Date:	**Wednesday 6 July 2016**
Time:	**9.30am**
Meeting Room:	**Reception Lounge**
Venue:	**Auckland Town Hall** **301-305 Queen Street** **Auckland**

Auckland Development Committee

OPEN ATTACHMENTS

ATTACHMENTS UNDER SEPARATE COVER

ITEM	TABLE OF CONTENTS	PAGE
16	**Port Future Study**	
	A. Port Future Study: Consensus Working Group Recommendations report - July 2016	3
	B. Consultants' report to the Port Future Study - July 2016	31
	C. Appendix to the Consultants' report to the Port Future Study - July 2016	265

Note: The attachments contained within this document are for consideration and should not be construed as Council policy unless and until adopted. Should Councillors require further information relating to any reports, please contact the relevant manager, Chairperson or Deputy Chairperson.

PORT
FUTURE STUDY
July 2016
Recommendations report of
the Consensus Working Group

Item 16

Attachment A

Table of Contents

3 List of figures
3 Glossary
5 Executive summary
7 Introduction
9 Study process
9 Study design
10 Member selection process
10 Reference Group
10 Consensus Working Group
11 Study scope
12 Methodology
13 CWG information gathering
13 Testing of outputs with Reference Group
13 Consultant's paper
15 Growth of Auckland's port
18 Two options for locating a new port
21 Expand or move?
22 Timing of a move
24 Conclusions and recommendations
26 Consensus Working Group members

List of figures

4 *figure one:* Waitematā Harbour and the port
9 *figure two:* Study timeline
12 *figure three:* Consensus Working Group Methodology
16 *figure four:* Waitematā shoreline section - 1840
19 *figure five:* Long list options
21 *figure six:* Short list options

Glossary

ADC	Auckland Development Committee (committee of Auckland Council)
ATAP	Auckland Transport Alignment Project
ATEED	Auckland Tourism, Events and Economic Development
CBA	Cost Benefit Analysis - *analysis that aims to assess the value of a project or competing projects on a quantitative basis*
CBD	Central Business District (in city centre)
Current footprint	Fergusson Terminal plus Freyberg, Jellicoe, Bledisloe, Marsden, Captain Cook Wharves, including what is currently consented as at July 2016.
CWG	Consensus Working Group
EY	Ernst & Young, trading as EY
GDP	Gross Domestic Product
ILM	Investment Logic Map - *output of workshops which bring together key stakeholders to ensure early agreement on problems, outcomes and benefits before any investment decisions are made or a specific solution is identified*
MCA	Multi Criteria Analysis - *analysis which assesses potential options against a set of qualitative criteria to identify those which would give the better outcomes.*
NPV	Net Present Value
NZTA	New Zealand Transport Agency
PFS	Port Future Study (The Study)
PIANC	World Association for Waterbourne Transport Infrastructure
POAL	Ports of Auckland Limited
PAUP	Proposed Auckland Unitary Plan
RG	Reference Group
Term	Short: 2015-2040, medium: 2040-2065, long 2065 onwards
TEU	Twenty-foot Equivalent Unit - the nominal standard intermodal container

figure one: Waitematā Harbour and the port

source: POAL port booklet 2014

Executive summary

The Port Future Study's objective is to recommend a long term strategy for the provision of facilities to accommodate sea-based imports and exports and the cruise industry flowing to and from Auckland and its wider region in an economically, socially, culturally and environmentally acceptable manner, taking into account competing uses for city centre waterfront space and the various impacts of options.

The Study was designed by and conducted for Auckland Council. The design called for an independent Consensus Working Group (CWG) to develop recommendations. The CWG provided information to a Representative Group (RG) comprising stakeholders and iwi representatives and received their guidance. A consulting study led by EY was conducted to identify and assess the options. This report should be read in conjunction with the Consultant's report.

Three issues were agreed by the CWG as foundations for the Port Future Study:

1. Capacity will constrain the port's ability to meet future freight and cruise demands, which may limit economic growth in the long term
2. Tension between, and competition for, limited resources for the CBD and POAL will lead to sub-optimal outcomes for one or both
3. Port activities create environmental, economic, social and cultural impacts which need to be understood and addressed

The Port Future Study found that:

In considering the options; 1) constrain the port, 2) downsize the port, 3) relocate trade volume, 4) grow the port, 5) build a new port, the CWG key findings reached by consensus are:

- Based on EY's findings, the existing Port will not be able to accommodate the long term freight task and cruise on the current footprint.
- That no further reclamation beyond what is already consented in the port precinct is required for freight purposes in the short to medium term.
- There is a need to secure sufficient berth length in the multi-cargo area for the short to medium term.
- Short-term pathways need to be created to enable the Port to continue to operate efficiently prior to a planned new Port being established due to the substantial lead times involved. In this regard, the CWG identifies that additional berth length needs to be provided to fulfil the short and medium term capacity requirements of the Port in response to cruise and multi-cargo requirements.
- Retaining the bulk of port functions provides a more feasible and superior outcome for Auckland, rather than shedding cargo elsewhere or downsizing Auckland's freight task, in the short to medium term. Shedding or downsizing freight operations may weaken the case for moving the port.
- In the long term, other existing North Island ports will be unable to cope with the totality of the Auckland freight task together with their own capacity requirements
- Cruise industry facilities should be retained and improved in Auckland's city centre
- Two possible new port locations - Manukau Harbour and Firth of Thames - have been identified as warranting more detailed investigation
- The triggers for a move would comprise economic, social, environmental and cultural triggers that make a move beneficial or demand/economic triggers that make a move necessary to achieve long term outcomes for Auckland.

Item 16

Attachment A

The CWG's recommendations to Auckland Council are the following:

Note, the CWG's recommendations are offered as an integrated package. Adopting some recommendations while not implementing others could result in adverse unintended consequences.

1. **A port relocation option is established for freight, noting:**
   - If the port is moved, then cruise ships should continue to be accommodated near the CBD
2. **Comprehensive investigation of the identified location area options - Manukau Harbour and the Firth of Thames - is undertaken to decide which specific option is chosen, noting:**
   - Investigation to identify the specific relocation option should include consideration of at least:
     - The long term engineering requirements, navigability, safety and availability of the Manukau and Firth of Thames options
     - The effect of a west coast versus east coast location on shipping and the competitiveness of the Auckland port and the national supply chain
     - The wider and long term implications of west coast versus east coast locations including on Auckland's long term transport strategy, land use development, land-side freight routes and the potential for a super-port
     - Mana whenua values, views and opportunities for each of the potential sites identified
     - The environmental impacts of the new site and analysis of consenting pathways
     - How and when any new port could be funded
3. **Regular monitoring of relocation triggers is undertaken to identify the time at which the port relocation option should be exercised, noting:**
   - The port may move when the social, environmental, cultural, economic, urban development or other conditions indicate that moving the port is **beneficial** for the city centre, or Auckland or New Zealand
   - The port may move when expected demand growth, expected capacity growth and the time required to complete the move indicate that moving the port has become **necessary**
   - It is possible that Auckland's future unfolds in a way that neither of the triggers for the beneficial or necessary cases will be "pulled", which would mean that the port would accommodate long-term demand at the current site
4. **Subject to confirmed and credible commitment to establishing a port relocation option and to establishing sufficient additional berth length to accommodate expected growth in large cruise and multi-cargo vessels, the port should not expand beyond its current footprint, noting:**
   - The work done so far for the Central Wharves Strategy implies the need for additional cruise berths and the Consultant's report endorses POAL's case that additional long berths are required to accommodate expected short and medium-term growth in cruise and multi-cargo operations
   - The Consultant has recommended a northern east-west berth at Bledisloe Wharf and the CWG is in agreement that a northern berth presents a viable short-term option. Exact specifications to meet future berth demand will be worked through.
   - The CWG recognises mana whenua and community opposition to any further extension of port operations into the harbour and that deciding the plan to provide the required berth capacity will require rigorous identification and evaluation of alternative options
   - The Port Future Study is a study to provide a long-term strategy for the location of the port and there are established processes for short-term berth provision decisions

Introduction

Trade is critical to Auckland's prosperity. New Zealand is a small, isolated trading nation and most international trade is by sea. The Auckland port has been and remains a very important contributor to the economic well-being and growth of Auckland and of New Zealand.

The first elements of Auckland's port as we see it today were established in the mid-to-late 1800's, however Tāmaki harbours had been plied by waka for many years before that. The confluence of people and trade in the area led to it also being known as Tāmaki Herenga Waka - Tāmaki the gatherer of many canoes.

The city of Auckland began to grow around the early port wharves in Commercial Bay and later expansion along the waterfront on land reclaimed from the Waitematā. Having the port adjacent to the city centre was important when the city was small and freight mobility limited. As Auckland has grown, the source and destination of freight shipments has spread out and is becoming more concentrated in the southern parts of the city.

In recent decades the CBD has become a commercial and consumption centre. The CBD, waterfront and Waitematā Harbour provide recreational opportunities for residents and visitors and contribute to liveabilty. The CBD is expected to grow in population and tourism numbers are projected to increase.

The growth of trade alongside growth of the inner city communities and increasing recreational use of the harbour has led to tension between the port and the community. This tension 'boiled over' with the 2015 proposal by POAL to extend Bledisloe Wharf 98 metres out into the harbour. Expansion was stopped by a High Court action bought by Urban Auckland.

That tension has contributed to the Port Future Study being commissioned by Auckland Council and to the Study's scope including the social, cultural and environmental impacts of location options.

With Auckland's population projected to grow to around 2.5m people in the next 50 years, the question of how growth in trade will be accommodated is critical to Auckland's economic future. Auckland scores very well on the natural and physical environment dimensions of liveability but less well on economic performance. Economic success is important for the well-being of the growing population and for affordability of the infrastructure that will be needed to keep the city operating effectively. However, economic success that diminishes liveability, is inconsistent with cultural and social values and harms the environment is likely to be a short -lived success.

Auckland Council has several key responsibilities relevant to the port's future. It is the owner of the port via Auckland Council Investments Limited; an important regulator via the district plan and granting of consents; and the shaper of the urban form via the Auckland Plan and other planning processes.

Auckland Council is also the delegated agent for ensuring that the Crown's statutory obligations to Māori under the Treaty of Waitangi are given effect to or taken into account. Auckland Council is the steward for the cultural, environmental, social and economic sustainability of Auckland, and the Study's recommendations recognise and highlight port issues which impact the relationships among citizens, ratepayers, residents, mana whenua, visitors, and customers of Auckland.

Item 16

Attachment A

Auckland must develop long term investment strategies for critical infrastructure in circumstances where the investment decisions, once made, require large and irreversible capital commitments with important cultural, social and environmental consequences. The provision of future port facilities is one example. Auckland must decide soon how to provide for the future growth of port capacity and about the implications of that long term strategy for short term port development plans. The CWG's recommended long term port strategy is being developed in the context of a great deal of uncertainty about future freight demand and technology potential, alongside strong community group advocacy for constraining port expansion, relocating the port and using the site currently occupied by the port for other uses. Modern port redevelopments usually introduce a mix of residential, commercial and amenity uses.

The challenge for the Port Future Study is to find the best port location solution that balances long term economic, cultural, social and environmental outcomes. The economy and people of Auckland depend on trade but modern industrial ports have adverse cultural, social and environmental impacts.

Three issues were agreed by the Consensus Working Group as foundations for the Port Future Study:

1. Capacity will constrain the port's ability to meet future freight and cruise demands, which may limit economic growth in the long term
2. Tension between, and competition for, limited resources for the CBD and POAL will lead to sub-optimal outcomes for one or both
3. Port activities create environmental, economic, social and cultural impacts which need to be understood and addressed

In leading the Port Future Study, the Consensus Working Group has been conscious of its accountability to the people of Auckland, and that, while noting the scope was limited to accommodating Auckland's freight and cruise task, the Study's recommendations may have effects on the wider region and on New Zealand as a whole.

If the port location decision was simple, then the solution would have emerged already from the many studies conducted previously. Many people we have spoken with and heard from during the course of the study have expressed confidence that they have the answer and have offered reasons for their proposed solutions. The solutions proposed and reasons offered are diverse and the thing they have most in common is the confidence with which they are expressed. As the CWG has developed shared understanding of the port location issues we have found that the issue is complex and multi-faceted, and that decisions must be made soon in the context of uncertainties that cannot yet be resolved.

Further, all of the feasible options identified in the Study would require material expenditure and would have harmful cultural, social and environmental impacts. The challenge is to find the best solution that protects future trade and cruise security, best realises the aspirations of Aucklanders and contributes to the vision of being the World's most liveable city, with the least cost and harm.

Study process

Study Design

The Auckland Council designed the Port Future Study as a Māori and stakeholder collaborative process to develop and recommend a strategy to accommodate Auckland's long-term future freight and cruise needs.

A Consensus Working Group (CWG) and larger Reference Group (RG) have been the vehicles for this collaborative process. Both groups have been led by an external Independent Chair and were without council officer or elected representative representation.

The CWG was resourced to engage consultant expertise to assist in evidence gathering and recommendation formulation. In this way, the Study was effectively 'handed over' to community, advocacy, business and iwi interests for the development of recommendations to Council.

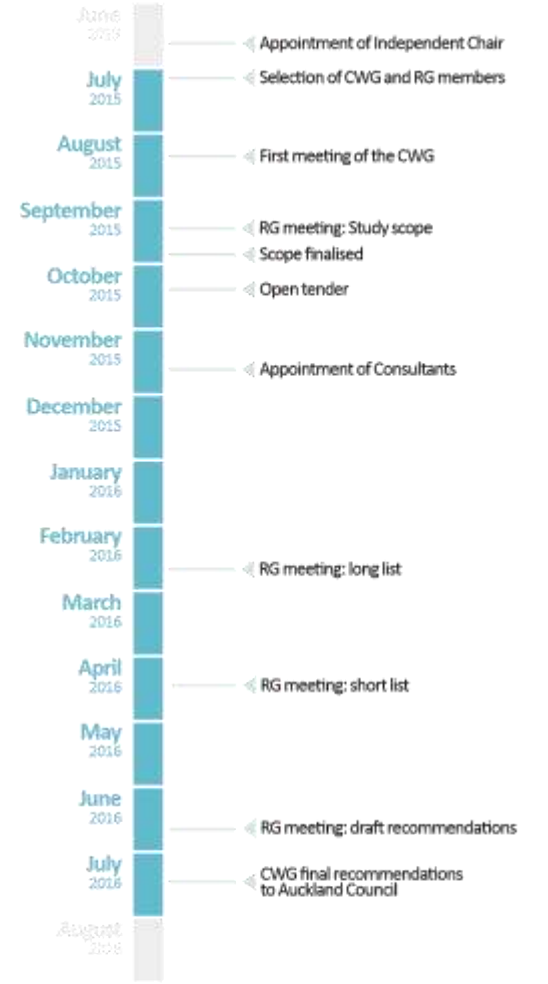
The CWG is required to provide its recommendation to the Auckland Development Committee of the Auckland Council. The CWG has worked together to understand the issues, invited presentations from external organisations, met with the RG and reviewed the evidence and conclusions from the Consultant's report in order to develop its' own conclusions and recommendations.

The Port Future Study is a study and it was not mandated to conduct a consultation or take decisions but rather to provide recommendations on a long term strategy to council for consideration. Further investigative, consultative and regulatory work will be required before the recommended strategy to secure the long term future for freight and cruise could be implemented.

The CWG is aware that there are several investigative and decision processes in progress that are considering matters that could interact with or affect the Port Future Study's conclusions. Auckland Transport Alignment Project (ATAP), the Central Wharves Strategy, Proposed Auckland Unitary Plan (PUAP) and Sea Change – Tai Timu Tai Pari are examining infrastructure issues which connect with those considered within the Port Future Study

Figure two presents the Port Future Study timeline

figure two: Study timeline



Item 16

Attachment A

Reference Group Member Selection

The purpose of the RG was to represent and report to stakeholders and iwi during the study, receive updates from the CWG and undertake work if required by the CWG.

The PFS was established in the context of the partnership between Auckland Council and Iwi within the framework of the Treaty of Waitangi which includes active mana whenua involvement in co-governance of wahapū (harbours) and in guardianship (Kaitiakitanga) of land and marine resources as well as recognising the interests of Māori in economic and social development.

Two separate selection processes ran in parallel at the outset of the study that reflected both stakeholder and mana whenua interests in the project. Stakeholder organisations were identified by council project staff and initially presented to the ADC on 14 May 2015, leading to the selection by those organisations of 64 individuals representing 46 organisations from environmental advocacy, businesses that trade directly and indirectly with the port, community groups, recreational marine groups, special interest groups, commercial interest groups and POAL. Mana whenua iwi chairs met with Mayor Len Brown 14 July 2015 to determine mana whenua participation in the study. At the meeting, iwi chairs offered representatives of the 13 iwi of the Tāmaki Collective as well as Waikato-Tainui as the vehicle for mana whenua membership of the RG, which resulted in 15 individuals joining the RG leading to a total of 79 RG members.

Officers and elected representatives were not invited to participate as members of the RG as it was decided that governance functions and responsibilities would play out after the study, following the reception of the CWG's recommendations to council.

The CWG distributed information to and met with the RG to receive feedback on the process and emerging conclusions. The RG met with the CWG on 30 September 2015, 19 February 2016, 13 April 2016 and 15 June 2016. Attendances at meetings reflected turnout of 30-40%.

Consensus Working Group Member Selection

The CWG was tasked with steering the Study, engaging and directing consultants and testing outputs with the RG. The CWG's ultimate purpose was to further their collective understanding of the issues and formulate recommendations, by consensus, for a long term strategy to accommodate Auckland's trade and cruise task.

Collaborative process theory suggested groups of around 12-16 members were optimal. In order to be most effective, CWG membership was to be representative of diverse perspectives. Four CWG seats were reserved for mana whenua representatives. One seat was reserved for the CEO of POAL. Eleven seats were made available for representatives from stakeholder organisations. Members were expected to act as representatives for their organisations as well as for other RG members who were not selected for CWG membership.

At their meeting with the Mayor on 14 July 2015, mana whenua offered the three iwi groupings of the 13 Tāmaki Collective as the mechanism to select CWG mana whenua representatives. A representative from Waikato-Tainui was included to reflect the boundaries of the iwi's rohe. This method produced 4 mana whenua CWG members appointed by Ngāti Whātua, Marutūahu, Waikato-Tainui, and the Waiohua-Tāmaki alliance.

The remaining 11 members of the CWG were selected at the stakeholder plenary 9 July 2015 by RG members through a facilitated session. A list of CWG members is included in the appendix.

Membership of the CWG placed considerable demands on the individuals involved and on the organisations they are from. The meeting schedule was demanding and there was often a great deal of preparation required. Meetings were often contentious but always constructive and there was a strong value that members were there to find the best possible long term solution for Auckland.

Individual members had to navigate their obligations as members of a group tasked with developing shared understanding and working towards a consensus solution, while at the same time representing constituencies with distinct and sometimes conflicting interests.

Study scope

The design of the study was developed by Auckland Council and included a draft scope of the study which articulated the options for analysis and provided a table of social, environmental, cultural and economic considerations. This draft scope was presented to the CWG at its first meeting and was adapted by the CWG to form a final scope.

The Study's scope required consideration of five options:

1. Constraining Auckland's port to its current footprint
2. Downsize Auckland's port by shifting some of the operations to another location
3. Relocating some or all volume or activity of Auckland's port
4. Enabling growth of Auckland's port in its current location
5. Building a new port elsewhere

The Study is required to consider a future period of at least 50 years for the purposes of future location options, and for freight estimations not less than 30 years.

The study design specified that the CWG would appoint consultants to conduct the investigation.

The study design further specifies that the consultants' methodology would identify a long-list of options before identifying a short-list for more in-depth analysis. The consultants were tasked with the development of a recommended long term strategy, supported by compelling evidence that the recommended solution is better than the alternative.

The CWG provided the final scope for the Port Future Study to the Auckland Development Committee on 15 October 2015 together with the study objective:

"The Port Future Study will recommend a long term strategy for the provision of facilities to accommodate sea-based imports and exports and the cruise industry flowing to and from Auckland and its wider region in an economically, socially, culturally and environmentally acceptable manner, taking into account competing uses for city centre waterfront space and the various impacts of options."

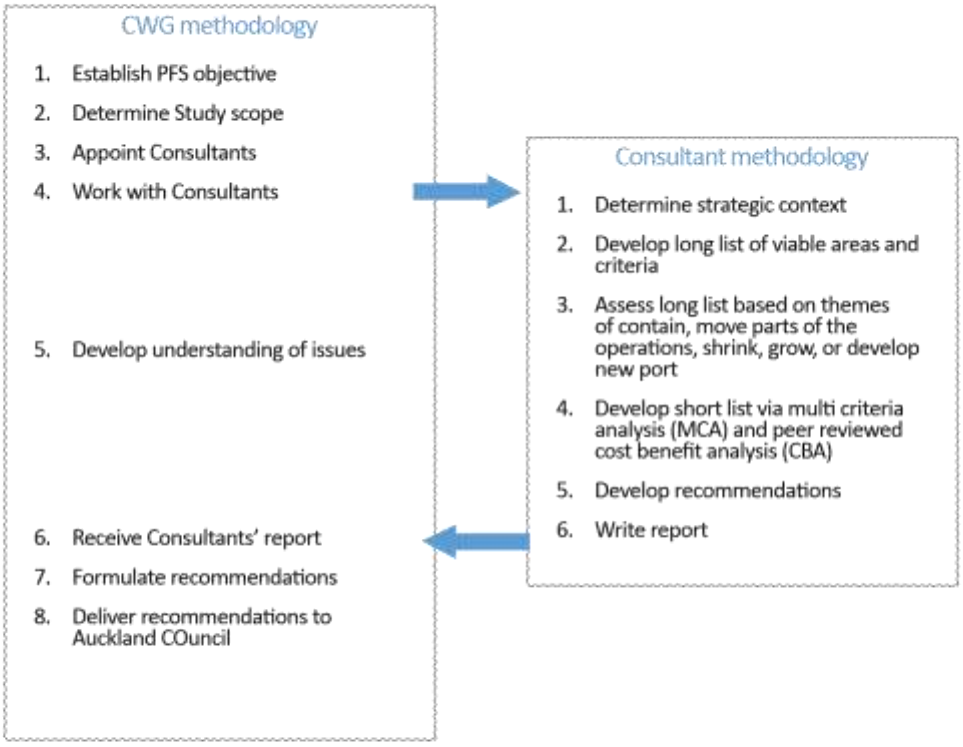
Item 16

Attachment A

Methodology

The methodology of the Port Future Study had several components. In preparation of its recommendations, the CWG worked to develop three inputs: CWG information gathering (including CWG and invited external presentations); input from the study's RG on study outputs including the draft recommendations and a technical paper prepared by consultants. These components are presented in figure three below.

figure three: Consensus Working Group Methodology



CWG information gathering

The CWG met 22 times during the course of the project for at least four to five hours on each occasion. CWG members used this time to prepare the study scope, make presentations to one another on the issues and perspectives in play, work with the consultants, review invited presentations from external presenters[1] and discuss implications of the evidence presented.

Testing of outputs with RG

The CWG distributed information to and met with the RG to receive feedback on the process and emerging conclusions. The RG met with the CWG on 30 September 2015, 19 February 2016, 13 April 2016 and 15 June 2016. Meetings were two to three hours in duration followed by a debrief session for CWG members. At each stage of the study the CWG took the feedback of the RG into account before proceeding.

Consultant's report

Following an open tender[2], in November 2015 the CWG, supported by Auckland Council's procurement team, appointed a consortium led by EY for delivery of the consulting services. The consortium comprised EY (economic, financial and consortium lead, with EY Tahi as cultural and Māori outcome lead), Black Quay (strategic port planning), Jasmax (urban planning), GHD (landside engineering support), Aurecon (landside transport planning), eCoast (natural environment), JLL (property and land holding)

The Consultant delivered its draft report to the CWG on April 30 2016 and its final report to the CWG on 22 June 2016.

Having chosen the appointed Consultant from among the bidders, the CWG relied upon the Consultant to implement the methodology. The CWG was engaged throughout the consulting stage, reviewing progress and providing guidance and input to the consultants. The CWG had the opportunity to review and respond to emerging conclusions and drafts of the Consultant's report.

The Consultant's methodology is covered in detail in its report appended. Early in the process the consultants led the CWG through an Investment Logic Mapping process which developed agreement about the issues being addressed in the study and produced the issues statement presented at the end of the Introduction above.

The consultants conducted analysis to estimate the long term future demand for freight and cruise services and the potential capacity of the port. POAL provided valuable input to that analysis and the consultants developed their own independent conclusions about future demand and capacity.

Both Northport and Port of Tauranga were considered as alternatives to provide Auckland with necessary port capacity in place of the existing port, and / or a new port. Notwithstanding considerable public discussion and advocacy of these ports to provide for Auckland's needs, the findings were that neither of these ports has sufficient capacity in the long term to accommodate both their own growth and cargo for Auckland. Therefore, they were discounted as feasible long-term options. Any temporary measures involving these ports would result in dislocation of existing supply chain infrastructure, operations and employment, require further investments, result in substantial environmental and amenity impacts and increase in freight costs. Any temporary measure would also spread the freight volumes that would be required to justify a port relocation.

A long-list of 27 potential new port locations was developed based on locations identified in previous studies[3] and a systematic examination of the physical characteristics of coastal areas near Auckland. This new foreshore scan and the previous studies assessed – at a high level - locations based on coastal geography, surround ecology, hydrology and environmental impacts

The long-list was reduced to a shorter list of 14 sites (including the current location) through a more detailed evaluation of the locations based on their physical suitability, eliminating locations based on their performance on seven criteria:

- Shipping navigation (potential, based on horizontal access and natural obstructions)
- Natural water depth (chart overlays, potential channel alignments)
- Natural land topography (presence of cliffs or other significant elevation at foreshore)
- Distance from identified industrial concentration
- Distance from existing primary land transport
- Feasibility of land for port footprint capacity and transport access
- Coastal processes (sediment transport, wave- and current- patterns)

1: Auckland Design Office, Auckland Transport, ATEED, City Centre Integration Group, KiwiRail, NZTA, Panuku Development Auckland, Martyn Evans Architects
2: The initial project design indicated a closed tender process, however in its work to define the project scope the CWG moved to an open tender approach. This was done to ensure RG and CWG member expectations of transparency were met.
3: Development Plan for Auckland Report, POAL, 1989, Port Development options for the Auckland Region, POAL 1999, Statement of evidence of Stephen John Priestly for POAL, hearing on the proposed Unitary Plan, 2014

The shorter list of 14 sites was reduced to the short-list using a multi-criteria analysis (MCA) led by the consultants but with detailed input from the CWG. In scoping the study the CWG included a list of 90 physical, economic, cultural, social and environmental criteria that were assessed as potentially relevant for the port location strategy. The consultants facilitated a collaborative process where the CWG reviewed the list of criteria, adding some, removing some and forming combinations to agree the final list of 36 criteria to be used for selecting the short-list ports. Percentage weightings were assigned to the criteria reflecting the CWG's consensus judgements about their relative importance to a long term strategy. When shortening the criteria list the consultants aimed to retain the most important criteria, while removing those which would be the same for all of the short-listed options.

The MCA scored each potential location against each of the criteria using a five-point scale. Each of the 14 potential short-listed locations was given a summary score based on the Consultant's assessment of the scores on each of the 36 criteria and the importance weightings gave the criteria judged to be more important a larger influence in the analysis.

A test of the robustness of the MCA analysis was made by ranking the shorter-list locations based on weighted and unweighted criteria and by eliminating the physical and economic criteria so that only cultural, social and environmental criteria were used in developing the ranking. The ranking among the locations was very similar regardless of which method was used, supporting the conclusion that the short-listed options were the best location options to consider in more detail.

A Cost-Benefit analysis (CBA) was used to compare the short-listed options. CBA is based on estimates of the monetisable future values and costs that will result from choosing an option. Discount rates are used to translate future values and costs into their equivalents in today's dollars. The estimated future values and costs that were included in the CBA were port revenues and operating costs (including capital and maintenance dredging), port construction investments, port maintenance costs, cost of land transport infrastructure, freight operating costs, and land value from sale of the current site.

The short-listed locations included three sites within the Manukau Harbour, two in the Firth of Thames and two off the coast at Muriwai. For both the MCA analysis and the CBA analysis the Manukau options were best, followed by the Firth of Thames options and then the Muriwai options.

In the course of their analysis, the consultants met with experts on the various matters being assessed. This included interviews with North Island port operators and other experts including the Auckland Harbour Master. They also met with mana whenua identified by the mana whenua CWG representatives to identify views held about the specific location options and the conclusions from that dialogue are summarised in the Consultant's report.

The CWG reviewed initial drafts of the Consultant's report and provided detailed comments to EY. The CWG commissioned peer reviews on the future trade demand and port capacity, on the CBA methodology and its application, and on the navigability and dredging requirements for the Manukau Harbour. Feedback from peer reviewers and CWG members has been used to inform EY and improve the quality of their report, and used to inform the CWG as it has developed its recommendations. Not all matters raised have been resolved but the CWG has concluded that remaining differences are not sufficiently material to alter its conclusions and recommendations.

Additional effort from the Consultants was also requested to conduct initial "fact-finding" conversations with mana whenua in the short-listed areas. This input provided some potentially indicative views on implications of new port locations, but was not intended or considered to be comprehensive or definitive, and does not have the standing of a Cultural Impact Assessment or other formal consultation process.

During the consulting process the CWG reviewed and debated evidence assembled by the consultants as well as input from third parties. The data and presentations allowed the CWG to develop shared understanding of the issues and evidence as a foundation for developing their consensus on conclusions and recommendations.

Growth of Auckland's port

Auckland's port and harbour accommodate freight trade, cruise ships, ferries, the fishing industry, private boats and tourism operators.

More and larger freight and cruise ships are anticipated, and growth of ferry services is planned. Recent port expansions and POAL's expansion plans have created public concern in themselves and that concern is heightened when people consider the expansions that might be implied as the port grows to meet the freight and cruise needs of a much larger Auckland.

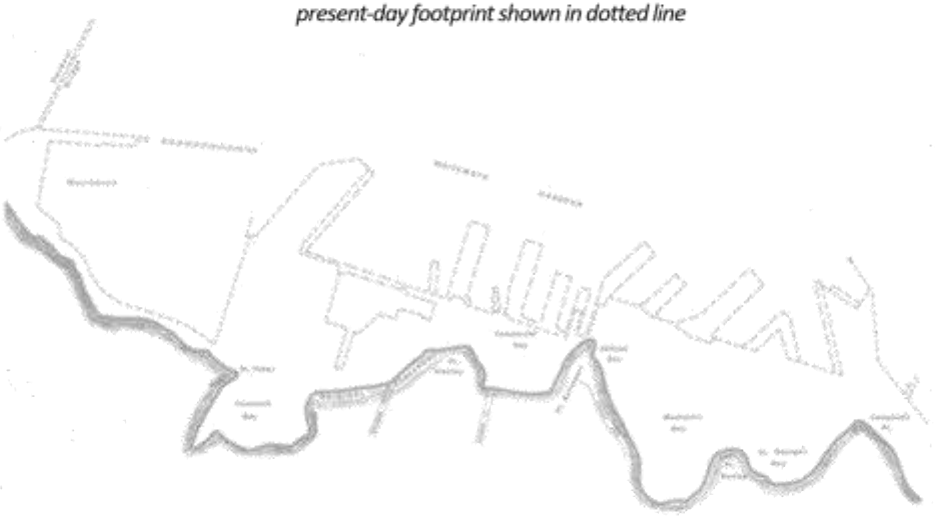
POAL has consents for port expansion work nearing completion at Fergusson Wharf. POAL sought approvals to create more berth length and cargo handling area at Bledisloe, which were overturned in the High Court. Local communities are concerned about the noise, air pollution, visual and congestion impacts of port throughput growth, and there has been strong opposition to having the port expand further into the Waitematā.

Port infrastructure location decisions establish facilities that have long lifetimes and high costs. Parts of the freight port are around 100 years old, but the vast majority of the modern freight port has been constructed post 1950, and parts such as Fergusson are still under construction. Parts of the cruise infrastructure are closer to 100 years old. Any new port considered should have an expected life of more than 100 years, and perhaps much longer, and would cost an estimated $4 billion to $5.5 billion dollars, depending on the location chosen.

Figure four shows the Waitematā shoreline in 1840, pre reclamation.

figure four: Waitematā shoreline section - 1840

present-day footprint shown in dotted line



For the purposes of this report, short-term is defined as from now to 2040, medium as 2040-2065, and long-term as beyond 2065. Over such long time periods there is great uncertainty about the demand for freight and cruise services and the consultants have committed considerable effort to develop estimates of expected demand. Estimating future demand requires taking a view of future population growth or GDP and the volume of trade per capita or trade per billion dollars of GDP. The Consultant's report describes the process and conclusions of that effort in detail.

In 2014/15, Auckland port's container throughput was around 970,000 twenty-foot container equivalent units (TEUs) per year, with over 3 million bulk tonnes of freight and close to 250,000 cars. As a short-hand we follow the Consultant's lead and refer to the basic growth of the port by referencing the container volumes handled, in millions of TEUs per year. It must be acknowledged that the port includes other important trades; specifically, bulk and multi-cargo[4], including vehicles, and cruise. There are estimated growth rates for these other trades in the Consultant's report. When this report refers to port growth in millions of TEUs that is a short-hand for growth of the port, with container growth in millions of TEUs and with accompanying growth of the other types of trade.

The long term future is uncertain and there has been considerable debate within the CWG about what future trade growth should be expected. However, the CWG is agreed that it is possible, and some would say likely, that the trade task will grow from around 970,000 today, to at least 3 million TEU per annum over the 50 years plus time horizon of the Study. Further, we should consider the possibility that demand could grow considerably beyond 3 million TEU over the much longer period during which we should expect Auckland's port to be used. EY's mid-point demand estimates have the port reaching three million TEU in about 40 years[5].

Auckland is unusual, in being a fast-growing city in a developed country. Most developed country populations are projected to grow only slowly if at all during the next few decades. Auckland's growth is projected to continue and may be sustained or even accelerated because New Zealand appears to be becoming increasingly attractive as a safe haven in a time of growing global uncertainties. New Zealand's resource endowments could become a foundation for growth of value-added exports to populous and resource-constrained Asian countries that would imply long term export growth and many affluent consumers demanding imports. We are also aware that over the long time horizon of the Port Future Study there could be major changes reducing freight demand growth or increasing port productivity; for example, an aggressive dematerialization and localisation of economies, disruption of the global growth path, or dramatic transformations of shipping or port technologies. These fundamental uncertainties may be much larger than the estimation uncertainties in the Consultant's demand and capacity forecasts.

There are three important operational constraints on the port's volume growth. The first is the footprint required to operate the port and to accommodate short term storage of freight. That is important because it is constrained by the boundaries of the current port precinct and public opposition to further expansion into the harbour via reclamation or wharf extensions.

The port has firm plans to increase throughput to just over two million TEUs per year and less firm plans and estimates that might allow the port to handle up to three million TEUs per year on approximately the current footprint. Those plans require capital investment in automation equipment that has not yet been committed and that automation investment could reduce the noise, emissions and lighting impact that the port has on surrounding communities. Volume growth would offset this potential for reduced environmental impacts.

The second constraint is the berth lengths to accommodate more frequent visits of larger cruise and cargo ships. Cruise berth capacity is already constrained at the port with berth length limitations preventing accommodation of the larger ships that are now being added to the global cruise fleet and starting to visit Auckland. Cruise visits are increasing as the global industry expands and Auckland is becoming a more popular destination.

The largest cruise ships could be anchored in the harbour and lighters could be used to ferry passengers to and from the shore but that would provide a lower quality experience for cruise passengers, reduce the attractiveness of Auckland as a cruise destination and reduce the economic benefit from cruise ship visits . There is a strong incentive to increase the number of berths available for cruise[6].

4 Multi cargo refers to break-bulk (timber, steel, 'high and heavy' machinery/trucks etc), bulk (gypsum, cement, sand and aggregates, wheat, iron sand etc), vehicles (new and used cars)

5 Previous reports (NZIER 2015, PWC 2012, ARH 2009) considering POAL capacity have indicated capacity may be reached between 2035-2045, depending on growth rates and other assumptions made. These dates are broadly in line with EY's findings.

6 Reprovisioning ships with food and supplies generates almost as much economic benefit as is generated from tourism spend. In 2014/15 there were 115 voyage calls and 188,500 unique passenger visits to Auckland, which generated $190.7m (Economic impact of the 2014–2015 cruise sector in New Zealand and forecasts to 2017, Cruise NZ)

The Central Wharves Strategy is being developed to accommodate expected cruise ship growth, including provision of berths for larger cruise ships, to expand public use of the waterfront and to provide for growth of ferry services. The preferred options being considered within the Central Wharves Strategy imply a need for additional berth provisions for vehicle and other multi-cargo operations. All recent studies, including the Consultant's report for the Port Future Study agree that berth capacity constraints are evident now, and if capacity is to match demand, some berth development will be required in the short term.

Berth development options have been proposed by the Consultant and POAL. We expect these and other potential solutions will be evaluated and decided upon using short-term planning processes.

The third physical constraint is the land-side transport connections via road and rail to move freight from the port for imports and onto the port for exports. POAL plans to materially increase rail use for land-side transport using existing rail lines. Major expansion of land-side rail connections is constrained by the need for freight to share the rail lines with passenger trains. Longer term, there are options to add one or two more rail tracks to release that constraint. Increasing rail traffic would increase noise and emissions effects on residents along the rail corridors.

Expanding freight volumes at the existing port would increase the contribution of trucks to congestion near the port, through Grafton Gully and along the Southern Motorway. There is potential to spread the timing of truck movements to reduce congestion impacts that would alleviate some consequences of short term growth.

Accommodating the planned growth at the port to two or three times current volumes might imply the need for large investments in fly-overs or trenching because of space constraints, and to limit adverse consequences of increasing traffic intensity for local land-owners and communities. The Consultants' report anticipates that large roading investment is only anticipated once the port reaches around 3m TEUs, implying that port growth would increase local congestion during the short and medium term. There are existing pressures on landside transport links in the area from non-port sources and it seems likely that a land-side road solution will be required.

The potential for trade growth, uncertain productivity improvement potential and limits to expansion mean that the CWG cannot be confident that the port will be able to accommodate long term demand growth on its current footprint.

That conclusion depends on the Study's time horizon. With a time-horizon greater than 50 years, say 80 or 100 years, as specified in the Port Future Study Scope, then an option for a new port or for a materially expanded port footprint should be created.

Long term demand growth is likely to exceed the expected capacity growth available at the Port of Tauranga and at Northport. Further, having Auckland's freight delivered from these more distant ports would imply large capital investments in port expansions and transport links along with long freight distances and correspondingly high freight costs.

In conclusion, there is sufficient probability that capacity on the current port footprint will be exceeded in the long term that a new or expanded port option should be created. The EY report states that there is a scenario where container capacity might be exceeded as early as 2039. It is also possible that future demand growth might be accommodated on the current site within the current footprint but there is sufficient uncertainty that it would not be prudent to rely on that possibility.

Two options for locating a new port

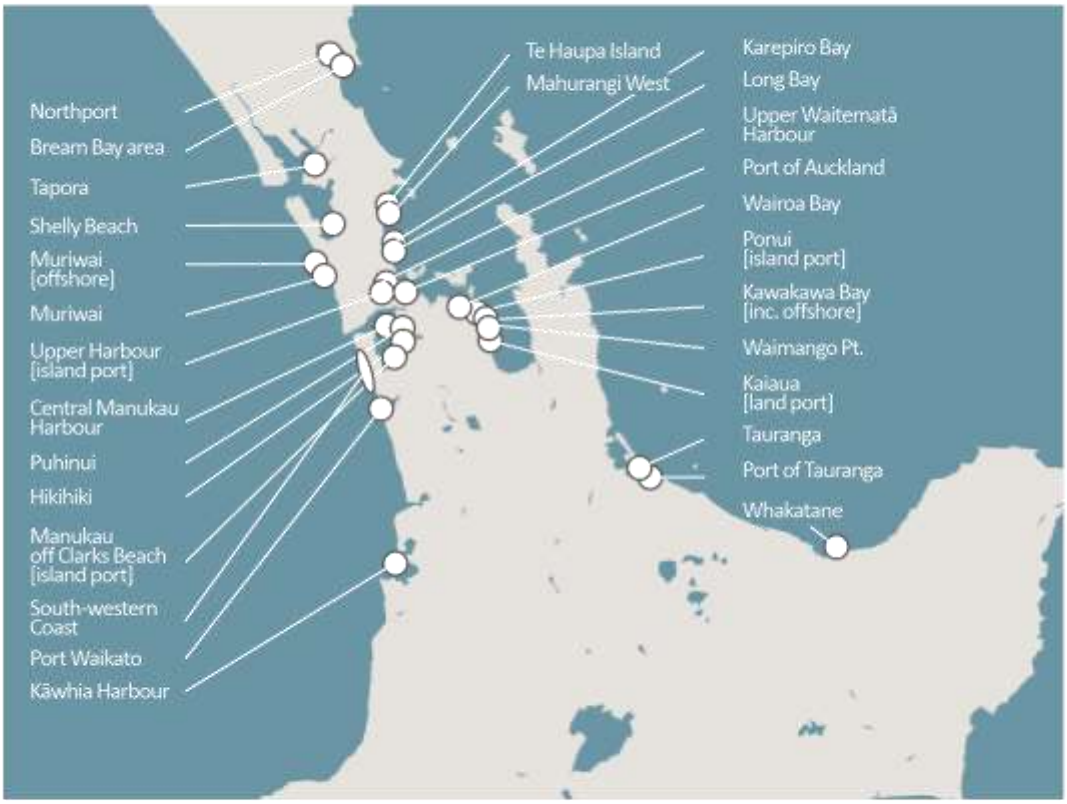
The Port Future Study methodology required identification of a long-list of options, reduction of that long-list to a short-list, and then more detailed assessment to select preferred option(s) from the short-list.

The long-list was identified by referencing locations considered in previous studies and a scan of the upper North Island coast-line. Locations were included for consideration if they appeared to meet the physical requirements for a port location.

