 knots in Papakura Channel (running east-west with the channel) at the central harbour site. Further into the harbour at the Hikihiki site, maximum current speeds are reduced and exceed 1.3 knots during highest spring tides in the upper Papakura Channel (running east-west). At the Puhinui site adjacent to the airport, there are presently low currents as this area is mudflat. The main channel entrance is the same as for Hikihiki. Note, channel current speeds in the Papakura Channel to the Hikihiki and Puhinui sites will be reduced by the dredging/deepening required to navigate container vessels to the berths.

The Papakura Channel is the access way to all 3 Manukau Harbour options



23.1.2 Muriwai

Site 6B Muriwai Offshore is in an extremely high energy wave environment (Mead et al., 2010) presents a major difficulty in determining any site. Would require extensive infrastructure. High sediment transport, a telecommunication cable landing site. Also the site of 2 Regionally Significant surf breaks (Frazerhurst, 2012) and Regionally Significant Ecology (Mead et al., 2011).

Site 6c Muriwai, North West is basically the same as the site straight off Muriwai, can be engineered, but extreme.

23.1.3 Western Firth of Thames

Site 14c Kawakawa is Semi-sheltered. Open to northerly wind and infrequent but energetic cyclone swell from the north. Low sediment transport rates. Would require extensive infrastructure. Currents up to 1.5m (E-W) during spring tides. Potential impacts on a regionally significant surfing break (Orere Point).

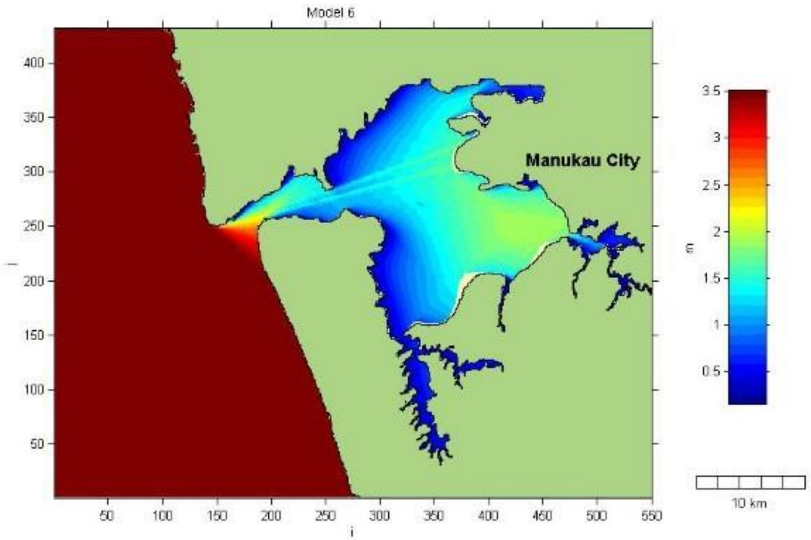
Site 15a Waimango Point is semi-sheltered. Open to northerly wind and infrequent but energetic cyclone swell from the north. Low sediment transport rates. Would require extensive infrastructure, although short dredged entrance channel.

23.2 Sites

23.2.1 Central Manukau Harbour (7A)

The central site option requires a 9km causeway to the port reclamation, and it is located on the Karore Bank adjacent to the main harbour channel. In terms of exposure to waves, long-period waves cannot penetrate through the relatively narrow harbour entrance into the harbour proper due to the process of refraction. However, wind-generated waves can get up to over 2m within the harbour. Mead *et al*., (2008) modelled a 100-year return period extreme wind event, which resulted in wave heights in excess of 2m during sustained winds of 30.5 m/s. This was with wind from the dominant wind direction (SW). At the central site, waves of over 2m could occur with strong winds from the SE quarter, which would affect the eastern and southern sides of the reclamation. However, these events are estimated to have a return period of <1 in 100-years (i.e. less frequent than SW events).

Wind-generated wave modelling of Manukau [18]



[18] Harbour (100-year return period wind of 30.5 m/s from 270^{0}T.

Tidally-driven currents dominate circulation patterns within Manukau Harbour, except on the shallower areas of intertidal flats, where wind-driven currents can sometimes dominate (Bell *et al*., 1998). The docking area to the south of the proposed reclamation is within the main harbour channel, the Papakura Channel. Current speeds during the highest spring tides exceed 2.3 knots in this area (running east-west with the channel); current speeds are also slightly higher on the ebb tide. Should these current speeds be in excess of those required for safe manoeuvring and mooring of vessels, engineering solutions such as dredging into the Karore Bank to create a relatively quiescent area would need to be considered.

Numerical modelling of Manukau Harbour (Bell *et al*., 1998) indicates that there are relatively low tidal flows across the Karore Bank; i.e. along the route of the causeway. Low currents follow the direction of the tide, and move up on the bank from the northern Purakau channel (southeast direction) and from the Papakura Channel (northeast direction). This reserves on the ebb tide, and is summarised in the statement "Hence currents on the intertidal flats are markedly slower than adjacent channels accompanied by a greater tendency for velocities to be directed normal to the isobaths higher up on the flats as they drain or flood" (Bell *et al*., 1998). Wind-driven currents are dominant on the tidal flats, and together with the wind-generated waves, suspend and move fine sediments on the flats. However, the causeway and the port reclamation are not expected to have major impacts on sediment transport, with the location and number of culverts being established through detailed data collection and numerical modelling.

23.2.2 Puhinui (7B)

The Hikihiki site is exposed to wind-generated waves of >2m during 100-year return period wind events from the westerly quarterly, which would impact the western and southern sides reclamation.

At the Puhinui site adjacent to the airport, there are presently low currents in the area is mudflat, although the southeastern corner of the port extends into Pukaki Creek, which likely has currents of up to 1 knot during peak flows. This would cause significant changes to circulation and consequent reworking of the seabed, channels and intertidal flats, unless it was piled or the port area shifted to the northwest to avoid the channel. The rail and road access routes would also be required to bridge the Pukaki Creek to avoid impacts on currents, circulation and consequent sediment transport.

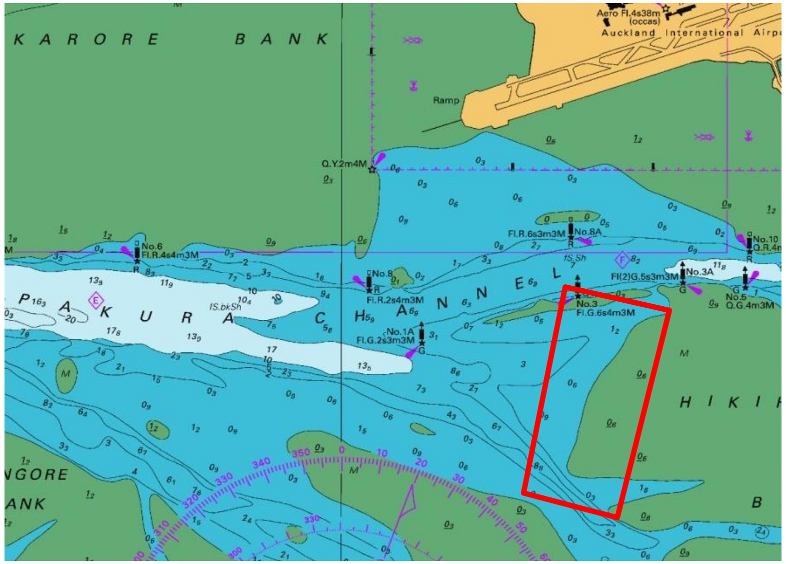
23.2.3 Hikihiki (7C)

The Hikihiki site is exposed to wind-generated waves of >2m during 100-year return period wind events from the westerly quarterly, which could impact the western side of the reclamation, and the northern and southern sides to a lesser extent; the eastern side is relatively sheltered because of the relatively smaller fetch.