The long-list was reduced to a short list using the MCA analysis. The options selected for the short-list included an expanded port on the current site, three locations in the Manukau Harbour, two locations in the Firth of Thames and two locations near Muriwai. The Manukau options were ranked more highly than the Firth of Thames options, followed by the Muriwai options.

figure five: Long list options

Indicative only. See Consultant's report for more detail



All of the options on the short-list could have a port capacity of approximately 10m TEUs and so would provide for capacity expansion for the long term.

The sites identified on the map should be regarded as indicative. Physical potential for a port at the site is confirmed but more detailed analysis would be required to determine the best specific positioning at each site.

The Manukau options are highest ranked in the Consultant's report on both the MCA analysis and the CBA analysis. Manukau is the closest location option to the current and expected future location of freight destinations and sources. Among the Manukau sites, the Puhinui site is the highest ranked option in the CBA, with the highest NPV advantage over expanding at the current site. For the long time horizons considered for the Study, the land transport freight cost advantage more than offsets the cost of port construction and relocation. Lower freight costs would reduce the costs of imports for consumers and industry and would increase the competitiveness of exports.

The prospect of establishing and operating a major freight port in the Manukau or indeed in any location raises many important questions. Transferring a port's impacts from one community to another requires careful consideration of the social and cultural consequences. It is not considered likely that a port relocation would be welcomed by communities or mana whenua in or near the new location. Further, there are already concerns about environmental impacts of past infrastructure developments on the Manukau and a history of contention about environmental care and remediation may make it difficult to establish agreements.

While the Manukau has had an operational port for many years, the potential environmental impacts would call for excellent harbour and port management practice and rigorous monitoring[7]. This expectation for excellent environmental outcomes is heightened by the recent strides made in remediation of the Manukau harbour and foreshore, and the strong sense of Kaitiakitanga felt by local Iwi, hapu and by Aucklanders more generally.

Any discussion of shipping matters involving the Manukau harbour will trigger concerns about the Manukau bar and channel. Weather and sea conditions experienced on the West Coast of New Zealand are challenging. The wreck of the Orpheus in 1863 and the challenges of the Manukau bar have created a widespread pre-conception that a major port on the Manukau would create unacceptable safety issues.

The Consultant's report is informed by analysis done by eCoast, which indicates that a major port on the Manukau is a feasible option, requiring initial dredging of the channel and on-going costs for channel maintenance. Conscious of the challenges of the Manukau and expecting a sceptical response to presentation of a Manukau option, the CWG commissioned a peer review of the eCoast work. The peer reviewer's conclusions were provided to eCoast leading to an updated, more conservative design which increased the estimated costs for establishing and operating a Manukau port but not by enough to alter the Study's conclusions.

Safety and navigability issues were assessed by testing the preliminary design and the resulting port functionality and safety using the PIANC guidelines, which are the standard for port location evaluation. The assessment indicates that a port at the Manukau would be feasible and safe. Weather conditions on the West Coast could lead to the port being closed occasionally, and this could become a more important concern over time because climate change is projected to increase the frequency and intensity of adverse weather. However, the port, once constructed, would not be unusual among existing ports, world-wide.

A safer and more reliable channel on the Manukau harbour would potentially increase utilisation by recreational, tourism and fishing boats. This could take pressure off the Waitematā harbour which is already highly utilised and with likely population and tourism increases will see its utilisation grow further.

The Consultant and the peer reviewer both indicated that the design work completed for the Port Future Study must be regarded as preliminary and that more detailed engineering assessments covering geology, hydrodynamics and reliability would be required before the feasibility of a Manukau port could be definitively confirmed. Therefore, pending the results of those studies, the Port Future Study cannot firmly recommend a Manukau port location.

A second possible knock-out for a Manukau location, identified by CWG members and others, was that a Manukau location would imply a major shift of shipping patterns. A preliminary study of additional shipping costs from the west coast location was completed by the consultants and the costs did not alter the conclusions of the CBA.

The physical characteristics of the Manukau Harbour, the west coast location and the potential difficulties with gaining the necessary land, agreements and consents imply that an alternative location should be examined in parallel at the next stage of port relocation planning.

A port relocation to the Firth of Thames might be required if more detailed analysis of the Manukau options demonstrates that it is not feasible, and would reduce any navigability, safety and shipping issues that might remain with a feasible West coast option. However, a location at the Firth of Thames would imply higher costs for land-side transport infrastructure and freight. The MCA and CBA both indicate that a Kawakawa Bay location would be preferred relative to a location nearer to Waimango Point.

Both of the identified Firth of Thames locations would raise important cultural, social and environmental issues, described in the Consultant's report, that would need to be navigated before an option could be established. Further, the preferred transport route to the coast would pass through a rural environment that would be substantially altered by construction of large scale road and rail links.

7 This applies to any other new location that might be decided upon, and relates to expectations for improvement at the current location.

Item 16

Attachment A

While a Manukau location might ensure freight is close to the to the industrial centres and would strengthen transport links down the western edge of the city, a Firth of Thames location might have different future land use benefits. A Firth of Thames location would create transport links that could open up land that is relatively close to Auckland for development. Growth of Auckland over the long term to accommodate the projected 2.5m plus population might require additional land so that land development potential in the east might become relevant to the final port location decision.

Another larger scale consideration follows from the larger potential scale of a relocated Port. Port of Tauranga's growth appears to be constrained long term so a future port at the Firth of Thames might become a "super-port" that would serve the upper North Island. While a super-port seems a more obvious option in the Firth of Thames, a super-port might also be located in the Manukau Harbour.

These wider transport, land use and upper North Island port strategy implications should be examined when deciding which of the port location options to develop.

Whichever option is chosen there will be important challenges and high capital costs and these should be considered in the context of the need to ensure provision of cost-effective facilities for freight services so New Zealand can sustain trade and economic well-being.

There would be implications for owners and other affected parties from changing the expected land use activities by designating corridors and rezoning for port precincts.

The MCA analysis together with advice received from mana whenua representatives and from others make it clear that gaining the agreements and consents to establish any new port would present a significant challenge. Similar challenges would be faced for a proposal to expand the port further into the Waitematā Harbour. Mitigations, offsets or other arrangements might help overcome obstacles but the specifics of these are beyond the scope of this study. Changes to legislation and/or regulation may make consent achievable.

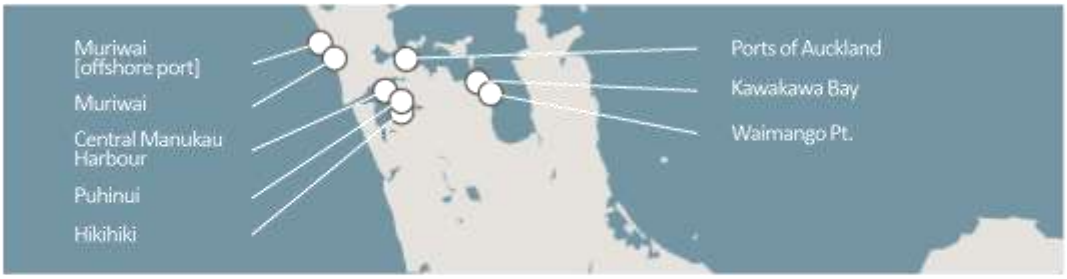
The CWG recognises the resurgence of the Māori economy involving new strategic partnerships between Māori, private sectors and local government. Noting that settlement processes continue, the CWG recognises trends towards engagement, confidence, realising and attaining potential, and of interdependence and partnership. We also understand, from the necessarily limited dialogue with mana whenua interests conducted during the study, that there have been some instances where promises of environmental protection alongside infrastructure development in Auckland have not been fulfilled.

There would be high capital costs for investment in relocation of the port and funding for infrastructure investment is constrained. Sale of land at the current port location would provide a partial offset. Capital markets might fund the construction provided there is a debt-servicing model. Internationally there are many funding/ownership models around major infrastructure investments such as a port which vary from full Council ownership to full private sector ownership. At both Auckland Airport and Port of Tauranga, Councils have minority shareholdings in publicly listed companies. Consideration could be given to funding the land component of the new port separately from the operating company, which might enable equity participation in the "landco" by Council and Iwi.

Establishing an alternative port location option now would be difficult and require material effort and expense. However, if an expanded port is required in the long term and an option has not been created the location options may become much more difficult because of other development and regulatory decisions. Auckland's people might then be faced with a choice between a much higher cost, more difficult port move or the ongoing high costs of longer distance freight within New Zealand. The costs of establishing an option would be much lower than the likely future costs resulting from needing a relocation option but not having one available.

figure six: Short list options

Indicative only. See Consultant's report for more detail



Expand or move?

The alternative to moving the port is to expand at the current location, reclaiming land as required to meet future demand. That is one of the options the CWG was specifically asked to consider and could become a default future outcome if a port relocation option is not created, because there are long term capacity constraints at both Port of Tauranga and NorthPort.

There are several reasons why expanding the port at the current location could be an unattractive long term option relative to a relocation.

First, in the long term, the current footprint at the port might be expanded materially but there is no certainty that such an expansion would be sufficient to accommodate the long term port growth. Expansion with high productivity might allow the port to grow to a container size of perhaps 4m TEUs or even more, with accompanying multi-cargo and bulk trades. However, a risk would remain that long term demand could exceed the feasible expansion. Recent growth has been driven partly by trends to containerisation and transfer of domestic manufacturing capacity to China but 50 years is a long time and the future is uncertain. A quadrupling of demand in the long term might seem unlikely, but the possibility should be considered in the context of port volumes in 2006 of approximately 700,000 TEUs, in 1996 of approximately 400,000 TEUs and in the early 1980's of approximately 100,000 TEUs.

Second, there is already considerable social pressure for moving the port or restricting its growth. A port with volumes much larger than the current volume would have a materially greater impact on the centre of Auckland city, on harbour users and on the communities living close to the port location. The city, harbour use and local communities are all expected to grow too, creating greater exposure to the environmental effects of the port, and increased contention. Social opposition to industrial ports has been an important driver of recent port relocation decisions internationally.

Over the long time horizons being considered it is reasonable to expect that a growing port on the current site and associated landside transport would use new technologies, especially substitution of electricity for fossil fuels and automation of conveyance of freight (both at the port and along land-side corridors), which would work to reduce air pollution, carbon emissions, light pollution and noise. Investment in best practice environmental technologies would alleviate the externalities created but despite such investments the scale of potential growth could create large adverse effects.

Third, if Auckland city and the CBD grow as expected, there will be demand for more land for commercial, residential and amenity uses. Anticipation of the long term development of Auckland as a liveable city indicates that the value of the port's land as a component of urban expansion may increase relative to the situation today. It is possible that redevelopment of the port land would contribute to continued improvement of the CBD and surrounds, as the Wynyard Quarter developments appear to be doing. These potential benefits have not been quantified within the CBA.

Fourth, the CBA completed by the Consultant indicates that moving the port to Manukau would provide a better economic outcome than expanding at the current location. The economic advantage is largely driven by lower freight costs due to locating the port closer to freight destinations. The economic advantage is estimated taking into account the estimated capital costs for establishing the new port and crediting the estimated value of the current port land released for redevelopment. The options to locate the port in the Firth of Thames are not currently shown to be more economically attractive than expanding at the current location but would release the capacity constraint.

Timing of a move

There is a strong logic to create an alternative port location option based on the long term risks from not having an option relative to the certain, near-term and smaller but important costs and difficulty of creating an option. It would be like creating an infrastructure corridor where the corridor might not be required but the costs of the infrastructure would be materially higher if plans and options are not put in place in advance.

Implicit in that analysis is that the port would be moved because expected demand is going to exceed expected capacity. In such an analysis the port would be moved as late as possible to defer costs, allow scarce capital to be put to better use and to accommodate the possibility that demand growth slows or technology changes emerge which might make the move unnecessary.

A second reason to move would be because the people of Auckland and the Auckland Council on their behalf decide that regardless of the freight demand growth, a move to the preferred alternative location would lead to economic, social, cultural and environmental outcomes that are better than the outcomes from remaining on the existing site. If moving the port could provide better outcomes than leaving it where it is then the timing of a port move becomes an important consideration.

In principle, there are three kinds of timing option. The first kind of option is to move the port when the combination of port volumes, expected growth and forecast capacity expansion signal that port relocation is required. The mid-point of the Consultant's analysis indicates a move being required in 2055 though there is a great deal of uncertainty. That would leave open the possibility that a move might never take place and so the relocation option would remain unexercised. It would also leave open the option for a later decision to move the port for other reasons.

The second kind of option is to move the port as soon as possible to realise the benefits from relocation, including social and political pressures in favour of relocation. Allowing 10 years for making a decision and completing planning, and then five years for development, the port might be able to relocate during the 2030s. Those times may prove optimistic given the difficulties likely to be encountered but they illustrate what an early option might look like.

The third kind of option is to seek a "sweet spot" for timing of a port move that is neither as late as possible nor as soon as possible. Finding such a sweet spot could allow for reduced uncertainty as evidence on future demand and capacity growth accrues. It might prove optimal to match relocation timing to the time when the city is ready to redevelop the port site for alternative uses. That might imply a relocation during the 2040s.

In any plan to preserve an option to move the port, the issue of immediate constraints on multi-cargo and cruise capacity remains to be addressed. Options for both have been investigated by EY and POAL, and reviewed by the CWG. A long-term option needs to be implemented for cruise, and a short – medium term option for multi-cargo. The requirement is for berth capacity – to cater for larger ships and more ships associated with the predicted growth in cruise and freight.

Creating a port relocation option is preferable to any short-term relocation of multi-cargo volume to Northport or Port of Tauranga because:

- Neither of those ports offers a long-term feasible alternative to Auckland because of their own capacity constraints, and so such a move would be temporary anyway.
- Relocation of volumes would result in split supply chains, additional freight costs and environmental impacts to transport cargo, redundancy of existing supply chain infrastructure and of associated employment and investment
- Volume expansion at the existing site retains economies of scale in operations, makes use of existing supply chain infrastructure and allows for more balanced growth of the port up to the capacity constraint
- Retaining concentration of volumes at the existing port protects the revenues and freight savings required to justify future investment in a new port

Port landside demand would be catered for with vertical infrastructure, such as a car park building.

Monitoring and reporting on triggers is important to understand the timing and value proposition of any move.

Regular, periodic monitoring and forecasting will be essential given there is a considerable and predictable delay between the point at which a trigger or triggers are 'pulled' and the point at which a new port location becomes operational. Consideration should be given to matters raised in the Consultant's report, for example but not limited to:

- Physical capacity constraints of port footprint and configuration against forecast demand for freight by trade type. Monitoring and reporting would likely include yard capacity, port productivity/efficiency, customer population growth and TEU per capita forecasts
- The port's physical externalities. Monitoring and reporting would likely include impacts on port environs such as light, noise and dust externalities, vehicle movements by vehicle type and congestion impacts
- Economic incentives for investment at current or new port location. Monitoring and reporting would likely include net present value of investment and associated benefit at current or alternate locations, and construction delivery estimations
- Social and cultural impacts and community feedback. Monitoring likely to include public expression of vision for Auckland, potentially expressed via elected officials, through Long Term Plan processes or direct engagement
- Environmental impacts. Monitoring and reporting likely to include research or information on impact of footprint and operations at current or alternative locations

Item 16

Attachment A

Conclusions and recommendations

The Port Future Study has considered the long term future of Auckland's freight and cruise activities.

It has developed a strategy that is robust in the face of the uncertainties which emerge when considering large infrastructure investments over 50-100 years, and takes into consideration the social, cultural, economic and environmental context within which the Port operates.

The principles of partnership within the Treaty drive the relationship between Crown, mana whenua, and Auckland Council and underpin the Study's recommendations, and the CWG recognises mana whenua as kaitiaki, and highlights the importance of culture and traditions related to ancestral lands, water, sites, wahi tapu and other taonga. These are meaningful and relevant given the subject matter and the recommendations presented here, and the CWG calls for readers and decision makers to hold respect for the mana of mana whenua, mātawaka, and the wider public.

The CWG's recommendations are offered as an integrated package. Adopting some recommendations while not implementing others is likely to lead to adverse unintended consequences.

Three issues were agreed by the CWG as foundations for the Port Future Study:

- Capacity will constrain the port's ability to meet future freight and cruise demands, which may limit economic growth in the long term
- Tension between, and competition for, limited resources for the CBD and POAL will lead to sub-optimal outcomes for one or both
- Port activities create environmental, economic, social and cultural impacts which need to be understood and addressed

In considering the options; 1) constrain the port, 2) downsize the port, 3) relocate trade volume, 4) grow the port, 5) build a new port, the CWG key findings reached by consensus are:

- Based on EY's findings, the existing Port will not be able to accommodate the long term freight task and cruise on the current footprint.
- That no further reclamation beyond what is already consented in the port precinct is required for freight purposes in the short to medium term.
- There is a need to secure sufficient berth length in the multi-cargo area for the short to medium term.
- Short term pathways need to be created to enable the Port to continue to operate efficiently prior to a planned new Port being established due to the substantial lead times involved. In this regard, the CWG identifies that additional berth length needs to be provided to fulfil the short and medium term capacity requirements of the Port in response to cruise and multi-cargo requirements.
- Retaining the bulk of port functions provides a more feasible and superior outcome for Auckland, rather than shedding cargo elsewhere or downsizing Auckland's freight task, in the short to medium term. Shedding or downsizing freight operations may weaken the case for moving the port.
- In the long term, other existing North Island ports will be unable to cope with the totality of the Auckland freight task together with their own capacity requirements
- Cruise industry facilities should be retained and improved in Auckland's city centre
- Two possible new port locations - Manukau Harbour and Firth of Thames - have been identified as warranting more detailed investigation
- The triggers for a move would comprise economic, social, environmental and cultural triggers that make a move beneficial or demand/economic triggers that make a move necessary to achieve long term outcomes for Auckland.

CWG's recommendations are offered as an integrated package. Adopting some recommendations while not implementing others could result in adverse unintended consequences.

1. **A port relocation option is established for freight, noting:**
   - If the port is moved, then cruise ships should continue to be accommodated near the CBD
2. **Comprehensive investigation of the identified location area options - Manukau Harbour and the Firth of Thames - is undertaken to decide which specific option is chosen, noting:**
   - Investigation to identify the specific relocation option should include consideration of at least:
     - The long term engineering requirements, navigability, safety and availability of the Manukau and Firth of Thames options
     - The effect of a west coast versus east coast location on shipping and the competitiveness of the Auckland port and the national supply chain
     - The wider and long term implications of west coast versus east coast locations including on Auckland's long term transport strategy, land use development, land-side freight routes and the potential for a super-port
     - Mana whenua values, views and opportunities for each of the potential sites identified
     - The environmental impacts of the new site and analysis of consenting pathways
     - How and when any new port could be funded
3. **Regular monitoring of relocation triggers is undertaken to identify the time at which the port relocation option should be exercised, noting:**
   - The port may move when the social, environmental, cultural, economic, urban development or other conditions indicate that moving the port is **beneficial** for the city centre, or Auckland or New Zealand
   - The port may move when expected demand growth, expected capacity growth and the time required to complete the move indicate that moving the port has become **necessary**
   - It is possible that Auckland's future unfolds in a way that neither of the triggers for the beneficial or necessary cases will be "pulled", which would mean that the port would accommodate long-term demand at the current site
4. **Subject to confirmed and credible commitment to establishing a port relocation option and to establishing sufficient additional berth length to accommodate expected growth in large cruise and multi-cargo vessels, the port should not expand beyond its current footprint, noting:**
   - The work done so far for the Central Wharves Strategy implies the need for additional cruise berths and the Consultant's report endorses POAL's case that additional long berths are required to accommodate expected short and medium-term growth in cruise and multi-cargo operations
   - The Consultant has recommended a northern east-west berth at Bledisloe Wharf and the CWG is in agreement that a northern berth presents a viable short-term option. Exact specifications to meet future berth demand will be worked through.
   - The CWG recognises mana whenua and community opposition to any further extension of port operations into the harbour and that deciding the plan to provide the required berth capacity will require rigorous identification and evaluation of alternative options
   - The Port Future Study is a study to provide a long-term strategy for the location of the port and there are established processes for short-term berth provision decisions

The Consensus Working Group thanks the many individuals and organisations who have contributed their time and information to support the Port Future Study. Reference Group members provided valuable guidance of our work. We also thank the Auckland Council which commissioned the study and has provided funding, logistical support, procurement and other advice to the Study, while operating in ways that have preserved the Study's independence. Our work could not have been completed without the contributions of our consultants led by EY and including Black Quay, eCoast, Aurecon, Jasmax and JLL. We thank the EY team and the other consultants for their effective engagement with us, and for the efforts they have made to produce the comprehensive technical report that supports our conclusions and recommendations.

Consensus Working Group Members

Michael Barnett

Michael Barnett is Chief Executive of the Auckland Regional Chamber of Commerce and Industry, and a Director of both the Auckland Chamber and New Zealand Chambers of Commerce and Industry. He is also Chairman of the Equal Employment Opportunities Trust.

Michael was recognised by the Queen in the 2011 New Year's Honours with a New Zealand Order of Merit for services to business.

Ngarimu Blair

Ngarimu Blair is the Deputy Chair of the Ngāti Whātua Ōrākei Trust and has had a long involvement in Treaty and Māori Heritage management issues in Tamaki Makaurau.

Ngāti Whātua Ōrākei are the resident iwi of the inner Waitematā and the port study area and maintain a marae and village that has over 500 tribal residents in Ōrākei. Ngāti Whātua Ōrākei regards the Waitematā as a taonga and has numerous ecological and heritage interpretation projects that actively seeks to restore the mana and mauri of the harbour.

Ko Tuperiri te tangata, ko Maungakiekie te maunga, ko te Waitematā te awa, ko Ōrākei te marae!

Rick Boven - Independent chair

Dr Rick Boven is Chair of both the reference group and the consensus working group. He has significant commercial experience, including leading many strategy projects for transport and infrastructure companies in New Zealand and internationally. He has experience working with Australian and New Zealand central and local governments, on economic and commercial strategies, infrastructure, regulation and organisation topics.

Rick's boardroom experience includes being a director of ASB Bank, Sovereign Insurance and of several international technology companies, and he is a Chartered Fellow of the Institute of Directors. Rick has experience of collaborative multi-stakeholder processes via participation in an investigation of greenhouse gas emission reduction technologies and policies, and from being a member of the Independent Review Panel for the Tai Timu Tai Pari - Sea Change project.

His qualifications include an MA in psychology, an MBA and a PhD in environment management.

Luke Christensen

Luke has been the Auckland Policy Director of youth led organisation Generation Zero since 2013.

Generation Zero is focused on ensuring young people have a say in the big decisions about the future of New Zealand, such as climate change, transport and planning.

Luke has led the policy work during Generation Zero's campaigns on the Unitary Plan, Safe Cycling, Congestion Free Network and Special Housing Areas and has been a contributor to transportblog.co.nz, writing about a wide variety of Auckland transport and planning issues.

In 2014, he completed his Masters of Urban Planning at The University of Auckland, and works for a transport planning consultancy based in Auckland. Prior to his Masters study, Luke gained four years' experience as a land surveyor.

Noel Coom

Noel is the General Manager, New Zealand of ANL Container Line and is based in Auckland.

During his 44 years working within the transportation industry he has focused primarily on shipping but also completed a period as Group General Manager for TranzRail. Noel has been posted overseas in both Los Angeles and Sydney and is currently Chair of New Zealand's International Container Lines Committee (ICLC).

Richard Didsbury

Richard Didsbury graduated in Engineering at Auckland University and has had a diverse career in property.

He founded and continues as a Director of Kiwi Property which is New Zealand's largest listed property company and led the development of Auckland's biggest shopping centre Sylvia Park and Auckland's premium office building, the Vero Centre. He is currently a Director of Auckland Airport, Skycity, and Hobsonville Land Company.

Prior to the formation of Auckland Council, he was a director of Infrastructure Auckland, Tourism Auckland, and chair of Auckland Waterfront Advisory Group.

His passion for excellence has resulted in projects which have redefined communities such as that at Matakana Village, and his support for artists and architecture is highlighted at Brick Bay Wines and Sculpture Trail. He also led the formation of, and now chairs, the Committee for Auckland.

Tony Gibson

Tony joined Ports of Auckland as Chief Executive Officer in early 2011. He joined the Company with 30 years of experience in shipping and logistics, first with Seabridge in Wellington, and then with Nedlloyd and P&O Nedlloyd.

He has worked in various Senior Management roles in Africa, Asia and Europe, including as European Director of Customer Operations in Rotterdam, before being appointed Managing Director - New Zealand and Pacific Islands in 2002.

Following a take-over by Maersk, Tony served as Managing Director of Maersk - New Zealand for three years.

Tony pursues his own business interests as a director and shareholder of ERoad, a road-user charge solution provider, and is Chairman of NorthTugz Limited.

Jenni Goulding

Jenni is an independent Resource Management consultant and has her own practice currently undertaking development feasibility and project management.

With over 30 years of experience, from local authority (city planner) to project manager for a large scale consultancy, Jenni is now a sole practitioner skilled at considering both business and environmental imperatives.

She has extensive experience in regional infrastructure planning from both community and developer/provider perspectives, particularly in relation to future planning for airports, and all New Zealand Airforce Bases, taking into account conflicting demands of other neighbouring land uses.

Jenni is a voluntary planning adviser to the Parnell community. She won the Waitematā Local Board award for outstanding contribution to community in 2013 with a pilot community structure plan 'Tomorrow Parnell'.

Jenni is a member of the New Zealand Planning Institute, BTP MNZPI

Rangimarie Hunia

Rangimarie Hunia is with Ngāti Whātua Ōrākei Whai Rawa, who have interests across the Tamaki Isthmus and land owners of Quay Park which sits adjacent to the Ports of Auckland.

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, where he has engaged in plan writing, resource consents, and appeals. He has authored Māori values assessments, including for infrastructure projects and proposed activities within the coastal marine area, and researched and written widely on Māori participation in environmental planning and on Māori environmental indicators.

Nathan is also a Treaty claims negotiator for his iwi, and a member of the Auckland Conservation Board. He has applied his background as a historic geographer in his planning work, and as a geo-spatial analyst. In the latter role, he was the GIS Administrator for Thames Coromandel District Council, undertook claims-related mapping for Te Rarawa in the north, and sites of significance mapping for Hauraki iwi. Recently, he has completed mapping of Auckland iwi tribal rohe for the Auckland Council.

He has a BSc (Hons) from the University of Waikato and is currently completing a PhD evaluating the treatment of Māori provisions in the RMA, and outcomes for Māori.

Item 16

Attachment A

Alan McDonald

Alan McDonald is the Policy Director of the Employers and Manufacturers Association (EMA).

The EMA represents the interests of more than 4,000 businesses in the area from Taupō northwards, with the majority of those members based in the Auckland region. EMA membership covers about 40 per cent of employees in New Zealand.

Greg McKeown

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

He has submitted to the Proposed Auckland Unitary Panel Hearing process at both Regional Policy Statement and more detailed Port Precinct levels, advocating for a comprehensive, broad and independent analysis of long-term port development options.

Maxine Moana-Tuwhangai

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

She is Chairman of Waikato Tainui's iwi authority, Te Kauhanganui Inc, and a member of the New Zealand Maritime Authority.

Maxine is an Accredited Environment Commissioner and has strong iwi links in the Waikato and King Country regions.

Julie Stout

Julie Stout is a leading 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 professions of Auckland, plus recreational harbour users.

Annabel Young

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

Annabel originally qualified as a lawyer and Chartered Accountant specialising in tax for 15 years. She is the author of "The Good Lobbyist's Guide" which is based on her experience as a Member of Parliament for two terms (National Party list MP).

After she left Parliament, Annabel ran the tax lobbying team at the New Zealand Institute of Chartered Accountants, was the Chief Executive of Federated Farmers and was the Chief Executive of the Pharmacy Guild.

Shane Vuletich

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

He has completed many notable projects in Auckland during his 17 years as a consultant including development of Auckland's tourism, major event and business event strategies, provision of advice on cruise tourism and infrastructure, and management of due diligence processes for major events including Rugby World Cup, Cricket World Cup, FIFA U20 World Cup and the NRL Auckland Nines.

Shane has a first class honours degree in economics from the University of Auckland.

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.

She has spent many years within the New Zealand Police as a senior manager and recently left policing to concentrate fully on the Te Ākitai Waiohua Treaty Negotiations in Tāmaki Makaurau.

Karen is the mandated Lead Negotiator for Te Ākitai Waiohua, Chair of the Te Ākitai Waiohua Iwi Authority, and the Pukaki Māori Marae Committee. She also holds Chair / Co Chair / Director roles on other community entities within Tāmaki.

Karen is a member of the Independent Māori Statutory Board and allocated to the following Auckland Council committees and groups:

Environment, Climate Change and Natural Heritage, Parks, Recreation and Sports, Civil Defence Emergency Management Group, Auckland Energy Resilience and Low Carbon Action Plan Steering Group, Auckland Domain Master Plan, Arts, Culture and Events, Regulatory and By Laws, Fukuoka Friendship Garden, Seniors Advisory Appointments Panel, Regional Strategy & Policy Corrections Facility at Wiri (Kohuora), Empowered Communities Political Advisory Group and the Hunua Project Political Advisory Group.

Consultant's report to the Port Future Study
June 2016
EY
Building a better working world

Contents

1 The Short Story 2
1.2 Recommendations 4
2 Executive Summary 8
2.1 Introduction 8
2.2 Determining the case for change 10
2.3 Strategic case and evidence gathering 10
2.4 Options assessment process 12
2.5 The short-list with the CBA 16
2.6 Recommendations 25
3 Project Scope 30
3.1 Project scope 30
4 Strategic Context 38
4.1 Role of port in an economy 38
4.2 Global role of seaports 39
4.3 New Zealand ports 39
4.4 Auckland in the New Zealand shipping system 41
4.5 Port location 41
4.6 Stakeholders 43
4.7 Ngā Mana Whenua o Tāmaki Makaurau collective settlement 46
4.8 Port of Auckland infrastructure 47
4.9 Port performance 49
4.10 Port role in Auckland vision 52
4.11 Auckland-centric considerations 54
4.12 Planning environment 58
5 Investment Logic Map 62
5.1 CWG ILM 62
5.2 Problem definitions 63
6 Social Transformation 66
6.1 City transformation and the role of the port 66
6.2 Advantages and disadvantages of a central city port 67
6.3 Global trends 70
6.4 Implications for this Study 70
7 Future State 72
7.1 Overview of assumptions 72
7.2 Demographic and economic conditions 73
7.3 Global trade 76
7.4 Growth by trade type 79
7.5 Multi-cargo 83
7.6 Cruise 88
7.7 Other relevant trends 92
7.8 Port operational productivity and trends 102
8 Capacity 107
8.1 Current capacity 107
8.2 Future container capacity 109
8.3 Future general cargo capacity 112
8.4 Future cruise capacity 119
8.5 Capacity conclusions 122

9 Options Analysis 124
9.1 Key assumptions 125
9.2 Other considerations 126
9.3 Option 1 - constrain Auckland's port to its current footprint 129
9.4 Option 2 - downsize Auckland's port by shifting operations to another location 131
9.5 Option 3 - relocate some or all volume/activity of Auckland's port 134
9.6 Option 4 - enable growth of Auckland's port in its current location 135
9.7 Option 5 - build a new port in a new location 137
9.8 Short-listed options 143
10 Cost Benefit Analysis 145
10.1 Methodology adopted 145
10.2 Land valuation 148
10.3 Discount rates 149
10.4 Approach to identifying costs and benefits 151
10.5 Methodology for inputs 152
10.6 Cost benefit analysis assumptions for options 160
10.7 Overview of CBA results 164
10.8 Comparison to the base case 200
10.9 Sensitivity testing analysis 207
11 Recommendations 209
11.1 Monitoring regime 209
11.2 Roadmaps 209
11.3 Roadmap variables 210
11.4 Roadmap scenarios 211
11.5 Protecting the option 212
11.6 Conclusion 212
12 Other Considerations 213
12.1 Governance/ ownership structure 213
12.2 Private sector involvement 213
12.3 National port strategy 214
13 Glossary 216
14 Bibliography 221

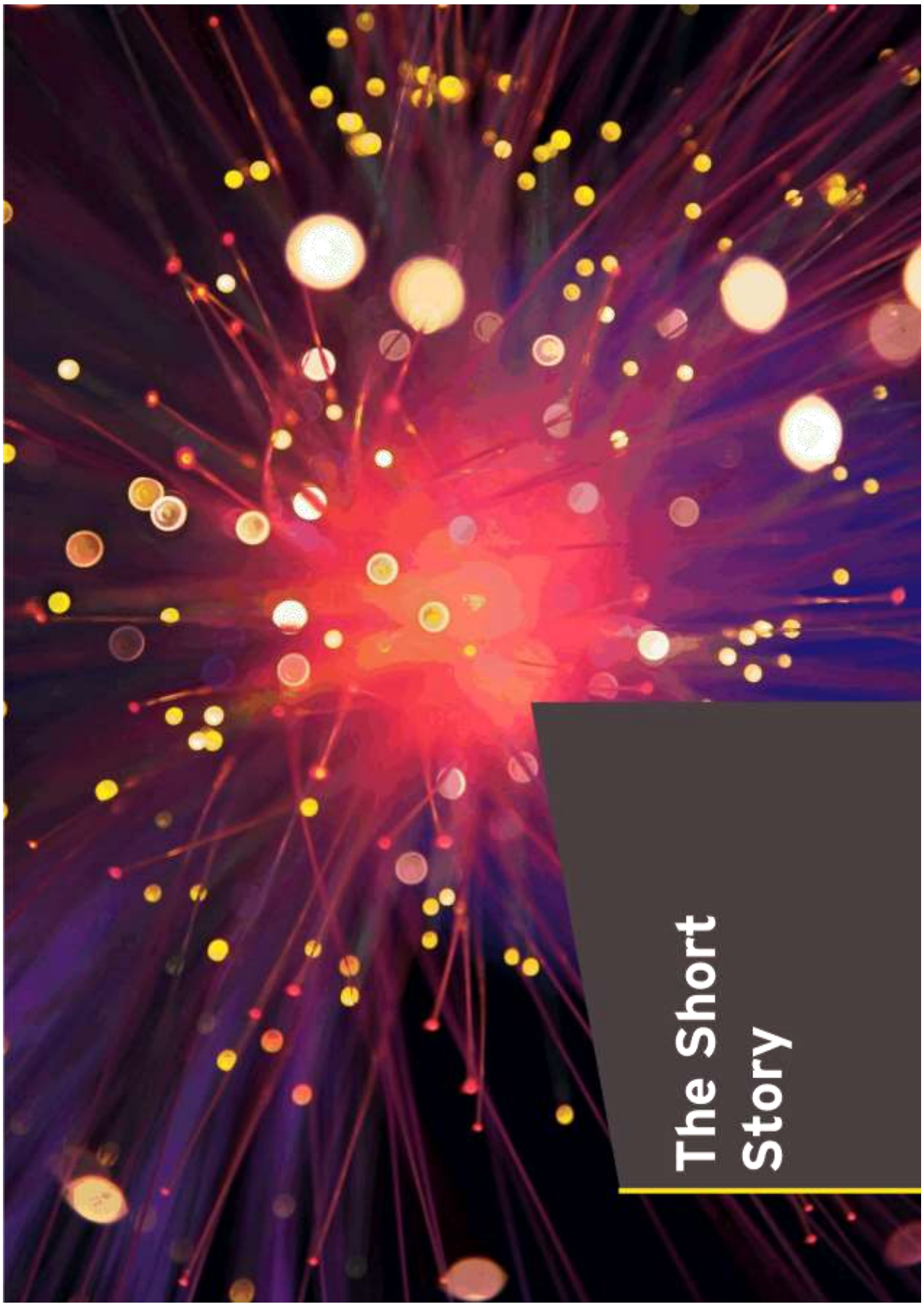
Item 16

Attachment B

Disclaimer

Ernst & Young (EY) was engaged on the instructions of Auckland Council to provide a comprehensive study of future port options in accordance with the engagement agreement dated 21 November 2015 including the General Terms and Conditions. The results of EY's work, including any assumptions and qualifications made in preparing the report, are set out in EY's report dated 22 June 2016 ("Report"). You should read the Report in its entirety. A reference to the Report includes any part of the Report. Unless otherwise agreed in writing with EY, access to the Report is made only on the following basis and in either accessing the Report or obtaining a copy of the Report the recipient agrees to the following terms:

1. The Report has been prepared for Auckland Council's use only.
2. EY has consented to the Report being published electronically or released into the public domain for informational purposes only. EY has not consented to distribution or disclosure beyond this. The Report may not be used or relied upon by any other party without the prior written consent of EY.
3. EY disclaims all liability in relation to any other party who seeks to rely upon the Report or any of its contents.
4. EY has acted in accordance with the instructions of Auckland Council in conducting its work and preparing the Report. EY has not been engaged to act, and has not acted, as advisor to any other party. EY makes no representations as to the appropriateness, accuracy or completeness of the Report for any other party's purposes.
5. No reliance may be placed upon the Report or any of its contents by any recipient of the Report for any purpose and any party receiving a copy of the Report must make and rely on their own enquiries in relation to the issues to which the Report relates, the contents of the Report and all matters arising from or relating to or in any way connected with the Report or its contents.
6. No duty of care is owed by EY to any recipient of the Report in respect of any use that the recipient may make of the Report.
7. EY disclaim all liability, and take no responsibility, for any document issued by any other party in connection with the Report.
8. No claim or demand or any actions or proceedings may be brought against EY arising from or connected with the contents of the Report or the provision of the Report to any recipient. EY will be released and forever discharged from any such claims, demands, actions or proceedings.
9. To the fullest extent permitted by law, the recipient of the Report shall be liable for all claims, demands, actions, proceedings, costs, expenses, loss, damage and liability made against or brought against or incurred by EY arising from or connected with the Report, the contents of the Report or the provision of the Report to the recipient.
10. The material contained in the Report, including EY logo, is copyright and copyright in the Report itself vests in the Auckland Council. The Report, including the EY logo, cannot be altered without prior written permission.


The Short Story

1 The Short Story

This comprehensive study was commissioned by the Consensus Working Group (CWG) of the Port Future Study. The objective of the Port Future Study is to recommend a long-term strategy for the provision of port facilities to accommodate sea-based imports and exports and the cruise industry flowing to and from Auckland and its wider region in an economically, socially, culturally and environmentally acceptable manner, taking into account competing uses for city centre waterfront space and the various impacts of options.

1.1.1 Is there tension between the port and the CBD?

Port of Auckland Limited (POAL) has a significant role in the Auckland and New Zealand economy. As a facilitator of trade in the supply chain for imports and exports, their activities generate wider economic benefits including employment, business activity and investment, and direct benefits from the cruise activities including facilitating tourism. In order to capitalise on these benefits, any long-term strategy must have a role for the port.

Auckland's population has grown by 22% since 2001. The central business district (CBD) is considered the engine room of Auckland, with the largest concentration of education and employment. The current CBD footprint is expected to grow as increasing residential and urbanisation continues, along with transport infrastructure improvements.

Increasing residential developments within the Auckland CBD also means that the population of the CBD will continue to grow. This has inevitably placed constraints on the current space and demand is expected to increase.

Determining the highest and best use for port land to accommodate the future of both the port and the CBD will be the crux of this study. "Best use" is an emotive topic that naturally is influenced depending on the priorities and value sets of the party determining the answer. This study attempts to provide hard evidence to the CWG in order to help inform the reader of this study. Our conclusions can only ever be a guide and ultimately, decisions will be made by policy makers using the evidence in this study as well as their own interpretation of the opinions and preferences of the Auckland community and New Zealand, looking generations into the future.

1.1.2 What is the future state?

Growth in New Zealand's population and economy is primarily driven by growth in Auckland and the North Island. Globally, world trade is predicted to grow with New Zealand's main trading partners gaining greater global market share. Our forecasts suggest that the demand for port activities including container trade, multi-cargo (including vehicles), and cruise will continue to grow in the short, medium and long-term.

Table 1: Port activity and forecasted average long-term growth rate range

Port activity	Forecasted range average long-term growth rate (per annum) up to 2060
Container trade (TEU)	2.1% - 5.0%
Multi-cargo (tonnage)	1.1% - 3.6%
Vehicles (unit)	0.6% - 2.3%
Cruise (Ship visits)	0.3% - 2.5%
(Passenger numbers)	1.2% - 4.2%

1.1.3 Who has the trade task capacity?

The ability to handle the long-term growing trade task depends on the long-term capacity of the port and the existing ports in the North Island.

1.1.3.1 POAL's capacity

Our technical and benchmarking assessment considers that in the long-term, POAL will be constrained due to the following reasons:

- In relation to container task and with the assumption of no further reclamation or land, there is a capacity limit on increases in operational productivity based on the next feasible port yard technology available.
- There is a limit imposed by berth capacity. Berth capacity relates to the length of the terminal where ships can dock. There is a trend that larger vessels are becoming more frequent, increasing the need for longer berths.

Taking a medium growth rate of 2.9% compounded annual growth rate (CAGR), and our assessment of POAL productivity figures, it is suggested that container capacity could be reached in the medium term as early as 2055. This date is sensitive to both these variables and depending on the view taken; this date could be hit substantially earlier (2039) or later (2070). However, we believe that based on the evidence, it would be prudent to anticipate that capacity will be exceeded over the long-term period of this study.

Our analysis found that capacity for vehicle trade could be reached in the short-term as early as 3 years or as late as 12 years under respective high or low growth scenarios. We have, however, assessed that there are a number of options to cope with capacity issues in the short-term. These range from partial relocation of the task, further reclamation or constructing vertical infrastructure. We consider that this is a key decision in the short-term, which must align with the holistic long-term strategy employed.

1.1.3.2 Existing North Island ports

Assessing the long-term trade task for Port of Tauranga suggests that the Port of Tauranga may be facing its own capacity issues, and would be unable to accommodate Auckland's trade task as well as its own.

Northport is effectively designed as a multi-cargo port. As such, it is potentially well suited to take some of Auckland's trade task and they have expressed an interest in doing so. Relocating multi-cargo to Northport would have a considerable impact on the supply chain for these goods, and associated negative costs for suppliers and freight operators, as most of the goods would have to be transported back to the Auckland region and further south. The related transport infrastructure pressures and loss of economic activity to the Auckland region would be significant.

1.1.4 The results

Our analysis of the short-listed options, in accordance with the scope of this study assesses which option could accommodate the long-term (50-100 years) trade task. The short-listed options are:

- Option 1: Constraining the Auckland's port to its current footprint (including what is currently consented)
- Option 4: Enabling growth of Auckland's port in its current location (Expand)
- Option 5: Building a new port elsewhere (New Port) - an initial physical, economic, environmental, social and cultural assessment was conducted in the form of a Multi-Criteria Analysis (MCA) on a number of potential sites to assess their viability. The outcomes of the MCA suggests the following appropriate site areas:
    A. Manukau - Central Manukau, Hikihiki, Puhinui
    B. Western Firth of Thames – Kawakawa Bay, Waimango Point[1]
    C. Muriwai – Offshore, North West Coast

These five options (Option 1, Option 4, Option 5a, Option 5b and Option 5c) underwent further detailed quantitative and qualitative assessment including an environmental, economic, social and cultural assessment and a cost benefit analysis.

The cost benefit analysis results for the short-listed options show that:

- Options 1 and 4 will be constrained in the long-term, even with significant capital investment. As a result, revenue and operating costs for POAL in these options will be capped at their respective trade task capacity limits. This means that there is no ability to generate additional revenue or achieve economies of scale as the overflow trade task will be re-directed elsewhere. In addition, there will be an increased cost to freight operators for having to transport any overflow trade task from other existing ports back to Auckland.
- Option 5 does not have a long-term constraint and the new port built will be able to achieve a trade task of up to 10 million TEU. Of the seven potential sites assessed for the CBA, the Manukau options had the highest net present value (NPV). Manukau was preferred because of its proximity to the main regions where the majority of the trade task is, and is expected to be, travelling. This would result in lower freight operating costs for freight operators.
- The alternative land use benefits that accrue to Option 5 are an additional benefit that is not realised in Option 1 and 4. The change in land use at the Waitematā site is expected to generate an economic benefit which captures the value of a redeveloped waterfront site.

[1] Mana whenua iwi tell us this area is incorrectly known as Waimangu Point.

1.1.5 Cruise

Cruise is an important part of the tourism industry in Auckland and New Zealand, providing over $500 million value per annum to the New Zealand economy. It is a growing industry in New Zealand, with Auckland being the busiest region. We consider the magnitude of the success of cruise in Auckland is due to the following reasons:

- The current terminal is in the city location, which provides close proximity to established tourist attractions and retail businesses.
- The current terminal provides easy accessibility to transport services and infrastructure.
- Auckland location functions as New Zealand's 'exchange port' for cruise ships, due to the international air links, and hotel capacity for in-between cruise stops.
- Auckland is an established cruise hub for Oceania and is currently rated highly for its visitor's experience.

Accounting for recent cruise trends it is anticipated that the cruise industry will continue to grow, with anticipated of increasing larger cruise vessels. It is recommended that cruise activities remain at the current location to cater for the growth in this industry and to capitalise on economic benefits from tourism to Auckland and New Zealand.

Although there is an opportunity cost to the cruise industry from a risk perspective in terms of currently docking in an area that is in the vicinity of an operating commercial port, due to the reasons above, we found that the economic benefits that accrue to the city from the proximity of cruise to the centre of Auckland's city outweighs this cost. It does however, raise the point that Auckland may be more attractive as a cruise location if the port is moved from its current location and cruise remains where it is.

Social and environmental considerations for cruise

Continued presence of the cruise terminal in the CBD would have positive social impact on the vibrancy of the CBD and immediately surrounding areas including Parnell, Newmarket the Eastern Bays, and other popular cruise passenger destinations within proximity of the terminal.

1.2 Recommendations

The port and the city are forecasted to grow and both will require significant investment and development over the coming years. In order to make these decisions, certainty over the future of the port will be required for effective planning and investment.

1.2.1 A monitoring regime

Our forecasts suggest that container trade, multi-cargo trade and cruise will reach capacity within the study time frame. It should be noted that there is always a degree of uncertainty when forecasting, and actual results may vary year on year.

This is the same for operational productivity rates. To mitigate this risk we recommend that a monitoring performance and reporting regime, including monitoring actual operational productivity, be instigated while other recommended actions are undertaken.

The creation of a "burning platform" for change depends on the degree to which the efficiency of the port operation and the impact of trade growth will be achieved. The information gathered in such a regime is likely to influence the urgency of execution of other (especially capital intensive) recommendations.

We believe that even should the CWG not agree the existence of a capacity constraint "burning platform" then the decision on whether or not, and when, to relocate the port needs significant further debate and discussion within the CWG to attempt to better reach a common view around the net benefits or dis-benefits (quantifiable or not) that accrue to the city if the port is relocated.

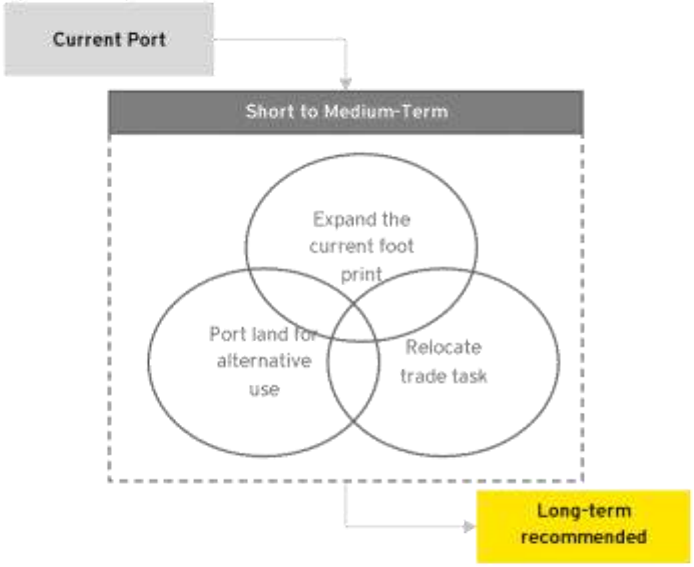
1.2.2 Roadmap - not just one path

The short to medium-term decisions will be highly dependent on the long-term strategy. Different decisions in for the long-term will lead to different paths and options in the short-term. For example, if trade capacity was expected to be reached within the next 30 years, there will be a decision required in the short-term on whether to reclaim, which necessitates a shorter planning timeframe; or build a new port, which we anticipate will require a 15 year timeframe (5 years planning and 10 years to build). This will have flow-on impacts on how transport corridors should be upgraded or protected for future freight traffic.

There is a combination of short to medium-term paths each with their own considerations. Each combination of scenarios could change the timing but would ultimately work towards the long-term solution employed.

We make no recommendation on the right road map as this would depend largely on the long-term strategy employed and require significant analysis to determine the "best" pathway. We recommend a detailed transition plan to be initiated based upon the agreed long-term strategy, setting out the agreed long-term strategy, setting out the appropriate viable roadmap for the short to medium-term.

Figure 1. Roadmap scenarios



1.2.3 Mana Whenua Iwi

Mana whenua iwi/hapu hold interests, associations and relationships to the present port location and the proposed short-listed sites. Three of the four proposed sites (Waitematā, Manukau and Western Firth of Thames) are presently part of separate Treaty Settlement negotiations with the Crown. This significantly elevates the importance of early constructive dialogue, co-design and shared decision making with mana whenua.

1.2.4 Protect the option

It is vitally important to recognise that we live in a dynamic environment and that this study shows preferred alternatives at this current point in time. It does not reflect how alternate sites might evolve and land use at these sites might change.

If the appropriate planning or option protection does not occur in the short-term with regards to the new sites, it is likely that the metrics around each site will fundamentally change if development in the alternate site areas is allowed to occur, which lessens the availability of land or restricts land use for any future port option.

This is particularly the case for the Manukau options, where development plans around areas which are less industrial (e.g. Drury) may make the site uneconomic in the future in the absence of Notices of Requirement and incorporation into Regional Plans. As such, we recommend that unless expansion of the current site is considered by policy makers to be an acceptable option at some future date, then it is critical that preferred alternate options are protected over the long-term to maintain their value.

1.2.5 Consider scope

The scope of this Study focused on developing a long-term strategy for the provision of facilities to accommodate sea-based imports and exports and the cruise industry flowing to and from Auckland and the wider region. The analysis indicates that it is highly likely that a new location will be needed in the medium to long-term. Whilst assessing ownership, governance and funding were not explicitly part of the scope of this work, investing in a new port provide some challenges in terms of funding and affordability.

There are potentially multiple sources of funding for a new port, including national, local and private funders. Potential joint ventures with Port of Tauranga or co-ownership/co-governance options with mana whenua iwi should be investigated in the next phase of work.

The next phase of work should also consider widening the scope to assess the New Zealand wide impacts on both exports and imports of having a new port in the Upper North Island, and what that means for both the configuration of land and sea-based supply chains, as well as for ownership, governance and funding arrangements. Such wider scope may lead to a different preferred alternate site.

1.2.6 Conclusion

Any decisions made today and in the medium-term will have significant impacts on the future of Auckland. There will be a need to make difficult decisions regarding the future of the port and the city, with trade-offs to be considered for all options. The chosen future state of Auckland may require some bold decisions today. Therefore, the next steps will be critical to enabling that future.

The decision as to whether a new port should be built and current port land returned to the city, or whether the Auckland's port is allowed to remain in its current location, recognising the likelihood for expansion over the long-term is difficult. There are also significant short/medium-term consequences of the long-term decision that might result in significant land area being available to the city (or not) within this shorter time horizon. There are flow-on impacts for both these options that will have a long-term impact on Auckland's economy, society, relationships with mana whenua iwi and urban form.

The Port Future Study initiative is a collaborative, stakeholder and mana whenua iwi focus study, with emphasis given on wider community involvement in the decisions about the ports future. A process for consultation and engagement with both mana whenua and the wider public should continue to ensure that the project retains community involvement and that any agreed future port will have all stakeholders' buy-in.

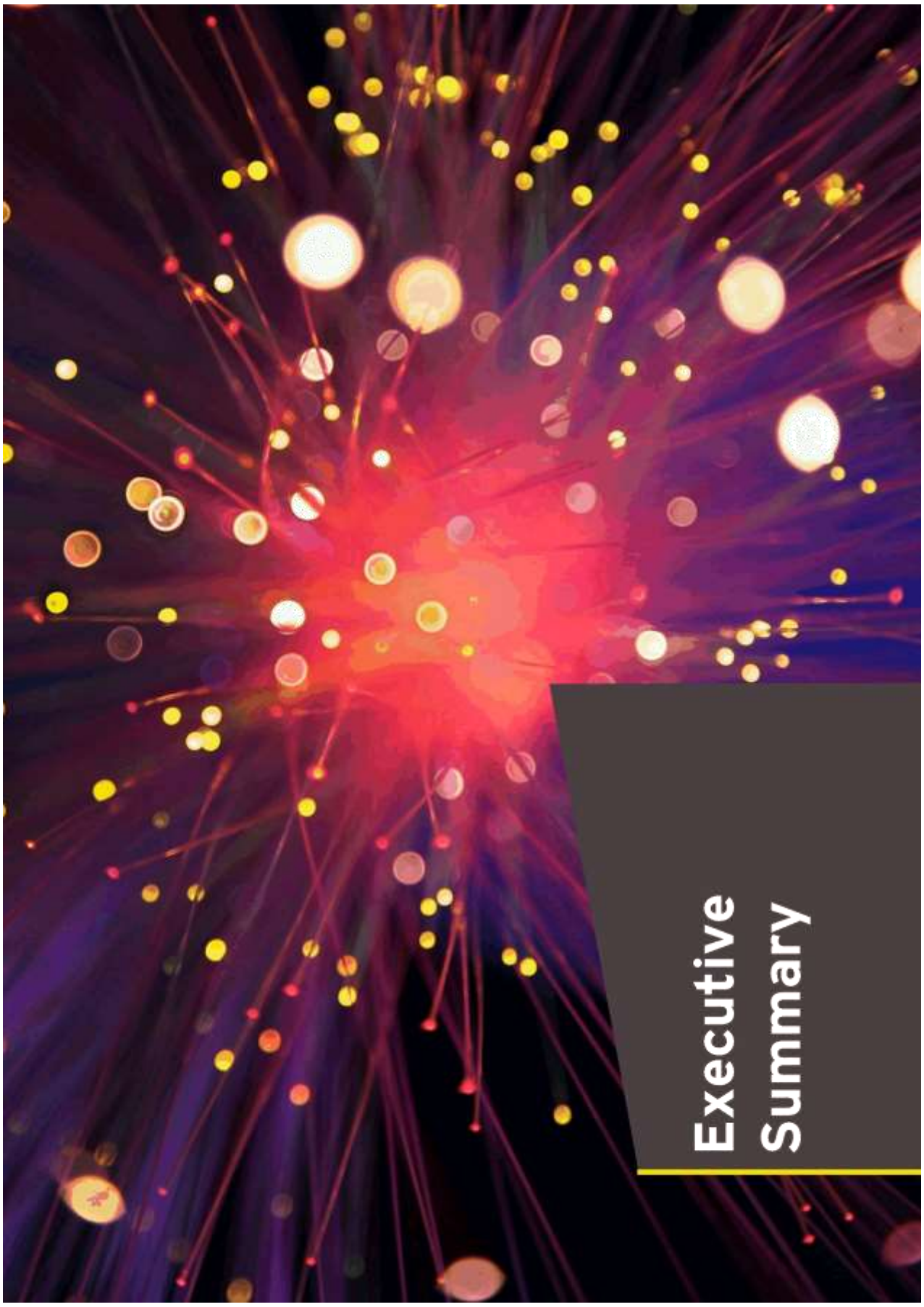
The way forward

Our study presents an independent, evidence based analysis of future trade options for Auckland. Based on our findings, we have made the following recommendations:

1. Recognise that POAL will almost certainly be capacity constrained in the long-term for both container and bulk cargo (a "burning platform").
2. Observe that there are a number of options available to meet the multi-cargo needs, such as relocating some task, reclamation or vertical infrastructure that should align with the long- term strategy employed.
3. Implement a monitoring regime to help proactively identify with clarity when triggers are reached that confirm the burning platform.
4. Develop a transition plan recognising that there are a variety of roadmaps to reach any end state and determining the short and medium-term roadmap will be critical once a long-term strategy is agreed. We have outlined the key pragmatic alternatives for consideration in the roadmap.
5. Protect the "next best alternative" which is currently identified as Manukau.
6. Recognise that there are further complex issues requiring more CWG consideration to determine how fast to implement change or whether change should be implemented.
7. Assess the appetite for a wider national debate on the long-term future port requirements that considers New Zealand wide imports and exports, which may have the potential to lead to a different preferred alternative.

We believe the CWG now has the facts and evidence to move forward and are in a position to make a recommendation on a future Port strategy. This will not be simple for the group given the wide views and valid concerns of the membership.

To achieve consensus will require substantial investment of time with a focus on the long-term; however, the analysis and recommendations of this study provide a foundation for the CWG to further add their values and the voice the community in their recommendations.


Executive
Summary

2 Executive Summary

2.1 Introduction

On 1 April 2015, the Auckland Development Committee (ADC) commenced the Port Future Study. The study design, scope and governance were endorsed by the Auckland Development Committee in May 2015.

The Port Future Study is an ADC initiative to recommend a long-term strategy for the provision of facilities to accommodate sea-based imports and exports and the cruise industry flowing to and from Auckland and the wider region.

The study considered the economic, social, cultural and environmental impacts of options, taking into account competing uses for city centre waterfront space.

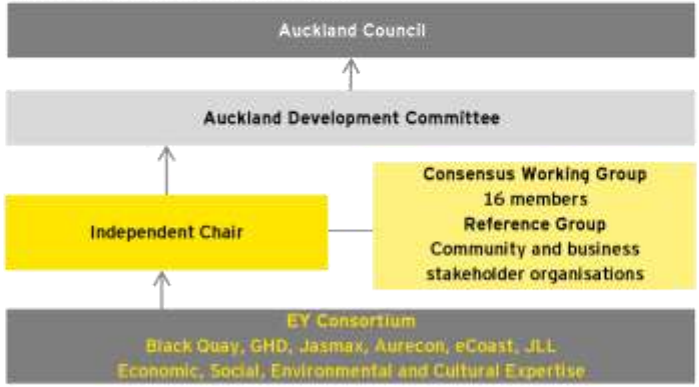
On 18 November 2015, EY's consortium was appointed to undertake a comprehensive study that looks at the impacts (positive and negative) of various options for the future of the Auckland port.

2.1.1 Governance

A distinctive component of this engagement is the importance placed on collaborative stakeholder engagement though both the Consensus Working Group (CWG) and the Reference Group (RG) led by an Independent Chair.

Figure 2 below represents the design structure of Port Future Study:

Figure: Governance structure of Port Future Study



2.1.2 Key tasks and scope

The Port Future Study explicitly considers the economic, social, environmental and cultural costs and benefits as well as the feasibility of a range of options to accommodate trade in the future. The options that will be assessed are:

- Option 1: Constraining Auckland's port to its current footprint
- Option 2: Downsize Auckland's port by shifting some of the operations to another location (Downsize)
- Option 3: Relocating some or all volume or activity of Auckland's port (Relocate)
- Option 4: Enabling growth of Auckland's port in its current location (Expand)
- Option 5: Building a new port elsewhere (New Port)

All options consider how port activities could be reconfigured (both current and future), and therefore also consider the wider impacts on and requirements of the waterfront and its surrounds; for example, the central wharves and cruise requirements. The Port Future Study is not restricted to the current 'port precinct'.

The Port Future Study must also give consideration to:

- The need to consider the longer term; at least 30 years for freight estimates and more than 50 years for port location.
- Alternative (higher and better) uses for the current port land and opportunity costs from different options.
- Recommendations about the timing of any changes proposed. The focus of the study is on recommending a port strategy from among the available options. It is not the explicit purpose of this study to consider ownership or governance issues. However, considerations when evaluating the options or implementation feasibility may include factors such as national and regional port strategies, or port ownership and governance.

The key deliverable is therefore a single recommendation about a long-term strategy for the port, together with compelling evidence that the recommended solution is better than the alternative options.

2.1.3 Methodology and process overview

The methodology applied to deliver this Port Future Study has combined the technical expertise of the project team, with the contextual knowledge held by the CWG and the RG. The key aspects of the methodology outlined in Figure 3 include:

- Strategic Case and Evidence Gathering: Established the context for the project, identify the 'problems' the project is looking to address.
- Criteria for Analysis: Identify and agree how the various options would be analysed.
- Long-Listing: The stage represents the initial identification of possible and feasible options.
- Short-Listing: In order to short-list the range of options, relevant technical and feasibility criteria were developed. This stage involved conducting a number of assessments including a physical viability assessment, and a multi-criteria analysis (MCA).
- Cost Benefit Analysis: a CBA was then conducted on the short-listed options.
- Recommendation: The recommended option that incorporates economic, cultural, environmental and social considerations.

Figure 2: Overview of project process and methodology

2.2 Determining the case for change

On the 3 December 2015, the CWG was invited to partake in an Investment Logic Mapping (ILM) workshop to consider and focus on defining what the key 'problems' are that the Port Future Study is trying to resolve. The problems identified provided the basis for the project team to analyse and assess whether there is a problem and how the five options identified above potentially address these problems. The CWG determined the following problems to be explored as part of this study:

1. **Capacity will constrain the ports ability to meet future freight and cruise demands, which may limit economic growth in the long-term**

   Capacity includes both the capital and the physical capacity at the current port location both landside, berth and transport network. Future freight includes the long-term trade task for multi-cargo and container goods, while also acknowledging a growing cruise industry. Understanding the role of the port will be critical.

2. **Tension between, and competition for, limited resources for the CBD and the port will lead to suboptimal outcomes for one or both**

   The port is located on the fringe of the Auckland CBD on reclaimed foreshore of the Waitematā Harbour. It is critical to understand the future needs of the port and the CBD to understand any potential suboptimal outcomes including the opportunity cost of the underlying land.

3. **Port activities create environmental, economic, social, and cultural impacts which need to be understood and addressed.**

   The port is a major link in the production supply chain. It supports the economic development of Auckland and New Zealand. Port activities have environmental impacts including noise, light, and other pollution, marine and coastal implications. The port is located on reclaimed foreshore of the Waitematā Harbour, a resource recognised to be of national significance within the Hauraki Gulf Marine Park. The Waitematā Harbour has significant value to Māori and mana whenua iwi. These implications need to be considered when assessing the viable options.

These three problems provided the basis for the strategic case and evidence gathering stage.

2.3 Strategic case and evidence gathering

2.3.1 Our key findings

Capacity will constrain the ports ability to meet future freight and cruise demands, which may limit economic growth in the long-term.

- Auckland's port has a significant role in the Auckland and New Zealand economy. As a facilitator of trade in the supply chain for imports and exports, they generate direct economic benefits including employment, business activity, and wider economic benefits from the cruise activities including tourism.
- Analysis of drivers and indicators of port activity, including population growth and national and world trade growth, and economic growth suggest a continual increasing trend, and growth in port activities.
- Consumption and technology trends suggest we are consuming more per capita. There may be disruptive technology and changes in preference of goods; however, overall volume of consumption and production of goods is expected to continue to increase.
- Capacity of a port is largely dependent on two factors; one by its infrastructure to accommodate trade volumes and size and number of vessels; and two by way of port productivity, i.e. the faster the turnaround, the greater the capacity.
- There is a trend moving towards larger vessels (for trade and cruise), which require more berth/port infrastructure.
- Port technology innovation which improves operational productivity is driven by large ports with smaller ports adopting previous technologies due to volume and cost.
- Our assessment of the future state and the port capacity suggests that the likelihood for capacity to be reached in the medium to long-term is high, which suggests economic growth may be constrained in the future.

Tension between, and competition for, limited resources for the CBD and the port will lead to suboptimal outcomes for one or both

- Since 1989, there has been a steady contraction of Port land eastward from the Harbour Bridge. POAL owns around 77 hectares of land in its current location, which is roughly double the area of Wynyard Quarter and one sixth of the current CBD.
- Historically, Auckland has developed from the foreshore. The gentrification of port land has also occurred from the eastern side, giving rise to redevelopment of port land for alternative use.
- An increasing CBD population, forecasted growth in CBD employment and education, accompanied by large transport infrastructure investment will lead to greater urbanisation, and demand for more resources in the CBD.
- The forecast trade task and capacity of the port suggest that in order for POAL to accommodate the future trade task, POAL will eventually have to increase their footprint in the long-term.
- Auckland's future vision for the city will have an impact on its social, economic, environmental, and cultural wellbeing. The decision on how to allocate scarce CBD resources is important for the future of the port and for the Auckland population and the city's growing urbanisation and demand for land.
- The alternative value of the current port land must be understood in the context of the existing tension.
- The trade-off between how resources are allocated will have flow-on implications for the need for increased transport infrastructure, congestion and environmental burdens on the city. This has to be weighed against the impact of a new port on its location, and the value of an alternative development at the existing port site.

Port activities create environmental, economic, social, and cultural impacts which need to be understood and addressed

- Port activities remaining in its existing location or moving to a new location will create environmental, economic, social, and cultural impacts which need to be understood and addressed before a decision can be made about the future of the port and the CBD.

2.3.2 Cruise

Cruise is an important part of the tourism industry in Auckland and New Zealand, providing over $500 million value to the New Zealand economy. It is a growing industry in New Zealand, with Auckland being the busiest region. We consider that the success of cruise in Auckland is due to the following reasons:

- The current terminal is in the city location, which provides close proximity to established tourist attractions and retail businesses.
- The current terminal provides easy accessibility to transport services and infrastructure.
- The Auckland CBD location functions as New Zealand's 'exchange port' for cruise ships, due to the international air links, and hotel capacity for in-between cruise stops.
- Auckland is an established cruise hub for Oceania and is currently rated highly for its visitor experience.

Accounting for recent cruise trends, it is anticipated that the cruise industry will continue to grow, with increasingly larger cruise vessels planned to stop in Auckland. It is recommended that cruise activities remain at the current location to enable Auckland to capitalise on the economic benefits for New Zealand's tourism that this industry provides.

Although there is an opportunity cost to the cruise industry from a risk perspective in terms of currently docking in an area that is in the vicinity of an operating commercial port, due to the reasons above, we found that the economic benefits that accrue to the city from the proximity of cruise to the centre of Auckland's city outweighs this cost. It does however, raise the point that Auckland may be more attractive as a cruise location if the port is moved from its current location and cruise remains where it is.

Social, cultural and environmental considerations for cruise

Continued presence of the cruise terminal in the CBD would have positive social impact on the vibrancy of the CBD and immediately surrounding areas including Parnell, Newmarket the Eastern Bays, and other popular cruise passenger destinations within proximity of the terminal.

Auckland Council has a vision that aspires for Auckland to have a Māori identity that is Auckland's point of difference in the world. Providing for the continued presence of a central cruise terminal provides a platform for greater and deeper cultural interaction with mana whenua iwi who are either based within close proximity of the terminal or wider Auckland.

2.3.3 Multi-cargo

The eastern wharves at the port cater for the multi-cargo trade. As it is largely dominated by vehicle trade, we completed a desktop assessment of the ports capacity for vehicle trade.

The indicative analysis found that capacity for vehicle trade could be reached in the short-term as early as 3 years or as late as 12 years under respective high or low growth scenarios. Note that our assessment is preliminary and would require further data and assessment to confirm the dynamic capacity for vehicle trade. This capacity analysis could be incorporated into the monitoring regime. We have, however, assessed that there are a number of options to cope with capacity issues in the short-term. These range from partial relocation of the task, further reclamation or constructing vertical infrastructure. We consider that this is a key decision in the short-term, which must align with the holistic long-term strategy employed.

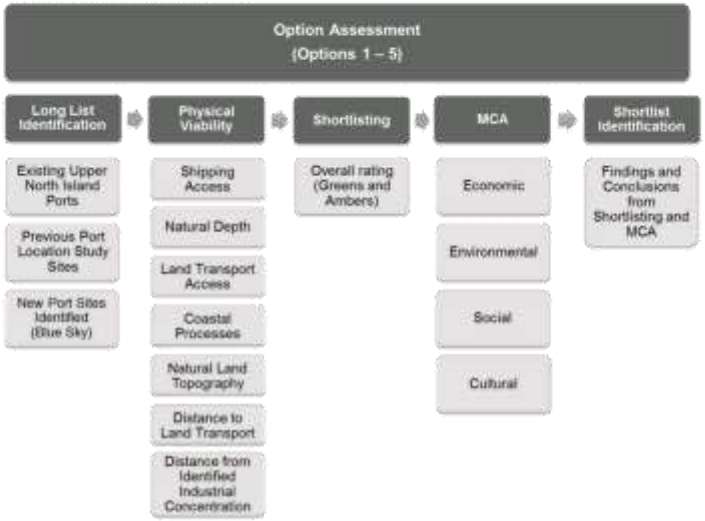
Figure 3: The growth of the CBD today and the 1840's foreshore

Source: The Waterfront Plan 2012, Auckland Council

2.4 Options assessment process

The process for assessing all five options is detailed in Figure 4 below:

Figure 4: Options assessment process



2.4.1 Long-list identification and physical viability

As determined in the ILM process, capacity was one of the main drivers for change. Therefore, we undertook a physical feasibility assessment of potential future port sites to determine their ability to handle the long-term trade task. During the long-list identification process, 30 sites and sub sites were identified, some were new sites and some had been considered in previous studies. The existing port site and upper North Island port sites were also included in the long-list.

The long-list sites underwent initial physical viability assessments and a short-list of potential future port sites was identified. This short-list was then progressed to the MCA to undergo further assessment on economic, environmental, social and cultural criteria.

2.4.2 MCA assessment

The short-list was assessed against the MCA evaluation criteria developed in conjunction with the CWG. The criteria for the MCA assessment consisted of economic, environmental, social and cultural criteria to assess the impacts for each of the short-list options.

The MCA process is designed to further refine the short-list for the CBA assessment. The results of the MCA showed that overall, the top three areas for a potential new port site were:

1. Manukau - Central Manukau, Hikihiki, Puhinui
2. Western Firth of Thames - Kawakawa Bay, Waimango Point
3. Muriwai - Offshore, North West Coast

2.4.3 Options progressed to the short-list

The next step in our assessment was to determine and define each of the five options outlined in 2.1.2 and how they compare to the future long-term trade task. This was to assess whether the option can meet the long-term viability posed in problem 1 identified above. If an option was unable to meet the long-term trade task, it was not progressed to the CBA.

In order to assess the options, a number of reasoned assumptions were made. Within each of the five options in scope, there were a number of scenarios, and analysis was carried out to highlight the optimal scenario for each. Table 2 on the following page is a summary of the options, the description and their ability to meet the trade task:

Table 2: Options assessment from long-list to short-list

Option	Description	Key assumptions	Short-term	Medium-term	Long-term	Progressing to CBA?
Constrain the port to its current footprint	▶ Ports of Auckland (POAL) would continue to be located at its current site and would continue to accommodate all trade types. ▶ This option is considered the 'do minimum' option, as it involves the least amount of change.	▶ The port would be constrained to its current footprint including consented land reclamation already under construction. ▶ It assumes that the port will increase its current container yard productivity levels by upgrading its technology. ▶ POAL will not be able to meet its multi-cargo trade task even in the short/medium-term under this option and would need its excess task to be accommodated by another port. ▶ This option will progress to the next stage standing as the status quo in order to benchmark the other options analysed.	x	x	x	Yes (Base Case)

Option	Description	Key assumptions	Short-term	Medium-term	Long-term	Progressing to CBA?
Downsize the port by shifting some operations to another location *(Downsize)*	▶ POAL would downsize its current port footprint relocating some its operations to another port and making land available for alternate uses.	▶ Gentrification of the port land would most naturally be driven from the western side of the waterfront starting at Captain Cook Wharf. We have assumed that downsizing would occur in stages, with Captain Cook in the short-term, progressing to Bledisloe in the medium-term. ▶ Downsizing would result in the ports capacity being reduced and would require its multi-cargo trade task to be relocated to another port from the medium-term. It is also dependent on the capacity of alternate ports to meet the excess task. ▶ The long-term trade task could not be met under this option due to capacity limitations at Port of Tauranga and Northport which mean it could not handle both its own growth and the excess POAL container task.	✓	x	x	No
Relocate some or all volume/activity of the port *(Relocate)*	▶ Option 3 is similar to Option 1 with the exception that any excess trade task (over and above the ports capacity) would be relocated to an existing North Island port.	▶ Due to the current established trade types, proximity to Auckland and potential to cater for future task, POT has been assessed for capability to accommodate container trade and Northport to accommodate multi-cargo trade. ▶ Port of Tauranga has capacity to meet POAL's excess container task in the short-term and possibly into the medium term, but cannot accommodate POAL's container task in the long-term without major expansion of its container terminal footprint over and above its current port development plan. ▶ In terms of a long-term solution, this option will not proceed to the CBA phase due to the capacity restriction at Tauranga. However, it should be noted that utilisation of both Tauranga and Northport may form part of a short to medium-term pathway, and Northport is potentially able to continue to service general cargo into the long-term.	✓	✓	x	No

Option	Description	Key assumptions	Short-term	Medium-term	Long-term	Progressing to CBA?
Enable growth of the port in its current location *(Expand)*	▲ Option 4 involves enabling growth at POAL's current site, allowing for expansion into the Waitemata Harbour and repurposing existing port land. ▲ Given POAL's productivity forecasts, it is expected that in order to meet both its container and multi-cargo tasks it will potentially require over 36 hectares of additional land in the medium term while in the long-term it could potentially require up to 61 hectares of additional land.	▲ This option assumes that current planning constraints would not be barriers to future reclamation of land in the harbour. ▲ Although large scale reclamation is expected to present opportunities to create more berths, berth capacity is still expected to be an issue in the long-term. ▲ Notwithstanding other considerations, this option could theoretically meet the long-term trade task with significant reclamation of land in the harbour, and therefore will progress to the CBA.	✓	✓	✓	Yes
Build a new port in a new location *(New Port)*	▲ Option 5 involves the construction of a new port to accommodate POAL's long-term trade task, including multi-cargo and container trade. ▲ Potential sites for a new port were identified (long-list of sites), driven from sites that had been discussed in previous port locations studies as well as new port sites identified through our further analysis.	▲ The long-list of new port sites were initially screened based on their theoretical physical viability. The sites that met the physical viability criteria then progressed to the MCA stage in order to be tested further. ▲ The MCA was developed in conjunction with the CWG, and includes economic, environmental, cultural, social implications. ▲ The findings of the MCA highlighted three potential areas for a new port: Manukau, Western Firth of Thames, and Muriwai. ▲ These three sites were progressed to the CBA stage for more detailed assessment. ▲ Under the assumption that to build a new port could take least 15 -20 years, we consider that this option will not be able to take the short-term trade task.	✗	✓	✓	Yes

2.5 The short-list with the CBA

The next step in the process was to carry out a CBA on the short-listed options. The CBA was carried out to determine and compare the quantifiable economic, environmental, social and cultural implications of each of the short-listed options. The costs and benefits for all the short-listed options are quantified on a real basis. The top five ranked options for the CBA are as follows:

Table 3: Ranked CBA by net value in NPV terms

Rank	Option	Cumulative Net Value (NPV - $ billion)
1	Option 5B: Puhinui	-$30.67
2	Option 5C: Hikihiki	-$32.48
3	Option 5A: Central Manukau Harbour	-$32.67
4	Option 4: High Productivity	-$33.26
5	Option 4: Low Productivity	-$33.39

The ranking reflects the lowest net loss across the appraisal period. All options recorded a net loss either due to a combination of the upfront capital investment required earlier in the period and high costs to freight operators to transport freight as volumes grew, and future benefits received over a later period being discounted, leading to lower net values.

Option 1 is ranked number six with a net loss of $33.41 billion. The positive variance between Options 1 and the top five options range between $2.6 billion to $150 million, as shown in Table 4 below:

Table 4: Comparison of the top five options relative to the do minimum option

Rank	Option	Cumulative Net Value (NPV - $ billion)
1	**Option 5B: Puhinui**	$2.74
2	**Option 5C: Hikihiki**	$0.93
3	**Option 5A: Central Manukau Harbour**	$0.74
4	**Option 4: High Productivity**	$0.15
5	**Option 4: Low Productivity**	$0.02

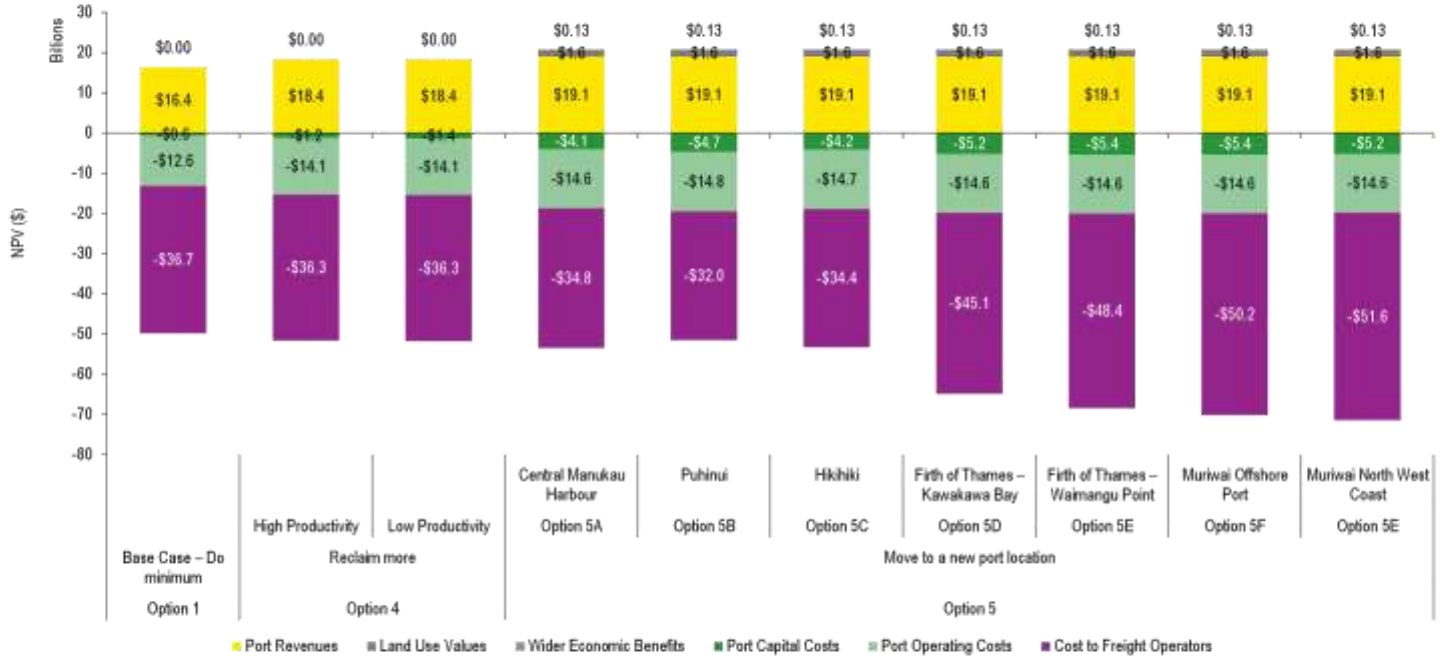
For Option 4, the higher capital and operating costs compared to Option 1 has been offset by higher Port revenues and lower freight operating costs due to less trade overflow having to travel to Auckland from other existing ports, thus there is a lesser volume travelling a lesser distance.

Out of all the options, Option 5 performs the best. Although there are higher capital and operating costs compared to Option 1, this has been offset by higher Port operating surpluses, lower freight operating costs for the sites with more favourable distances such as the Manukau sites, and the realised land value from redevelopment at the Waitematā site. Option 5 also performs better than Option 1 and 4 due to POAL capacity for the future trade task not being capped.

The option with the highest cumulative net loss is Option 5: Muriwai North West Coast with a net loss of $50.73 billion.

Figure 5 below summarises the NPV for the options over the 100 year model period. The CBA results are presented in Net Present Value (NPV) using a real discount rate of 2.5%.

Figure 5: NPV of options 1, 4 and 5



For the costs and benefits that were not quantified, Table 5 on the following page provides a qualitative discussion of the economic, environmental, social and cultural impacts for all the options. It should be note that the cost to freight operators were based solely on the fuel costs and distance (kms) travelled to transport freight from the respective port sites to their destination and does not reflect the true value of time or increasing congestion on the network. Therefore, it is likely that the freight operator costs are underestimated for port sites where the transport network is near or at capacity and overestimated for port sites where the transport network is not at capacity. In order to accurately calculate the congestion costs for all options, detailed transport modelling as well as network capacity modelling will need to be undertaken.

Table 5: Key findings of the multiple considerations for the short-listed options

Description	Economic	Environmental	Social	Cultural
Option 1: Constrain the port to its current footprint (do minimum)				
▸ Option 1 allows for POAL to increase capacity and efficiency in its current area through technological advances, but does not allow for any expansion via land reclamation other than the reclamation that has already been consented.	▸ It is expected that in the long-term, POAL profitability could be impacted assuming that the trade task handled is capped due to capacity constraints. This means that the variable cost per unit will grow whilst revenue growth is capped. This has flow on impacts on the competitiveness of the port as the trade task overflow would go to other existing ports. From a shareholder and landholder perspective, this has an impact on the value of the port asset.	▸ No change to coastal processes as port maintains the same footprint. ▸ Impact on Auckland Harbour traffic will remain the same, albeit with an increased number of vessels, however at a constrained footprint, will not increase by a degree readily quantifiable. ▸ No additional impact on marine ecology. ▸ No material change in carbon footprint is anticipated if the port remains within its current physical footprint without any change to operational capacity. However, should operational efficiencies be achieved and throughput increase, a steady increase in carbon footprint over time is anticipated. ▸ Increased noise effects may occur in line with throughput increases and in particular additional machinery, equipment and truck movements. ▸ Constraining the port to its existing physical footprint would confine the light spill effects to the current footprint, on the assumption that no	▸ Opportunities for enhanced public access to the waterfront and recreation opportunities are constrained should the port remain in its current location albeit within its existing footprint. ▸ If the port remains in the Waitematā Harbour 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 be a negative impact on the quality of urban form and design for Auckland as a growing city that has emphasis around its waterfront. ▸ If the port remained where it was there would be significantly less opportunity for Auckland to make its waterfront more accessible to the population for recreational activities.	▸ The Crown's acquisition of title to the foreshore and harbour for the port undermined the rangatiratanga of mana whenua iwi and negatively impacted upon their ability to contribute to city developments in appropriate and meaningful ways. ▸ The main developments of interest were the reclamations which have prevented mana whenua iwi from returning intermittently to their traditional areas around the port site and from actively retaining an association with their wider rohe. ▸ There remain outstanding Treaty of Waitangi questions concerning title, foreshore and harbour management and the appropriate recognition of rights and responsibilities stemming from the interests and relationships held by mana whenua iwi. Resolving these questions are extant matters for consideration as part of the Waitematā harbour settlements.

Description	Economic	Environmental	Social	Cultural
		additional light sources and no change to the location and orientation of the existing light source(s) within the existing Port would be required.		
Option 4: Enable growth of the port in its current location (Expand)				
▶ Option 4 would see the port expanding its current footprint to accommodate growing trade volumes. Assuming that an ASC system is adopted in the medium to long-term, the port is expected to need to expand their footprint by up to 47 hectares to meet the predicted 4 million TEU task for containers. ▶ It is assumed that even with widespread reclamation and upgraded technology, the physical limits of this Option means that the trade task that is the maximum the port can handle will be capped at 4 million TEU.	▶ It is expected that in the long-term, the port profitability could be impacted assuming that the trade task handled is capped due to capacity constraints. ▶ This means that there is a chance that the return generated to offset the additional capital investment in increasing capacity will not be sufficient due to trade task capacity limits limiting revenue growth. ▶ This means that the variable cost per unit will grow whilst revenue growth is capped. This has flow on impacts on the competitiveness of the port as the trade task overflow would go to other existing ports. From a shareholder and landholder perspective, this has an impact on the value of the port asset.	▶ The reclamation is unlikely to impact on coastal processes to any extent, since it does not encroach out into the main channel and since the foreshore is already highly modified by various reclamations and jetties. ▶ The increased throughput handled in Option 4 impacts on the carbon footprint of the port. ▶ Increased noise effects may occur in line with port expansion, the proximity of any expanded footprint to residential areas will determine the scale and potential of noise impacts. There will also be associated noise and probably congestion impacts along key transport corridors. ▶ Increased light spill may occur subject to the location and orientation of any reclamation.	▶ Expanding the ports footprint would have significant impact on the Auckland population and city. The existing footprint would increase further reducing opportunities for public access to and use of the waterfront. ▶ Increased use of the shipping lanes would occur alongside expansion with impacts on recreational uses of the water space within the harbour and potentially constrained and reduced recreational opportunities. Potential increased conflict between commercial and recreational use of the harbour.	▶ Reclamations in the past have prevented mana whenua iwi from returning intermittently to their traditional areas around the port site and from actively retaining an association with their wider rohe. The proposed additional reclamation under this option would only increase the degree of alienation experienced by mana whenua iwi to the existing site and wider area. ▶ Any increase in the port footprint should require a detailed Cultural Impact Assessment.