The Hikihiki site further into the harbour, where maximum current speeds are reduced, although still exceed 1.3 knots during highest spring tides in the upper Papakura Channel (running east-west). The present location has the reclamation blocking the Papakura Channel. This would have an extensive impact on coastal processes, since this channel services a significant area of the eastern Manukau Harbour, including the Pahurehure Inlet. Large changes in current patterns and circulation would occur, which would cause significant reworking (erosion and accretion) of the harbour seabed, channels and intertidal flats.

With respect to the causeways for road and rail transport, both would be required to be built on piles due to them crossing the harbour channels and current directions, which run east-west.

Location of the potential Hikihiki site

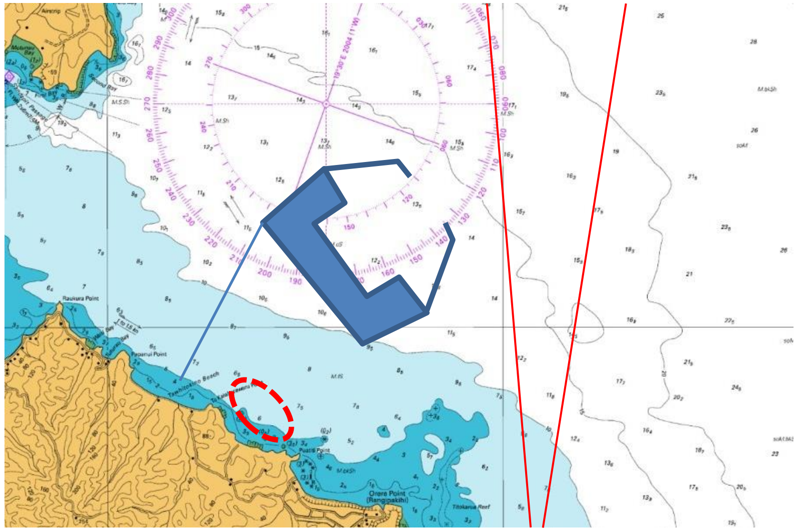


23.2.4 Kawakawa Bay (14C)

Kawakawa Bay is in a semi-sheltered location, which is open to northerly wind and infrequent but energetic cyclone swell from the north. As a result, there are relatively low sediment transport rates. Tidal currents are up to 1.5m (E-W) during spring tides on the southern side of the port. The presence of the port could increase these currents by restricting the entrance width to the channel between the island and mainland, which would need to be investigated. In addition, the causeway would need to be constructed on piles to mitigate impacts on currents, circulation and sediment transport, since it is located across the area of strongest current speeds.

There is the potential to impact on a regionally significant surfing break (Orere Point). However, the port and breakwaters do not extend into the 'swell corridor' for the break, so it is unlikely to be an issue.

Approximate swell corridor for Orere Point[19]



[19] Regionally significant surf break. East-west currents are denoted in the red ellipse.

23.2.5 Waimango Point (15A)

Waimango Point is located just 10km southeast of Kawakawa Bay, and so is exposed to very similar wave conditions; it is in a semi-sheltered location, which is open to northerly wind and infrequent but energetic cyclone swell from the north. As a result, there are relatively low sediment transport rates. Tidal currents are up to 1.0m (N-S) during spring tides on the western side of the port. The presence of the port could increase these currents by compressing the space between the port and mainland, which would need to be investigated. In addition, the causeway would need to be constructed on piles to mitigate impacts on currents, circulation and sediment transport, since it is located across the area of strongest current speeds.

A potential impact that would require detailed investigation is the potential to cause the development of a salient behind the port structure, i.e. a widening of the beach, due to reduce exposure/protection by the port. The potential for this to occur is higher in this location than at Kawakawa Bay since the structure is closer to the land, and because this site has wide open beaches that are not in equilibrium with the dominant wave directions (unlike the pocket beaches in the lee of the Kawakawa site).

23.3 Marine Ecology

23.3.1 Central Manukau Harbour (7A)

Port site 7A proposed for the central Manukau Harbour is located east of Puponga Point and adjacent the offshore margin of Karore Bank within the Purakau Channel. The benthic sediments are reported to be diverse ranging from relatively coarse with dead shells, shell grit and very little sand to fine sand with considerable amounts of iron-sand (Kelly 2009). The benthic ecology within the proposed port area has not been studied in great detail, although Grange (1977; 1979) described three types of benthic communities that fall within and immediately adjacent to the proposed footprint. These include a *Halicarcinus* (crab) / *Bugula* (polyzoan) community, an *Amalda* (gastropod) / *Myadora* (bivalve) community, and a *Fellaster* (echinoderm) / *Pagurus* (hermit crab) community - summarised in more detail in Grange (1977;1979) and Kelly (2009). This range of community types over a relatively small spatial scale infers the area is of high ecological diversity relative to other regions of the harbour and thus likely important as foraging habitat for a range of fish species.

Common benthic and pelagic fishes that utilise the harbour endurance and are likely to be found within the 7A port footprint include flatfish, rig, kahawai, trevally, yellow eyed mullet, parore, red gurnard, and snapper respectively.

The region encompassing and adjacent to the proposed 7A port has a high fishing effort compared to inshore regions (Hartill *et al*. 2007; 2008). A range of sharks, rays and marine mammals (dolphins, whales, seals) are also common within this section of the harbour. The Department of Conservation are presently undertaking acoustic monitoring for Maui's dolphin presence adjacent Puponga Point (Andrew Wright – Department of Conservation *personal communication*).

Shallow benthic regions characteristic of Puponga Point, Cornwallis and Mill Bay i.e., located within the south-west region of the Wairopa Channel and north-west of the proposed port are considered ecologically significant due the occurrence of scallops in tandem with high abundance and diversity of benthic bivalves (Mead *et al*. 2007; Kelly 2009). Heavy metal contaminants (copper and zinc) within oysters measured at Cornwallis are much lower than that recorded in oysters from the inner Manukau Harbour reference sites, inferring higher water quality across this section of the harbour (see Kelly 2009).

The proposed port to land connection dissects the large Karore Bank which is designated as Coast Protection Area (CPA) 1 and 2. This coastal protection classification reflects the ecological significance of the bank within the harbour due to:

1. A high diversity of sandflat habitats between high tide and low spring tide.
2. Supporting the largest areas of seagrass habitat (*Zostera* spp) within the Manukau Harbour.
3. Exceptionally high biological diversity of bivalves and associated macrofauna and infauna, which collectively support high densities of fishes and wading birds.

Effects associated with the construction and maintenance of Port 7A are likely to include:

- Disturbance and/or permanent modification of benthic sediments due to port construction and maintenance dredging. The benthic sediments are presently comprised of coarse grain sizes, large whole shell fragments and shell-hash to fine clean sand with high iron content. An increase in sediment contaminants derived (heavy metals, HMW PAH's etc) from port occupation/activities within the confines of the port through time are likely.
- Potential fair-field benthic and water quality effects associated with disposal of dredge material.

- Change in water quality associated with construction and maintenance dredging, e.g., increase in sediment plumes which affects water clarity and productivity.
- Reduction/change in benthic diversity resulting from construction and maintenance dredging.
- Alteration to trophic functioning.
- Loss/change in foraging habitat for species such as snapper, flat fish, red gurnard and rig.
- Increased potential for invasive species incursions.
- Restriction of marine mammal movement migratory pathways into the inner harbour – Maui's dolphin of particular concern.

Effects associated with the proposed 7A connection route are likely to include:

- Change to seagrass abundance and distribution within the Karore Bank.
- Loss or alteration to foraging habitat for fishes and wading birds (loss of trophic functioning).
- Alteration to biodiversity and benthic community composition.
- Increase in benthic sediment contaminants (heavy metals HMW PAH's etc) along port to mainland connection route.
- Restriction or alteration to marine species (fish, mammals) movement pathways within the central harbour.
- Port to mainland connection routes.