Description	Economic	Environmental	Social	Cultural
Option 5: Build a new Port				
▶ Option 5 considers that a new port will be built. There is a short-list of areas from the MCA process that are being considered. These sites are located in: Manukau, Western Firth of Thames and Muriwai.	▶ The long-term profitability of the port in the new location will increase as trade volumes increase until a maximum of 10 million TEU is reached. ▶ There will also be an additional benefit of land value realised due to new developments occurring at the former port site. ▶ For all Option 5 'New Port' sites, it is considered that the following economic impacts would be imminent. This includes the need for significant upfront capital investment, to accommodate the long-term trade task. Unlike Option 1there is therefore no opportunity cost in relation to loss of potential revenue to the port. ▶ POAL profitability could also increase assuming that the cost per unit would be reduced as volumes traded increase in the long-term. If the scale of port operations increased this could drive greater competition and potentially take business from competing ports.	▶ There is expected to be a significant positive impact for Auckland if the existing port land was redeveloped as a high quality mixed use environment including residential use and open space, with improved access to the water's edge. This would allow Auckland to maximise the highest value land use for the waterfront land, and provide commercial growth opportunities. ▶ Any significant environmental benefits in the CBD need to be offset by environmental impact at the proposed alternative sites	▶ For all Option 5 sites, building a new port in a different location will lead to the port land being returned for redevelopment. This would increase opportunities for recreational access to and use of the CBD Waterfront and remove current constraints relating to the use of shipping lanes and ship berthage. Opportunities for changes in land use, development of the harbour waterfront space and creation of new public spaces in that area create amenity enhancement opportunities within the CBD waterfront.	▶ Shifting the port would benefit mana whenua iwi who have interests and relationships in and to the area where the current port is located. Benefits include increasing the degree of mana whenua engagement and interaction to the area where the present site is including environmental and cultural programmes. ▶ Displacement of port activity could negatively impact on whanaungatanga (relationships of a familial nature or through shared experiences) between mana whenua iwi who are presently affected by the ports current location and those mana whenua who may be affected by the new port's location.

Description	Economic	Environmental	Social	Cultural
Option 5: Build a new port in a new location - Manukau				
▶ This would involve a new port being built in the Manukau area in one of three sites: Central Manukau Harbour, Puhinui and Hikihiki	▶ This option has the lower capital costs compared to the Western Firth of Thames and Muriwai sites. ▶ The range of capital costs for each of the sites within the Manukau area differs depending on the natural characteristics of each site. Puhinui has the highest capital cost due to the amount of dredging required, whilst Central Manukau Harbour has the lowest because of the natural depth. ▶ The proximity to its primary industrial customers may provide overall economic benefits such as time value savings through a reduced time for freight to travel to customers.	▶ The building of a new port in the Central Manukau Harbour is not expected to have major impacts on sediment transport. However, Puhinui and Hikihiki will be more likely to cause large changes to circulation, currents and consequent sediment transport. ▶ A reduction in carbon footprint may be achieved subject to the location of a new port within the harbour and proximity to land. If a new port can be located without the need for a substantial causeway, the carbon footprint would be less than expanding the existing port footprint. ▶ A new site within the harbour located close to land would see a reduction in carbon footprint and have a lower overall carbon footprint in comparison to other options. A new port located in Central Manukau Harbour would see an increased carbon footprint compared to Puhinui and Hikihiki, but would be less than the Western Firth of Thames and Muriwai options.	▶ Building a new port in the Manukau area has wider implications for increased economic activity in the area, including increasing business activity and demand for commercial/industrial land and to a smaller degree of residential surrounding the area. ▶ As the area surrounding the proposed sites is largely zoned industrial, building a new port in the area is unlikely to have the same adverse effects on community and social amenity as the other options would have.	▶ Auckland Council identifies at least 17 mana whenua groups who may hold differing interests and relationships in the Manukau harbour. ▶ There remain outstanding Treaty of Waitangi questions concerning title, foreshore and harbour management and the appropriate recognition of rights and responsibilities stemming from the interests and relationships held by mana whenua iwi. Resolving these questions are extant matters for consideration as part of the pending Manukau harbour settlements. ▶ There is no definitive list of the extent to which each mana whenua group holds mana whenua in the Manukau harbour and to what areas. This identification process takes significant time and most usually occurs as part of the Treaty Settlement process with the Crown. ▶ It is possible that any future settlement in the Manukau will include elements of co-governance, for example with respect to elements such as water quality and decision making powers.

Attachment B **Item 16**

Description	Economic	Environmental	Social	Cultural
				▸ Large public infrastructure projects in the Manukau have negatively impacted on taonga species in the harbour and the mana and the kaitiakitanga of mana whenua iwi. It is against this background that mana whenua support for options across the Manukau has been generally negative. ▸ These aspects will need to be further defined and considered in a more detailed Cultural Impact Assessment.
Option 5: Build a new port in a new location – Western Firth of Thames				
▸ There are two sites that were being considered within the Western Firth of Thames area; Waimango Point and Kawakawa Bay. Both sites would require transport access to be developed around the Hunua ranges and would likely be linked to Auckland through the Clevedon Valley.	▸ The capital costs to construct a new port in Western Firth of Thames is similar to constructing a new port in Muriwai due to the large scale reclamation required	▸ A new Port in the Western Firth of Thames would result in an increased carbon footprint. Whilst accessible to SH1 and the south and east of the North Island, the travel distance from SH1 to the ports landside activities increases the carbon footprint. Whilst the increase is not as high as the Muriwai option, it represents a material increase from the Manukau and the existing site options.	▸ The social impacts of a new port within the Western Firth of Thames would need to be comprehensively assessed as part of a Social Impact Assessment, should this option be carried forward for further evaluation. The effect on amenity of communities that overlook the proposed site and those who are affected by the rail and road access corridors through the Clevedon valley would need to be a key focus of any assessment.	▸ There are a number of mana whenua iwi who hold interests in the Hauraki Gulf and would consider themselves affected by a new port being built in the Western Firth of Thames including the members of the Marutuahu confederation of iwi and Waikato Tainui. ▸ No Deed of Settlement has been executed in regard to the Western Firth of Thames or with the Hauraki Collective yet. Any future settlement negotiations could include co-governance over the Firth of Thames and/or co-ownership interests in the proposed sites.

Description	Economic	Environmental	Social	Cultural
		▶ Given the relatively quiet rural nature of this location the change in noise environment will be material. There are a number of residences along the coastline that may be impacted by the change in noise environment, subject to the location of the port and the landside activities ▶ The existing night time environment would also change with the presence of a 24 hour operating port, associated landside activities and causeway all creating a potential night time illumination into the sky and adjacent viewpoints.	▶ This assessment should also include the impact on recreational opportunities within the harbour and how the ports location might impact existing access to and use of the coast. In addition, community aspirations around the use and protection of the Western Firth of Thames and the Clevedon Valley, both coastal and landside and community and stakeholder values associated with the area of impact would need to be defined and considered. The area of social impact is expected to be relatively stretched given the length of the new access corridor and the communities located along the route.	▶ The Hauraki Gulf area holds significant historical, cultural and spiritual meaning for tangata whenua within the area. The proposed Western Firth of Thames sites will have an impact on the tangata whenua relationship to the Hauraki Gulf. This impact will require consideration by the Hauraki Gulf Forum. ▶ The proposed Waimango Point location is in close proximity to an area of high Māori conservation value, cultural significance which is one of the few areas of Māori land ownership in this area. A land bridge may mitigate this impact however reclamation is unlikely to be supported by mana whenua iwi or the local Māori land owners. ▶ Some of the mana whenua iwi in this area are open to discussing the potential building of a new port provided they are involved in the design, implementation and governance of the process over time. These aspects will need to be further defined and considered in a more detailed Cultural Impact Assessment.

Description	Economic	Environmental	Social	Cultural
Option 5: Build a new port in a new location – Muriwai				
▶ This would involve a new port being built in the Muriwai area in one of two sites: Muriwai Offshore Port or Muriwai North West Coast.	▶ The capital costs to construct a new port in Muriwai are similar to constructing a new port in the Western Firth of Thames due to the large scale reclamation required.	▶ This option will have the greatest increase in carbon footprint given its distance from industrial centres where freight travels to and from existing motorway links. ▶ As Muriwai is a relatively rural location, there will be a significant change in the noise impact in the area and along the transport route. ▶ The existing night time environment would also change with the presence of a 24 hour operating port, associated landside activities and causeway all creating a potential night time illumination into the sky and adjacent viewpoints. ▶ There are also likely to be significant visual effects of increased traffic and access infrastructure (earthworks, road and rail) through Huapai/Kumeu which is an attractive rural landscape. Although population figures are currently low in this area, further residential growth is expected, but of a nature that will reinforce and enhance the rural character.	▶ There will be associated adverse social impacts of the new port at Muriwai on the amenity of communities that overlook the proposed site, and the impact on recreational opportunities on the water and along the Muriwai beachfront. ▶ Despite the area being sparsely populated, it is a highly popular destination for Aucklanders and visitors and a new port in this location might impact existing access to and use of the coast and community aspirations around the use and protection of Muriwai beach, both coastal and landside and community and stakeholder values associated with the area of impact. This will need to be further defined and considered in a more detailed Social Impact Assessment study.	▶ Muriwai is of significant importance for mana whenua iwi that hold interests and relationships to this area. ▶ Mana whenua iwi continue to exercise kaitiakitanga over this area. For example mana whenua iwi continue to contest the road designation placed over Muriwai beach and the impact that this designation has on shellfish reproduction and local wildlife. ▶ The creation of a new port will need to consider the impacts upon the ability of the mana whenua iwi to continue to discharge their kaitiakitanga obligations. ▶ The ability to gather food from the area may also be impacted. This would diminish the standing and mana of the mana whenua iwi. ▶ Important tribal taonga are still being found in the Muriwai beach area (a kauri waka was rediscovered in 2009 at Muriwai beach) ▶ These aspects will need to be further defined and considered in a more detailed Cultural Impact Assessment.

2.6 Recommendations

The port and the city are forecasted to grow and both will require significant investment and development over the coming years. In order to make these decisions, certainty over the future vision for Auckland and the future role of the port will be required for effective planning and investment.

2.6.1 A monitoring regime

Given that the results of the analysis suggest that POAL can work on its current footprint in the medium-term, the creation of a "burning platform" for change depends mainly on two factors: the degree to which the port will meet its productivity targets and the rate of actual trade growth compared to the forecasted growth rates. For example, if productivity numbers are less than expected, the ability of the port to handle additional capacity will be compromised, thus shortening the timeframe for decision making on the future of the port. Similarly, if growth rates for trade volumes are higher than the forecasted numbers, this shortens the timeframe for when capacity limits are reached and thus leads to shorter timeframes for decision-making.

Implementing a monitoring regime is a way of mitigating the risk of the above scenarios. The regime would determine when trigger points indicating the need for a new port (or further expansion of the port) occur based on how capacity and trade growth develops over the short to medium-term.

The rate at which changes in these two key variables will intensify or postpone the need to move elsewhere (or expand) is critical in considering the long-term plan for the port and the city. It is important that Auckland is well-prepared to make decisions when it needs to, and with a coherent strategy underpinning those decisions.

An ongoing monitoring framework that reports on the efficiency and performance of the port against the required benchmark efficiency gains necessary to operate on the present site, combined with monitoring of trade growth, will ensure that there are built-in time buffers for decision making and will also ensure that any subsequent decision is informed and robust.

This monitoring approach will ensure that disruptive changes (e.g. 3D printing), as well as ongoing megatrends (e.g. urbanisation, increased consumption trends) can be reflected progressively in planning for the ports future over the next 20-50 years, and the future port strategy updated accordingly.

2.6.2 It is not just about capacity

We acknowledge that even without the "burning platform" of future constrained capacity, there are many factors that support (and many that do not) a relocation of the port activities to an alternative site.

These considerations would also impact significantly on the short and medium-term solution that might be preferred. These considerations span the whole spectrum from economic, social, cultural to environmental and all will have an impact on the decision on whether to relocate the port.

Even in the absence of the burning platform, the CBA results showed that the additional benefit from redeveloping the land at the existing port site and savings to freight cost operators are enough to indicate that the new port option in the Manukau area ranks higher than Options 1 and 4, in which the port remains in its current location. These factors will need to be considered in more detail with further studies done to validate the costs and benefits.

Therefore, we believe that should CWG not agree that there is a capacity constraint burning platform then the decision on whether or not and when to relocate the port needs significant further debate and discussion within the CWG to attempt to better reach a common view around the net benefits or dis-benefits (quantifiable or not) that accrue to the city if the port is relocated or remains where it is.

The scope of this Study focused on developing a long-term strategy for the provision of facilities to accommodate sea-based imports and exports and the cruise industry flowing to and from Auckland and the wider region. The analysis indicates that it is highly likely that a new location will be needed in the medium to long-term. Whilst assessing ownership, governance and funding were not explicitly part of the scope of this work, investing in a new port provide some challenges in terms of funding and affordability.

There are potentially multiple sources of funding for a new port, including national, local and private funders. Potential joint ventures with Port of Tauranga or co-ownership/co-governance options with mana whenua iwi should be investigated in the next phase of work.

The next phase of work should also consider widening the scope to assess the New Zealand wide impacts on both exports and imports of having a new port in the Upper North Island, and what that means for both the configuration of land and sea-based supply chains, as well as for ownership, governance and funding arrangements. Such wider scope may lead to a different preferred alternate site.

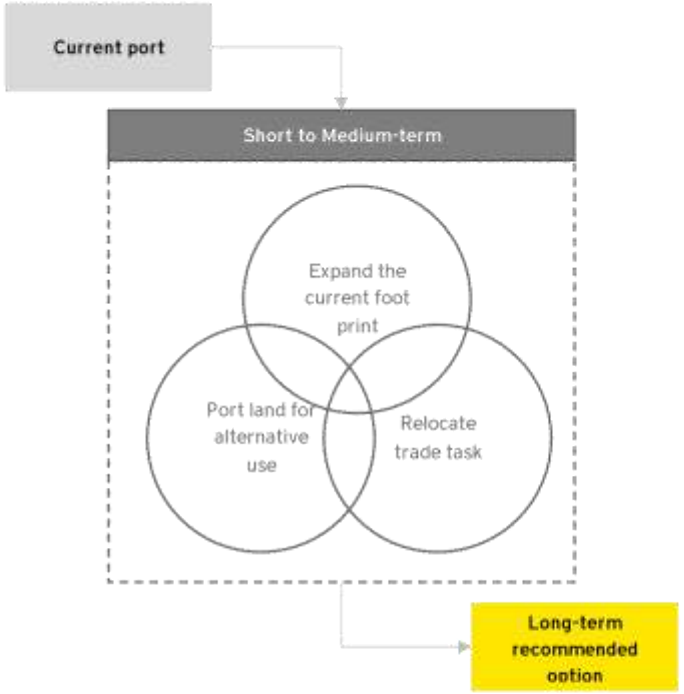
2.6.3 Roadmap scenarios

The short/medium-term decisions will be highly dependent on the long-term decision. For example, if trade capacity was expected to be reached within the next 30 years, there is likely to be a decision in the short-term on whether to allow some reclamation or accelerate building a new port which we anticipate will require a minimum 15 year timeframe (5 year planning and 10 years to build) while allowing for any short-term demand that cannot be met to overflow to other ports. This will have flow-on impacts on how transport corridors should be upgraded or protected for future freight traffic.

There is a combination of short to medium-term paths each with their own considerations. Each combination of scenarios could change the timing but would ultimately work towards the long-term solution employed.

Figure 6 on the following page is an example of the identified roadmap scenarios. There are a number of combinations of short to medium term paths, each with their own considerations. Each combination of roadmap scenarios could change the timing but would ultimately work towards the long-term solution employed.

Figure 6: Roadmap scenarios



For example, some combinations of the scenarios are listed below:

Reclamation of some land

- This roadmap only applies to the new port option; as future reclamation is assumed under the expand option. Reclaiming additional land in the harbour would allow the port to temporarily continue to handle its trade task for both containers and multi-cargo for longer, without the need to relocate excess trade task to another port. Reclamation would be limited to only accommodate the medium-term trade task, or at a consented level.

  The opportunity (including environmental and cultural) cost for the reclamation should be taken into account along with the benefits for the temporary fix.

Relocation of all/part of trade type

- Relocating some/all of the ports multi-cargo or container trade tasks would allow for shortfalls in capacity to be accommodated by other existing ports. There are significant freight and supply chain implications which would require detailed planning and co-ordination.

Reducing the current port footprint

- Reducing the current port footprint would make land available for alternative uses. There are obvious trade implications, as this reduces the capacity for trade; therefore consideration for the trade task will be critical. The potential benefit will be that potential value from the port footprint could be used to develop a new site for example, using the recycling of capital principle.

We make no recommendations on the right road map forward as this would depend largely on the long-term strategy employed and require significant analysis to determine the "best" pathway. Instead, we recommend a detailed transition plan to be initiated based upon the agreed long-term strategy, and with an appropriate viable roadmap for the short to medium-term.

2.6.4 Protect the option

We live in a dynamic environment and this study shows preferred alternatives at this current point in time. It does not reflect how alternate sites might evolve and land use at these sites might change. If the appropriate planning or option protection does not occur in the short-term with regards to the new sites, it is likely that the metrics around each site will fundamentally change if development in the alternate site areas is allowed to occur. This will lessen the availability of land and/or restrict future land use for any new port option.

This is especially important for the Manukau options, where development plans in surrounding areas which are less industrial (e.g. Drury) may make the site uneconomic in the future in the absence of Notices of Requirement and incorporation into Regional Plans. The proposed infrastructure investment for transport in this area will also have implications on the feasibility of building a port in this area, just as a new port development in that area will have an impact on any current proposed infrastructure investment.

For example, if the desired future state is to have the land at the port site returned to the city for redevelopment, then a decision in the short to medium-term would be how the ports existing and future trade task should be handled. This would mean that a new port would have to be built and planning for this should start immediately, in order to protect the option value. This also means further investigation into the possible new sites, such as detailed engineering and design, environmental impact assessments, and consultation with transport agencies including New Zealand Transport Agency (NZTA), KiwiRail and Auckland Transport (AT) will need to happen.

As such, we recommend that unless expansion of the current site is considered by policy makers to be an acceptable option at some future date, then it is critical that preferred alternate sites are protected over the long-term to maintain their value.

2.6.5 Conclusion

Any decisions made today and in the medium-term will have significant impacts on the future of Auckland. There will be a need to make difficult decisions regarding the future of the port and the city, with trade-offs to be considered for all options. The chosen future state of Auckland may require some bold decisions today. Therefore, the next steps will be critical to enabling that future.

The decision as to whether a new port should be built and current port land returned to the city, or whether the Auckland's port is allowed remain in its current location, recognising the likelihood for expansion over the long-term is difficult. There are also significant short/medium-term consequences of the long-term decision that might result in significant land area being available to the city (or not) within this shorter time horizon. There are flow-on impacts for both these options that will have a long-term impact on Auckland's economy, society, relationships with mana whenua iwi and urban form.

The Port Future Study initiative is a collaborative, stakeholder and mana whenua focus study, with emphasis given on wider community involvement in the decisions about the ports future. A process for consultation and engagement with both mana whenua and the wider public should continue to ensure that the project retains community involvement and that any agreed future port will have all stakeholders' buy-in.

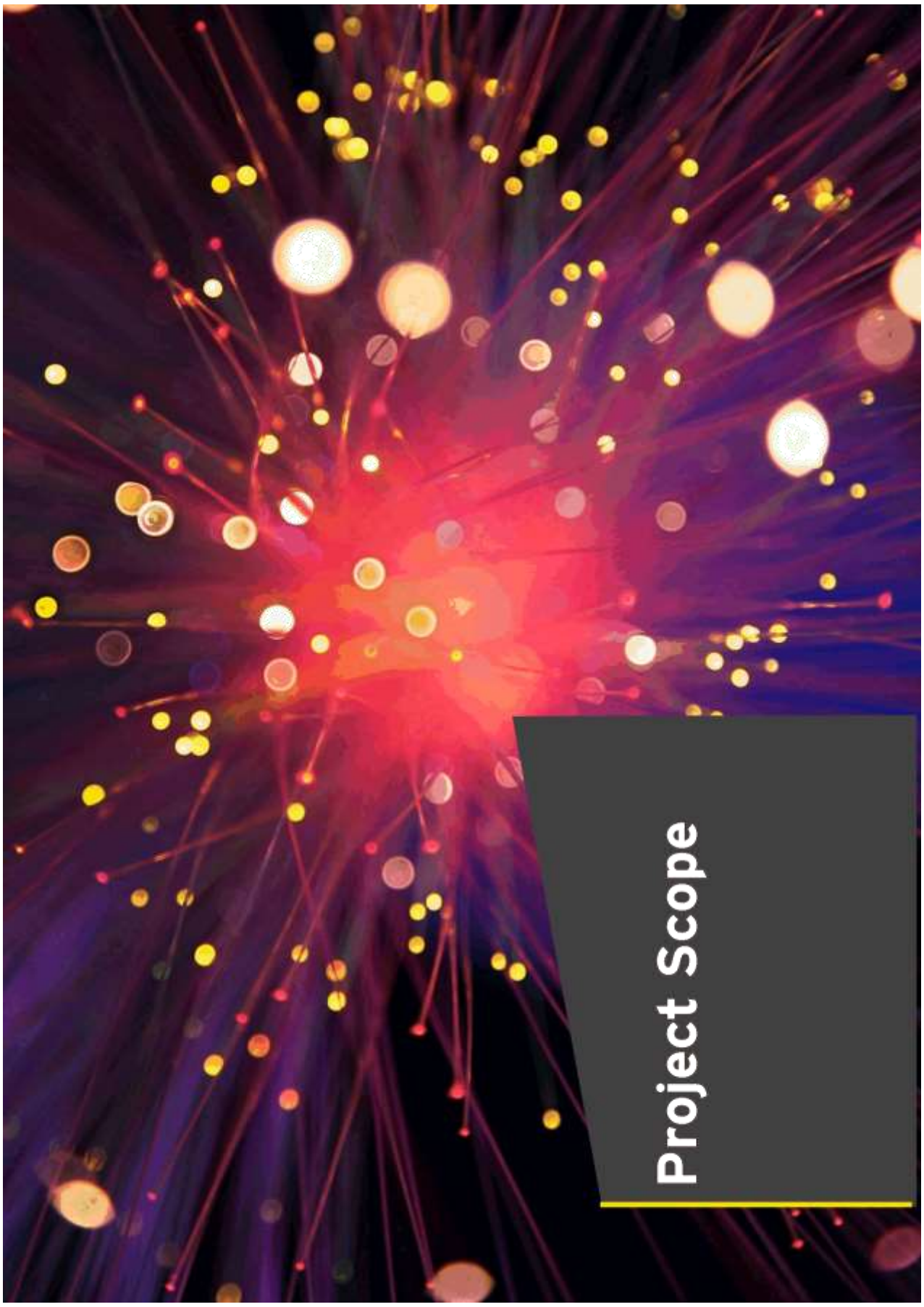
The way forward

Our study presents an independent, evidence based analysis of future trade options for Auckland. Based on our findings, we have made the following recommendations:

1. Recognise that POAL will almost certainly be capacity constrained in the long-term for both container and bulk cargo (a "burning platform").
2. Observe that there are a number of options available to meet the multi-cargo needs, such as relocating some task, reclamation or vertical infrastructure that should align with the long term strategy employed.
3. Implement a monitoring regime to help proactively identify with clarity when triggers are reached that confirm the burning platform.
4. Develop a transition plan recognising that there are a variety of roadmaps to reach any end state and determining the short and medium-term roadmap will be critical once a long term strategy is agreed - we have outlined the key pragmatic alternatives for consideration in the roadmap.
5. Protect the "next best alternative" which we identify as Manukau.
6. Recognise that there are further complex issues requiring more CWG consideration to determine how fast to implement change or whether change should be implemented.
7. Assess the appetite for a wider national debate on the long-term future port requirements that considers New Zealand wide imports and exports, which may have the potential to lead to a different preferred alternative.

We believe the CWG now has the facts and evidence to move forward and are in a position to make a recommendation on a future Port strategy. This will not be simple for the group given the wide views and valid concerns of the membership.

To achieve consensus will require substantial investment of time with a focus on the long-term; however, the analysis and recommendations of this study provides a foundation for the CWG to further add their values and the voice the community in their recommendations.


Project Scope

3 Project Scope

3.1 Project scope

In September 2014, POAL sought resource consents under the Resource Management Act 1991 (RMA) to begin the expansion of Bledisloe Wharf by extending its two wharves by 98 and 92 metres respectively, and the demolition of Marsden Wharf. Auckland Council approved each of the submissions made and determined that POAL proceed without public notification. Following the public announcement of the planned works, Urban Auckland notified POAL that it intended to bring proceedings against them. In June 2015, the High Court ruled that the lack of public consultation made the previously granted consent invalid.

In March 2015, the Mayor of Auckland directed Auckland Council to undertake a full study on the future of the port covering the social, cultural and environmental considerations associated with all potential options.

On 1 April 2015, the Auckland Development Committee resolved to commence Port Future Study. The study design, scope and governance was approved by the Consensus Working Group (CWG) and was endorsed by the Auckland Development Committee in May 2015. On 18 November 2015, EY was appointed by the CWG as the consultants to undertake technical analysis to support the Port Future Study.

3.1.1 Study objectives

Numerous studies have been commissioned over the years looking at the economic impact of the port and its place in the New Zealand freight system. However, an all-inclusive location study investigating the economic, social, environmental and cultural costs and benefits, and the feasibility of a range of long-term options (including moving the port) has never been undertaken.

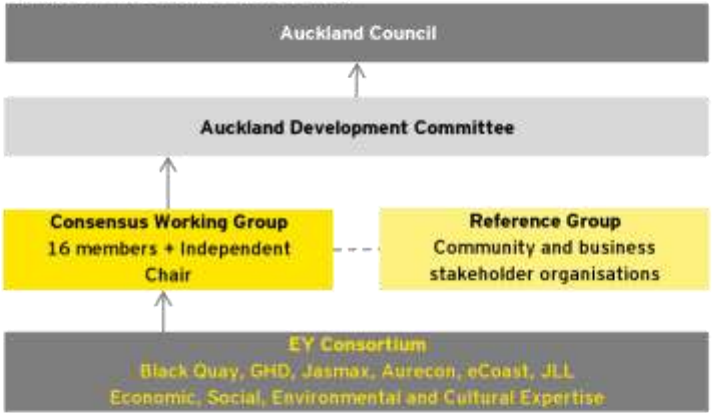
The objective of the Port Future Study is to recommend a long-term strategy for the provision of facilities to accommodate sea-based imports and exports (and the cruise industry) flowing to and from Auckland and the wider region in an economically, socially, culturally and environmentally acceptable manner, taking into account competing uses for city centre waterfront space and the various impacts of options.

3.1.2 Governance

The Port Future Study to bring together a wide range of interested groups and mana whenua members. In addition it was designed to be conducted independently from Auckland Council and without political representation.

A distinctive component of this study is the importance placed on collaborative stakeholder engagement though both the Consensus Working Group (CWG) and the Reference Group (RG) (see Appendix 1 for details). The formal governance relationships are depicted in Figure 8 below:

Figure 8: Governance structure of Port Future Study



While many projects include explicit stakeholder engagement, the fairly unique element of this engagement is that the project has essentially been 'handed-over' to stakeholders under the expectation that they work through and understand the study findings and that they make recommendations to Auckland Council on the best way forward from their consensus viewpoint. Auckland Council will then be expected to make decisions on matters arising from the Port Future Study with these recommendations in mind.

Specific roles and responsibilities of the various study participants are noted in Table 6 below:

Table 6: Roles and responsibilities of the Port Future Study participants

Mayor's Office

This process has been a mayoral initiative to provide Aucklanders with an opportunity to have their say on the future of Auckland's port.

Auckland Council

Auckland Council was involved in establishing the CWG and the RG; they have appointed the Independent Chair and are providing administrative assistance to the project.

Consensus Working Group

There are 16 members of the CWG. 12 members are from stakeholder organisations and 4 are from mana whenua. The role of the CWG is to:

- Engage with the RG
- Finalise and agree the scope of the study that will direct consultant work
- Provide direction and decisions as required and receive the consultant report
- Make recommendations to Auckland Council about the future of the port

Reference Group

The RG consists of stakeholder organisations from Auckland's wider community with an interest in the future of the port. Mana whenua of the Tāmaki Collective and Waikato-Tainui are also represented. The purpose of the 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 required by the CWG

EY Consortium

Working with CWG to deliver an evidence-driven and objective Port Future Study.

3.1.3 Scope of work

The Port Future Study will explicitly consider the economic, social, environmental and cultural costs and benefits as well as the feasibility of a range of options for the future port. The options that will be assessed are outlined in Figure 9 below:

Figure 9: Options

All options consider how port activities could be reconfigured (both current and future), and therefore also consider the wider impacts on and requirements of the waterfront and its surrounds, for example the central wharves and cruise ship requirements. The Port Future Study is not restricted to the current 'port precinct'.

The Port Future Study must also give consideration to:

- The need to consider the longer term; at least 30 years for freight estimations and more than 50 years for port location.
- Alternative (higher and better) uses for the current port land and opportunity costs from different options.
- Recommendations about the timing of any changes proposed.
- The focus of the study is on recommending a port strategy from among the available options. It is not the explicit purpose of this study to consider ownership issues. However, considerations when evaluating the options or implementation feasibility may include factors such as national and regional port strategies or port ownership and governance.

The key deliverable is therefore a single recommendation about a long-term strategy for POAL, together with compelling evidence that the recommended solution is better than the alternative options.

As you read this Port Future Study you will note the many sensitivities and complexities involved in outlining this long-term strategy. The impacts arising from the current site and potential impacts from the proposed sites on the national and Auckland economy, mana whenua, society and the environment, cannot be satisfactorily resolved in any single study. Holding those conversations required greater time than was available for this study. Such large scale infrastructure discussions involve the public of Auckland and wider New Zealand, and ultimately become political decisions of national significance. The Port Future Study process is intendeds to illustrate what the future might look like to reassure stakeholders and mana whenua that there should be multiple future points at which they will be able to involve themselves in this debate.

3.1.4 Forward Guidance from Treaty Principles

In this section we highlight relevant Treaty Principles and suggest how these Treaty Principles might be applied to the forward process for consideration by the CWG.

Mana whenua iwi hold interests in and relationships with the land and water in the area where the present port is located and where the proposed short-list sites are indicated. Three of the four proposed sites (Waitematā, Manukau and the Western Firth of Thames) are all presently part of separate extant Treaty Settlement negotiations with the Crown. Two proposed sites, the Waitematā harbour and the Manukau harbour, are specifically recognised as areas over which future harbour settlements have yet to occur. Similarly, the Firth of Thames could likely result in some form of co-management and co-governance framework over the area.

The 2010 Ngā Mana Whenua o Tāmaki Makaurau and Crown Framework acknowledged that the Tamaki Makaurau iwi have spiritual, ancestral, cultural, customary and historical interests in the Manukau and Waitematā harbours and that recognition of those interests will be addressed through redress as a part of the settlement of their historical Treaty claims.

The Manukau Harbour and Waitematā Harbour are recognised by the Crown and the mana whenua o Tāmaki (the customary tribes of Auckland) as having extremely high spiritual, ancestral, cultural, customary and historical importance to ngā mana whenua o Tāmaki Makaurau (Auckland).

The 2010 Ngā Mana Whenua o Tāmaki Makaurau and Crown Framework and subsequent Tāmaki Collective Settlement acknowledged that the Tamaki Makaurau iwi have spiritual, ancestral, cultural, customary and historical interests in the Manukau and Waitematā harbours and that recognition of those interests will be addressed through redress as a part of the settlement of their historical Treaty claims.

For completeness we note Auckland Council also recognise Ngati Wai, Ngati Manuhiri, Ngati Rehua, Te Uri o Hau, Te Ahiwaru and Waikato Tainui, who are not specifically identified in the Tamaki Collective Act, as having mana whenua interests in Auckland. Furthermore, Waikato Tainui also holds specific interests in the Manukau and Waitematā harbours. All these Treaty Settlement discussions are being progressed by the respective mana whenua iwi. How these interests, relationships and future Treaty Settlements are navigated is of critical importance.

We note the Local Government Act 2002 places responsibilities on the Auckland Council to recognise and respect the Crown's obligations in respect of the Treaty of Waitangi, and in particular the Treaty's principles. Whilst the Crown is recognised as the primary Treaty of Waitangi partner, in delegating responsibilities to the Council, the government meets its partner responsibilities by placing obligations upon local authorities to either give effect to or take into account the principles of the Treaty.

There have been numerous iterations of the principles of the Treaty of Waitangi and their application, in the context of the Port Future Study, the following key principles require consideration by the CWG:

- *Partnership* – this is a well-established principle describing the relationship between the Crown and Māori (and from which other key principles are derived), an overarching obligation is attributed to each party to act reasonably, honourably and in good faith toward the other.
- *Redress* – falling broadly within the principle of partnership, this principle recognises the burden on the Crown to provide redress to historical wrongs.

  Mana whenua iwi want to preserve their harbour Settlement redress options (including direct negotiation of foreshore and seabed related matters) in respect of the proposed short list sites considered in this Study. To the greatest extent possible recommendations reached by the CWG should apply the partnership principle and seek to preserve in good faith this optionality. All endeavours should be made to ensure that one process does not prevent or impinge on the future Settlement options available to mana whenua iwi.

- *Active Protection* - this principle encompasses the Crown's obligation to take positive steps to ensure that Māori interests are protected. Particular emphasis in this regard is given to the Crown's obligations in respect of Māori property rights.
- *Mutual benefit* - this principle provides that both Treaty partners should benefit from the partnership.

  Formally engaging, resourcing and involving mana whenua iwi in the future process including the blue-print and detailed co-design of any future options will assist to actively protect the interests of mana whenua iwi in respect of the proposed future sites. This may be particularly important in light of the potential for co-governance or co-management Settlement options over potential and actual Port sites.

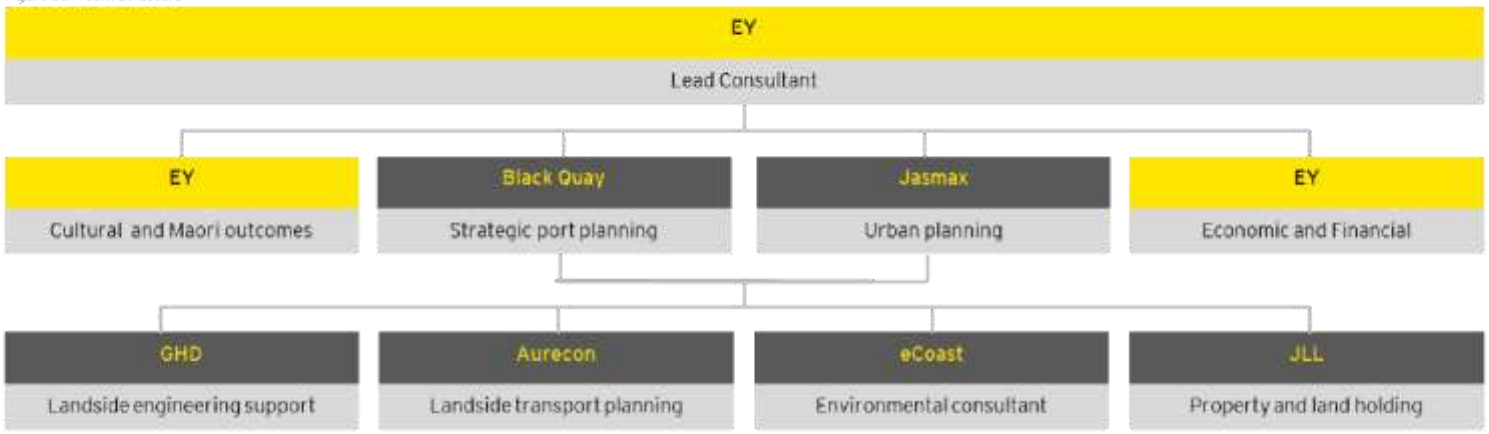
  Mana whenua iwi may in some cases see themselves, as natural long-term partners. The opportunity to become involved in a long term opportunity on terms that mitigate negative aspects and provides prosperity for mana whenua iwi has the potential for uptake by some mana whenua iwi in specific locations. However, the opportunity needs to be progressed as a meaningful partnership.
- *Duty to make informed decisions* – inherent in the Crown's obligation to act in good faith is the duty to make informed decisions on matters affecting Māori interests. This in turn gives rise to the Crown obligation to consult with Māori in particular circumstances. The future study is one such circumstance.
- *Rangatiratanga* - this principle recognises Māori rights of independence, autonomy and self-determination including the right of mana whenua to exercise authority over their own affairs. Matters of significance to Māori are therefore able to be managed themselves.

  Mana whenua iwi continue to express and assert rangatiratanga over areas in which they hold interests and relationships. This includes the proposed short-list sites. The historical record as it pertains to the present port strongly indicates mana whenua interests and relationships were ignored with serious and significant negative impacts upon local mana whenua iwi in respect of the current port site. Recognition of the rangatiratanga of mana whenua iwi over the short list sites might be incorporated by making a commitment to ensure that the mistakes of the past are not repeated in agreeing to move forward with new potential locations.

3.1.5 Team

Decisions on Port of Auckland have large and diverse implications for the future of the city. The subject matter is highly complex and requires a genuinely multi-disciplinary approach to the determination of study inputs and the application of these inputs to rigorous and road-tested analytical frameworks. The EY-led team has all competencies covered, with subject matter experts from Black Quay, GHD, Aurecon, Jasmax, JLL and eCoast.

Figure 10: Team Structure



3.1.6 Methodology

The methodology applied to deliver this Port Future Study has combined the technical expertise of the project team, with the contextual knowledge held by the CWG and the RG. The methodology employed has been designed to create the highest level of insight within the time allowed for the study by focusing on material factors for decision making. The critical outcome of this process is to determine the impacts of each of the options to form the basis for future detailed design and evaluation of a preferred option or options. The timeframes for the Ports Future Study are defined as follows

- Short-term: 2015-2040
- Medium-term: 2040-2065
- Long-term: 2065 onwards

Key elements of the methodology are outlined in Figure 11 below and detailed further in the following section.

Strategic case and evidence gathering

Established the context for the project, the 'problems' the project is looking to address and to identify and agree the benefits of addressing these problems. This would require an assessment of potential scenarios for the long-term future of the port.

Criteria for analysis

Identify and agree how the various options would be analysed, is there a common driver? How do we determine the detail and what is the scope of each option?

Long-listing

This phase of the project includes identifying possible options, including a range of sub options or variations. Options include alternative locations that have considered through other studies and a 'blue sky' list of potential new locations, alongside partial relocation options, and broad consideration of relocating to other existing port technical feasibility.

Short-listing

In order to short-list a range of options, relevant technical and feasibility criteria were developed. This stage involved conducting a number of assessments that are detailed in Table 7 on the following page. A physical viability assessment was carried out to determine if sites could potentially support a port or expansion. Following this a multi-criteria analysis (MCA) framework was applied to each potential site. This process established a short list of options that were progressed to the next phase for greater detailed assessment.

Cost benefit analysis

This phase involves a detailed technical assessment of the short listed options using Cost Benefit Analysis (CBA). This helps facilitate direct and meaningful comparisons across the options on a consistent basis to ultimately develop evidence based recommendations.

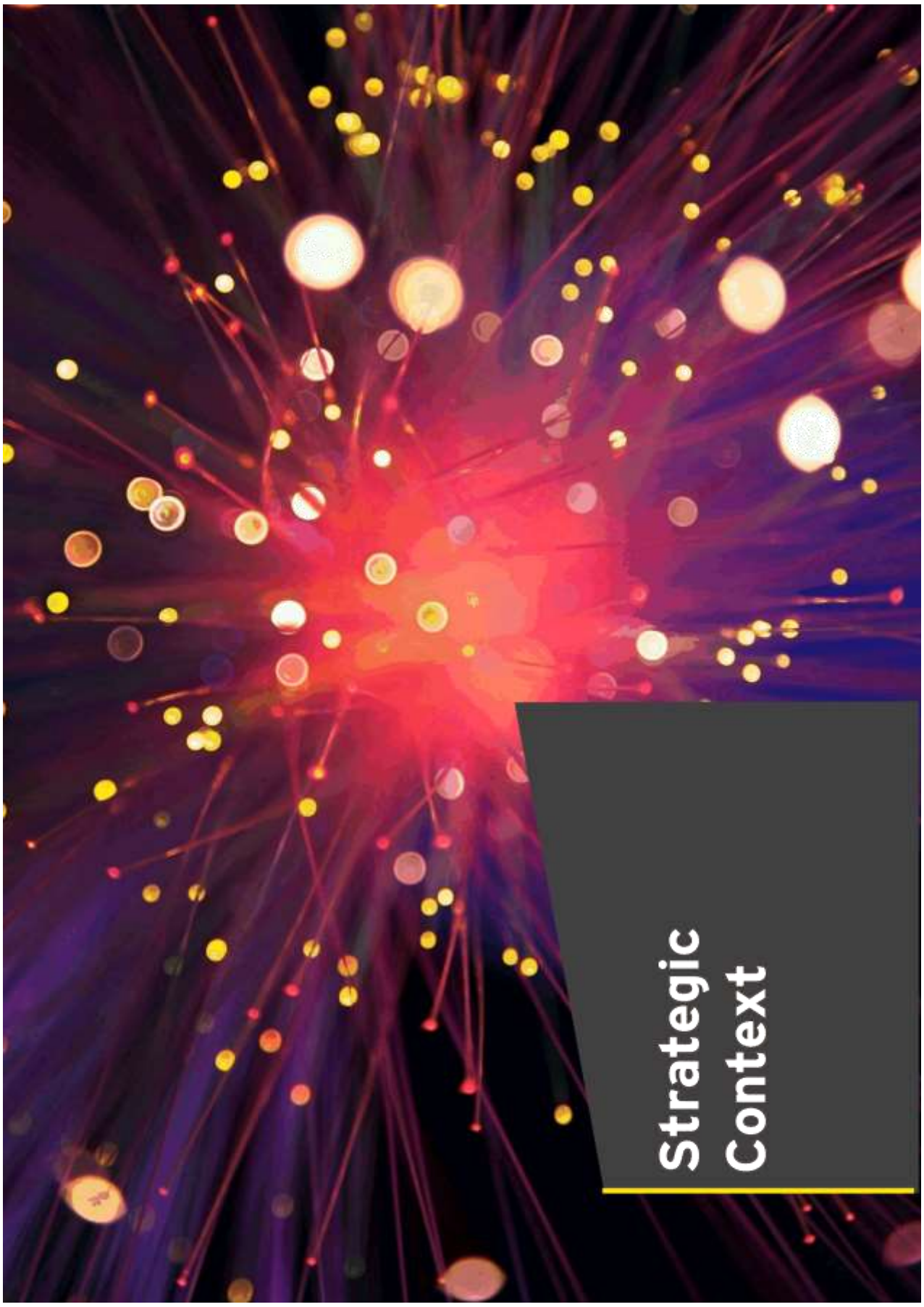
Recommendation of port strategy

The recommended option that incorporates economic, cultural, environmental and social considerations, and provides the most appropriate path forward for Auckland.

Figure 11: Key aspects of methodology

Table 7: Overview of methodology

Assessment	Purpose	Factors assessed	Outcomes
Physical Viability Assessment	The physical viability assessment was undertaken to determine which of the long listed options had the potential to support a new port or expansion and growth. The aim of this assessment was to provide an initial screening of options.	▸ Shipping access ▸ Natural depth ▸ Coastal processes ▸ Natural land topography ▸ Distance from existing primary land transport ▸ Feasibility of land transport access ▸ Distance from identified industrial concentration	Options that were deemed to have adequate physical viability were progressed to the next stage. This included a number of sites where further investigation was needed to determine whether or not they should be discounted.
Multi Criteria Assessment	The MCA was undertaken to assess the potential options against a set of consistent criteria in order to determine optimal outcomes. The weightings of each of the MCA criteria were determined in line with the ILM outcomes.	▸ Physical/operating capacity ▸ Economic ▸ Social ▸ Cultural ▸ Environmental	The MCA resulted in all potential options being ranked according to their individual scores. The rankings of these determined the options that required further analysis and a more detailed technical assessment.
Capacity Assessment	A key consideration of whether options were viable in the long-term was establishing if they could handle the expected long-term trade task. The capacity assessment determined if the options met this requirement.	▸ Land side capacity for container long-term trade task ▸ Land side capacity for general cargo long-term trade task ▸ Berth capacity for expected future fleet	The capacity assessment highlighted the options that were able to meet the long-term trade task, and as such, these were the options that further qualitative analysis was undertaken on and were progressed to the cost benefit analysis stage.
Cost Benefit Analysis	The CBA assessed the value each option by quantifying all costs and benefits in monetary terms, where possible, and discounting them to a common point in time to determine the net benefits of each option.	The market and non-market impacts of the following factors were assessed: ▸ Economic ▸ Social ▸ Environmental Where it was not possible to quantify or monetise the benefits associated with these factors, they are assessed qualitatively.	The CBA assessment ranked the options based on their cumulative net present value.


Strategic
Context

4 Strategic Context

The following section outlines the context in which the Port Future Study is being undertaken. Key factors include clearly establishing:

- the role of a port in an economy
- the significance of ports in New Zealand
- the current performance of POAL and its role in the New Zealand shipping supply chain.

Further to this the current operational environment is detailed, including highlighting key influences such as:

- Auckland port's key stakeholders
- future issues expected to be faced by Auckland
- the current planning environment for Auckland and New Zealand
- the expected role of the port in Auckland's future.

Finally, the case for change is clearly established including highlighting key problems that the Port Future Study is trying to address and identifying the benefits associated with addressing these.

4.1 Role of port in an economy

4.1.1 Positive impacts

There are generally considered to be three primary benefits that ports drive for any economy:[2]

1. **Facilitators of trade:** Ports often serve as significant pieces of economic infrastructure (albeit as part of a wider supply chain) for local and national economies. Ports enable heightened levels of trade for both producers and consumers within the economy.[3]
2. **Value-add activity**: There are four types of value added activities associated with ports as follows:
   - direct impacts are jobs and incomes that are generated by the construction and operation of a port
   - indirect impacts relate to the employment and operations of commercial activities that rely on the port (e.g. exporters)
   - induced impacts refer to the employment and income generated by the employees of the port and indirect industries spending their incomes in the economy
   - catalytic impacts are generated by the port through its role as a driver of productivity growth and attractor of new firms into the economy.[4]
3. **Spill-over benefits**: The presence of a port is often accompanied by a raft of ancillary activities (often marine-based) which leverage off the investment of port infrastructure. For example, increased tourism activity and spend from cruise ships and marine science.

The extent to which these benefits materialise in any jurisdiction is determined by a range of unique characteristics including:

- distance from markets
- port location and configuration
- supporting infrastructure
- type and nature of the freight
- political environment
- governance of the operations
- population and demography.

[2] OECD (2013) *Competitiveness-of-Global-Port-Cities-Synthesis-Report, EY assessment*
[3] IBID
[4] IBID

4.1.2 Negative impacts

A port can create a number of negative impacts or externalities on the immediate location and population surrounding it. These factors are mostly related the following factors:

- environmental externalities including noise, light, impact on marine and pollution
- opportunity costs of forgone alternate land uses.

4.1.3 Effects on location

The extent to which the benefits of having a port located in a given location offset the associated negative externalities is dependent on the magnitude of the cost and the cost of mitigation/remediation. The balance between location and externalities is a key factor in determining the optimal location of a port.

4.2 Global role of seaports

In the context of globalisation, ports are considered to have an integral role in international supply chains. It is estimated that around 90% of the world's merchandise and commodities are transported by ship. Ports serve and operate as an international gateway by linking the flow from sea to land and domestic to global supply chains.

International trade has allowed manufacturers to relocate/outsource production to more cost efficient locations such as developing economies, while also connecting to a global customer base. International trade also increases competition and contestability, which impact both international and domestic productivity, specialisation and economic growth.

4.3 New Zealand ports

New Zealand is a geographically remote island nation with a relatively small domestic market and a trade dependent economy. International trade makes up around 60% of New Zealand's total economy activity[5]. New Zealand's key sources of exports receipts include pastoral-based products such as dairy, meat and forestry as well as services such as tourism, education and commercial services. The economy is also reliance on the import of raw materials and capital equipment for industry.

New Zealand's economic performance is dependent on an efficient domestic and international freight and logistics network. Ports play a critical role in the movement of freight into, out of and through New Zealand[6]. There are 14 New Zealand ports servicing import, export and domestic markets across the North and South Island. The locations of these ports are highlighted in Figure 12:

Figure 12: Location of New Zealand ports

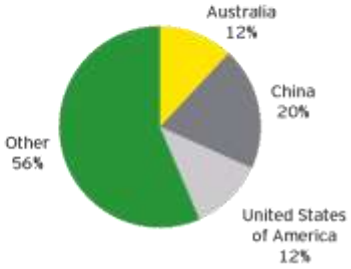
[5] New Zealand Foreign Affairs and Trade, 2016, *Trade Policy*. Accessed from https://www.mfat.govt.nz/en/trade/nz-trade-policy/

[6] Ministry of Transport, 2011, *Container Port Productivity*

4.3.1 New Zealand trade profile

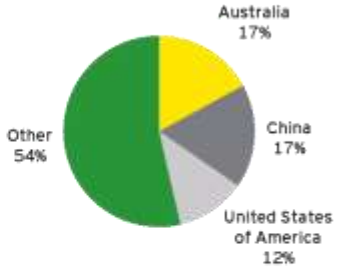
New Zealand accommodates trade from a range of countries, but the most significant links are with China, Australia and the USA for both import and export markets. Figures 13 and 14 show the international locations of exports from and imports to New Zealand. By volume, oil and coal, and food dominate New Zealand's import composition making up around 69% of imports. For exports, forestry products, food and dairy dominate 78% of its export composition. Figures 15 and 16 show the total trade composition for 2015 by volume[7].

Figure 13: New Zealand sea import origins by value (2015)



Source: Statistics NZ, 2015

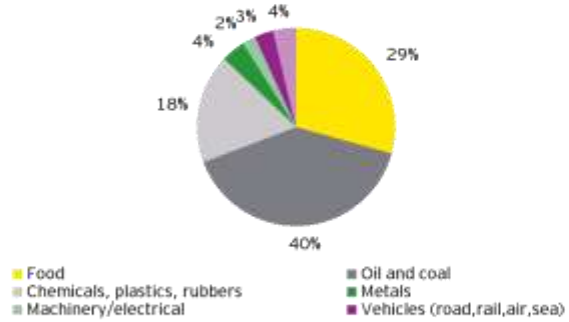
Figure 14: New Zealand exported destinations by value (2015)



Source: Statistics NZ, 2015

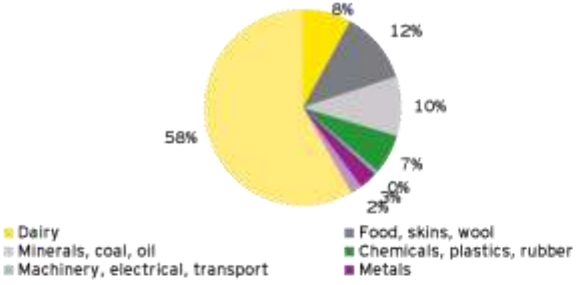
[7] Ports of Auckland Looking forward to another year, 2014

Figure 15: New Zealand sea import composition by volume (2015)



Source: MOT FIGS, 2016

Figure 16: New Zealand sea export composition by volume (2015)



Source: MOT FIGS, 2016

4.4 Auckland in the New Zealand shipping system

Auckland's port is the largest and busiest container port in New Zealand and is a key importing port for the New Zealand market. The port services New Zealand's largest population with 70% of the imports that pass through the port bound for the Auckland market.

4.5 Port location

POAL is located on the east coast of the North Island, on reclaimed foreshore of the Waitematā Harbour.

4.5.1 Port history in the Waitematā Harbour

The name for the harbour where the port is presently located is Wai-te-matā which means 'obsidian waters' - the glassy surface resembled volcanic obsidian rock. In Te Arawa tradition, the harbour was named by their ancestor Tamatekapua, when he placed a volcanic stone as a mauri (talisman) in its waters near Birkenhead. The Ngāpuhi people called it Te Wai-o-te-mate (the waters of death) - a reference to the battles to control the Tāmaki isthmus. The Waitematā harbour is an important, and common, geographic reference point for many iwi upon first arriving to Aotearoa as part their migration histories. The sheltered water's on the landward side of Rangitoto Island has long made the Waitematā an ideal harbour for voyaging waka and an ideal tauranga waka (landing area).

Mana whenua iwi were significantly affected by the taking of their land and foreshore and seabed to build the present port. Mana whenua iwi have spiritual, ancestral, cultural, customary and historical interests in the Waitematā harbour. In the course of preparing this comprehensive study, the consortia met with mana whenua identified by the mana whenua CWG representatives. They have outlined their histories with regard to the establishment of the port. This historical record indicates mana whenua rights, interests and relationships were ignored with serious and significant negative impacts upon local mana whenua iwi. Indeed, Ngāti Whātua and members of Marutuahu iwi spoke of an ongoing theme of disempowerment in relation to the establishment of the port, POAL and its ongoing activities. We note that Waikato Tainui did not provide comment on the impact of the present port on the iwi; however, we were informed that Te Wherowhero (later King Potatau) had a summer residence in Kohimarama on the Waitemata harbour.

What we presently know is POAL began with the establishment of the port in the late 1800s. Since this time, there have been a number of significant developments. The key development milestones for the port are outlined below.[8]

- The Auckland Harbour Board was established to administer the port by an Act of Parliament in 1871. In 1875, the Auckland Harbour Foreshore Act was introduced, giving the Board over 5,000 acres of the Waitematā Harbour seabed.
- Development between today's Princes Wharf and Kings Wharf, now part of the Bledisloe container terminal, was completed between 1904 and 1924. During this time, the wooden Queen Street Wharf was replaced by the present-day concrete wharf (1906-1913).
- Marsden Wharf was built between 1909 and 1911.
- The 'red fence' was erected for added security between 1913 and 1923.
- Princes Wharf, named in honour of the Prince of Wales who visited Auckland in 1921, was built between 1913 and 1923.
- Captain Cook Wharf, named after Captain James Cook, was built in 1922.
- The Western Reclamation and Western Wharf extension were completed in 1931.
- Bledisloe Wharf was built between 1937 and 1948 and was originally designed for frozen export cargo.
- Jellicoe Wharf, originally built solely for imports, was completely in 1952.
- Freyberg was completed in 1961.
- The Fergusson container terminal was built as a specialist container operation in 1971.
- Bledisloe Wharf (now Bledisloe Container Terminal) was also redeveloped to handle more containers.

[8] http://www.poal.co.nz/about_us/history_auckland.htm

4.5.2 Corporate profile

Ports of Auckland Limited (POAL) is a port company established under POAL Companies Act 1998 (Port Companies Act). POAL Companies Act requires POAL to operate as a "successful business". POAL's directors are also subject to the Companies Act 1993 (Companies Act), which requires the directors to act in the best interests of the company.

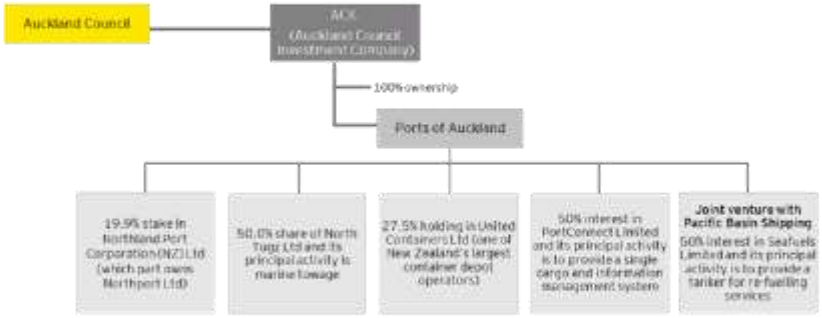
In 1988, Ports of Auckland Limited was formed, purchasing the Auckland Harbour Board's land and assets for a mix of cash and equity amounting to approximately $250 million, and took over the operations of the commercial port.

POAL shares were allotted 80% to the Auckland Regional Council, and 20% to the Waikato Regional Council. Waikato sold their shares in a public float and POAL was listed. In 2005, Auckland Regional Holdings, made a successful on-market bid for the shares it did not own and took POAL back fully under Auckland Regional Holding control. The takeover bid is believed to have been motivated by the desire to simplify land transfers between POAL and Auckland Regional Council.[9]

The ownership of POAL has been intentionally structured so that it acts as a standalone company, independent of Auckland Council. Figure 17 outlines the corporate structure. However, POAL is 100% owned by Auckland Council Investments Limited (ACIL) a Council Controlled Organisation owned by Auckland Council and therefore dividends issued by POAL flow through to Auckland Council. Auckland Council has not provided POAL with any additional capital since reacquiring a 100% ownership stake in 2005. All new capital expenditure has been funded out of profits or by debt.

POAL holds a 19.9% stake in Northland Port Corporation (NZ) Ltd, which part-owns Northport Ltd and a 50.0% share of North Tugz Ltd. Ports of Auckland are also part of the Seafuels joint venture with Pacific Basin Shipping, operating the Awanuia tanker to provide a refueling service for cruise ships and commercial vessels calling into the Waitematā Harbour.

Figure 17: POAL Corporate Structure

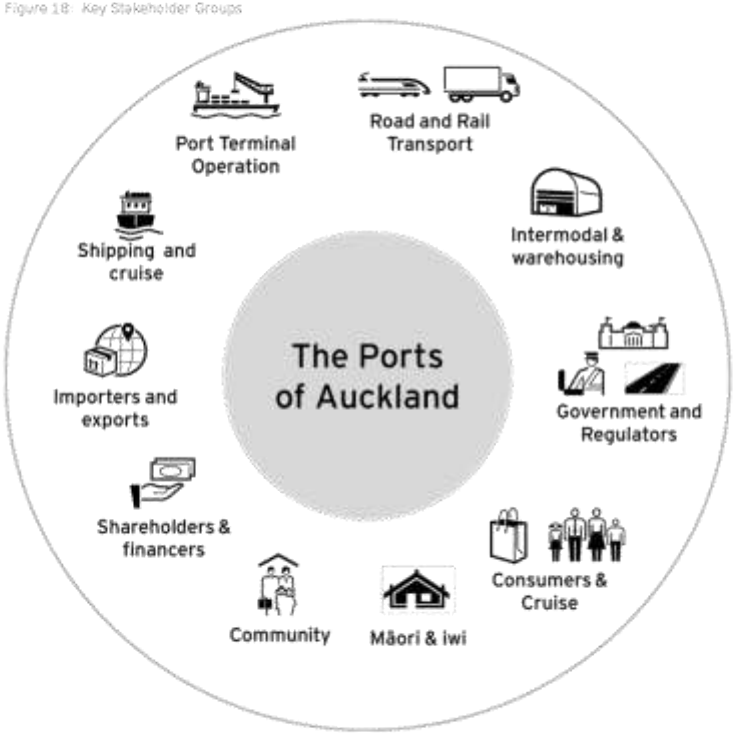


[9] Treasury, 2010, *Short History of Post-Privatisation in New Zealand*

4.6 Stakeholders

The impact of Port of Auckland's activities and developments are not limited to only Auckland's port precinct. The port plays a key role in major elements of the New Zealand supply chain and wider economy and as such, has a significant number of stakeholders. POAL's major stakeholder groups are outlined in Figure 18 below:

Figure 18: Key Stakeholder Groups



The following sections outline the key considerations related to each stakeholder group.

4.6.1 Government and regulators

Ministry of Transport

The Ministry of Transport (MoT) provides policy advice dedicated to transport, and has the overall aim of improving the performance of the transport system and transport Crown entities. New Zealand ports are a key component of the New Zealand transport network and as such, MoT is a key stakeholder in the port.

New Zealand Transport Agency

The New Zealand Transport Agency (NZTA) allocates funding for land transport infrastructure and services through the National Land Transport Programme. In addition, NZTA manages the State Highway network, including maintenance, improvements and operations activities. NZTA is a key stakeholder in the port due to the impact of ports on the wider infrastructure network.

National Infrastructure Unit

The National Infrastructure Unit creates and monitors the National Infrastructure Plans. They establish cross-government frameworks for infrastructure project appraisal and capital asset management, and monitor the implementation and use of those frameworks.

Ministry of Business, Innovation and Employment

The Ministry of Business, Innovation and Employment (MBIE) is tasked with growing the New Zealand economy, encourage businesses to be more competitive, improving job opportunities and by ensuring quality housing is more affordable. Encouraging trade, specifically through New Zealand export markets, is a key focus for MBIE and as such any developments relating to Ports are of interest.

Auckland Council (Regulator)

The regulatory arm of the Auckland Council has responsibility for issuing environmental, land use and resourcing consents across the Auckland region. In this capacity, any developments at the port that require these consents are dependent on Council approval.

Auckland Transport

Auckland Transport is a Council Controlled Organisation, with the primarily responsibility of planning, investing, and maintaining local roading infrastructure as well as providing public transport to Auckland. POAL is a significant user of local roading infrastructure and as such is a key stakeholder.

Auckland Tourism, Events and Economic Development

Auckland Tourism, Events and Economic Development (ATEED) is a Council Controlled Organisation tasked with driving innovation and transforming the local economy. In addition, ATEED operate in the tourism market (both domestic and international) promoting Auckland as a tourist destination. ATEED are a key stakeholder in the port due to the ports significant role in the Auckland economy and role in facilitating cruise in the tourism industry.

4.6.2 Customers

Shipping companies

The shipping companies are the primary customers of Ports of Auckland. Cargo loading and discharging, industrial services in port, combining and separating cargoes, and inventory management on cargo movements are a few of the services that the shipping companies obtain from POAL.

Cruise companies

Cruise is a crucial component of the New Zealand tourism industry with New Zealand's popularity as a cruise destination rising over the last few years. The cruise liners have a substantial positive impact on the New Zealand economy. The cruise liners obtain berthing and other services from Ports of Auckland.

KiwiRail

KiwiRail manage rail freight services, rail infrastructure along with urban train passenger services across New Zealand. In addition, they operate passenger and freight ferry services across the Cook Strait. They have a key role in the freight supply chain moving large volumes quickly from the seaport to alternative sites that are closer and more accessible to cargo owners. KiwiRail as a customer of the port effectively reduces the congestion on and off the seaport.

4.6.3 Suppliers

Seafuels Ltd

Seafuels provides a vessel refueling service for cruise, commercial and container ships stopping at Ports of Auckland. With 3,900 tonne tanker carrying the fuel, Seafuels are the only bunkering service on this scale in the Auckland region.

4.6.4 Shareholders

Auckland Council Investment Limited

Ports of Auckland is 100% owned by Auckland Council Investment Limited (ACIL), a council controlled organisation of Auckland Council. In a shareholder capacity role the primary focus of ACIL would be to ensure that returns are satisfactory, and risks are minimised.

4.6.5 Community

Māori and Iwi

The Waitematā and Manukau Harbours, Muriwai and the Western Firth of Thames are all areas of significance to mana whenua iwi. As a minimum, mana whenua iwi seek recognition of their underlying interests and relationships to and in those areas. In addition, mana whenua iwi insist upon safeguards against negative impacts that any future port options may have on their respective future Treaty Settlements.

Recreational users

Several recreational users will be interested in the availability of public areas for recreational purposes, such as the Hauraki Gulf.

Local residents

The Local Community will be interested in any future development or changes that will impact them. In particular, they may want transparency, awareness of, and input to, the long-term development and operation of the port and intermodal terminals.

4.6.6 Human capital

Maritime Union of New Zealand

Ports of Auckland employ around 550 FTEs to allow for quick turnaround of cargo. The employees at the port are represented by Maritime Union of New Zealand offering a range of services to its members like negotiating employment agreements, providing work related legal advice and promoting the interests of working people.

4.6.7 Environmental

Department of Conservation

Department of Conservation is a government agency responsible for conserving New Zealand's natural and historic heritage. This includes coastal management and marine mammal conservation.

Ministry for the Environment

Ministry for the Environment (MoE) is government's principal adviser on the environment in New Zealand and on international environmental matters, including regulation, standards, policy statement and strategies. MoE also engages with other government agencies on marine issues.

Environmental NGOs

Environmental non-government organisations (ENGOs) are not for profit environmental organisations funded by both private and non-private sources. The ENGOs' goals are generally aimed at conservation, training and assistance and focusing on environmental solutions to foster the relationship of New Zealanders have with its unique natural heritage.

4.6.8 Regulatory operations

Maritime New Zealand

Maritime New Zealand is to ensure that all maritime activities are carried out safely, with minimal impact on the environment and nation's security. Few of the duties that Maritime New Zealand is responsible for are developing and monitoring maritime safety rules and marine protection rules, educating the maritime community about best practice in safety and environmental standards and conducting safety inspections of all New Zealand ships and foreign-flagged ships calling at New Zealand ports.

WorkSafe New Zealand

WorkSafe New Zealand was set up by the government and its primary objective is to promote and contribute to securing the health and safety of workers and workplaces.

New Zealand Customer Service

New Zealand Customs Service is the government agency ensuring the security of our borders by protecting the economy from illegal imports and exports. Their coverage also includes the seaports.

4.7 Ngā Mana Whenua o Tāmaki Makaurau collective settlement

Following a lengthy settlement negotiations process, the Ngā Mana Whenua o Tāmaki Makaurau Collective Redress Act ("the Tāmaki Collective Act") came into effect in late 2014. This settlement impacts on the Port Future Study, both explicitly and via implied understandings and consequent expectations around future utilisation of the region's assets.

The Tāmaki collective iwi and hapu are: Ngai Tai ki Tamaki; Ngāti Maru; Ngāti Paoa; Ngāti Tamaoho; Ngāti Tamatera; Ngāti Te Ata; Ngāti Whanaunga; Ngāti Whatua o Kaipara; Ngāti Whatua Orakei; Te Akitai Waiohua; Te Kawerau a Maki; Te Patukirikiri; and hapū of Ngāti Whātua (other than Ngāti Whātua o Kaipara and Ngāti Whātua Ōrākei) whose members are beneficiaries of Te Rūnanga o Ngāti Whātua, including Te Taoū not descended from Tuperiri.

For completeness, we note Auckland Council also recognise Ngati Wai, Ngati Manuhiri, Ngati Rehua, Te Uri o Hau, Te Ahiwaru and Waikato Tainui, who are not specifically identified in the Tamaki Collective Act, as having mana whenua interests in Auckland.

The Tāmaki Collective Act provides collective settlement redress for the shared interests of the Tāmaki Collective iwi/ hapū in maunga (mountains), motu (islands) and lands within Tāmaki Makaurau. The collective approach recognises that the iwi and hapū have various overlapping customary interests within the region, with separate consideration of such interests being impossible to singularly delineate and define to the exclusion of others. It should be noted that the historical claims of the respective iwi/hapū in the Tāmaki Collective will be made through iwi/hapū - specific settlements. The collective redress provided will also form part of each individual iwi/hapū Treaty settlement.

4.7.1 Maunga

In recognition of the historical, cultural and spiritual association of the iwi and hapū with their maunga, the settlement vests 14 maunga in the collective (to be held in trust by a specifically established entity), with public access and existing third party interests to be preserved. The majority of maunga will be administered under a co-governance arrangement between iwi/hapū, Auckland Council and the government. The Tamaki collective has entered into a management agreement with the Department of Conservation in relation to certain decision-making matters.

4.7.2 Motu

In recognition of their historical association, four motu (Rangitoto, Motutapu, Motuihe and Tiritiri Matangi) were vested in the collective and then later re-vested back in the Crown as reserves, with public access to be preserved.

4.7.3 Harbours

Whilst the Tamaki Collective Act does not provide specific redress for the Manukau and Waitematā harbours there is a Crown acknowledgement of their traditional, cultural and spiritual importance to the Tamaki Collective. Furthermore, Waikato Tainui, also assert interests in several of the short-listed port sites.

It is reasonable to assume that Manukau and Waitematā harbours and the Firth of Thames (Tikapa Moana) will be dealt with by way of Treaty Settlement with the Crown. Other Treaty Settlements which have involved co-governance and co-management over areas of natural landscape (such as the Waikato River) could be applicable to Treaty Settlements in respect of these sites.

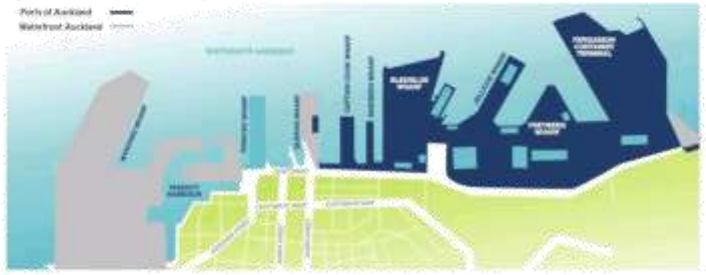
The terms 'co-governance' and 'co-management' are used to describe negotiated arrangements between iwi and the Crown. These arrangements also involve, and carry obligations for, regional councils, and local councils to share governance and management of natural resources.

Finally, mana whenua iwi will want to preserve their Treaty Settlement optionality in respect of potential short-listed sites considered in this Study. To the greatest extent possible, recommendations reached by the CWG should seek to preserve options.

4.8 Port of Auckland infrastructure

Port of Auckland is broadly made up of a primary container terminal to the east (Fergusson) and a number of multi-cargo wharves to the west (Freyberg, Jellicoe, Bledisloe, Marsden and Captain Cook). Bledisloe has historically acted as a secondary/backup container but now is primarily dedicated to multi-cargo handling (mainly of vehicles). A map of the port showing its relationship with the wider Auckland waterfront is outlined below. Appendix 2 provides a further view of POAL's layout and Appendix 3 shows the supporting infrastructure around the Auckland region.

Figure 19: Auckland ports' city footprint



Specific characteristics of the various wharves and terminal are as follows:

- Fergusson Terminal is a dedicated container terminal and has five modern container cranes, capable of handling up to 6,500 TEU vessels coming to New Zealand. It has a fleet of 37 modern, low-emission diesel-electric straddle carriers, all of which can lift two twenty foot containers at a time.
- Bledisloe Terminal handles general cargo vessels of varying types including car carriers. Bledisloe has three older container cranes capable of servicing container ships but none are currently in use. Lift on-lift off (Lo-Lo) operations at the multi-cargo wharves are carried out using ship's cranes. These wharves also handle roll-on roll-off (Ro-Ro) throughput, which is mainly cars, but includes trucks, buses, trains, tractors, heavy machinery, project cargo and other freight.
- Freyberg Wharf handles mostly bulk cargo, but also some break bulk[10] and containerised cargo.
- Jellicoe Wharf handles break bulk[11] and vehicle carriers, and from 2016 will be used by Holcim New Zealand to import cement. This wharf was previously used by the cruise ship Queen Mary 2; however, as a result of the increase in Pacific trade will not be possible after the 2015/2016 cruise season.
- Captain Cook Wharf is used for vehicle trade. It has one western berth capable of accommodating modern car ships.
- Marsden Wharf has been partially demolished and is only used for vehicle storage.

Port of Auckland supports the cruise industry through the provision of berthage, marine and logistics services on the Waitematā Harbour. This involves managing the logistics of every cruise call, including berthing ships, processing passengers, and working with shipping agents, hospitality and tourism providers, stevedores, Customs, MAF and other agencies, to ensure each visit goes smoothly. POAL currently handles between 100 -108 cruise ships annually.

Queens Wharf's 'Shed 10', is the primary cruise gateway in Auckland with Princes Wharf acting as a secondary cruise berth. Other Port of Auckland infrastructure has sometimes handled cruise ships when there were issues with the length required to berth larger ships (Jellicoe) or when there are more than two cruise ships in the Harbour (Bledisloe).[12]

4.8.1 Recent land release

Since 1989, there has been a steady contraction of Port land eastward from the Harbour Bridge. Today, POAL owns around 77 hectares of land in its primary location on the CBD waterfront and roughly 105 hectares of total land (including at Wiri, Gabbador Place, Onehunga and Pikes Point). Table 8 on the following page outlines POAL land that has been sold over the last twenty years. See Appendix 4 for historic sale of land since 1998.

[10] Coal, silica sand, gypsum, black sand and wheat for example.

[11] Tropical fruit, timber, steel and vehicles etc.

[12] POAL assert that from the 2016/17 cruise season they will no longer be able to accommodate longer cruise ships at Jellicoe Wharf. The visit of the Queen Mary 2 to Jellicoe Wharf in March 2016 will be its last in the current configuration.

Table 8: Sale of port land since 1996

Location	Date	Ha
Viaduct Harbour	1996	22.0
Princes Wharf	1998	2.3
Downtown Ferry Area	2002	1.0
Easter Viaduct	2003	0.7
Westhaven Marina	2004	54.0
Hobson Wharf Marina	2004	2.2
Western Reclamation	2007	18.0
Western Viaduct	2007	1.2
Harbour Bridge Park	2007	3.7
Hobson Wharf, Maritime Museum	2007	3.5
Teal Park	2007	0.5
Queen's Wharf	2010	2.9

4.8.2 Port developments

POAL has undertaken a range of developments to accommodate expected growth since 1989. In 1989, POAL Development Plan was released and outlined an intensive programme of reclamation to future proof the Auckland port. In 2011, based on the 1989 analysis, POAL proposed 22.6 hectares of reclamation. This proposal was rejected and so POAL revised its plans.

In September 2014, POAL sought resource consent under the Resource Management Act 1991 (RMA) to begin the expansion of Bledisloe Wharf. This revised plan included extending Bledisloe's two wharves by 98 and 92 metres respectively, and the demolition of Marsden Wharf. Auckland Council approved each of the submissions made and determined that POAL proceed without public notification. In June 2015, the High Court ruled that the lack of public consultation made the consents invalid.

4.8.2.1 Developments currently underway

Port of Onehunga Sale

POAL is currently negotiating with Panuku Development Auckland to sell Port of Onehunga to make the land available for public use. The construction of a new cement import facility at Port of Auckland will see all cement handing operations consolidated at the Waitematā Port from late 2016, and is the final phase in the move of all freight operations from Onehunga.

Terminal Automation

POAL plans to significantly automate its container operations. This will involve upgrading the currently used system which can stack containers up to three high, to a new automated system that could stack containers up to four high. POAL has begun consultation with staff given the impact it could have on some roles and plan to make a decision in the near future.

Marsden Wharf Demolition

The Marsden Wharf is in the process of being demolished in order to modernise POAL layout and increase berth space at Bledisloe and Captain Cook Wharves. POAL have begun the demolition of the northern piled section of Marsden Wharf and have completed the removal of concrete deck. The piles have been left in place until POAL can obtain consent to dredge the Marsden basin and remove them.

Fergusson Container Terminal Extension

Consent for the expansion of Fergusson Terminal was obtained in 1998 and covered three major projects:

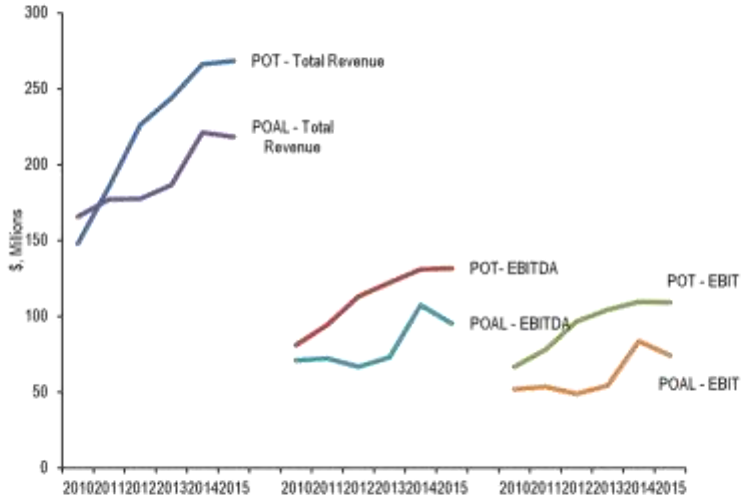
- Reclamation: This has been underway since the early 2000s. There are around three hectares of reclamation remaining until the work is complete.
- Fergusson main wharf extension: A 50 metre extension northward of the main Fergusson Terminal Wharf was undertaken and was completed in 2015.
- Fergusson North Wharf: This new wharf will extend 310 metres east from the Fergusson main wharf extension, across the north face of the Fergusson reclamation. The new wharf construction is underway and will be completed in early 2017 and will provide a deep water berth.

4.9 Port performance

4.9.1 Financial performance

In 2014/2015, revenue from on-going operations was $215.4 million – up approximately two percent from $211.0 million in 2013/2014. Total group revenue was $218.3 million, down approximately one percent from $221.2 million the year before, reflecting the sale of POAL subsidiary Conlinxx part way through the year.[13] Below is a snapshot of the five year historical financial performance of POAL compared with the Port of Tauranga:

Figure 20: Five year historical financial performance comparison

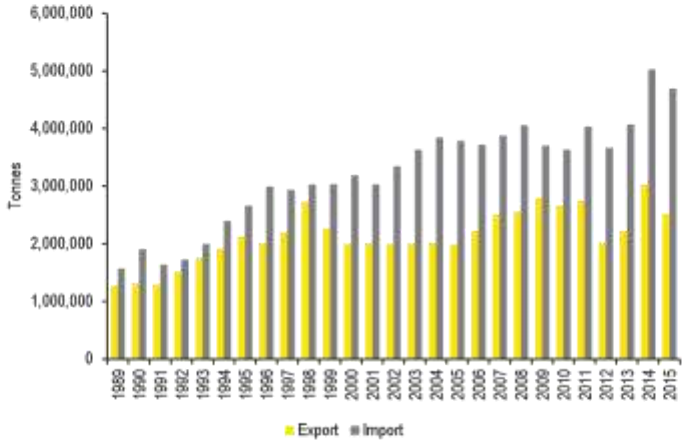

300
250
200
150
100
50
0
$, Millions
POT - Total Revenue
POAL - Total Revenue
POT- EBITDA
POAL - EBITDA
POT - EBIT
POAL - EBIT
2010201120122013201420152010201120122013201420152010201120122013201420152

4.9.2 Operational performance

4.9.2.1 Trade volumes

Ports of Auckland are considered to be an 'import port', historically handling more imports than exports. Figure 21 below shows the growth of imports and exports by volume at Ports of Auckland since 1989:

Figure 21: Ports of Auckland import/export volumes (1989 - 2015)



Source: Statistics NZ, 2015

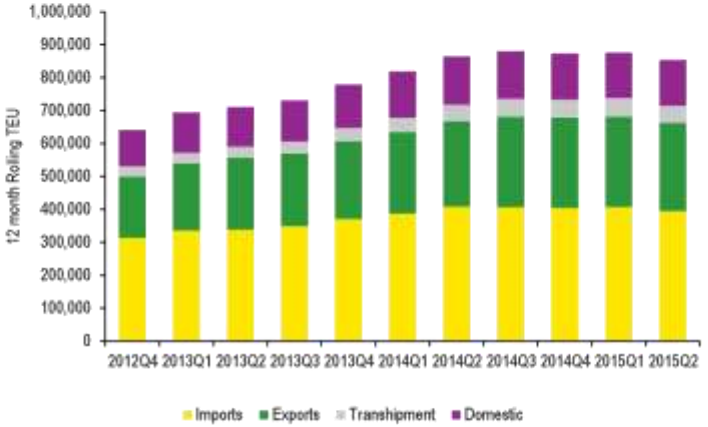
The Auckland port is the busiest container port in the country. POAL handled 972,434 container TEUs (twenty-foot equivalent units) in the 2014/15 financial year, a 0.4 percent increase on 2013/2014. POAL's TEU volumes since 2012 are outlined in Figure 22.

The multi-cargo wharves handled over 5.9 million tonnes of non-containerised cargo in 2014/15 including over 243,000 cars and 26,899 tonnes of road metal[15].

[15] POAL Annual Report http://2015annualreview.poal.co.nz/assets/ports_of_auckland_annual_review_2015.pdf

Auckland has experienced a 5.84% cumulative annual growth in cruise voyages and cumulative annual growth of 4.11% for unique passengers since 2011/12. For the 2014/15 year there were 115 voyage calls to Auckland, and 188,500 unique passenger visits. This represented approximately 90.6% of total cruise voyages to New Zealand, and 93.6% of unique passengers' visits respectively.[16]

Figure 22: Ports of Auckland 12 monthly rolling TEU (2012 -2015)



Source: MOT

[16] Economic Impact of the 2014-2015 Cruise Sector in New Zealand and Forecasts to 2017.

4.9.2.2 Productivity

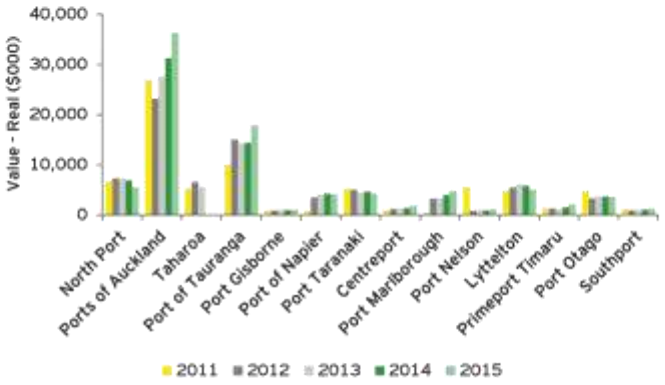
The most recent container port productivity figures[17], published by the Ministry of Transport, show that in the April - June quarter of 2015 POAL was the best performing container port in New Zealand on all three performance measures - crane, ship and vessel rates. POAL state that improvements in productivity across the port have come about as a result of the three key reforms outlined below, all of which are ongoing.

- Restructuring the company to create a 'one port' approach by bringing the planning and processes for multi-cargo and container terminals closer together.
- Optimisation of the port layout and operating processes - amongst other things, by improving container truck grid, so more containers can get in and out more smoothly.
- More efficient labour model - including, finalised negotiations with the Maritime Union over a new collective agreement.

4.9.3 New Zealand port performance

As outlined previously, POAL handle the highest value of trade of all New Zealand ports. However, by total tonnage or gross volume, POAL ranks second to Tauranga and Northport respectively. Figure 23 and Figure 24 below show the value and volume of throughput at Ports of Auckland, compared to other New Zealand ports.

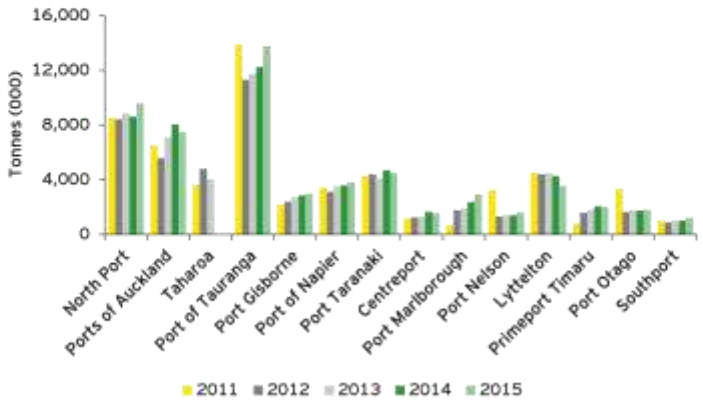
Figure 23: New Zealand ports throughput by value



Source: Statistics NZ, 2015

[17] http://www.transport.govt.nz/sea/figs/

Figure 24: New Zealand ports throughput by weight



Source: Statistics NZ, 2015

Port operations can be considered to be natural monopolies due the high fixed capital costs which arguably do not make it efficient to duplicate infrastructure investments. Currently there is a degree of competition in the New Zealand ports sector. There are nine major container ports servicing the New Zealand market, which is high in comparison with Australia who has six major container ports servicing a significantly larger trade task and population.