23.3.2 Puhinui (7B)

Site 7B located immediately south of Auckland Airport and Wairoa Island, straddles lower regions of the Papakura Channel, Waokauri Creek, and Puhinui Creek within the inner Manukau Harbour. The southern shore of Wairoa Island is designated as CPA 1 and mudflats extending to the Papakura channel designated as CPA 2. Collectively, these coastal protection classifications are due to ecologically significant vegetation sequences (shrublands, saltmarsh and saline vegetation), pristine intertidal sandflats and diversity of biota and marine habitats.

Specifically the sandflats adjacent Wairoa Island support dense and diverse marine invertebrate communities, which in-turn support a range of international migratory birds, New Zealand endemic birds and a range of threatened species. An artificial bird roost has been established on Wairoa Island.

The proposed port connections (road and rail) traverse mud and sandflats east of Wairoa Island (CPA 1 and 2) onto the mainland proper. The proposed rail and road network routes along the Puhinui coastline will directly traverse or lie immediately adjacent to ecologically significant intertidal shell banks that are utilised as high-tide roost by endemic waders and internationally significant migratory birds. The vegetation sequence beyond the shellbank, which would be dissected by the proposed road-link, is described as the best and least disturbed areas of saltmarsh in the Manuaku Harbour (ARC coastal plan; Kelly 2009). The saltmarsh habitat transitions into kanuka forest and more mature native forest above Mean High Water Springs.

Effects associated with the construction and maintenance of Port 7B are likely to include:

- Considerable disturbance and permanent modification of intertidal sandflats and benthic habitats adjacent Wairoa Island resulting from port construction and maintenance dredging. The benthic sediments are presently comprised of mudflats and large areas of fine clean sand and shellbanks.
- Potential fair-field benthic and water quality effects associated with disposal of dredge material.
- Increase in sediment contaminants derived (heavy metals, HMW PAH's etc) from port occupation/activities within the confines of the port through time are likely.
- Change in water quality associated with construction and maintenance dredging, e.g., increase in sediment plumes which affects water clarity and productivity.
- Reduction/change in benthic diversity resulting from construction and maintenance dredging.
- Alteration to trophic functioning.
- Loss of, or disturbance to important wading and roosting habitat for endemic and threatened international migratory birds.
- Loss/change in foraging habitat for fish species such as snapper, flat fish, kahawai, kingfish and rig.

- Increased potential for invasive species incursions.

Effects associated with the proposed 7B connection routes are likely to include:

- Disturbance to, or loss of, ecologically significantly coastal vegetation (saltmarsh and coastal forest) characteristic of the northern Puhinui coastline.
- Disturbance to, or loss of bird roosting habitat.
- Alteration to biodiversity and benthic community composition.
- Increase in benthic sediment contaminants (heavy metals HMW PAH's etc) along.

23.3.3 Hikihiki Bank 7C

Site 7C is located within the Papakura Channel west of the Hikihiki Bank. Ecological data is relatively sparse within the immediate footprint of the proposed port. Grange (1977; 1979) describes the general subtidal benthic communities in this region being typified by a *Halicarcinus / Bugula* community) and an *Amalda / Myadora* community, thus sharing elements of site 7A. Benthic substrates are likely to be comprised of areas of coarse sand and shell hash (subtidal channels) and intertidal sand and mudflats.

The port connection proposed from site 7C to the mainland transverses the north-western boundary of the Hikihiki Bank and thereafter dissects the Puhinui Bank following the identical road and rail routes proposed for the Port 7B Puninui connection.

Effects associated with the construction and maintenance of Port 7C are likely to include:

- Disturbance and/or permanent modification of the subtidal benthic habitats within the Papakura Channel and to a lesser degree the north-western intertidal sand and mudflats of Hikihiki adjacent Wairoa Island.
- Increase in sediment contaminants derived (heavy metals, HMW PAH's etc) from port occupation/activities within the confines of the port through time are likely.
- Change in water quality associated with construction and maintenance dredging, e.g., increase in sediment plumes which affects water clarity and productivity.
- Potential fair-field benthic and water quality effects associated with disposal of dredge material.
- Reduction/change in benthic diversity resulting from construction and maintenance dredging.
- Alteration to trophic functioning.
- Loss/change in foraging habitat for fish species such as snapper, flat fish, kahawai, kingfish and rig.
- Increased potential for invasive species incursions.
- Restriction of movement of fishes and marine mammals within the Papakura channel.

Effects associated with the proposed 7C connection routes are likely to include:

- Disturbance to, or permanent loss of, ecologically significantly coastal vegetation (saltmarsh and coastal forest) characteristic of the northern Puhinui coastline.
- Disturbance to, or loss of bird roosting habitat.
- Alteration to biodiversity and benthic community composition.
- Increase in benthic sediment contaminants (heavy metals HMW PAH's etc) along port to mainland connection routes.

23.3.4 Kawakawa Bay (14C)

The benthic habitat within the immediate footprint of 14c is predominantly mud and very fine mud with > 70% clay content (NIWA 2005). Ecologically, the benthos of mud habitats in this region are likely to be dominated by the bivalve *Theora lubrica*, ostracods, amphipods and polychaetes characterising muddy substrata; polychaetes (Wong and O'Shea 2009). Historically green-shell mussels were present on the benthos (Morrison *et al*. 2003) and recent efforts have been directed at restoring these. Rocky reef habitat is restricted to headlands and terminates in reasonably shallow water < 10m depth.

Kawakawa Bay itself is typified by dense beds of the cockle with pipi and wedge shells also apparent (Grant and Hay 2003).

Fish species richness is described as low to moderate for this region of the inner Hauraki Gulf (Smith *et al*. 2013) although commercial, recreational and customary fishes such as snapper, john dory and Kahawai occur within this region of the gulf and are commonly associated with muddy substrates (Kendrick and Francis 2002). Recreational fishing effort is moderate ranging between 51-100 boats per km^2 (based on 2011-12 aerial (Seasketch 2016).

The port connection proposed from site 14C to the mainland dissects the Sandspit Passage to Raukura Point. The benthic substrate of Sandspit Passage is predominantly fine mud with high clay content. Intertidal beaches are characterised by coarse shell and patches of fine mud. Raukura Point coastal area is designated as CPA2 with sections of the coastline immediately south designated as CPA1 due to native vegetation sequences.

Effects associated with the construction and maintenance of Port 14C are likely to include:

- Disturbance to and/or slight modification of the subtidal benthic habitats within the proposed footprint.
- Potential fair-field benthic and water quality effects associated with disposal of dredge material.
- Increase in sediment contaminants (heavy metals, HMW PAH's etc) derived from port occupation/activities within the confines of the port through time.
- Change in water quality associated with construction and maintenance dredging, e.g., increase in sediment plumes which affects water clarity and productivity.
- Reduction/change in benthic diversity resulting from construction and maintenance dredging.
- Alteration to trophic functioning.
- Loss/change in foraging habitat for fish species such as snapper, flat fish, kahawai, kingfish and john dory.
- Increased potential for invasive species incursions.
- Restriction of fish movement within this section of the coast.

Effects associated with the proposed 14C connection routes are likely to include:

- Disturbance to, or permanent loss of, ecologically significantly coastal vegetation characteristic of the Kawakawa Bay and Raukura Point coastline.
- Alteration to biodiversity and benthic community composition.
- Increase in benthic sediment contaminants (heavy metals HMW PAH's etc) along port to mainland connection routes.

23.3.5 Waimango Point (15A)

The potential Port site 15A offshore from Waimango Point shares a degree of commonality with Kawakawa Bay in terms of the physical nature of the benthos (predominantly fine silty mud) and main benthic communities present are dominated by polychaete worms, amphipods and occasional bivalves particularly *Theora lubrica*. As for port site 14A, green-lipped mussels were historically abundant along this stretch of coastline (Morrison *et al*. 2003) and mussel farming and mussel spat farming takes place immediately to the south of Waimango Point.

As for the Kawakawa Bay - Raukura Point region to the North, fish species richness is described as low to moderate for this region of the inner Hauraki Gulf (Smith *et al*. 2013), however fishing effort is particularly concentrated > 150 boats per km^2 around the existing mussel farms and snapper is a popular targeted species.

The benthic substrate along the proposed port to mainland trajectory is predominantly fine mud with high clay content (NIWA 2005). Intertidal beaches are characterised by coarse shell and patches of fine mud. The coastal area encompassing Waimango Point is classified as CPA 2.

Effects associated with the construction and maintenance of Port 15A are likely to include:

- Disturbance to and/or slight modification of the subtidal benthic habitats within the proposed footprint.
- Potential fair-field benthic and water quality effects associated with disposal of dredge material.
- Increase in sediment contaminants (heavy metals, HMW PAH's etc) derived from port occupation/activities within the confines of the port through time.

- Change in water quality associated with construction and maintenance dredging, e.g., increase in sediment plumes which affects water clarity and productivity.
- Reduction/change in benthic diversity resulting from construction and maintenance dredging.
- Alteration to trophic functioning.
- Loss/change in foraging habitat for fish species such as snapper, flat fish, kahawai, kingfish and john dory.
- Increased potential for invasive species incursions.
- Restriction of fish movement within this section of the coast.
- Disruption to, or loss of, aquaculture activities along this section of coastline.

Effects associated with the proposed 14C connection routes are likely to include:

- Alteration to biodiversity and benthic community composition.
- Increase in benthic sediment contaminants (heavy metals HMW PAH's etc) along port to mainland connection routes.

23.4 Fish Species

23.4.1 Manukau Harbour

25 Fish species recorded

Recreational fishing data - Provided landings (number of fish killed) by recreational fishers from charter vessels, Nov 97 – Oct 98, for 7 selected species a.

Beach seine – Provided unpublished data on fish abundance from their surveys at Manukau (Francis and Morrison, unpublished data).

Beach seine/outrigger trawl - Numbers of fish caught at Pahurehure Inlet (37.03'S, 174.53'E) (1 km^2 tidal flat) by time of day and state of tide and size data (Morrison *et al.* 2002). Thirteen species of fish were caught by beach seines, and 17 species of fish and one squid by outrigger trawls. Table below from (Morrison *et al.* 2002).

TABLE 2. Overall numbers of fish caught by beach seine and outrigger trawl by time of day and state of tide

			Beach seine				Outrigger trawl				
			Day		Night		Day		Night		
Species	Family	Code	High	Low	High	Low	High	Low	High	Low	Total
Engraulis australis	Engraulidae	EAU	46	245	76	6	3695	487	2329	157	7041
Aldrichetta forsteri	Mugilidae	AFO	286	2049	775	81	160	184	228	387	4150
Acentrogobius lentiginosus	Gobiidae	ALE		389		1172	196	209	512	566	3044
Peltorhamphus latus	Pleuronectidae	PLA		124		850	3	18	207	76	1278
Mugil cephalus	Mugilidae	MCE	353	2	1			1	3	76	436
Rhombosolea leporina	Pleuronectidae	RLE	5	137	12	119	32	9	49	7	370
Rhombosolea plebeia	Pleuronectidae	RPL	8	82	10	135	41	2	21	5	304
Triplefin	Tripterygiidae	TRI		34		76	3	4	15	17	149
Hyporhamphus ihi	Hemiramphidae	HIH			7	1	5	2	11	3	29
Trachurus novaezelandiae	Carangidae	TNO			1				16	10	27
Sepioloidea pacifica	Sepiadariidae	SPA							11	4	15
Pseudocaranx dentex	Carangidae	PDE		3			3		1		7
Leptoscopus macropygus	Leptoscopidae	LMA		1		1				2	4
Anguilla dieffenbachii	Anguillidae	ADI				2			1		3
Genyagnus monopterygius	Uranoscopidae	GMO							3		3
Ophisurus serpens	Ophichthidae	OSE								2	2
Pipefish	Syngnathidae	SYN							2		2
Retropinna retropinna	Retropinnidae	RRE								1	1
Total			698	3066	882	2443	4138	916	3409	1313	16 866

Visual observations – Major spot for 7 gills sharks, great whites, spiny dogfish and bronze whalers. The size of the harbour and the feeding opportunities is probably why so many sharks are present (major nursery for snapper/gurnard). Great whites currently being satellite tagged in the Manukau - one 2.1m juvenile spent the 26 days the tag lasted within the Manukau Harbour (usually <3m) (6m white also caught in a net) (Clinton Duffy, pers. comm.).

23.4.2 Firth of Thames

21 Fish species recorded. Trawl data – The State of the Environment Report has a brief description of the Firth of Thames (Box 6.5). Here they cite a report by Lundquist *et al.* (2004) that mentions the Firth is a productive habitat for fish and a range of species is found, including: benthic soft-sediment feeders such as yellowbelly flounder (*Rhombosolea leporina*), dab flounder (*R. plebeia*), and short finned eel (*Anguilla australis*), snapper (*Pagrus auratus*), schooling fish such as yellow-eyed mullet (*Auchenocerus punctatus*), pilchard (*Sardinops pilchardus*), ahuru (*Auchenocerous punctatus*), and grey mullet (*Mugil cephalus*), and shark species which feed in the area (for example rig (*Mustelus lenticulatus*)) or use the Firth for birthing (rig, hammerhead (*Sphyrna zygaena*), bronze whalers (*Carcharhinus brachyurus*) and school sharks (*Galeorhinus galeus*) (Anon 2004).

Trawl data (NABIS) – Consistently good snapper catches recorded in this region with an average around 400 kg (max 1141 kg).

23.5 Areas of significance for coastal birds

The whole Manukau Harbour meets the RAMSAR criterion denoting international significance, as it regularly holds 20,000 or more water birds. It is one of the most important New Zealand summer sites for Arctic migrant wader species, particularly bar-tailed godwit and lesser knot. The Manukau Harbour also contains greater than 1% of the population and is one of the top ten wintering sites for the following indigenous shorebirds: New Zealand pied oystercatcher, pied stilt ((Not Threatened), black stilt (Acutely Threatened, Nationally Critical), and banded dotterel (Chronically Threatened, Gradual Decline). It is also known to hold greater than 1% of the total northern New Zealand dotterel (Acutely Threatened, Nationally Vulnerable) population outside of their breeding season. The Manukau Harbour is regarded as a critically important wintering site for wrybill (Acutely Threatened, Nationally Vulnerable), holding, at times, greater than 30% of the total population.