Auckland Regional Holdings concluded the number of ports in New Zealand has resulted in duplication and inefficient investment in the supporting infrastructure.

4.10 Port role in Auckland vision

Auckland has stated the goal of becoming the world's most liveable city.[18] This vision is explained in some detail in the Auckland Plan – an aspirational vision document which explains at the highest level how Auckland will accommodate growth to 2040. The Auckland Plan is detailed further in Section 4.12.1.

While the Port Future Study is looking at the comparatively narrow issue of accommodate Auckland's long-term sea-based trade (and the cruise industry), there are a wide range of considerations – both international and domestic – that contribute to the strategic context for this study.

4.10.1 Hallmarks of successful international cities

The specific components that characterise a 'liveable' (or a successful) city are subjective, multifaceted and are unable to be easily generalised. Research has highlighted some of the relevant factors for the strategic context of the Port Future Study, which are outlined in the following sections.

4.10.1.1 Play to your strengths

Successful cities make the most of what little they may have to power ahead of competitors. A common theme across all cities studied by the World Bank[19] was the clear identification of competitive advantages and the conscious leveraging of these endowments.[20]

Auckland's identity as a city will inevitably mean a number of things to a range of people. The 'Auckland Story', a brand being established by ATEED, focuses on the duality that defines the city; the contrast of a thriving global city set in unique and beautiful natural surroundings including three harbours and a

[18] Auckland Council, 2012, The Auckland Plan
[19] World Bank (2015) Competitive cities for jobs and growth : what, who, and how http://www-wds.worldbank.org
[20] Examples include a skilled workforce, geography, language, cultural ties, technical know-how, existing industry base, and product and market knowledge. For example, in Bucaramanga, Colombia, the city used oil revenues to invest in universities with a specialisation in oil industry research, a strategy that has created broader technical skills that have spilled over into new industries.

volcanic isthmus.[21] In this context, the promotion of Auckland as a city combined with the preservation of Auckland's natural amenity appears to be paramount.

Furthermore, the role of a waterfront in showcasing the features of harbours worldwide is increasingly recognised as being important:

> *"Today, in the contemporary city, the success of the quality of life embodied in public spaces is increasingly accepted as a guarantee factor for an overall success. In this respect, the urban waterfront is in the spotlight."*[22]

The presence of a vibrant Auckland waterfront is undoubtedly a 'pull' factor for residents, businesses and tourists and is referenced numerous times on Auckland's tourism collateral.[23] The waterfront also plays a unique role within Auckland's city centre due to its access to water-based recreation, trade, transport and premium residential and commercial land values.[24] If Auckland is to play to its strengths, it would look to preserve the attraction of its waterfront at least, and expand the importance of this unique endowment, at most.

4.10.1.2 Collaborate and invest for the future

Cities use a number of interventions to increase competitiveness including:

- institutions and regulation
- infrastructure and land
- skills and innovation
- enterprise support and finance.[25]

[21] ATEED - http://www.aucklandnz.com/images/uploads/page_images/Supporting_Auckland_Growth_and_Competitiveness.pdf

[22] Fatma Waterfronts: Potentials for improving the quality of urban life. Istanbul Technical University Faculty of Architecture, Istanbul, TURKEY

[23] http://www.aucklandnz.com/discover/areas/central-auckland;

[24] Waterfront Auckland http://www.waterfrontauckland.co.nz/waterfront-auckland/places/

[25] World Bank (2015) *Competitive cities for jobs and growth : what, who, and how* http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2015/12/08/090224b083c371d5/2_0/Rendered/PDF/Competitive0ci000what0Owho00and0how.pdf?bcsi_scan_01d939382f6c0b14=0&bcsi_scan_filename=Competitive0ci000what0Owho00and0how.pdf

One important component that often ties these factors together is the utilisation of collaborative strategic master-planning. We note that the Auckland Plan is the document (which resulted from a comprehensive collaborative process) that best reflects this endeavour.

However, a fully integrated master plan that bridges the aspiration of the Auckland Plan with the realities of key municipal documents (such as the long-term Plan, the Unitary Plan and the Auckland Economic Development Strategy), alongside funding and operational plans from all the parties investing in Auckland's future success is a work in progress.

Getting agreement to city-shaping documents such as these is immensely challenging and the combination of a wide-range of efforts. However, the OECD note that kick-starting collaborative initiatives around tangible high-profile projects can help rally forces at the initial stage and progressively lead to setting a "bigger picture". Developing a long-term view is also particularly difficult.

Given the importance of Port of Auckland to the region and the nation, and the flow on implications for land use, transport and urban amenity (amongst other things) it is of crucial importance that all policy areas are well understood and well-coordinated.[26] Agreeing to a future that is robust enough to endure political and investment cycles is paramount.

4.10.2 International port trends

Global trade and the use of ports continue to face growth pressures. These growth pressures are leading to port and supply chain operations that are increasingly efficient; scale and productivity is king. This pressure has resulted in a range of responses including:

- improvements to technology and systems
- increasing scale of operations
- greater co-location and collaboration between freight hubs and port hubs (air and sea)
- port rationalisation.

A key determinant of supply chain efficiency is the distance from markets and the level of congestion that can be expected moving goods to and from the port.

[26] OECD (2015) *Governing the City*. Accessible from http://www.oecd-ilibrary.org/urban-rural-and-regional-development/governing-the-city_9789264226500-en

With changing consumer trends (particularly towards online shopping) and increasing urbanisation (with the concurrent impact of congestion), these are real trade-offs that cities must make.

Other cities are also exploring whether relocation options hold merit. This view is expressed in a recent OECD report on port-city competitiveness:

> *"Whereas its location might have been good a few decades ago, ongoing urbanisation might pose challenges for further expansion, with more limited acceptance of negative impacts on the one hand and opportunity costs of port land use on the other hand. At some point, both the port and the city have an interest in relocating (part of) the port to another site that has less opportunity costs and that provides the port more possibilities for expansion."*[27]

Building on this notion, Table 9 shows that port relocation discussions are not just confined to global super ports. Smaller cities than Auckland (Marseille and Bremen) have considered, and reacted to this option.

Table 9: Examples of Ports Relocated from the Central City[28]

Old city port	Old city port population	Old city port throughput (TEU, 2013)	New port site
Shanghai	23,416,000	33,620,000	Yangshan
Rio de Janeiro	11,727,000	430,000	Sepetiba
Kolkata	4,496,694	N/A	Haldia
Busan	3,906,000	17,690,000	Busan New Port
Auckland	1,500,000	970,000	N/A
Marseille	852,516	1,097,740	Fos
Bremen	548,547	5,830,711	Bremerhaven

[27] OECD (2014) The Competitiveness of Global Port-Cities: Synthesis Report http://www.keepeek.com/Digital-Asset-Management/oecd/urban-rural-and-regional-development/the-competitiveness-of-global-port-cities_9789264205277-en#page52

[28] OECD (2014) The Competitiveness of Global Port-Cities: Synthesis Report http://www.keepeek.com/Digital-Asset-Management/oecd/urban-rural-and-regional-development/the-competitiveness-of-global-port-cities_9789264205277-en#page52 and http://www.worldshipping.org/about-the-industry/global-trade/ports

4.11 Auckland-centric considerations

4.11.1 Business locational theories

Neoclassical location theory focuses on location-related factors that affect profit maximisation or cost minimisation. Weber's (1909) study examined location choices that minimise transport costs to both input and output markets. A business chooses a location that is between its input and output markets.

Businesses locate themselves close to inputs if they are costly to transport or they account for a high share of costs, or close to output markets if finished goods are costly to transport. Land-use types will vary between proximity to port and proximity to market, depending on what goods they transport.[29]

Freight composition of these inputs can be thought of in two broad categories:

- *Consumer Goods*[30]*:* The dominant logistics chain for these goods is: Port -> warehouse -> consumer. The *Transport, Postal and Warehousing* sector therefore best represents the sector which will accommodate this land-side freight task. Since 2009, this sector has experienced increasing GDP share in Auckland which suggests an increasing demand for land.[31] Future retail trends with online shopping and shop front retail will only exacerbate this trend.
- *Inputs into manufacturing*[32]*:* Manufacturing activities will receive inputs direct to site or, like consumer goods, will follow a Port -> warehouse -> manufacturer, pattern.

[29] Mare, D; and Coleman A (2011) *Patterns of business location in Auckland* Motu Working Paper 11-08 http://motu-www.motu.org.nz/wpapers/11_08.pdf

[30] Consumer goods include vehicles, consumer electronics, apparel fabric and textiles, and fresh and preserved food.

[31] Statistics New Zealand; EY analysis

[32] Inputs into manufacturing include machinery

[32] http://eds.aucklandcouncil.govt.nz/develop-an-innovation-hub-of-the-asia-pacific-rim/#p2-6-action-2-2

[32] A sub-category under the 'business land' zoning typology noted in the capacity for growth study 2013 y and equipment, coal, petroleum, metal and metal products, timber and timber based products, cement and sand.

Manufacturing is an important part of the Auckland economy and represents 9.9% of GDP[33] and is also a sector that Auckland is focusing on as part of its Auckland Economic Development Strategy.[34]

While both of these categories have different drivers, they both occupy the same land use category – light industrial.[35] Understanding where this land is located, and crucially where future land is planned to be released, assists in understanding projected landside movements.

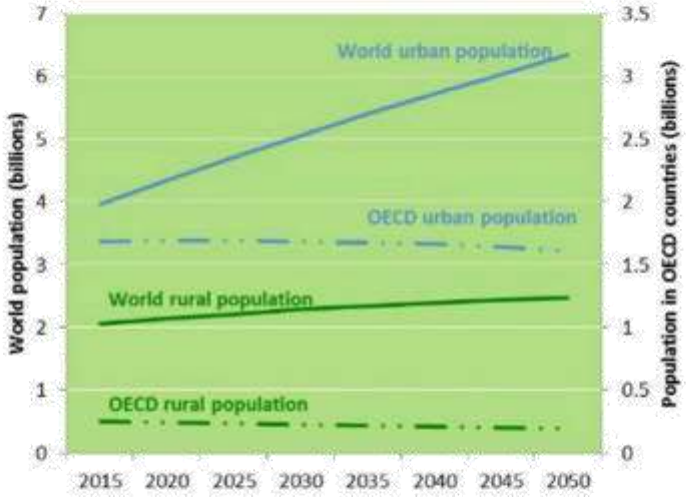
While there are light industrial land classifications right across Auckland, the highest concentration sits in the southern central isthmus (around Penrose, Onehunga, Otahuhu, and Mt Wellington) and further south through the airport and Mangere.[36] Primary areas of currently vacant industrial land of sufficient scale to accommodate growth are around the Airport.

The Future Urban Land Supply Strategy demarcates the majority of future industrial land is expected to be made available in Auckland's South.[37] Therefore, while there is a range of light industrial land currently, or projected to be, available right across Auckland, the increasing focus is clearly towards South Auckland.[38]

4.11.2 Central business districts

One of the overwhelming global mega-trends of the last four decades has been urbanisation. Figure 25 demonstrates that all around the world there has been a movement from rural areas towards cities; in fact, more than half the world's population now lives in cities.

Figure 25. Global population projections[39]



[33] Infometrics (2015) *Annual Auckland Economic Profile* https://ecoprofile.infometrics.co.nz/Auckland/PDFProfile

[34] http://eds.aucklandcouncil.govt.nz/develop-an-innovation-hub-of-the-asia-pacific-rim/#p2-6-action-2-2

[35] A sub-category under the 'business land' zoning typology noted in the capacity for growth study 2013 http://www.aucklandcouncil.govt.nz/EN/planspoliciesprojects/reports/technicalpublications/Documents/tr201401capacityforgrowthstudy2013results.pdf

[36] Appendix 5 provides an overview of current business land zoning

[37] Appendix 6 provides a geographic overview of the broad locations for future land supply – the expectation is that a high concentration industrial land in particular will locate in the South.

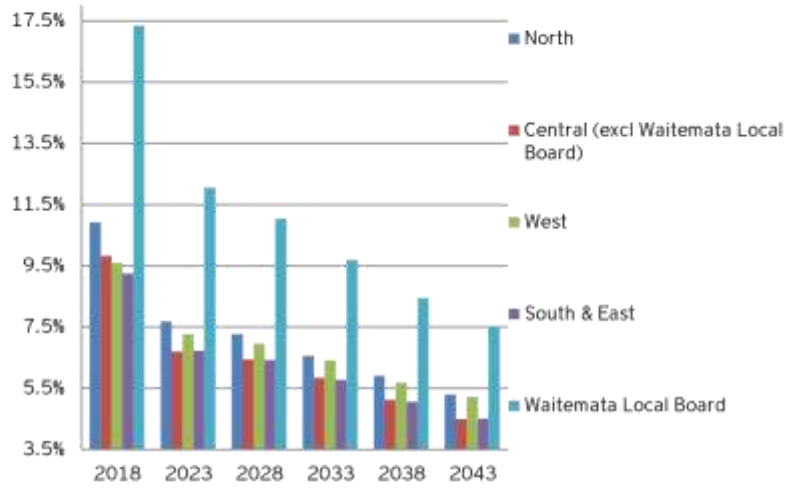
[38] In 2014, 56.7 hectares of vacant industrial land was taken up across Auckland. Three-quarters of this uptake was by industrial activities and the majority of this was focused in South Auckland (Drury, Karaka, Takanini, Pukekohe). Further industrial land is being planned in the future urban areas and will be structure-planned and zoned over time.

[39] United Nations, Department of Economic and Social Affairs, Population Division (2014). World Urbanization Prospects: The 2014 Revision

Auckland and New Zealand is no exception to this trend and the projected growth of Auckland's CBD is evidenced by three main areas:

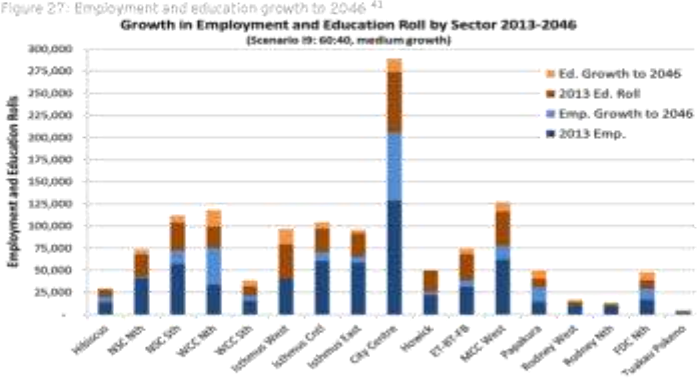
- Population projections: Statistics New Zealand forecasts that over 150,000 people will live within the CBD by 2043 (see Figure 26). This is an increase of almost 90% on 2013 numbers - and is clearly the highest forecast growth in people of any Auckland local board area.
- Employment and education projections: Similar to population projections, Auckland Transport has projected that the majority of employment and education roll growth in Auckland will occur in the CBD to 2046 (see Figure 27).
- Investment in the CBD: The continuing trend for a greater proportion of people living and working in the CBD provides the basis for a range of investments that will further crystallise the city as the 'growth engine' of Auckland. The coming decade is set to see over $10 billion of investment by the public and private sector in the city centre including the City Rail Link, central city bus corridors and terminals, light rail, various substantial property developments and the International Convention Centre.

Figure 26: Auckland sub-regional population growth[40]



[40] Statistics New Zealand (2015) Subnational population projections, 2013(base)-2043

Figure 27: Employment and education growth to 2046 [41]



Furthermore, market rents for office space and retail space in the central city are increasing faster than elsewhere.[42] One reason that land value is a particularly useful measure of infrastructure provision, and of local spill-overs, is that land is a fixed factor. Other factors (labour and capital) migrate in response to new opportunities and bid up the price of the fixed factor in the area in which those opportunities arise. The bids placed on land therefore reflect the value of the local opportunity.[43]

This evidence all signals that the city will be the place people will want to live and work in the future – this implies much higher population densities – which also implies much higher externalities (growing over time) POAL will have to manage.[44]

[41] Auckland Transport – Presentation to CWG (March 2016)

[42] http://www.jll.nz/new-zealand/en-gb/Research/Auckland%20CBD%20Office%20Q1%202016.pdf?ee4d8e73-7b18-4be2-a1d5-616632750ec8 ; http://www.colliers.co.nz/find%20research/office/nz%20cbd%20office%20report%202015/

[43] Grimes, A and Liang, Y (2009) Spatial Determinants of Land Prices in Auckland: Does the Metropolitan Urban Limit Have an Effect? Motu Working Paper 07-09 Motu Economic and Public Policy Research

[44] Externalities, in the form of consenting issues, have already presented themselves (http://www.nzcel-conf.auckland.ac.nz/docs/arenocomplaintsinstruments.pdf refers) and these problems will become more acute as more people live, work and play in the CBD.

4.11.3 Industrial land requirements

Significant future trade growth, by association, implies a need for considerable uplift in transport, freight and warehousing capacity. Predicting the future long-term location of industrial land (land use type that provides for transport, warehousing and logistics) is an immensely complex task, particularly when land use plans do not look beyond 30 years. However, there is some information that provides a steer of the general scale and nature of the provision of this land:

- While there is much conjecture about currently available vacant industrial land in Auckland, some estimates put it at around 300ha.45 This estimate is based on an analysis of each individual parcel of industrial land and has been overlaid with some 'feasibility' assumptions (is serviced and is available for sale and able to be immediately developed). Roughly half of this vacant land is located in just three areas - Airport Oaks, Mangere, East Tamaki and Manukau. Other land is more widely dispersed.
- The Future Urban Land Supply Strategy[46] provides a less certain guarantee of developable areas, but is the best indication available. This Strategy is similar to the status quo in that the Southern Transport Corridor (Manukau to Drury and through To Bombay) is where there is greatest scope to provide further industrial land. Similarly, there are other pockets with potential (particularly Silverdale) but the majority resides in Auckland's industrial south.
- The specific quantum of land required to meet growth is difficult to assess because land markets are dynamic and because technology improvements may ensure a more productive use of space; warehousing capacity and operations will continue to evolve over the long-term.

[45] P.Fontein Auckland Industrial Land Fine Grained Analysis , 2014 http://static1.squarespace.com/static/546d47b8e4b07b4ef0db4b25/t/547ae229e4b0d6f577779f86/1417339445092/SD4+Industrial+FGA+2014+11+20+Final+Report.pdf

[46] Auckland Council, Future Urban Land Supply http://www.aucklandcouncil.govt.nz/EN/planspoliciesprojects/plansstrategies/Councilstrategies/Pages/futureurbanlandsupplystrategy.aspx

4.12 Planning environment

Planning for a city involves identification of a desired future vision for the city, including potential design and the steps required to be undertaken to move towards that desired future. There are challenges in developing the right strategy, setting the right framework and environment when there are different objectives, aspects and drivers for councils, national agencies, and the port. Aligning wider government infrastructure and city plans, with port development plans can provide a whole-of-region view, drive longer term master planning, and drive greater supply chain efficiencies and efficient capital investments. Alternatively, agencies planning in isolation of each other can potentially create bottle necks, additional congestion costs and/or inefficient use of capital expenditure.

The role of the port is wide ranging; its activities are unique and diverse which can have a multitude of positive and negative implications to the Auckland region and the wider country. The future development of the port, for example, is strategically important to enable efficient supply chain impacting the wider economic development of the region/country. Co-ordination of planning is critical in order to drive and develop an efficient sustainable port and the related infrastructure.

Under the *Local Government Act 2002 Amendment Act 2014*, local governments are required to prepare infrastructure strategies for at least a 30 year period. However, certain infrastructure assets have longer life cycles, for example storm water assets, footpaths and bridges typically have 100 year life cycles.

Port infrastructure can have useful economic life of more than 50 years; particularly in the case of maritime access shipping channels[47]. This can create an inherent timing tension in aligning port planning strategies compared with city planning and supporting infrastructure.

In order to understand potential impacts from the future of the port, this section discusses the ports current strategic operating environment and discusses what role the port plays in relation to wider strategic plans and achieving the future vision, both regionally and nationally.

[47] Infrastructure Australia – National Ports Strategy, 2011.

4.12.1 The Auckland Plan

Auckland Council is the local governing body for the Auckland Region. It serves a number of functions; one of which being to meet the current and future needs of its communities. The Auckland Council formulates a number of key documents that outline its long-term strategies, implementation plans, regulations and policies, and their operational financial budgets; all of which are underpinned by the Auckland Plan.

First adopted in March 2012, the Auckland Plan is a 30 year long-term plan. It is a comprehensive long-term strategy for Auckland's growth and development. The Auckland Plan is governed by the Local Government (Auckland Council) Act 2009. Section 79 of the Act describes what the plan must include and address.

4.12.1.1 Purpose of the Auckland Plan

The purpose of the Auckland Plan is to contribute to Auckland's social, economic, environmental, and cultural wellbeing, through an effective long-term (20-30 year) strategy for Auckland's growth and development. To achieve this purpose the Auckland Plan must:

- set a **strategic direction** for Auckland and its communities that integrates social, economic, environmental, and cultural objectives
- outline a high-level **development strategy** to give direction and enable coherent, coordinated decision-making by Auckland Council and other parties
- describe **Auckland's role** in New Zealand
- identify the **existing and future location of** residential, business, rural production and industrial **activities**
- identify the **existing and future location of critical infrastructure facilities** (such as transport, water supply, wastewater and stormwater disposal), other network utilities, open space, and social infrastructure
- identify **nationally and regionally important recreational and open space areas, and ecological areas** that should be protected from development, environmental constraints on development, and **landscapes and areas of historic heritage value**
- identify the **policies, priorities, land allocations, programmes and investments** to implement the strategic direction.

4.12.1.2 Key initiatives

The Auckland Plan is the vision of the region. At a high level, the plan seeks to address the following initiatives in Auckland:

- reducing transport and housing shortages
- giving children and young people a better start
- creating more jobs, and
- protecting the environment.

The Auckland Plan aims to have the following specific outcomes by 2042:

- **A fair, safe and healthy Auckland**: That Auckland will have a strong and equitable society, in particular for children and young people. Auckland will have robust public services including, public facilities, parks and sporting amenities, high quality housing addressing the damp, cold, overcrowded and uninsulated living conditions.
- **A green Auckland**: Pollution will be low and minimal, including coastlines, air, water consumptions, greenhouse gas emissions, and waste products. Energy supply will be resilient and sustainable.
- **An Auckland of prosperity and opportunity**: This includes high development of technology, small and medium businesses, and employment opportunities across Auckland. Focus on global connectivity.
- **A well-connected and accessible Auckland**: Infrastructure will be up to date and meet the needs of the community. Businesses move freight efficiently, using roading and rail transport networks. Sea and air ports play a critical role in export and the economy.
- **A beautiful Auckland that is loved by its people**: Urban areas will be full of character; coastal areas will thrive in recreational opportunities, and productive rural areas that make a significant contribution to exports.
- **A culturally rich and creative Auckland**: A major tourist attraction, local arts and cultural events. Aucklanders' creativity and innovation is evident in our arts and the export earnings of our creative industries. Quality sporting parks and facilities support high levels of year-round participation, from elementary to elite level.
- **A Māori identity that is Auckland's point of difference in the world**: Māori culture and identity is celebrated by all Aucklanders and is our point of difference in the world. Te Tiriti o Waitangi/ Treaty of Waitangi is appropriately recognised and given effect with Māori in Tāmaki Makaurau exercising their Rangatiratanga/ self-determination. Māori values are integrated into planning, decision-making, and operations. Māori are empowered, and enjoy a high, safe standard of living, across the social, economic and cultural spectra.

4.12.2 Supporting plans

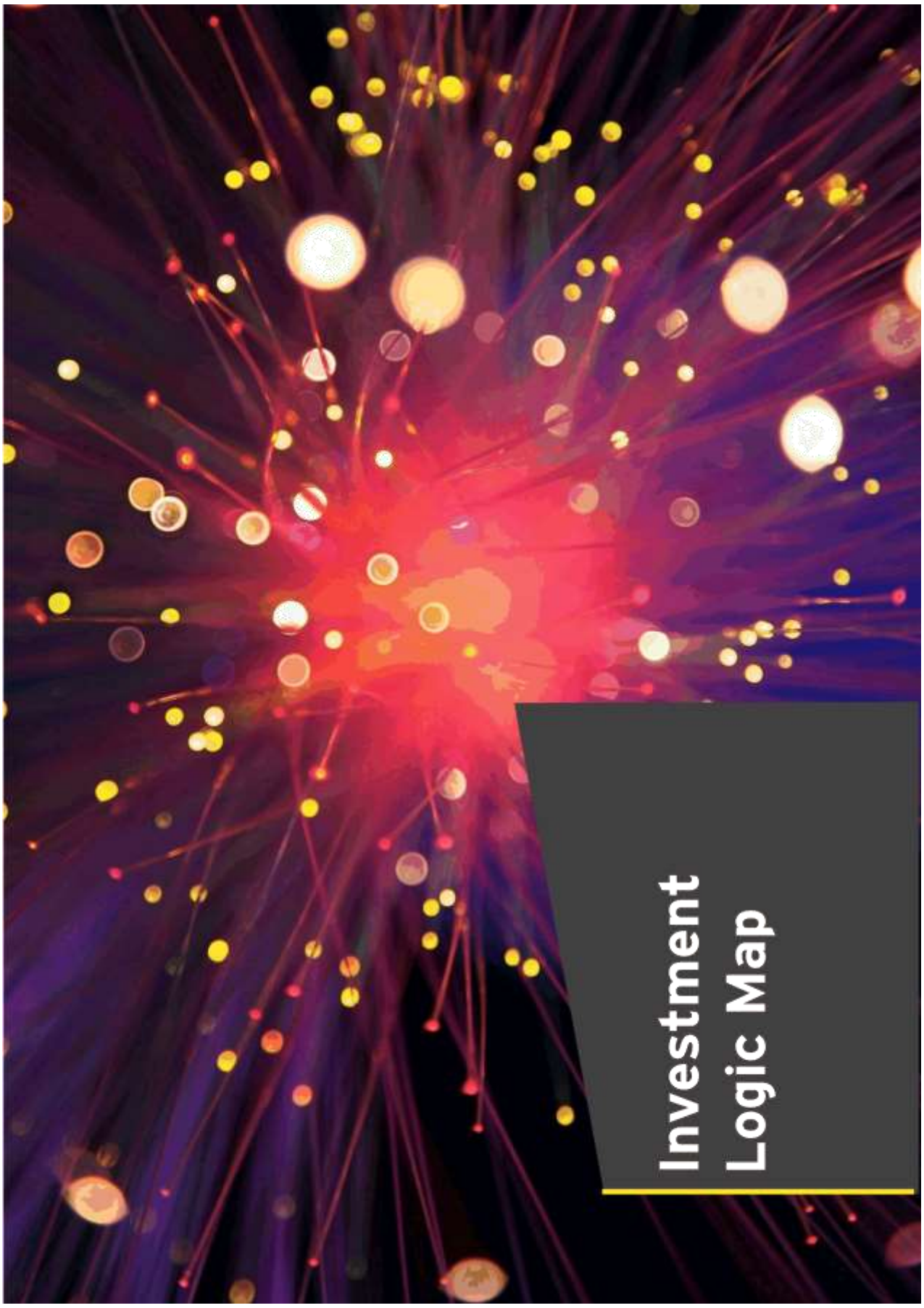
The following plans and strategies have been created by Auckland Council to support the realisation of the Auckland Plan and its vision. The following diagram is not an extensive list; it is a list of key documents we consider to be particularly relevant to this study.

Figure 28 provides a brief overview of the supporting plans that can be impacted/ considered from any changes to the development plans of Port of Auckland. See Appendix 7 for more information on the supporting plans.

4.12.3 National plans

Ports and their associated infrastructure are typically considered national significant assets due to their economic and social importance and the enduring nature of the infrastructure. The future of the port also has national infrastructure planning implementations. Generally these are in relation to the related supporting infrastructure in the supply chain namely transport strategies. See Appendix 8 for a summary of the key national policy, strategy and planning documents that currently will need consideration when considering the development and growth of the port.

Figure 28: Auckland Plan and supporting plans


Investment
Logic Map

5 Investment Logic Map

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. Its focus is strongly on logical grounds to ensure that any proposed investment makes sense. It tests and confirms that the rationale for a proposed investment (or decision) is evidence-based and sufficiently compelling to convince decision makers to commit to invest in further investigation and planning. In summary, the ILM seeks to answer the following key questions:

- What is the problem?
- What is the best strategic response to the problem?
- What benefits does any investment need to deliver?
- What are possible strategic responses to the problem?

5.1 CWG ILM

On the 3 December 2015, a facilitated ILM workshop was held with the CWG in order to determine how the port's stakeholders (represented by the CWG) define the problem regarding the future of the port.

The structure of the ILM is to challenge the stakeholders to clearly and succinctly define the problems. The CWG identified and agreed three key problems through the workshop. These problems and their assigned weightings are outlined in Figure 29. A detailed overview of the ILM Workshop output can be found in Appendix 9.

Figure 29: ILM Workshop Problem Findings and Weightings

Problem Finding 1	35%
Capacity will constrain the port's ability to meet future freight and cruise demands, which may limit economic growth in the long term	

Problem Finding 2	35%
Tension between, and competition for, limited resources for the CBD and POAL will lead to suboptimal outcomes for one or both	

Problem Finding 3	30%
Port activities create environmental, economic, social, and cultural impacts which need to be understood and addressed	

5.2 Problem definitions

The following section provides a more robust definition of the problems and details their component parts.

Capacity will constrain the port's ability to meet future freight and cruise demands, which may limit economic growth in the long-term

- "Capacity" refers to both land side capacity within the ports gates, and berth capacity. In addition, it refers to the capacity of both the road and rail network. It is expected that both land side, berth and transport capacity will present a constraint to the ports future operations.
- "Freight" refers to all container and multi-cargo trade (including bulk break and vehicles). Freight is being constrained by land side capacity as well as berth length.
- "Cruise" refers to all large passenger ships that visit Auckland. Cruise is also being constrained due to the increasing size of ships and lack of available berth length.
- "Economic growth" refers to the benefits that are derived from port operations to both the Auckland and New Zealand economies. Given New Zealand's current position as a net-importer, and its reliance on export markets it is essential that the port can accommodate all demand in the future.
- Both freight and cruise drive economic growth for both the Auckland and New Zealand economies.

The primary benefit of addressing this problem will be to increase efficiency and sustainability of port activities.

In order to determine the significance of the problem above, analysis needs to be carried out on the below areas. Each area is discussed in more detail in the referenced sections:

- Current productivity and capacity of the port
- Technology options and their effect on capacity
- Future trade and fleet forecasts
- Future cruise trends

Tension between, and competition for, limited resources for the CBD and Auckland's port will lead to suboptimal outcomes for one or both

- Ports are a product of evolving cities. As cities grow there is increasing pressure on land. Many cities compete for land that was historically used for port activities.
- For Auckland, the port and the city centre effectivity occupy the same space and so as the city and port both grow, the competition for land intensifies.
- "Suboptimal outcomes" refer to situations in which the competition for limited resources results in negative effects. This includes a situation where the ports competitiveness is reduced, or where Auckland city is less liveable.

Addressing this problem will maximise opportunities and improve business confidence for the CBD and harbour.

In order to determine the significance of the problem above, analysis needs to be carried out on the below areas. Each area is discussed in more detail in the referenced sections:

- Highest value land use for the current port land.
- Future capacity needs of POAL.

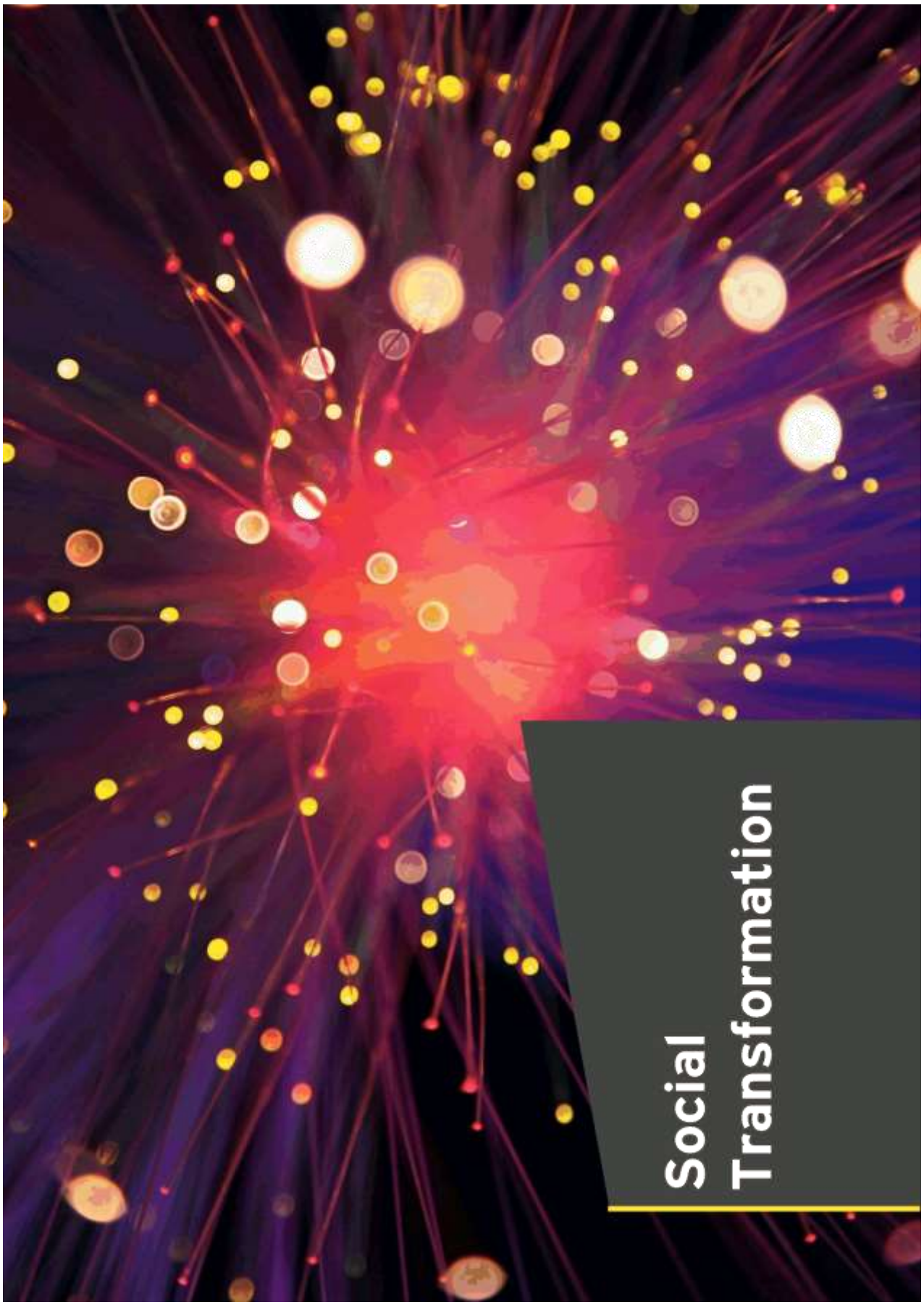
Port activities create environmental, economic, social, and cultural impacts which need to be understood and addressed

- "Impacts" refer to the positive and negative externalities which port activities create.
- "Environmental" impacts include the effect that port activities have on marine and wildlife, as well as the noise and light impacts.
- "Economic" impacts refer to the commercial return of POAL including revenue, employment, supply chain and wider economic drivers.
- "Social" impacts refer to the impact that port activities have on people including the tension between a working waterfront for people, leisure, transport, cruise and trade.
- "Cultural" impacts refer to the impact that port activities have on the values of both mana whenua and the wider population of Auckland.

Addressing the above problem will promote the improved wellbeing of people and place.

In order to validate the above problem, further evidence is required relating to the following areas. This evidence if required for both the current port site and any potential new sites:

- Significance of site to iwi and communities
- Impact of site on iwi values
- Evidence of how iwi, communities and people interact with the port site
- Environmental impact of site on sea and land
- Impact on heritage values.


Social
Transformation

6 Social Transformation

One of the problems identified during the ILM process was the *"Tension between, and competition for, limited resources for the CBD and POAL will lead to suboptimal outcomes for one or both."*

This section explores the evolution of Auckland as a port city and how subsequent urbanisation trends has impacted on this evolution and led to tension between the CBD and the port and how resources are currently used.

6.1 City transformation and the role of the port

The role that a port plays in the transformation and evolution of a city is ever evolving as the purpose and aspirations of cities have changed, in response to shifts in demographic, technological and economic influences.

In the early 1840s, Auckland established itself as a hub of a growing overseas and coastal maritime trade. The city's growth throughout the 19th and 20th century saw substantial growth through the period of industrial revolution, during and post-World War II. This necessitated further expansion of port storage facilities and land reclamation. Trade volumes and the number of ships increased significantly. With the advent of containerisation, larger ships and a new railway serving the eastern side of the North Island, Auckland port eventually became the largest import container port.

The 21st century mega trends heralded in the technological era where the Auckland city centre became dominated by financial service businesses, earning its title as the CBD. Less prominence was placed on goods and services being traded through the port, and the importance of the port to the city's culture and civic pride diminished somewhat. As urbanisation in the city continues and Auckland's population continues to grow, there is the growing challenge of accommodating a growing population and economy.

Auckland is now clearly experiencing an urbanisation renaissance and liveability phenomenon, epitomised by its clearly defined aspirations to be the world's most liveable city, with a Māori identity that is its point of difference in the world.

Changes in public views on waterfront space has inevitably placed tension on the role that the ports now play in light of this new transformation.

As the values of the city and its people have changed, the importance that they once placed on the role of the ports in the economy has shifted to valuing amenity and urban form over that of the ports contribution to the economy.

This was seen in the 2011 Rugby World Cup when Auckland, as host, decided to open up the North Wharf and Jellicoe Street Park to public use. Having access to the waterfront space meant Aucklanders were now able to spend their "leisure" time visiting parts of the city centre with access to the waterfront. Another further example can be seen at the Wynyard Quarter development, with its overwhelming public response to the new urban attraction, with over 50,000 visitors in the first weekend alone.

These changes have further cemented the changing perception of the centre of Auckland as bland, boring and business dominated to one of a potentially world class urban leisure and recreation destination.

As the rate of urbanisation accelerates and continues towards the city's water edge, it is likely that there will be increased tension over future land use for the area. The figure below shows how accessible the waterfront currently is and the amount of access that could potentially happen if the ports land was returned to the public:

Figure 30: Publicly accessible water's edge in the city centre versus privatised water's edge

As the value of the land increases in line with growing demand for city centre sites, major redevelopment and regeneration within the city core of former industrial sites will continue to occur. As land is scarce within the CBD area, the tension between how the land at the waterfront area is currently used will only escalate.

6.2 Advantages and disadvantages of a central city port

The above section set out the evolution of the role of a port within a city, culminating in the current situation where there is pressure on the industrial nature of port land in a city aspiring to be the world's most liveable city.

This is not to say that the port's role in Auckland's city and economy is no longer relevant. This section will set out the advantages and disadvantages of having a central city port location, specifically in relation to Auckland. This is by no means an assessment of the regional impacts (whether positive or negative) of the port.

6.2.1 Advantages

There are many advantages that are associated with a well-functioning port. Ports play an essential role in facilitating trade and in the global and local supply chains. They can lower the cost of trade, generate value-added benefits, increase employment and attract certain economic sectors, all of which are related to urban wealth.

The table below sets out some of the other advantages of having a port in the central city location:

Table 10: Advantages of a port in the central city

Advantages	Description
History and tradition	Having the port in the central city, where it is visually prominent, helps to provide recognition of the history of the city, and a visual and nostalgic response as to the purpose and history of the city. It therefore helps to create a sense of place and identity to the city.
Point of difference	In a world where many cities are striving for a point of difference, a central city port can provide this unique visual identity, especially as many other cities are losing or have lost their working waterfront (although the opposite could also be argued – that having a port in the central city area is seen as a negative point of difference).
Feeling of connection	In a country as far removed as New Zealand, having the port in a visually prominent location can help people to feel connected, by seeing ships from overseas arriving and departing.
Diversity of employment	The port provides a range of employment opportunities, not otherwise found in the central city area, in particular a range of blue collar jobs.
Visually interesting	To many the port is visually interesting, a departure from the otherwise repetitive picture of office and apartment buildings. This is particularly so at night, where many can argue the waterfront is given a greater diversity through the lights and workings of the port.
Protecting of views	Although the port land itself is occupied by port infrastructure, cargo and containers, their coverage is relatively light compared to a fully built out urban environment of commercial and residential buildings. This ironically therefore provides views through the port land from the land to the sea, and vice versa. If the port land was fully developed, there would be the danger that such development would block sea views from inland, thus effectively privatising the waterfront view.

6.2.2 Disadvantages

Most of the advantages of having a port in a central city location accrue to the region and adjacent regions. The disadvantages of a port in a central city location is felt directly in the immediate or local vicinity of the port, through issues such as pollution, poor air quality, transportation impacts and the impact on mana whenua Maori to interact and associate with their whenua.[40]

The table below sets out some of the disadvantages of having a port in the central city location:

Table 11: Disadvantages of a port in the central city

Disadvantages	Description
Visual impact of industrial use	Although some can find a port and its related infrastructure attractive (as described above), many will argue that it is essentially an industrial use in a central city location, and the stacking of containers, bulk cargo piles, and the parking of cars is not appropriate in a 21st century central city location that is aspiring to be the world's most liveable.
Loss of views	One of the most prized assets of the central city is the views from the publicly accessible parts of the waterfront eastwards towards the mouth of the harbour and Rangitoto. The port, sitting immediately to the east of the central city, to some extent blocks these views, and therefore has an impact on the amenity of the city.
Conflict with other harbour users	The Waitematā Harbour is one of Auckland's best assets, and contributes significantly to the reputation of Auckland being one of the best cities to own and sail a boat in the world. It was for good reason the city is known as the City of Sails. But a port in a central city location creates conflicts with other users of the water, particularly given the danger posed by the size and lack of maneuverability of the large ships using the port.
Land-side transportation conflicts	An essential component of the port is the transportation of goods to and from the port, which has to take place on road or rail. In a central city location, this places competition for road and rail space in an environment not particularly conducive to the movement of large quantities of freight. This can be seen particularly along Beach Road, Quay Street and Stanley Street, where the urban environment is negatively affected by the presence of large freight vehicles and the need for roads to be designed to take large vehicles. Similarly, the need for rail space means freight trains competing with commuter trains, and results in freight trains having to travel through inner city suburbs (often at night) thus impacting on the amenity of these neighbourhoods, and their ability to attract high quality transit oriented development.
Loss of access to the water's edge	The port has to be a secure site, and as a result, there is no public access to the water's edge along the length of the port land. Despite the size of the Waitematā Harbour, the extent of public access to the water's edge is relatively limited in the city centre, constrained by private sites running to the water's edge and/or transport infrastructure, although it has improved considerably in recent years through the addition of Viaduct Harbour and Wynyard Quarter
Loss of opportunity of high density land use	Ports by their nature require large amounts of land, relative to the number of people who are employed on the site. In this era of high demand for central city land, for increasing density of employment and residential use, the low density use of the port land sits somewhat uncomfortably with the aspirations and objectives of the city centre, and represents a missed opportunity for a far more efficient and intensive use of the land. Agglomeration effects and high job density are generally considered to be factors of urban economic growth, and these agglomeration effects can be reduced by the presence of large low density central city uses

[40] Appendix 25 sets out some of the Māori values that may have been impacted by current port activities.