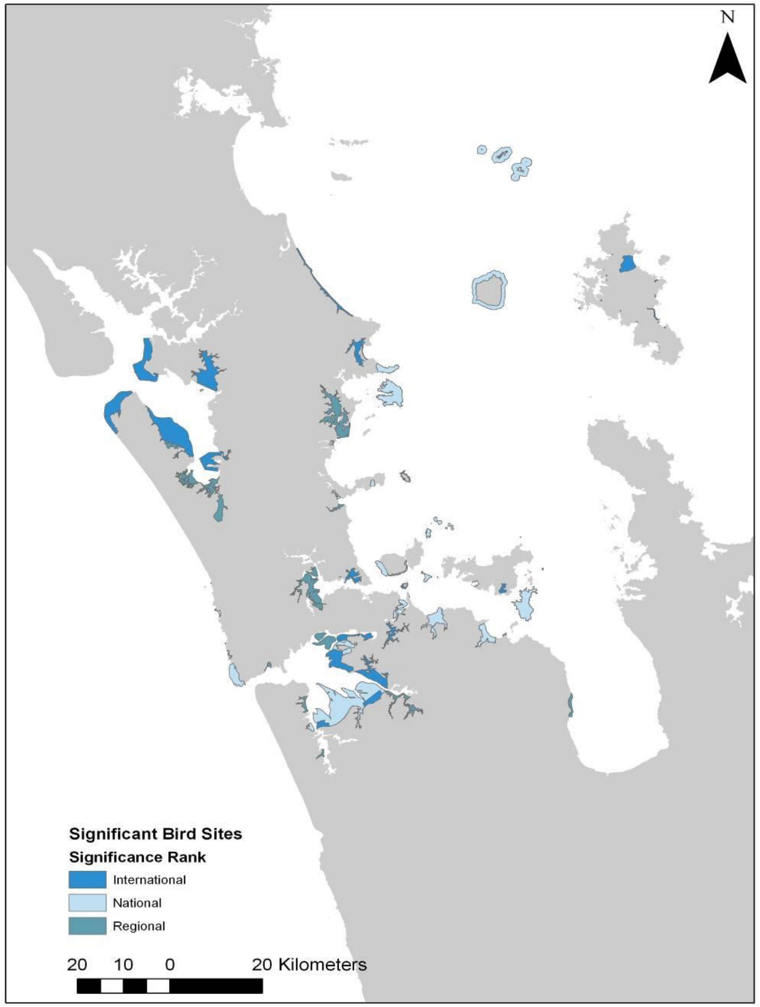
The Manukau's intertidal flats cover approximately 18,000ha when exposed at low tide, and are very important as foraging areas for shorebird species. There are a number of important high tide roosts around the harbour, including foreshore and shell banks at Karaka, the old Mangere sewage ponds, Puhinui, Clarks Beach, Ambury Park (all internationally significant) and Pollok Spit (nationally significant). At spring high tides, shorebirds at these roosts also utilise adjacent farmland.

Areas of saline vegetation are likely to provide habitat for cryptic marsh bird taxa such as Australasian bittern (Acutely Threatened, Nationally Endangered), banded rail, spotless crake, marsh crake, and North Island fernbird (all At Risk, Sparse). Spotless crake and North Island fernbird are known from Awhitu, although specific information is lacking on the distribution of many of these taxa throughout the Manukau.

At the entrance to the Manukau Harbour, northern New Zealand dotterels are known to breed around stream mouths flowing across the extensive areas of sand at Whatipu (nationally significant).

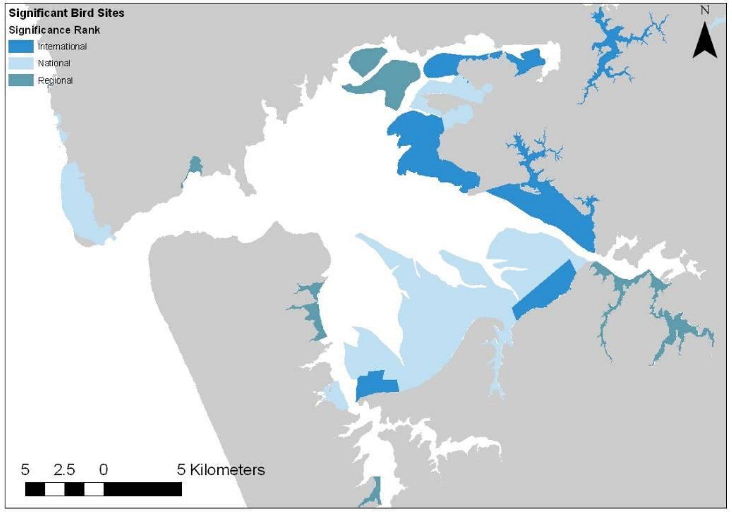
References: Dowding and Moore 2006, Melville and Battley 2006, ARC 2004, Parker 2004, Veitch and Habraken 1999, Cromarty and Scott 1995, DOC 1994.

Areas of significance to coastal birds[20]

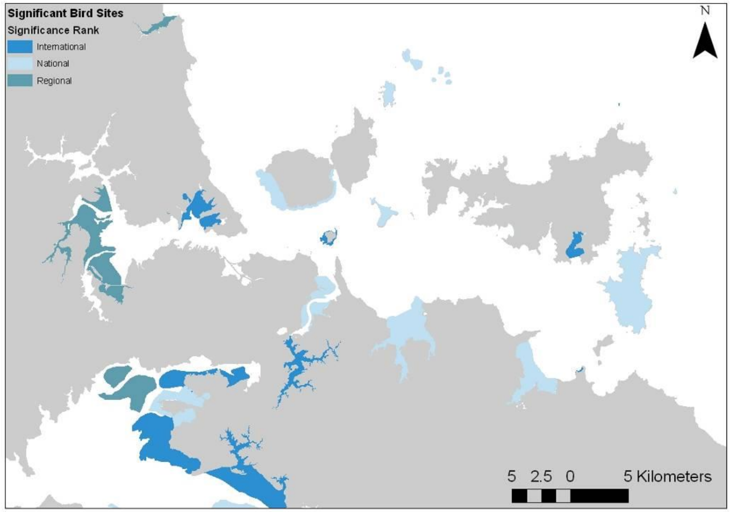


[20] The delineated areas depict the broader areas that are described in the results (namely, Kaipara Harbour, Manukau Harbour, the outer Hauraki Gulf and the inner Hauraki Gulf).

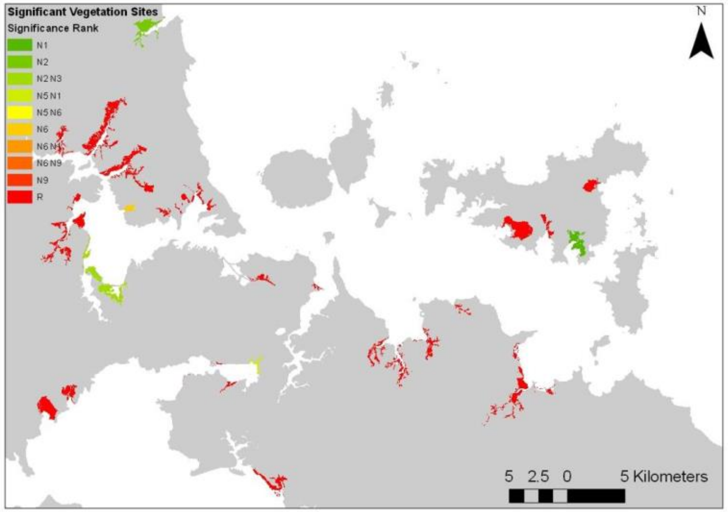
Areas of significance to coastal birds in the Manukau Harbour



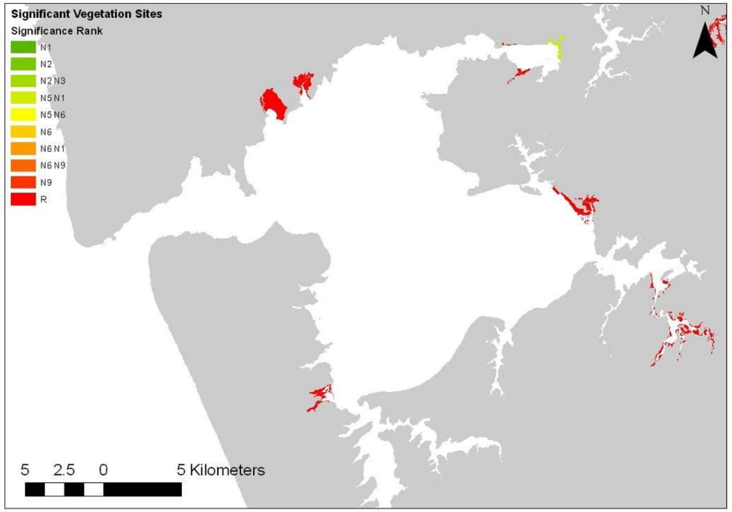
Areas of significance to coastal birds in the inner Hauraki Gulf