Disadvantages	Description
Impact on adjacent land use opportunities and land values	The port is essentially an industrial land use, and consequently this has an impact on the land value of neighbouring property. In a central city location, where land value is typically very high, in addition to missed opportunities on the port site itself, the port can reduce opportunities on adjacent sites by constraining property values and reducing the attractiveness of the sites. Ngāti Whātua, and other mana whenua iwi, arguably experience twice the level of the impact and lost opportunity as others. Firstly through the imposition of the port on their traditional land and waters that ignored their underlying rights, interests and associations to the area. Secondly, land returned to Ngāti Whātua as Treaty Settlement land is adjacent to the current port and its full commercial development is constrained.
Constraints on the port operation, and clustering opportunities	In a central city location, surrounding land has been developed for non-port related uses, and the port has become increasingly land constrained, putting pressure on the efficient processing of cargo, and limiting growth and expansion opportunities. In a less pressured land use environment, the port could expand much more easily, potentially allowing for an increase in both efficiency and throughput. Equally, ports generate secondary or related employment opportunities, but in a city centre location there is much less opportunity for these businesses to cluster and locate around the port. Again, a less constrained land use environment would provide a greater clustering opportunity for port and maritime related businesses, including maritime education and knowledge based industry
Security issues	Ports represent potential security issues, both through the transport of hazardous goods and the risk of explosions, and also through the threat of terrorism as the port (and its ships and cargo) could represent attractive terrorist targets, not ideal for a central city location. As a result, security needs to be high at the port, further reducing public interaction.

Disadvantages	Description
Air quality / pollution	Air emissions represent a major negative environmental impact. Contaminants include oxides of nitrogen (NOx) and oxides of sulphur (SOx). For example, more than half of the SO2-emissions in Hong Kong are related to shipping. Even though maritime transport is seen as a rather clean mode of transport in terms of emission/km, shipping-related carbon dioxide emissions were estimated to be 3.3% of global emissions on 2007.[49]
Water quality / pollution	Ports are a source of pollution of water, but detailed information on emissions in water is rather scarce in comparison with air emissions. One major source of water pollution in ports is oil spills, coming from port runoff, unloading and loading of oil tankers, removal of bilge water, and leakages. Oil spills are coming from normal activities, accidents and illegal dumping practices. Even though tanker accidents are remembered as an important source of water pollution, some estimates indicate that normal shipping operations are responsible for over 70% of the oil entering the sea from marine transportation.[50]
Waste	Port activities produce waste, especially from oil terminals, fuel deposits and dry-docks operations, which produce oily and toxic sludges. But waste also comes from ships and from dredging operations.[51]
Noise	There are various noise impacts from ports, coming from different sources: moving and berthed ships, moving of cargo and containers, cranes, trucks, trains and other industrial activity such as processing of bulk cargo. These different sources of noise can have large impacts. Given a central city location, where the harbour is one of Auckland's main recreation tourist attractions, and is surrounded by sensitive residential areas, these types of pollution are a distinct disadvantage to having a central city port.

[49] OECD (2013) *Competitiveness-of-Global-Port-Cities-Synthesis-Report*
[50] OECD (2013) *Competitiveness-of-Global-Port-Cities-Synthesis-Report*
[51] OECD (2013) *Competitiveness-of-Global-Port-Cities-Synthesis-Report*

Disadvantages	Description
Biodiversity	Ports' impacts on biodiversity mainly come from air emissions, dredging and the transfer of ballast water. One of the main sources of disruption of the balance of ecosystems is the introduction of non-indigenous marine species through the transfer of ballast water. These alien species can enter in competition with local species and cause heavy environmental impact. Sulphur and nitrogen compounds emitted from ship, oxidising in the atmosphere, can contribute to acidification, causing acid depositions that can be detrimental to the natural environment, such as lakes, rivers, soils, fauna and flora.

6.3 Global trends

The urbanisation phenomenon is not one that is local only to Auckland; it is a trend that is happening globally. Examples of cities experiencing similar trends include: Vancouver, Vienna, Zurich, Copenhagen, Stockholm and Melbourne.

These cities are all competing for global recognition, hoping to attract global businesses and employees to relocate and settle, thus improving the economic well-being of the city.

All these cities have large ports whose importance has been over-shadowed (and potentially threatened) by the rise of these cities on global liveability indexes where topics such as urban amenity, visual qualities, sustainability, walkability and cycling have become important. As with Auckland, the waterfront areas in these cities have become an important focus, and recognising the amenity benefit that views over, and connections to the water can bring. Where the port in those cities are located within the central area or city fringe, there has been tension between the ambition of the city to achieve liveability and urban amenity and the economic contribution that the port has made which has enabled this urban wealth.

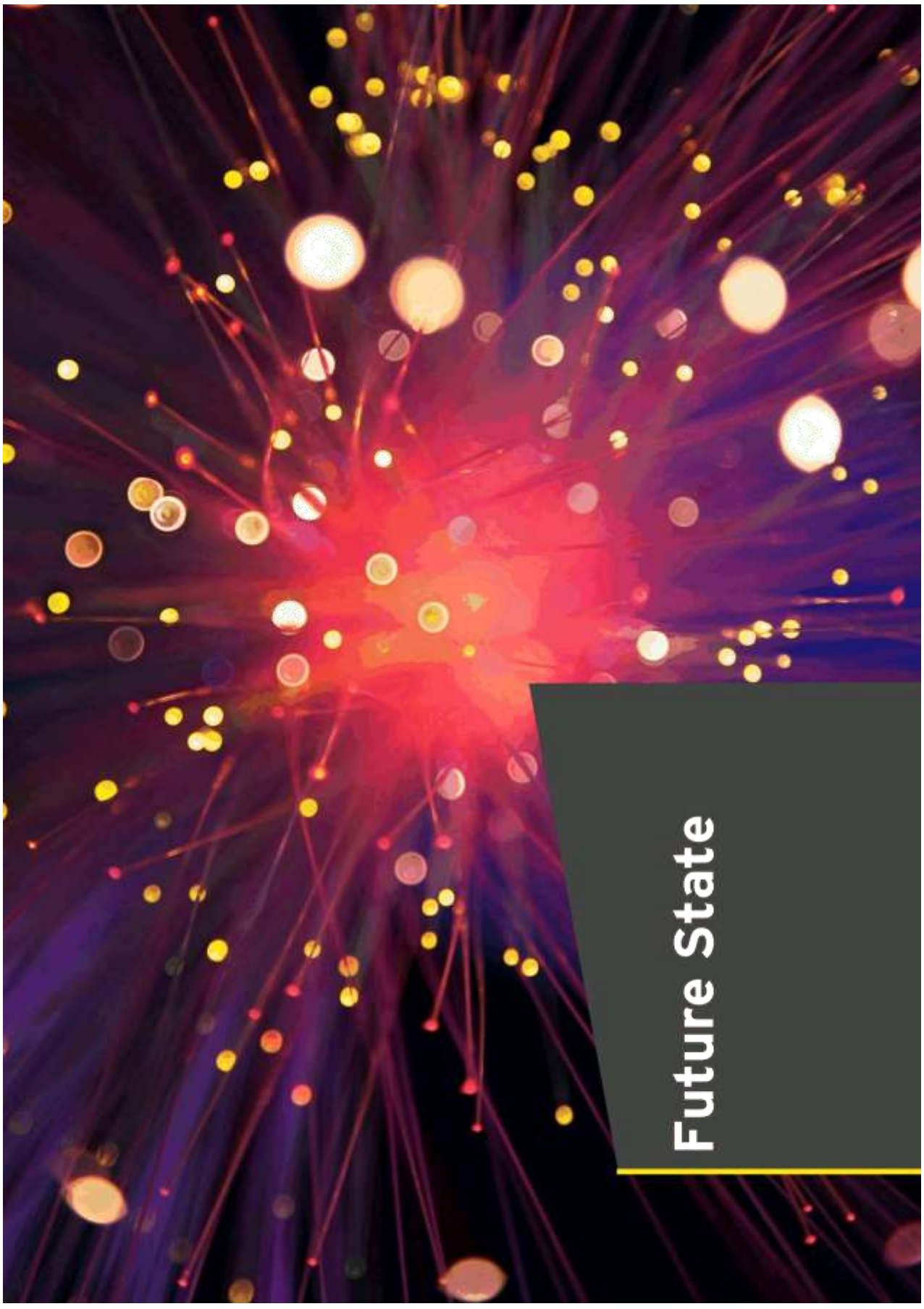
6.4 Implications for this Study

The debate around the changing role of the port within the city is one that is much needed as can be seen from this study.

It is clear that the port is an essential economic component of a city-region. However, the changing land use within the city from purely industrial to business to the present mixed uses of residential and commercial, it is clear that the economic value add and base has shifted from one relying on the port to a more diversified range of businesses.

It must be noted that Auckland is not alone in facing this issue. Indeed, as discussed in earlier sections, many ports have been located in central city locations, and a number of cities have tackled, or are in the process of addressing this issue through a variety of approaches. This includes complete or partial relocation of the port, or using creative design solutions to allow much greater interaction between the public and the port. More detailed case studies can be found in Appendix 10.

The role of the CWG is to decide, based on the evidence presented in this study, how to make the trade-offs between the future vision of Auckland and how the city's scarce resources should be best allocated to their highest value use. This means making a decision on whether to keep the port in its current location or choosing to move the port to an alternative location.


Future State

7 Future State

The aim of this section is to explore what the main drivers of port activities are and what this means for the future trade task. This section addresses these questions by exploring a range of projected long-term scenarios, port and shipping trends which frame the future supply and demand. This section will discuss the following assumptions and drivers, including:

- Demographic and economic conditions
- The current state: context to the ports trade profile
- Growth by activity type:
  - Containers
  - Multi-cargo
  - Vehicles
  - Cruise
- Current port and other relevant trends
  - Consumption trends
  - Shipping fleet trends
  - Terminal and berth operational productivity trends

7.1 Overview of assumptions

To project port activity to 2060 we believe that using a combination of population, national GDP and world trade projections from official sources to forecast the imports and exports into the port provides the most robust measure to use as a base to forecast freight throughput.

Considering that international trade accounts for most of the activity at POAL, this approach seems the most appropriate. A range of other sources have also adopted this approach.[52]

A literature review has been undertaken to supplement the forecasts presented in this section. A number of reports compiled in the recent past have provided growth forecasts for Ports of Auckland and we have presented these forecasts in order to provide a comparison.

The 2015 trade figures have been used as a baseline. A number of data sources forecast up to 2060 only including Statistics New Zealand. Therefore for the purpose of this chapter, we have consistently explored future state assumptions for a period of 45 years up until 2060. It is possible to extrapolate the analysis further and some sources forecast further; however, our findings suggest that the growth post-2060 would yield similar results and conclusions. Where assumptions and analysis has been made before and after 2060 has been explicitly stated.

It should be noted that there is always a degree of limitation to forecasting. This is because it is difficult to predict when periods of instability, or when significant events may occur in the future. The limitations of using forecasts naturally extends as the forecast period extends. Accordingly, our forecasts focus on the long-term average growth in global trade, with acknowledgement that there will inevitably be forecast volatility. The main focus of this chapter is not to provide the exact predicted rate of change, but rather to examine higher trends and probable outcomes based on the analysis of certain assumptions and drivers. The forecasts therefore need to examine alternate scenarios, to test different overall rates of economic and trade growth assumptions.

Conclusions made in this section should be considered in conjunction with our wider assumptions and understanding of general limitations to forecasting set out in Appendix 9.

[52] These economic drivers were also discussed in the PwC UNI Port study 2012 and NZIER Report 2014

7.2 Demographic and economic conditions

Demographic and economic projections are the bedrock of many demand-side projections. With the assumption that Port of Auckland's trade activities types do not change significantly in the future, we consider the key underlying drivers are:

- population growth
- economic growth
- the location of economic activity in Auckland.

These inputs help frame all of our projections for each individual trade-type. A summary of these inputs is provided in Table 12 in driving our analysis:

Table 12: Summary of key inputs

Input(s)	Timeframe(s)	Data Point(s)
National Population Projections (2068)	2030	5.21m
	2045	5.70m
	2060	6.00m
Auckland Population (2043)	2030	1.95m
	2045	2.30m
	2060	2.67m
National GDP growth (2060)	2030	$348b
	2045	$492b
	2060	$669b
Auckland GDP growth (2060)	2030	$123b
	2045	$174b
	2060	$237b

Source: Statistics New Zealand, OECD, EY analysis

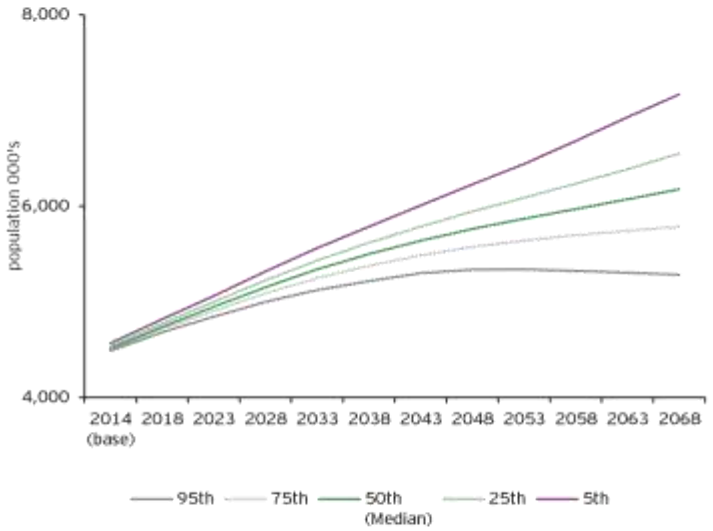
7.2.1 Population

7.2.1.1 National population projections

The growth of the national population will impact future activities of POAL, as an increase in the consumer base and the existing exporter base will drive greater trade growth. According to Statistics New Zealand, the New Zealand population as at September 2015 is estimated to be 4.6 million.

This is forecasted to grow, to 5.6 million by 2043 and to 6.2 million by 2068.[53] By 2043, 75% of the population will be living in the North Island.[54] Figure 31 shows the various population projection scenarios conducted by Statistics New Zealand. We have adopted the median projection for the purpose of this study, in order to keep a relative medium forecast rate.

Figure 31: National population projections to 2068 (under various scenarios[55])



Source: Statistics NZ, 2014

[53] Statistics New Zealand, National Population Projections: 2014 (base)-2068. 50th percentile (median) used.

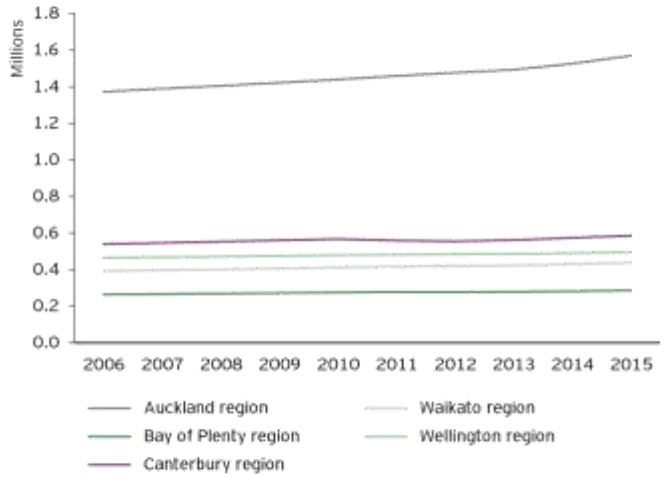
[54] Statistics New Zealand, Subnational Population projections 2013 (base) -2043.

[55] Statistics New Zealand - Percentiles indicate the probability that the actual result is lower than this percentile. For example, the 25th percentile indicates a 25 percent probability that the actual result for a given year is lower than this percentile.

7.2.1.2 Auckland population projections

North Island population growth is the key driver of New Zealand's total population. Specifically, Auckland is New Zealand's largest city and is a key contributor to this projected growth. With a current population of approximately 1.5 million, Auckland's population has also rapidly grown in recent years. Between 2006 and 2015 the population grew by 14.5% - approximately double the rest of New Zealand average. Figure 32 provides an overview of this growth against other major regions in New Zealand:

Figure 32: Historic population growth, selected regions (2006 - 2015)



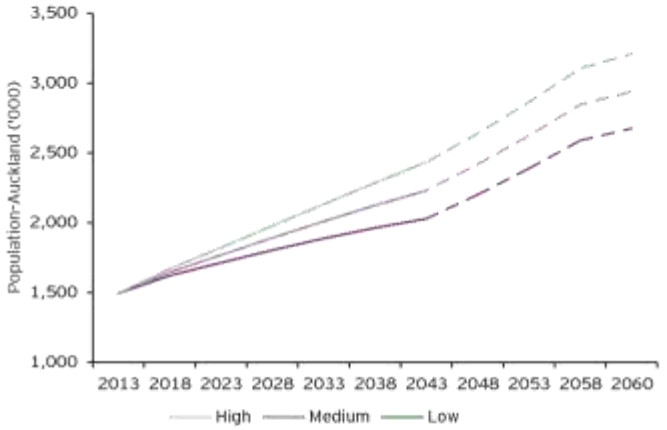
Source: Statistics NZ, 2015

Auckland's future population is forecast to rise significantly. By 2043, Statistics New Zealand projects that the Auckland region will accommodate an additional 740,000 people (under its medium growth scenario).

Extrapolating these growth assumptions (compounded annual growth rate of 1.34%) out to 2060, Auckland's population will be over 2.3 million people (nearly 1 million more than today's population).[56]

Figure 33 shows our analysis on the projected Auckland population to 2043. The dashes represent our analysis by extrapolating out Statistics New Zealand's growth rates under a high, medium and low scenario.

Figure 33: Auckland demographic projections, total population (2013-2060)



Source: Statistics NZ, EY

The location of Auckland's population is also expected to change significantly. Urban planning changes contemplated under the Proposed Auckland Unitary Plan (particularly around zoning and plans for residential densification), policy decisions covered in the Draft Future Urban Land Supply Strategy and current and planned transport investments, will inevitably have a large impact on the location of demand for goods and the productive centres which produce goods and services. These documents all point to a continuing growth of the urban fringe - in particular, towards the south of Auckland.

[56] Statistics New Zealand, Subnational Population projections 2013 (base) -2043

Appendix 6 demonstrates the projected growth areas (by proxy of land release) that Auckland Council is predicting over the next 30 years. Changes in demographics can impact what we produce and consume, which could impact the future activities and volumes at the ports.

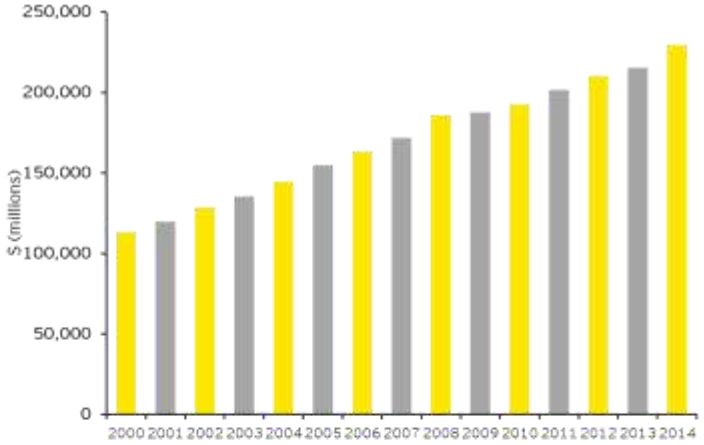
7.2.2 Economic conditions

7.2.2.1 National economy

Gross domestic product (GDP) represents the region's income earned from production and is the primary indicator of economic activity. As discussed in Section 4.1, Role of a Port, the Auckland port plays an important role part in the economy; evidence suggests a positive correlation between a nations' GDP and port activity.

Since 2000, New Zealand has experienced an average annual growth rate of 5.2%. Figure 34 shows the growth in real national GDP between 2000 and 2014:

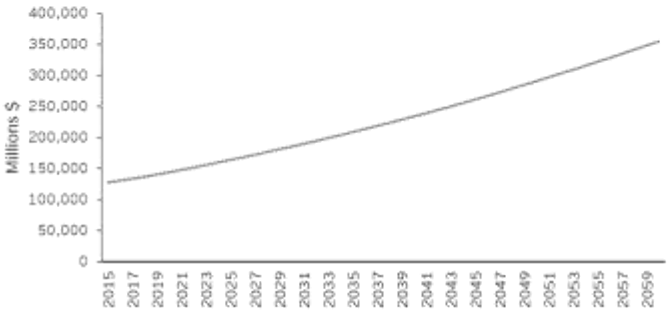
Figure 34: New Zealand's GDP growth (2000 - 2014) (Current Prices)



Source: Statistics NZ, 2015

A number of organisations forecast long-term GDP. Using growth multipliers obtained from the Organisation for Economic Cooperation and Development (OECD), we have projected GDP growth to increase to $354 billion by 2060[57] as shown below in Figure 35. The OECD predicts that New Zealand's GDP will grow on average at a rate of 2.30% per annum, which is higher than other OECD countries, which average around 1.94%. This growth is broadly in line with world GDP growth forecasts of 2.6%.

Figure 35: New Zealand real GDP projection (2015 - 2060)[58]



Source: OECD 2015, EY analysis

The New Zealand Treasury (the Treasury) considers that real GDP[59] will also continue to grow in the next five years at an average rate of 2.6% per annum. This is consistent with the historical average of 2.6% over the 1992 and 2015 period.[60] The Treasury also forecast as part of their long-term fiscal model (up to 2060) real GDP to grow on average 2.1% per annum.[61] These two bands are broadly consistent with the OECD growth forecasts utilised in our projections.

[57] OECD, GDP long term forecast indicator, using 2014 official figures as a baseline
[58] IBID
[59] Real GDP excludes inflation impact
[60] Half Year Economic and Fiscal Update 15 December 2015
[61] *NZ Treasury, Long term Fiscal Model 2013. http://www.treasury.govt.nz/government/longterm/fiscalmodel*

There is a degree of correlation between both the growth in the value of trade and the volume of trade to GDP. Since 2000, the compound annual growth rate (CAGR) of imports and export value at the port has been 3% and 1% respectively, accounting for a total CAGR value of trade through the port of 2.34%.

In terms of weight handled, the CAGR over the same period was 3% for imports and 2% for exports, accounting for a total CAGR weight of trade through Port of 2.22%. The CAGR GDP over the same period was 2.6%. This supports the notion that historically GDP and port activity grow at similar rates.

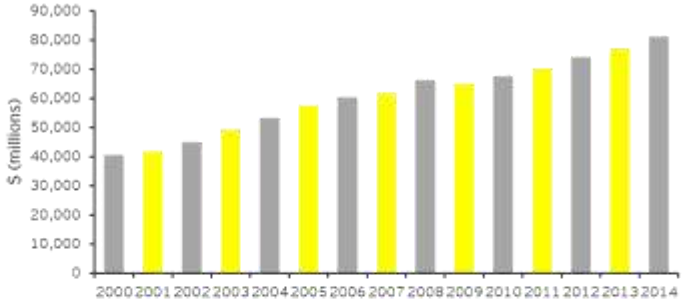
7.2.2.2 Auckland economy

Auckland is New Zealand's largest economy and represents around 35% of New Zealand's total GDP. Auckland's GDP has grown at an average annual rate of 5.09% since 2000, compared to 5.2% for the rest of the country.

Figure 36 shows Auckland's GDP growth for the period 2000 - 2014.[62]

Applying the same OECD growth multipliers and extrapolated Treasury growth rates as above, Figure 37 demonstrates that Auckland's GDP is projected to reach $237 billion by 2060:

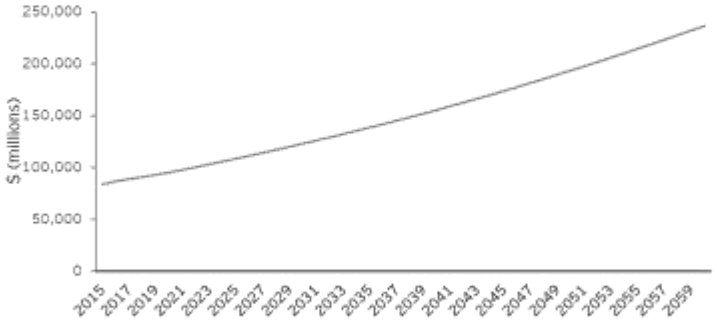
Figure 36: Auckland regional GDP (2000 - 2014)



Source: Statistics NZ, 2015

[62] Statistics New Zealand, Infoshare, 2015appen

Figure 37: Projected Auckland regional GDP (2015 - 2060)



Source: OECD 2016, EY analysis

7.3 Global trade

Global trade volumes are notoriously volatile from year to year. It is considered that the next few years are likely to carry the global economy into the next wave of globalisation, underpinned by sophisticated and pervasive digital technology that reduces international trade barriers, improves communication between cultures, levels the playing field for entrepreneurs and start-ups, and forms the foundation for an "always-on" global economy.[63] As the world continues to integrate and immigration and emigration numbers change the demographics of nations, the reliance on world trade will continue to increase.

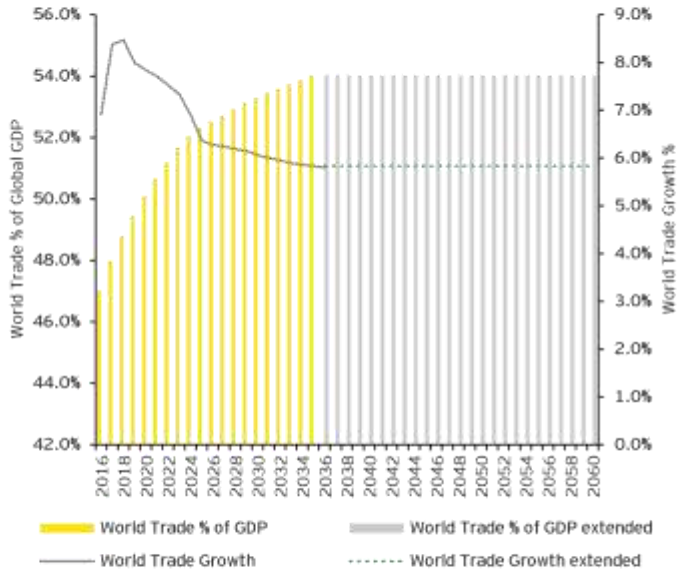
Three mega-trends help support this view, namely:[64]

1. the diversification of developing country exports into a wide range of manufacturers that greatly increases the potential size of their markets
2. the emergence of a larger middle and upper class in developing countries that makes them increasingly important customers
3. increased financial integration that facilitates and stimulates trade.

[63] HSBC Trade Winds: shaping the future of international business
[64] Carnegie Policy Outlook: The transformation of World Trade 2010

Trade as a proportion of global GDP, is therefore expected to continue to increase in the short-term, as the world economy gains strength and confidence. This supports New Zealand's forecast trade growth which is detailed in Figure 38 below:

Figure 38: World trade % of GDP and growth [65]



Source: Oxford Economics 2016

In support of the general theme of increased global trade, Oxford Economics has forecast import and export growth (in value) for New Zealand to 2035. These findings are shown in Figure 39 and indicate an average 3.07% growth per year into 2040. On a volume basis, Oxford Economics forecast New Zealand's projected trade to grow at an average 3.58% p.a. on a CAGR[66] basis to 2040.

[65] Oxford Economics, 2016

[66] Based on New Zealand's portion of trade to world trade, and world trade growth.

The Treasury also estimates that, on average, import and exports volumes will increase by around 2.9% p.a. over the next five years.[67] Although these are short-term rates, they provide an indication that the growth trend is in line with population estimates and New Zealand's growth, and world trade growth, demonstrating that as New Zealand grows, its trading activity is expected to also increase.

Figure 39: Trade value growth forecasts for New Zealand

Source: Oxford Economics 2016

[67] Half year economic and fiscal update 2015 additional information, average of total imports and exports.

7.3.1.1 Key trading partners

The country of origin and destination of imports and exports respectively is also an important driver of future activity for the port. The growth and future trade of the countries that contribute to the freight flows at the port are an important consideration, as they can also provide an indication on potential future needs of the port; for example, greater demand for New Zealand products from an increase in standard of living in China.

China, Australia and the USA account for 44% of all goods being imported into New Zealand and handled at the port. They also account for 56% of all goods being exported from the port. To understand the trend over the recent history of the port, we have calculated the CAGR over the period from these countries.

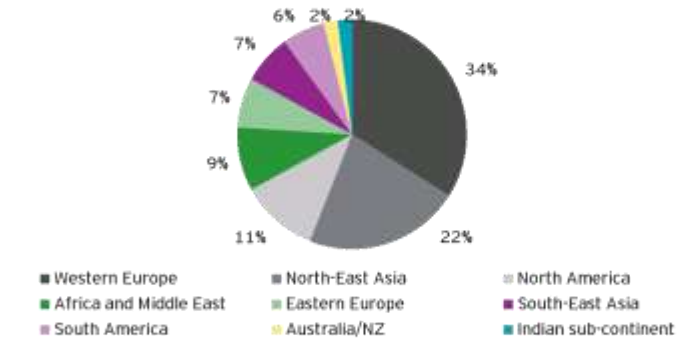
Table 13: Trade analysis by country (2000-2014)

Country	Import CAGR	Export CAGR
Australia	0.02%	5.00%
China	9.50%	8.40%
USA	3.45%	-3.49%

The calculated historic growth rates indicate that, with the exception of exports to the USA, the rate of growth of port activity involving these countries has been increasing, and in the case of China, at a high growth rate. Although it may seem that historical exports to the USA are declining (primarily due to the global financial crisis), it must be noted that the year on year growth rate has been increasing at a significant rate of 17% and 35% for 2013 and 2014.[68]

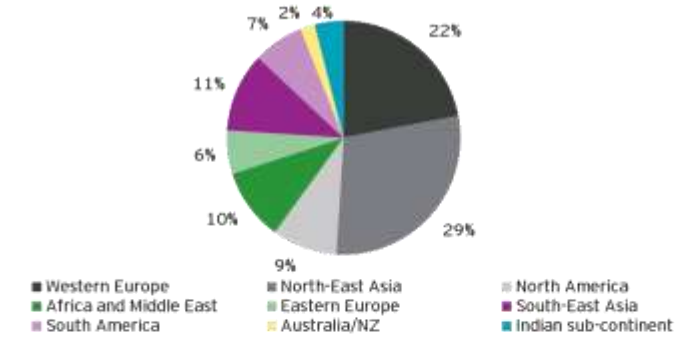
As shown in Figure 40 and Figure 41, Asia-Pacific's share of global exports is forecast to rise from around 30% in 2015 to 46% in 2050. Western Europe's share is expected to decline from 34% to 22%, and North America's to fall from 11% to 9%. Trade between the economies of Asia is projected to be especially dynamic in coming decades, growing from 17% of total global exports to 27% between 2015 and 2050.[69] All these forecasts suggest that an increasing global trade for all of the ports key trading partners. For example export market share growth of Asia will impact the port.

Figure 40: Share of exports 2015



Source: HSBC, 2015

Figure 41: Share of exports 2050



Source: HSBC, 2015

[68] Statistics NZ, 2015

[69] HSBC Trade Winds: shaping the future of international business

7.4 Growth by trade type

7.4.1 Container trade

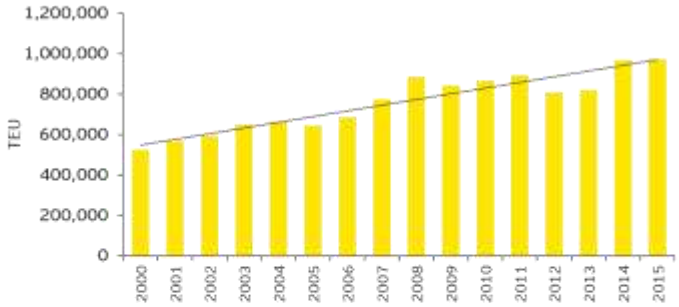
Container trade is any merchandise that is loaded into and shipped in an intermodal shipping container. The unit of measurement for containers is 'twenty foot equivalent' unit (TEU). It is important to note that reference to TEU also includes equivalent consideration of *forty foot equivalent units'* (FEU) and other box types, all of which are counted as TEU. i.e. 1 FEU = 2 TEU and so on.

For the purpose of this section, container trade is considered to be the number of TEU moved at POAL including imports and exports, empty and full containers, moved by road, rail and coastal trans-shipment.

Historically, POAL has seen strong growth in container trade. Twenty years ago TEU volumes were 381,000, and in 2015 TEU volumes had increased to 972,434. **Error! Reference source not found.** Figure 42 shows the last fifteen ears of TEU volumes, increasing at a CAGR of 4.2%.

A presentation by Auckland Regional Holdings, suggests 'a rule of thumb' measure for container growth is the GDP growth rate multiplied by 2-2.5x. Based on GDP projections, this implies a growth rate for containers of 4.6%-5.8%.[70] We have used this measure for indicative purposes only.

Figure 42: Ports of Auckland container TEU 2000-2015

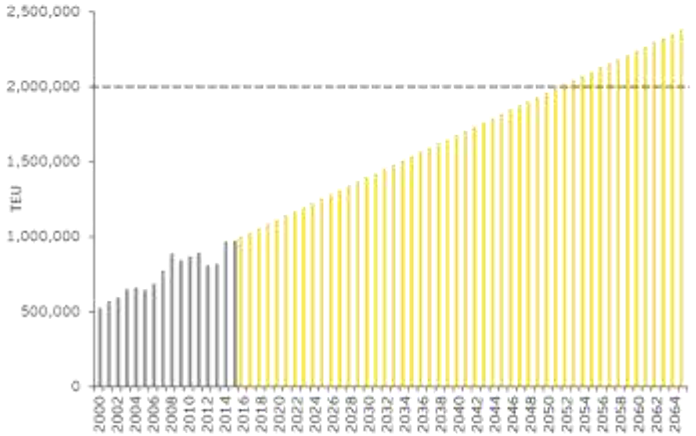


Source: POAL annual reports

[70] Auckland Regional Holdings, Long term optimisation of the New Zealand port sector, 2009

Based on the past 15 years, POAL have averaged TEU growth rate of 4.2% p.a., equivalent to around 27,000 additional TEU per year. A historical linear trend based on this growth would forecast that 2 million TEU would be reached in 37 years (2052/medium term) and 3 million in 72 years (2087/long-term). We note there are limitations using historical performance to predict future forecast. Figure 43 shows a continual increasing trend only:

Figure 43: Linear forecast on historical growth



Source: POAL annual reports, EY analysis

The following table outlines a range of drivers for TEU forecasting and the basis we have used to project container trade for Auckland to 2060 as subsequently shown in Table 14 below:

Table 14: TEU projections (2016 - 2060)

Driver	Forecast Period	CAGR (%)
GDP (OECD)	2060	2.3%
Historical TEU (5 years)	2060	2.3%
Historical TEU (10 years)	2060	4.2%
Historical TEU (20 years)	2060	4.8%
New Zealand forecast volume trade growth (Oxford Economics)	2060	3.6%

Source: OECD, POAL Annual reports, Oxford Economics, EY Analysis

A range of other studies have forecast expected growth rates, and the findings of the relevant literature reviews are outlined in Table 15.

Combining all these inputs, Figure 44 and Table 15 shows the wide range of projections that have been used by various reports and which incorporate the fundamental economic drivers of GDP and World Trade.

We have extrapolated relevant growth rates, to highlight the range of total TEU projected under each of these scenarios.

Table 16 on a subsequent page outlines the total projected TEU across a number of scenarios.

Table 15: TEU projections (2016 - 2060)

Report	Source	Report Date	Forecast Period (yrs)	Forecast Range	CAGR (%)
Transport Access to Ports of Auckland, Submission on International Freight Services	Ports of Auckland	2011	30	2040	5.0%
Upper North Island port and port-related infrastructure supply and demand study	PwC	2012	30	2041	2.3%-3.2%
Fairgray (Market Economics) - Statement Evidence (Proposed Auckland Unitary Plan)	Hearing evidence Auckland unitary plan	2014	27	2041	2.1%-2.6%
Port Study 2	NZIER	2014	45	2060	3.2%
Provided from POAL management (Short-term)	Ports of Auckland	2015	5	2020	4.6%
Half Year Economic and Fiscal Updated- (imports and exports)	NZ Treasury	2015	5	2020	2.9%

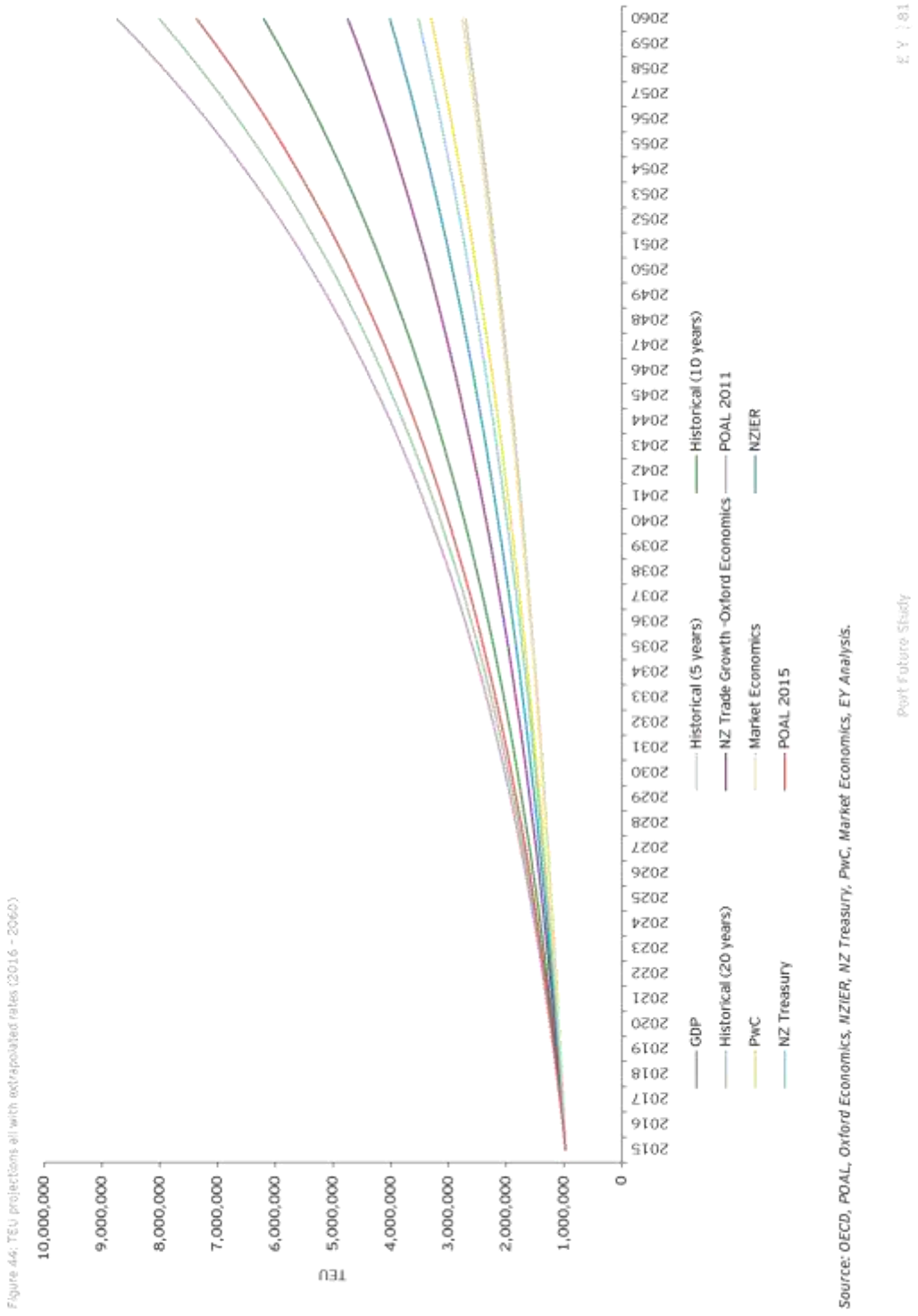


Figure 44: TEU projections all with extrapolated rates (2016 - 2060)

Source: OECD, POAL, Oxford Economics, NZIER, NZ Treasury, PwC, Market Economics, EY Analysis.