Areas of coastal vegetation with significance in the inner Hauraki Gulf



Areas of coastal vegetation with significance in the Manukau Harbour



24. Manukau Harbour Dredge Volumes

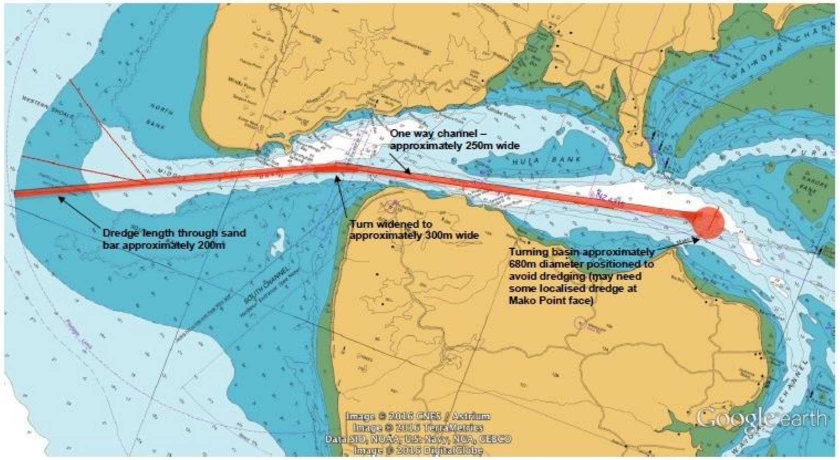
The digital bathymetry for Manukau Harbour (developed by Mead et al., 2007), was used to estimate the volumes of material that will require dredging for the navigation channels for the 3 Manukau Harbour options.

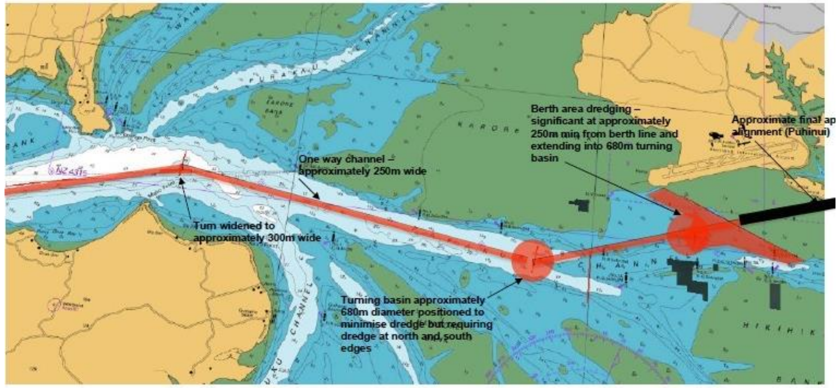
Assumptions:

- The digital data is only as good as the nautical chart, as so there are likely to be changes to the seabed and channels that are presently unknown;
- The uncharted area cross the bar was assumed to be a uniform 10 m deep (as in the digital chart);
- Channel slopes of 1:2.5 have been applied;
- Channel width of 250 m and turning circles of 680 m have been applied;
- Channel depth of 15.5 m has been applied, and;
- Channel lengths have been scaled from the maps below.

Sections of the channel were incorporated into a copy of the Manukau Harbour digital chart and compared against the existing chart (using Surfer surface analysis software).

Manukau Harbour Channel Route





Dredge volumes for sections of the channel route shown in the figure above:

Location	Volume m^3
Entrance Bar 2 km @ 10 m	2,840,750
2 km total comprising either side at 11-15.5 m	900,000
Total	**3,740,750**
Central turning circle	1,560
Hikihiki turning central ridge	68,000
Hikihiki turning south	465,000
Hikihiki turning north	96,000
Total	**629,000**
Puhinui channel (2.9 km)	8,702,944
Puhinui turning circle	5,116,252
Puhinui dock (4.1 km long @ 250 m wide)	16,380,013

Channel Depth

The Manukau Heads are well-known to be energetic and active, which means it is a very complex environment in terms of hydrodynamics and sediment transport. In the absence of field data and calibrated numerical modelling, there is limited information with which to determine the requirements for capital and maintenance dredging. The available information has been applied to provide an 'envelope' of potential requirements for the Manukau Harbour entrance channel:

- The minimum requirements based on the available information (existing dredge channels, bathymetric and sediment transport).
- The maximum requirements based on PIANC's (The World Association for Waterbourne Transport Infrastructure) methods to determine the theoretical size of an entrance channel and estimate channel maintenance volumes.

In terms of the minimum requirements for the channel dimensions, the following parameters were applied to determine the capital dredge volume as per our study but adapted slightly to account for flatter side slopes:

- Depth of 15.5m (other ports around New Zealand are currently deepening to 14.5m for the next generation of container vessels). Note, the tidal range at Manukau Heads is up to 3.5m.
- Channel width of 250m, with side slopes of 1:2.5.
- In addition, based on the nautical chart and the satellite imagery that is available for the Manukau Harbour entrance, it was assumed that the average depth across the ebb-tidal delta is 10 m (along a route of some 2 kilometres).

In terms of the maximum requirements for the channel dimensions, the following parameters were applied to determine the capital dredge volume using PIANC concept design guidelines without wider consideration of local factors and benchmarked operations at other New Zealand ports:

- Depth of 21.78m rounded to 22m (using PIANC, 2014) for all tide access (i.e. access management options are not considered).
- Channel width 343m (using PIANC, 2014), although 250m width at the bottom of the channel (as applied in the minimum options) is considered suitable (i.e. the width of the channel will be substantially greater at the level of the existing seabed), with side slopes of 1:5;
- A shallower average depth across the ebb-tidal delta was also applied (5m), based on a range of 2-8.0m depths across the proposed channel area; this is in relation to an historic nautical chart when the main channel was further north and so shallower than today through the middle of the bar (i.e. worst case).

The PIANC guidelines (2014) are well known in the industry to be highly conservative and are intended to provide only base figures which are then considered in the localised context and environment. Adopting the PIANC method greatly overstates the depth requirements for the Manukau channel and turning areas.

Whilst the Manukau Harbour is unique in terms of its comparison with the Waitemata Harbour for instance, it is more useful at an early study stage such as this to compare current operational depth at major New Zealand ports and then apply what is known to the specific Manukau location.

In simply following the PIANC guidelines, one is left with figures that are clearly overstated both in the local and international maritime context. In other words, the implementation of a 24m channel would be unheard of in a practical application.

As part of our study, we sensitivity tested for the PIANC guidelines and then considered more common sense parameters based on local conditions at Manukau and at major ports around New Zealand.

Whilst at this stage it is difficult to argue against the pure use of the PIANC guidelines, we stress that the upper limit figures provided are considered to be well beyond what is required.

The analysis of dredge volumes was undertaken using surface analysis software. Sections of the proposed entrance channel for both options were incorporated into a copy of the Manukau Harbour digital chart and compared against the existing chart. The results of the minimum and maximum assessment are presented in the table below:

Capital dredging requirements for the Manukau Harbour entrance channel[21]

Minimum requirements	
Location	**Volume m³**
Entrance Bar 2 km @ 10 m	2,901,250
2 km inside bar at 11-15.5	1,150312
Central Turning Circle	2,480
Total	**4,054,043**
Maximum requirements (old chart)	
Location	**Volume m³**
Entrance Bar 2 km @ 5 m	11,390,000
3 km inside bar @ 10-24 m	8,400,000
1.5 km outside bar @ 10-24 m	1,515,000
Central Turning Circle	2,480
Total	**21,307,480**
Maximum requirements (current chart)	
Location	**Volume m³**
Entrance Bar 2 km @ 10 m	7,440,000
3 km inside bar @ 10-24 m	8,400,000
1.5 km outside bar @ 10-24 m	1,515,000
Central Turning Circle	2,480
Total	**17,357,480**

[21] Considers the minimum volumes (best case scenario) and maximum volumes (conservative/worst case scenario). The conservative scenario has been considered with the current nautical chart as well has a historic nautical chart when the main channel was further north and so shallower than today through the middle of the bar (i.e. worst case).

Inner Channels and Docking

Similar to the two scenarios considered for the outer entrance channel, the inner channel has been considered with:

- Depth a minimum required depth of 15.5m.
- A maximum concept design depth of 18m from the PIANC guidelines (rounded up from 17.8m).
- Channel width of 250m, with side slopes of 1:2.5 for both cases.

Note, no dredging is required between the central Manukau turning circle and the Hikihiki site. The volumes for these scenarios are presented in the tables below:

Capital dredge volumes for minimum and maximum channel requirements for the Hikihiki and Puhinui sites

Minimum requirements	
Hikihiki Turning Circle	
Central ridge	68,000
South	465,000
North	96,000
Total	**629,000**
Minimum requirements	
Puhinui Channel and Dock	
Channel (2.9 km)	8,702,944
Turning	5,116,252
Dock (4.1 km @ 250 m wide)	16,380,013
Total	**30,199,208**

Maximum requirements	
Hikihiki Turning Circle	
Central ridge	89,250
South	540,000
North	126,000
Total	**755,250**
Maximum requirements	
Puhinui Channel and Dock	
Channel (2.9 km)	11,724,250
Turning	5,873,712
Dock (4.1 km @ 250 m wide)	19,557,000
Total	**37,154,962**

The total volume range for capital dredging for the 3 potential docking sites are presented in the table below:

Total capital dredge volumes for minimum and maximum channel requirements.

	Dredge Scenario (m^3)		
Port Option	Minimum	Max current chart	Max Old chart
Central Site	4,054,043	17,357,480	21,307,480
Hikihiki Site	4,683,043	18,112,730	22,062,730
Puhinui Site	34,882,252	55,267,692	59,217,692

Maintenance Dredging

With respect to maintenance dredging:

- The minimum requirement considers alongshore sediment transport calculations and dredging volumes for other entrance channels around New Zealand.
- The maximum requirement considers the PIANC (2014) estimate of 10-15 % of the capital dredging volume.

As above, without in depth investigations, it is difficult to determine what volumes of maintenance dredging will be required. Sediment transport on Auckland's West Coast is dominantly from south to north, driven by the predominant wind and wave climate from the southwest – occasional reversals occur during northwest wind and wave conditions. Various estimates have been made with respect to the net sediment transport to the north that range from 175,000-275,000m^3/yr (Gibb, 1989; McComb, 2001: Phillips, 2005). Southward reversal of sediment transport during northwesterly events has been estimated at around 100,000m^3/yr, with total gross sediment transport rate across the harbour entrance (in both directions) is likely to be of the order of 275,000-375,000m^3/yr (Mead *et al*., 2010). In simple terms, this is the amount of sediment that is moving along the coast, or across the ebb-tidal delta (north and south), and could be captured and require maintenance dredging. It is noted that there are other processes also occurring in the harbour entrance that are not including in this type of assessment (e.g. sand moving in and out of the harbour, both transient on its way along the coast, sand moving in and staying in the harbour (sink) or potentially moving out of the harbour (source), although these can't be assessed without an in depth investigation.

Further considerations are dredging volumes that are currently removed for maintenance around New Zealand. Although Port Taranaki in New Plymouth is relatively sheltered in comparison to the Manukau Harbour Entrance, due its orientation to the predominant swell direction, there is a high potential for sediment transport from the southwest to the northeast since it is relatively oblique to the incident wave direction. Port Taranaki dredged 1.3Mm^3 of material from the entrance channel between 1989 and 1998, some 145,000m^3/yr (McComb and Black, 2000). While McComb (2001) calculated that sediment transport in the area was of the order of 220,000m^3/yr. Similarly, at Port Otago some 500,000m^3/yr of gross sediment transport has been previously calculated, although around 200,000-250,000m^3 of entrance channel maintenance dredging will be required each year with the 14 m deep entrance channel (P. McComb, pers. comm.). Thus, less material that transported across the channel required dredging.

By comparison, Tauranga Harbour requires in excess of 200,000m^3 of maintenance dredging on average per annum, although the net sediment transport is only of the order of 68,000-77,000m^3/yr (either southeast or northwest, depending on whether El Nino or La Nina is dominating). The volume of dredging required is substantially greater than the volume of gross sediment transport along this coast (e.g. ~211,000m^3 to the northwest and 114,000m^3 to the southeast during El Nino conditions (Mead et al., 1998). This also represents less material that transported across the channel required dredging.

The annual dredging volumes at other locations around New Zealand suggest that dredging requirements of 275,000 to 375,000m^3/yr are feasible. Note, 375,000m^3/yr is comparable to 10% of the capital dredge volume (PIANC, 2014), which would be 405,000m^3/yr.

When the PIANC (2014) method is applied, annual maintenance dredge volumes of 2,489,000 to 3,733,500m^3 are indicated. While there are multiple processes occurring at the entrance of the Manukau Harbour, it is unlikely that these volumes of material would accumulate in a dredged channel in a single year. These volumes are likely substantially higher than reality, although in the absence of an in depth investigation present an upper limit based on the PIANC (2014) methods.

Potential impacts of the channel entrance include disruption of alongshore sediment transport, which may impact negatively on beach health. Although it would be difficult to attribute cause and impact on a yearly basis in such a complex and active system, ongoing removal of sand from the system (i.e. captured within the channel) would likely lead to chronic impacts. This can be managed by determining which direction sediment was being transported when it was captured (north or south) and disposing of the required proportion of dredged material to dedicated sites to the north and south of the channel. Given the distance offshore of the channel from the entrance into the harbour, the existing depth of the natural channel, the dominance of northern sediment transport and the geology of the northern inner entrance to the harbour (i.e. cliff and boulder beaches), as well as through the processes of refraction, it is unlikely that proposed channel would have an impact inside the harbour due to wave-penetration.

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25. Maori Values Framework

The purpose of this Appendix is to evidence the range of Māori values considered and discussed with Mana whenua members who participated in the discovery process for the benefit of the CWG. This Appendix is not exhaustive or definative and a full Culutral Values Impact Assessment is required if any of the sites progress.

Māori values are instruments by which Māori people view/interpret/experience and make sense of the world (Marsden 1988) and are derived from Māori beliefs. While there may be variation in the specific value attributes at the community level there are a number of universal values and beliefs that will apply to each of the proposed sites. These universal values apply to land, water, and air and are essential ingredients of a Māori world view.

	Definition	Application
Mana	Prestige, authority, control, power, influence, status, spiritual power, charisma - mana is a supernatural force in a person, place or object. Mana goes hand in hand with tapu, one affecting the other. The more prestigious the event, person or object, the more it is surrounded by tapu and mana. Mana is the enduring, indestructible power of the atua and is inherited at birth, the more senior the descent, the greater the mana. The authority of mana and tapu is inherited and delegated. Mana gives a person the authority to lead, organise and regulate communal expeditions and activities, to make decisions regarding social and political matters. A person or tribe's mana can increase from successful ventures or decrease through the lack of success. The tribe give mana to their chief and empower him/her and in turn the mana of an ariki or rangatira spreads to his/her people and their land, water and resources. Almost every activity has a link with the maintenance and enhancement of mana and tapu. Animate and inanimate objects can also have mana as they also derive from the atua and because of their own association with people imbued with mana or because they are used in significant events. There is also an element of stewardship, or kaitiakitanga, associated with the term when it is used in relation to resources, including land and water.[22]	The preservation of mana by both respecting the views of mana whenua Iwi and giving them a space to voice their perspective as members of the CWG mantains the status of mana whenua Iwi and their importance to this discussion. Furthermore this recognses the importance of mana whenua Iwi input into the CWG process. The establishment of the present Port has impacted, and any future port will impact, upon the mana of the mana whenua Iwi. Whether this results in a gain in mana or a reduction in mana will depend upon the weight that is applied to the views, expectations and aspirations of the mana whenua. Success, from a mana perspective, for some mana whenua Iwi in terms of the present site equals restricting the present Port to its current footprint and the eventual closure of large parts of the Port. Success from the perspective of other mana whenua Iwi could also be preventing the existing Port from moving into their rohe. Building a new port will create additional ecomonic benefits to any area. While new shipping technology will reduce further the need for labour, new roading infra-structure and construction of the new port itself will bring with it consequential commercial and economic development opportunities together with associated social development opportunities. The link between the prosperity (wealth, health, education and environmental) of tribes and their mana is longstanding and therefore some Iwi may view the build of a new port as a positive opportunity for local development that is mana enhancing.

[22] http://maoridictionary.co.nz/search?idiom=&phrase=&proverb=&loan=&histLoanWords=&keywords=mana

	Definition	Application
Tapu	Restriction, prohibition - a supernatural condition. A person, place or thing is dedicated to an atua and is thus removed from the sphere of the profane and put into the sphere of the sacred. It is untouchable, no longer to be put to common use. The violation of tapu would result in retribution, sometimes including the death of the violator and others involved directly or indirectly. Appropriate karakia and ceremonies could mitigate these effects. Tapu was used as a way to control how people behaved towards each other and the environment, placing restrictions upon society to ensure that society flourished. Making an object tapu was achieved through rangatira or tohunga acting as channels for the atua in applying the tapu. Members of a community would not violate the tapu for fear of sickness or catastrophe as a result of the anger of the atua. Intrinsic, or primary, tapu are those things which are tapu in themselves. The extensions of tapu are the restrictions resulting from contact with something that is intrinsically tapu. This can be removed with water, or food and karakia. Because resources from the environment originate from one of the atua, they need to be appeased with karakia before and after harvesting. When tapu is removed, things become noa, the process being called whakanoa.	Tapu (and noa) are important binary forces within the world of Māori. When tapu is applied to an area the site is often referred to as a wahi tapu (a scared place). Waihi tapu are often highly personal to the local people and place, and are significant to them. Making public or exposing the waihi tapu can remove the tapu of an area and interfere with the privacy inherently required of some waihi tapu.[23] For Maori, wahi tapu is an "umbrella term" that applies not only to urupa (burial grounds) but other places that are set apart both permanently and temporarily. These include places associated in some way with birth or death, with chiefly persons and with traditional canoe landing and building places. Temporary tapu (rahui) are usually imposed and removed on hunting or fishing grounds or cultivations to conserve and protect the resource. They also include places associated with particular tupuna and events associated with them.[24] The importance of wahi tapu is recognised in several pieces of legislation including the Resource Management Act 1991. Section 6(e) of the Act states all persons exercising functions and powers under the Act, in relation to managing the use, development, and protection of natural and physical resources, shall recognise and provide for the national importance of the relationship of Maori and their culture and traditions with their ancestral lands, water, sites, waahi tapu, and other taonga. While it is not appropriate to set out in this report the areas of wahi tapu that exist in the proposed sites we not that such a delicate exercise will be required during any future plannign phases.
Kaitiakitanga	Guardianship, stewardship, trusteeship, trustee, trust – often expressed as a duty over resources (i.e. land and water) and people.[25]	Kaitiakitanga and mana are intertwined principles that in practice reinforce the ability people to tangibly exercise this principle or value. The inability of a group to exercise kaitiakitanga can be interpreted as the diminuition of mana. For example for the people of Whatapaka marae flounder is a reknowned food resource which is provided at special occasions to mark their significance. This resource has become over the centuries synomounous with the identity of Whatapaka. To lose this resource could suggest that the ability to act as kaitiaki has been ineffecive.

[23] http://www.justice.govt.nz/tribunals/waitangi-tribunal/Reports/wai0038/ch6_06 - Te Roroa Claim

[24] http://www.justice.govt.nz/tribunals/waitangi-tribunal/Reports/wai0038/ch6_05 - Te Roroa Claim

[25] http://maoridictionary.co.nz/search?idiom=&phrase=&proverb=&loan=&histLoanWords=&keywords=kaitiakitanga

	Definition	Application
		Moreover losing the ability to harvest flounder would be to lose an important marker of their identity as a people. Based on the Māori world view humans are one part of the natural world, kaitiakitanga is how Māori traditionally exercised their obligations to manage the environment. Examples of this in practice include: • temporary bans (rāhui) on taking food from an area • using the lunar calendar (maramataka) to decide when to plant and harvest • take only what is needed • hunt and fish only for food, not as sport
Whānaungatanga	Relationship, kinship, sense of family connection - a relationship through shared experiences and working together which provides people with a sense of belonging.[26]	Whanaungatanga is an important value – which in this tribal context is based both on actual kinship ties and also, just as importantly, a shared tribal experience and broader Maori history across New Zealand. Indeed this notion of whanaungatanga also extends internationally to other indigenous peoples. This deep concept of shared experiences and networked relationships is a powerful binding infleunce that quickly allows the power of shared histories and knowledge to create long lasting values based relationships. Whanaungatanga will be impacted in two macro ways – by mana whenua iwi showing a preference that is contrary to the views of the affected mana whenua iwi. For example for the current port to remain in central Auckland or conversly by preferring that a new port is built there is displacement affect that will impact on mana whenua iwi. Conversly, at this macro level whanaungatanga will not impacted if a mana whenua iwi clearly asks for new port (and no other mana whenua iwi takes the same stance).

[26] http://maoridictionary.co.nz/search?idiom=&phrase=&proverb=&loan=&histLoanWords=&keywords=whanaungatanga

	Definition	Application
Whakapapa	Genealogy, genealogical table, lineage, descent - reciting whakapapa was, and is, an important skill and reflected the importance of genealogies in Māori society in terms of leadership, land and fishing rights, kinship and status. It is central to all Māori institutions. There are different terms for the types of whakapapa and the different ways of reciting them including: tāhū (recite a direct line of ancestry through only the senior line); whakamoe (recite a genealogy including males and their spouses); taotahi (recite genealogy in a single line of descent); hikohiko (recite genealogy in a selective way by not following a single line of descent); ure tārewa (male line of descent through the first-born male in each generation).[27]	Whakapapa (and kaitiakitanga) is the platform upon which tribal associations and traditional practices to an an area are built. This association is shown for example in tribal sayings that references land marks or refer to the natural environment as being that same as the people. Modern day activities can impact upon this relationship. Ngāti Whātua spoke of the severing of their relationship to areas through port activities in the Waitematā. , In the Manuka Harbour, for example, members from Pukaki marae spoke of the impact of the airport and sewerage plant on their relationship to areas of the foreshore and seabed. Importantly, future approaches should try and mitigate these impacts.
Manaakitanga	Hospitality, kindness, generosity, support - the process of showing respect, generosity and care for others.[28]	The ability of tangata whenua to practice manaakitanga is very important. An inability to undertake this practice with respect to manuhiri (visitors) is seen as an afront and can impact negatively on the mana of those tangata whenua.
Rangatiratanga	Chieftainship, right to exercise authority, chiefly autonomy, chiefly authority, ownership, leadership of a social group, domain of the rangatira, noble birth, attributes of a chief. Kingdom, realm, sovereignty, principality, self-determination, self-management - connotations extending the original meaning of the word resulting from Bible and Treaty of Waitangi translations.[29]	In the context of this study, rangatiratanga relates to the the ability of mana whenua to exercise their chiefly autonomy over their respective tribal domains. The systematic infrastructure development in the Manukau and Waitematā Harbours to date has taken away the ability for mana whenua in and around those harbours to exercise their rangatiratanga. If not managed effectively, proposed port construction will have a similar effect.

[27] http://maoridictionary.co.nz/search?idiom=&phrase=&proverb=&loan=&histLoanWords=&keywords=whakapapa
[28] http://maoridictionary.co.nz/search?idiom=&phrase=&proverb=&loan=&histLoanWords=&keywords=manaakitanga
[29] http://maoridictionary.co.nz/search?idiom=&phrase=&proverb=&loan=&histLoanWords=&keywords=rangatiratanga