Table 16: Scenario analysis extrapolated TEU (m) under different growth rates

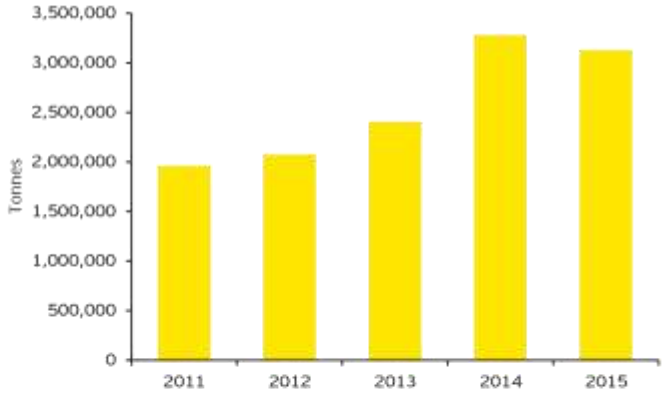
Report	Growth Rate (%)	Base year 2015 TEU	2020	2025	2030	2035	2040	2045	2050	2055	2060	2065	2070	2075	2080	2085
Fairgray - Low	2.10%	0.97	1.08	1.20	1.33	1.47	1.63	1.81	2.01	2.23	2.48	2.75	3.05	3.38	3.75	4.17
PwC - Low	2.30%	0.97	1.09	1.22	1.37	1.53	1.72	1.92	2.16	2.41	2.71	3.03	3.40	3.81	4.26	
Fairgray - High	2.60%	0.97	1.11	1.26	1.43	1.62	1.85	2.10	2.39	2.71	3.09	3.51	3.99	4.54		
NZ Treasury	2.90%	0.97	1.12	1.29	1.49	1.72	1.99	2.29	2.64	3.05	3.52	4.06				
NZIER	3.20%	0.97	1.14	1.33	1.56	1.83	2.14	2.50	2.93	3.43	4.01					
PwC - High	3.20%	0.97	1.14	1.33	1.56	1.83	2.14	2.50	2.93	3.43	4.01					
POAL - Short-term	4.60%	0.97	1.22	1.52	1.91	2.39	2.99	3.75	4.69							
POAL - 2011	5.00%	0.97	1.24	1.58	2.02	2.58	3.29	4.20								

7.5 Multi-cargo

Multi-cargo referred to in this study includes both bulk cargo and break bulk cargo. Bulk cargo is commodity cargo that is transported unpackaged in larger quantities. Bulk cargo is classified as either liquid or dry and examples include petroleum, grains or coal. These commodities are normally transported in a ships 'hold' and small quantities are usually palletised or drummed. Break bulk cargo covers the variety of goods that must be loaded onto the ship individually i.e. not in containers or in bulk, sometimes on pallets, in boxes or other storage means. Items include iron, steel, machinery, and wood pulp. Vehicles are an example of break bulk, which are assessed in detail further below. Multi-cargo volumes for the purpose of this study are measured by tonnes.

Historically, there has been growth in multi-cargo. In the last four years, multi-cargo by tonnage has increased at a CAGR of around 13%. This is shown in Figure 45:

Figure 45: Ports of Auckland multi-cargo (2011-2015)



We have projected multi-cargo trade for Auckland to 2060 as shown in Table 17 below and Figure 46 on the following page (excluding vehicles as this is discussed in detail in section 7.5.1). It should be noted that the multi-cargo activity would be determined on the underlying trading industries such as agricultural products, raw materials and other commodities. Growth assumptions will vary among industries and will impact the multi-cargo activity forecasts. However, for the purposes of this study we have utilised GDP and forecast trade growth to drive our projections. This assumes that GDP and trade growth is an indicator of net aggregation of changes in the multi-cargo industries; for example, volatility within certain industries can be offset by opposing forces in other industries due to a diversified trade task.

Table 17: Multi-cargo projections (2016 - 2060)

Driver	Forecast Period	CAGR (%)
GDP (OECD)	2060	2.3%
New Zealand forecast volume trade growth (Oxford Economics)	2060	3.6%

A range of other studies have forecast expected growth rates, and the findings of the relevant literature review are outlined in Table 18:

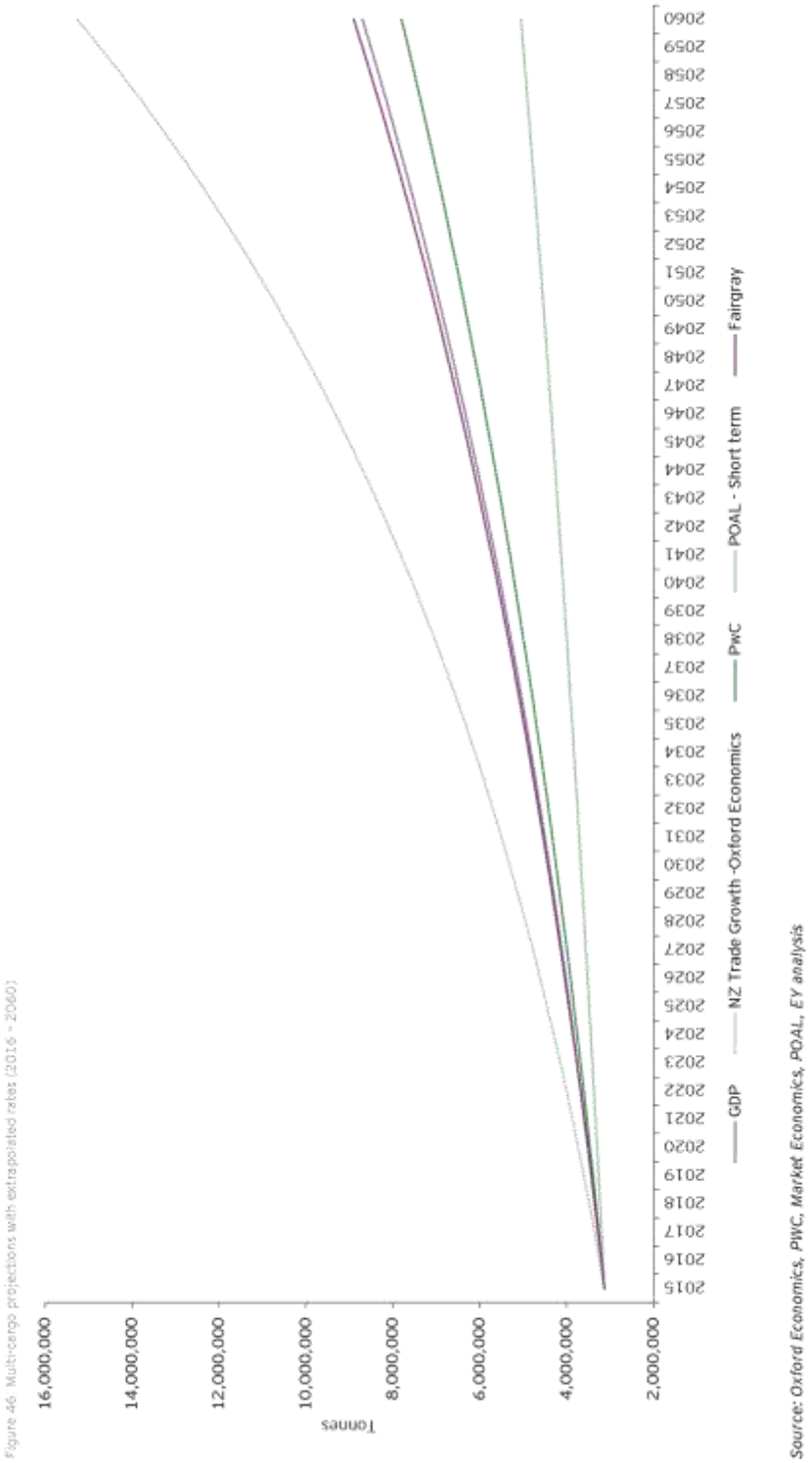
Table 18: Multi-cargo projections (2016 - 2060)

Report	Source	Report date	Forecast period (years)	Forecast period	CAGR (%)
Upper North Island port and port-related infrastructure supply and demand study	PwC	2012	30	2041	1.9%-2.2%
Provided from POAL Management (Short-term)	Ports of Auckland	2015	5	2020	1.07%
Fairgray (Market Economics) - Statement Evidence (Proposed Auckland Unitary Plan)	Hearing evidence Auckland unitary plan	2014	27	2041	2.1%-2.6%

Source: EY analysis

Item 16

Attachment B



7.5.1 Vehicles

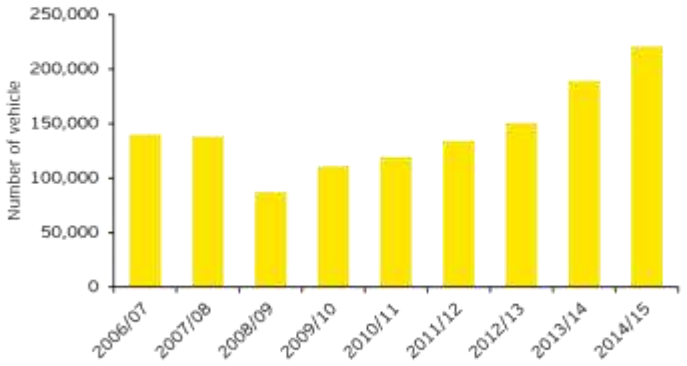
Vehicles are the largest import category in New Zealand, accounting for over 45% of imports (by tonnes) during 2006/7 and 2013/14.[71] In 2015, vehicles were the second largest import category by value making up around 9.8% of total imports, second only to machinery.[72]

Both new and used vehicles imported into New Zealand are mainly from Japan, with over 75% of imported vehicles in 2014 entering New Zealand through Auckland. This highlights Auckland's importance as the largest market and central hub for vehicle wholesaling, refurbishment and distribution.

Other ports which handle significant volumes of vehicle imports are Tauranga, Napier, Wellington, Lyttelton and Dunedin.[73] Vehicles occupy a significant amount of landside yard space at POAL as they need to be temporarily parked for processing prior to being collected by vehicle refurbishers and wholesalers.[74] In 2015, POAL reached near capacity storage for vehicles around seven days per month.[75]

The number of vehicles being imported has historically reflected an upward trend as demonstrated in Figure 47. The decrease in 2008 reflects the global financial crisis (GFC); however, it is evident that historically there is an overall growth trend.

Figure 47: Historic Vehicle Imports, Auckland (2006-2015)



Source: POAL Annual reports

Vehicle ownership rates are an important determinant of the expected uptake of vehicles in the future. In 2014, New Zealand's vehicle ownership per 1,000 head of population was higher than in Australia, Japan, the United Kingdom and the United States. In 2011, New Zealand had the 6th highest car ownership in the world, with 597 passenger cars per 1,000 people.[76] This rate has increased to New Zealand's highest level ever at about 740 vehicles per 1,000 persons or 74% as at 2014.[77]

Historically there has been a link between population growth and increased car imports.[78] Population growth has shown a historical upward trend in Auckland as discussed earlier in this section, and is predicted to continue into the near future. We have used population growth as an indicator that supports the case for projected growth in volumes of vehicle imports.

[71] NZIER report to Auckland Council Port Study 2 Final Report, 2015

[72] Calendar year- Statistics New Zealand – Goods and Services trade by country 2015

[73] Ministry of transport 'Demand Survey' Ministry of Transport, 2014 and, NZIER report to Auckland Council Port Study 2 Final Report, 2015

[74] 'How we can meet increasing demand for ports in the Upper North Island' PWC, 2012

[75] NZIER report to Auckland Council Port Study 2 Final Report, 2015

[76] 'Number of Motor Vehicles in New Zealand 2015' EHINZ, 2015 (www.ehinz.ac.nz)

[77] Ministry of Transport, Annual fleet statistics.

[78] NZIER report to Auckland Council Port Study 2 - Final Report' NZIER

Table 19: New Zealand vehicle demand projections (2015 - 2060) (EY Range)

Range	Driver	Forecast Period	CAGR (%)
Lower range	Population	2060	0.60%
Mid-range	Imports from Japan	2060	1.86%
Upper range	GDP (OECD)	2060	2.30%

Source: Statistics New Zealand, EY analysis

There are other potential trends that may impact vehicle volumes, including increasing car share schemes, public transport and increase in active transport modes infrastructure. However, anecdotal evidence suggests that these have a minor impact in comparison to car ownership. It has also been commonly agreed that trade flows are also linked to GDP growth.[79] This is due to the notion that vehicle consumption is both a driver for productivity, and also as a consumption good as a result of higher incomes. This has been evidenced by ownership rates tapering off during the GFC as consumers delayed purchasing major items. Ownership then swiftly grew in line with the recovering economy.[80]

Another important factor is that vehicle technology is consistently evolving this may impact the consumption of vehicles. The latest trends suggest a possible move towards fully electric and self-driving cars. Consumption of these goods from advancement in technology is discussed later in this section in Consumption and Technology. However we expect that the advancements in technology would probably equate to an increase in section 7.7.1.

Our upper and lower band projections were based on the two main drivers; population and GDP. The mid-range projection was based on forecast data from Oxford economics of imports from Japan into New Zealand.

A range of other studies have forecast expected growth rates, and the findings of the review of relevant literature are outlined in Table 20 and presented in Figure 48 on the following page.

All projections within the range (excluding mid-range based on import values from Japan) have all utilised population growth as an underlying driver or benchmarking figure to assist in predicting the vehicle imports. The mid-range is an appropriate upper limit as it takes into account forecast data from the largest source market (Japan) of vehicle imports which we believe is a reasonably strong indicator of future vehicle imports.

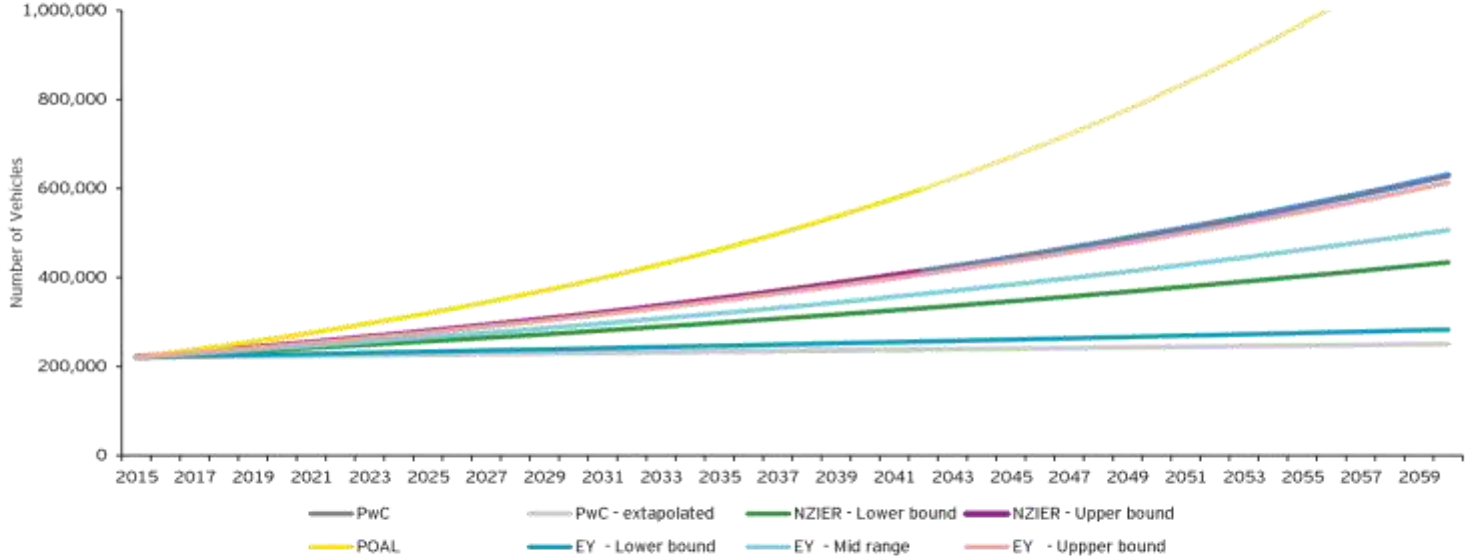
[79] NZIER report to Auckland Council Port Study 2 - Final Report' NZIER, 2015 and 'Ministry of Transport Demand Survey' Ministry of Transport,2014

[80] NZIER report to Auckland Council Port Study 2 Final Report, 2015

Table 20: Comparison of various vehicle forecasts from other relevant reports

Report	Source	Report Date	Forecast period (yrs)	Forecast units	Forecast Period	Growth Rate	CAGR (%)
Upper North Island port and port-related infrastructure supply and demand study	PwC	2012	30	Vehicle weights (Million tn.)	2041	8.8%	0.28%
Port Study 2	NZIER	2014	28	Light vehicle numbers	2041	19-46% by 2025	1.5-2.4%
Provided from POAL Management (Short-term)	Ports of Auckland	2015	5	Light vehicle numbers	2020	20%	3.7%

Figure 48: Projected Vehicle Imports (All projections) Auckland with extrapolated rates (2016-2060)



Source: NZIER, POAL, PWC, EY

7.6 Cruise

7.6.1 Context

The cruise sector has recently experienced significant growth, solidifying its position in the tourism industry and adding economic value to the country.[81] For the 2014/15 cruise season, the cruise industry has added $436 million in value to the New Zealand economy, while supporting 8,365 jobs. It is also expected to grow to $543 million in the next season.[82]

Globally, the cruise industry has experienced significant growth in recent years, with the annual passenger growth being averaged at 7.5% since 1980 and the number of passengers boarding cruise ships being doubled in the last decade to 21.3 million in 2013.[83]

Over the last eight years, cruise voyages coming into New Zealand have grown at 13% and passengers at 23% each year. The most common cruise itinerary for New Zealand is Trans-Tasman, which commences its journey in Sydney, taking two nights to cross the Tasman Sea and then visits Fiordland, Port Chalmers, Akaroa, Wellington, Napier, Tauranga, Auckland and the Bay of Islands before returning to Australia.[84]

In 2014/15, Auckland was the busiest cruise region compared to other New Zealand locations with 115 voyage calls, 132 port days and a total of 188,500 unique passenger port days.[85]

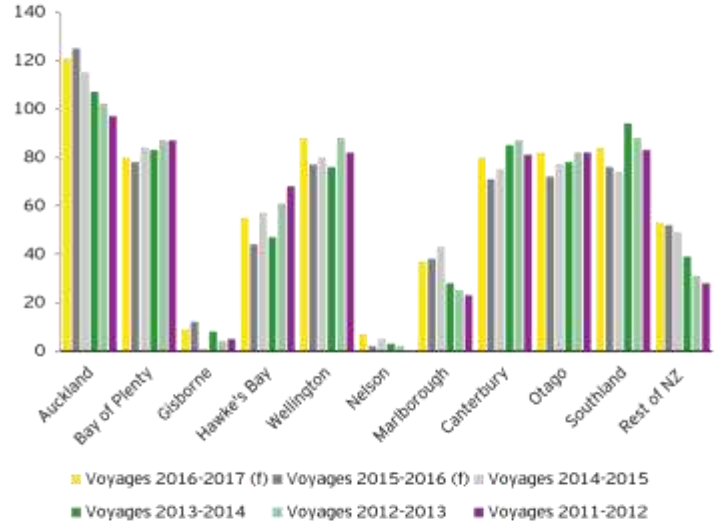
For 2015/16, Auckland is scheduled to have 125 voyages (8.7% more compared to last year), 148 vessel port days and 249,400 passenger port days (32% more than last year).[86]

Auckland is considered New Zealand's 'Exchange hub' where passengers and crew disembark having reached their final destination or embark as the start of their cruise.

More and more cruise lines are using POAL as an exchange hub. This is primarily due to the international air links and hotel capacity for pre/post cruise stopovers.

The following figures show a graphical representation of Auckland as the busiest cruise location in comparison to other New Zealand regions.

Figure 49: New Zealand regional cruise voyages (2011/12 - 2016/17)



[81] M.E Spatial, 2014 (http://www.tourism2025.org.nz/assets/Uploads/Cruise-Report-2014.pdf)

[82] Cruise New Zealand website 2016,(http://cruisenewzealand.org.nz/about/), Cruise New Zealand, 2015 (http://cruisenewzealand.org.nz/wp-content/uploads/2015/01/2014-2015-SUMMARY-Economic-Impact-Report-FINAL.pdf)

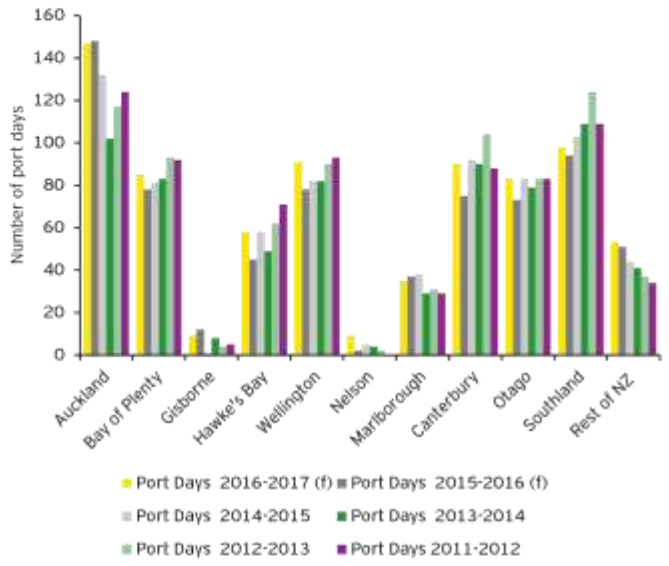
[83] Market Economics, 2014 (http://www.tourism2025.org.nz/assets/Uploads/Cruise-Report-2014.pdf)

[84] Tourism New Zealand website, 2015

[85] Passenger port days refers to the number of passenger being in a port for number of days, ie one passenger port day is one passenger in one port for one day.

[86] Cruise New Zealand Data retrieved April 2016

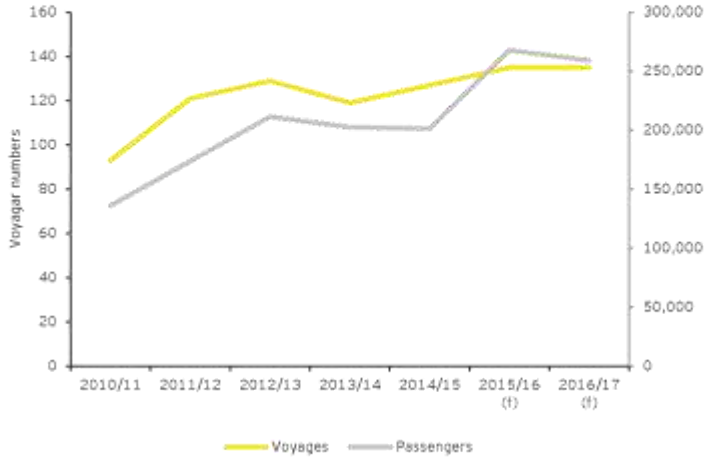
Figure 50: The number of port days (2011/12 - 2016/17)



Source: Market Economics, 2014

As illustrated in Figure 51, the number of cruise ship visits show a steady increase in both voyage numbers and passenger numbers and is forecast to continue on this upward trend into 2017.

Figure 51: Historical voyage and passenger numbers Auckland (2011-2017)



Source: Cruise NZ, 2016

The number of vessels visiting New Zealand historically has been driven by key decisions made by the cruise lines head offices (mostly in the USA) and regional offices (mostly in Sydney) and is linked with the number of tourists wishing to visit New Zealand on a cruise.

Australia, followed by the USA is currently the largest source market as demonstrated by Figure 52 on the following page.[87] Australia's ability to fill cruise ships is likely to be a driver of growth in future years given it is the world's leading cruise market in terms of market penetration and growth.[88]

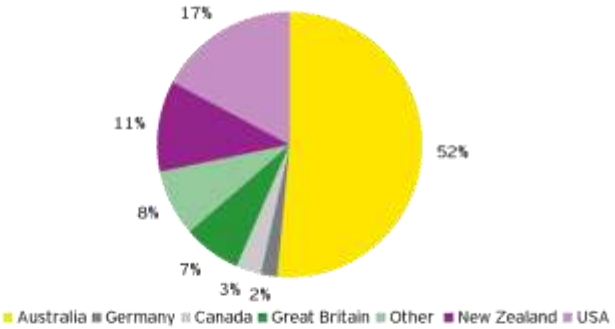
[87] Source: Cruise New Zealand website 2016 (http://cruisenewzealand.org.nz/about/)
[88] Economic impact of the 2014-2015 Cruise sector in New Zealand and forecasts to 2017' Cruise New Zealand,

There is also potential demand arising in China. Industry forecasts have placed China second only to the U.S. in passengers by 2017.[89] The number of Chinese cruise passenger rose by 79% between 2012 and 2014 and China has seen significant investment in cruise infrastructure as construction of terminals commenced in Xiamen, Shanghai, Sanya and Tianjin during 2011-2014.[90] The Chinese government's also targets 4.5 million in Chinese cruise traffic by 2020.[91]

We could potentially see a flow on effect to New Zealand destinations in the long-term especially as New Zealand peaks are generally in reverse to major global cruise providers, due to the southern hemisphere location of New Zealand and the resulting opposite seasons compared to northern hemisphere countries.

Tourism New Zealand forecast more than 60 new ships will be built internationally between 2014-2018.[92]

Figure 52: Passenger source markets visiting New Zealand (2014-2015 cruise seasons)



Source: Cruise NZ, 2016

[89] Fast Sailing: China's Cruise Market To Become World's Second Largest By 2017' Forbes, 2014

[90] 'China seen as next boom for cruise industry', 2015, Cruise New Zealand Website http://cruisenewzealand.org.nz/2015/08/china-seen-as-next-boom-for-cruise-industry/

[91] IBID

[92] Tourism NZ website, market trends, 2015

7.6.1.1 Growth in cruise vessels

There is a global trend of larger ship sizes with increased capacity, and current new builds are averaging around 4,000 passengers at double occupancy. This trend gives rise to infrastructure challenges, namely berth lengths, wharf strength (ability to manage winds due to lengths and air drafts) and berthing pockets that are required in order to host these sizeable vessels.[93] Auckland is already seeing evidence of this with one of the world's largest vessels, the Ovation of the Seas (350 metres and 4,500 passenger capacity) being forced to berth at anchor on its visit in late 2016 (not berthing but rather anchoring in the Waitematā Harbour).

POAL have made clear that there is not sufficient berth availability to accommodate vessels such as this. Jellicoe wharf was previously used to accommodate large cruise vessels (the Queen Mary II berthed there in early March 2016), but the port is under pressure from potential disruptions from bulk freight users and have therefore advised that Jellicoe will no longer be available for cruise operations.

Historically in New Zealand, cruise ships would be deployed after the shoulder seasons from Alaska, but we are currently on the cusp of change. A new push into the Chinese cruise market by cruise operators will see newer and larger cruise ships arriving in New Zealand.

In New Zealand, we are seeing the impact of this global trend by the entry of Explorer of the Seas, sister ship to Voyager of the Seas (currently the largest ship in terms of passenger numbers to operate in New Zealand) who will make ten voyages to New Zealand in 2015/16.[94] Looking forward, Ovation of the Seas will visit New Zealand three times in 2016/17 and has an additional three bookings in 2017/18.[95]

[93] 'Cruise Action Plan for Auckland' ATEED,

[94] 'Cruise Action Plain for Auckland' ATEED, 2015 and discussions with ATEED 2016

[95] 'Cruise Action Plan for Auckland' ATEED, additional discussions with ATEED 2016

7.6.1.2 Growth in cruise popularity

Currently, the cruise industry is the fastest growing sector in the tourism industry.[96] New Zealand's popularity as a cruise destination has grown significantly in the last few years, with the sector growing five-fold in the last ten years.[97] It is expected that the 2016-2017 season will continue the growth and lift New Zealand cruise visit records onto a higher average.[98]

Beyond the 2015-2016 and the 2016-2017 seasons, the upward trend is forecast to continue. This can be attributed to Australia's ability to fill ships and the potential demand arising out of China.

Research conducted by the Hong Kong Tourism Board estimates the market of first time cruisers to be as large as 83 million and the Australasian region is an attractive destination as it offsets the Chinese winter.

Congestion in Sydney and other neighbouring countries such as the western Pacific Islands may also shift more vessels into New Zealand. This is evident from recent developments and investments in Port of Brisbane to competitively lure cruise business from Sydney.

In addition, Tourism New Zealand as part of their Tourism 2025 National Framework has highlighted, for the first time, the increasing importance of the contribution from the cruise sector to the total tourism industry. As such, they have declared they are taking a larger role in marketing New Zealand as a cruise destination internationally.[99]

If their marketing campaigns are successful, these are also likely to stimulate additional growth in this space.

[96] IBID

[97] Tourism NZ Statistics, 2015

[98] Economic impact of the 2014-2015 Cruise sector in New Zealand and forecasts to 2017" Cruise New Zealand

[99] Tourism NZ Statistics, 2015 (http://www.tourismnewzealand.com/markets-stats/sectors/cruise-sector/)

7.6.2 Future state: cruise

Auckland Tourism, Events and Economic Development (ATEED) model scenarios for the potential cruise growth in Auckland. The primary assumptions that ATEED make include:

- Continued rapid growth of cruising in Asia combined with the impact of the expanded Panama Canal has the potential to accelerate the growth of the cruise industry in Auckland (accelerated case).
- Infrastructure investment is required to enable these larger ships to visit; this will provide an opportunity to influence the deployment decisions of cruise lines and to favour Auckland as the exchange hub.
- It is anticipated that based on recent trends, cruise ship visits will reach 120 by 2020. But, without infrastructure investment the growth in ship visits and passengers will slow, due to the larger ships which are replacing older and smaller ships in the Oceania region being unable to berth in Auckland.
- Does not include any additional marketing campaigns and their positive impacts.
- There is scope to intervene and influence the deployment decisions of cruise lines and to grow the number of ship visits to Auckland (influenced case).

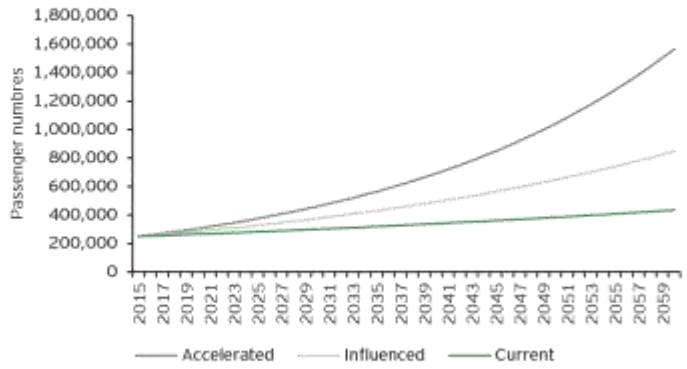
We have based our forecasts for the cruise industry primarily on the scenarios conduced from ATEED's Cruise Action Plan. The scenarios forecast estimated ship visits and passenger numbers. These are outlined in Table 21 and have been extrapolated and presented in Figure 53 and Figure 54 respectively:

Table 21: ATEED cruise forecasts

	Estimated ship visits	Estimated passengers	Forecast period	Forecast period (yrs)	CAGR (%) - ship visits	CAGR (%) - passengers
Accelerated	180	460,000	2030	15	2.5%	4.2%
Influenced	150	375,000	2030	15	1.2%	2.8%
Current	130	300,000	2030	15	0.3%	1.2%

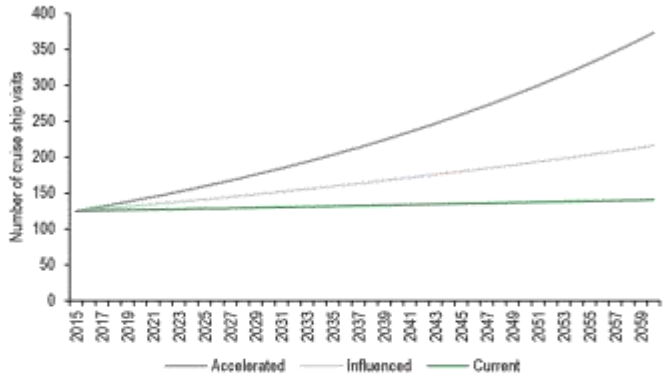
Source: ATEED Cruise Action plan, 2015

Figure 53: Scenarios for cruise ships visits (2015-2060)



Source: ATEED, 2015 and EY

Figure 54: Scenarios for cruise passenger numbers (2015-2060)



Source: ATEED, 2015 and EY

7.7 Other relevant trends

This section outlines other major relevant trends that may also impact the future state of port activities. Namely they are:

- Consumption and technology
- Shipping vessel sizes, performance and development of strategic alliances
- Port operational performance trends.

7.7.1 Consumption and technology

Consumption is a key driver for future freight forecasts, along with technological advancements in both production and products. Accordingly, an assessment of the relationship between consumption of products and technology has been conducted.

The key questions we sought to answer included:

- What are the historical trade trends given the advancement in technology?
- What is our consumption rate?
- What are the large trends that will impact our freight forecasts?

This section is an overview of our findings, however more detail can be found in the Appendix 11.

7.7.1.1 Historical trends

According to the World Trade Organisation, the volume of world exports more than quadrupled between 1980 and 2011, with most of the growth attributable to increased shipments of manufactured goods.[100] During this period, the types of goods traded and consumed has changed due to technological advances and shifting consumer preferences.

Figure 55 outlines an extract of the World Customs Organisation's summary of products that have been added and deleted from the index of traded products between 1992 and 2007:[101]

Figure 55: Extract World Customs Organisation, summary changes from 1992 and 2007

Table B7 New and old products in international trade
Products deleted due to low volume of trade between HS1992 and HS2007
Horse hair (050300), natural sponges (050900), asbestos (252400), lead carbonate (283670), rolls of instant print film (370520), photographic film in rolls (3702[92]), equine hides/skins (410140), articles of caligni (420610), whole beaver furskins (430140), whole seal furskins (430170), carbon paper (480910 and 481610), punch cards for machine reading (482330), bow ties (611720), headgear of furskin (650502), articles containing asbestos (numerous subheadings under headings 6811 and 6812), lead pipes (780500), photo typesetting machines (844010), several products related to printing under heading 8443, shuttles for weaving machines (844491), typewriters and word-processing machines (several subheadings under heading 8469), vinyl record players (several products under heading 8519), cassette tape recorders/players (several lines under heading 8520), magnetic tapes (852311-12), cigar or cigarette holders (961490)
Products retained despite reduced shares in world trade between HS1992 and HS2007
Sardines (0302610), dogfish and other sharks (0302650), eels (0302660), snails (0307[60]), oysters (1302[11]), cotton seed oil (1512[21]), natural barium carbonate (2511[20]), waste oils containing polychlorinated biphenyls or PCBs (271091), lead monoxide (282410), heavy water or deuterium oxide (284510), carbon tetrachloride (290314), hexachlorobenzene and DDT (290362), numerous photographic film and paper products under the heading 3705-3706, anti-knock engine preparations based on lead compounds (381111), raw furskins of fox (430160), dictionaries and encyclopedias (490110), silver tableware (821561), magnetic tape video recorders (852110), photographic film cameras (900540 and 900651-59)
Additions to the HS classification to represent new/rising/regulated products in world trade
Live primates (010611), live whales/dolphins (010612), live reptiles (010620), live birds of prey (010631), detailed breakdowns for many fish products under the headings 0302 and 0304, detailed breakdowns for cut flowers under heading 0603, coca leaf (121130), semi-conductor media including "smart cards" (852351-59), dental floss (330630), pulp from recycled paper/cardboard (470620), car air conditioners (841520), various codes related to printers under the heading 8443, portable computers (847130), industrial robots (847950), machines for manufacturing semiconductors and integrated circuits (848690), machines and apparatus for the manufacture of flat panel displays (848690), wind-powered electric generating sets (850231), line telephones with cordless handsets (851711), telephones for cellular networks (851712), safety airbags (870895)
Other products whose shares in world trade have risen significantly between HS1992 and HS2007
Connectors for optical fibres (853670), color data/graphic displays (854040), other liquid crystal display devices (901380), anthracite coal (270111) as well as other grades of coal, liquified natural gas (271111), rare earth metals (280530), ethylene glycol (290531), umbrella frames (660310), household/laundry-type washing machines (845020)

Source: UN Comtrade database.

Technology has had large impacts to the products that we consume since the 1980's, including:

- The size of products have changed
- Consolidation and multi-use of products
- Availability of new products that didn't exist previously
- Some products have changed very little or not at all.

Technology has also impacted how and what we produce. Motor vehicle production/assembly for example has changed from being domestically produced (also importing parts and components) to purely imported, due to a combination of greater demand for vehicles, and the lower cost to import in relation to the quality.

7.7.1.2 Unknown consumption drivers

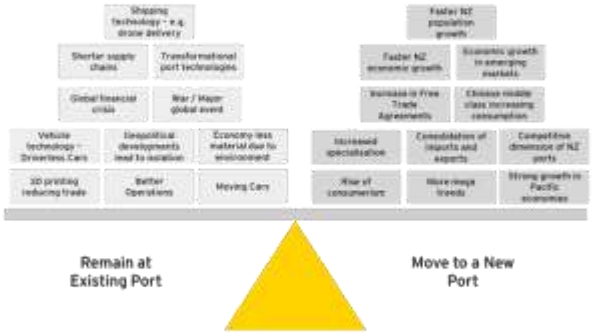
It should be noted that the trade forecasts contained in this study are based on a number growth rates. These growth rates may not consider unknown factors that could change the trajectory of trade across all trade types.

Figure 56 outlines a number of factors that could arise and impact the rate at which Auckland's trade task is expected to grow. Factors that, if eventuated, would likely reduce trade at the Auckland port and could mean that the port does not reach its capacity and can remain at its current Waitematā site. Conversely, there are a number of factors that would accelerate the growth in Auckland's trade task and therefore would mean that expanding or relocating the port operations is necessary sooner than is forecast.

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

[101] Ibid

Figure 56: Push and pull forecast factors



7.7.1.3 Consumption - TEU per capita

Despite advancements in technology, overall TEU consumption and production has been increasing. Table 22 shows historically Auckland's increasing traded TEU and the increasing population:

Table 22: Ports of Auckland traded TEU and Auckland Population (approx.)

Year	POAL TEU	Population	TEU per Capita
1995	381,000	1,115,800	0.34
2000	524,690	1,201,500	0.44
2005	644,306	1,348,900	0.48
2010	867,368	1,439,600	0.60
2015	972,434	1,569,900	0.62

Source: POAL annual Reports, Statistics NZ, EY Analysis.

Historically, there has been a trend of increasing TEU per capita. We could expect this to potentially reach 1 TEU per person per year in 32 years (2047/medium term) under a linear trend per capita.

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

With this in mind, our forecasts suggest that Auckland's consumption and production could possibly reach 1.03 TEU per capita by 2045 under a 2.9% growth rate scenario.[102]

7.7.1.4 Technology megatrends – forecast testing

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.

Below is a summary of our assessment of the megatrends relevant to the future freight task for the port. More detail can be found in Appendix 11.

Overall, we consider that the increasing trend of consumption will continue to rise, due to the following reasons:

- **Productive Technology.** Technology adopted by producers such as 3D printing provides cheaper production costs leading to more competitive pricing which creates greater accessibility and can feed greater consumption of goods.
- **Lifecycle of products.** Although technology has replaced other traditional products, for example the alarm clock with smart phone, the lifecycle and turnover of technological items are more frequent than ever. For example, a typical consumer would upgrade their smartphone every few years, compared to, historically, the number of times an alarm clock was replaced.
- **Connectivity**. There has been greater connectivity and globalisation, resulting in greater access to new markets and suppliers.
- **Urbanisation**. Globally the world is becoming increasingly more urbanised, resulting in increasing ability to consume or create more products.
- **The need for resources**. The need for and development of critical resources are always changing, for example use of lead for piping, asbestos are materials no longer demanded; however, new resources and innovations such as solar and battery technology create new demand.

[102] Extrapolating NZ Treasury forecasts.

- **New markets**. Increasing technology to suit new demand markets that did not exist previously, for example overall people live longer than before, and development in these products that are tailored to support their life.
- **Disruptive technology**. Technology that could dramatically change the traditional supply chain/ production would only be adopted if it is economically viable domestically and whether the benefits of "on-shore" production result in a superior product. This may occur for some products and not for others. An example of this is motor vehicle assembly.

7.7.2 Vessel trends

7.7.2.1 Container vessels - global trends

The median container vessel bracket is expected to continue the historic trend of increasing ship sizes over the medium to long-term. The maximum vessel size of the global fleet has grown by an average of 45% over the last five years. By 2017, Ultra Large Container Vessels (ULCVs) are expected to reach around 20,000 TEU in carrying capacity, increasing to 22,000 TEU by 2020. There is expected to be some rationalisation of the global fleet's top end vessels after this time.

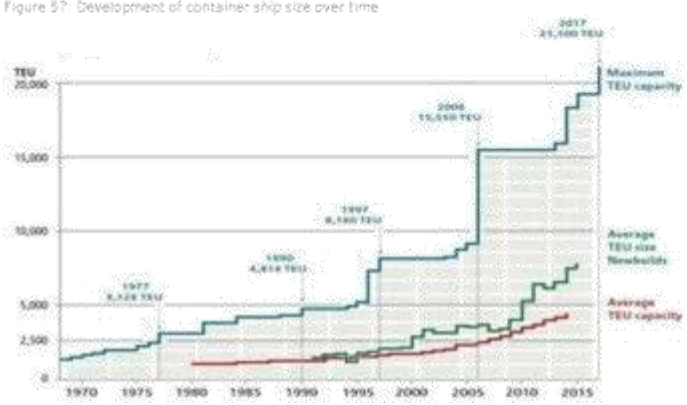
The strive for economy of scales has led to a current overcapacity of tonnage versus demand, however this has made little difference as the industry continues to chase the largest shipping companies for market dominance. Whilst there will be an inevitable correcting of capacity, it is difficult to predict when this may or might happen.

The current global order book reflects the trend of increasing vessel sizes with vessels of 10,000 TEU and larger accounting for almost 60% of current orders.[103] The next largest order bracket is for vessels between 8,000 to 10,000 TEU. Figure 57 shows the historic trends in maximum container vessels and the growth in both average TEU size, new builds and the average TEU capacity.

[103] Lloyds register of shipping data, 2015

Currently, the vast majority of 13,000+ TEU vessels are deployed on the North Europe-Asia route, but numbers are growing on the Asia-Mediterranean route and to lesser extents on the Asia-US West Coast and Asia-Middle East routes.[104] The Asian market is driving growth in global containerisation, largely reflecting the growth in the Chinese export sector.

Figure 57: Development of container ship size over time



Source: OECD[105]

By 2020, Asian ports are expected to account for 65% of the global market share, with 40% being Chinese driven or destined. The three largest shipping companies (MSC, Maersk and China Shipping) are driving the demand for 18,000 TEU vessels and above, and are already operating these on primary routes. The global container shipping market is experiencing significant challenges that appear likely to continue well into the short to medium term. Although the factors attributing to this are complex, largely speaking, the GFC of 2008 has changed the industry in ways that are likely to be permanent.

[104] IBID
[105] The Impact of Mega-Ships, OECD, 2015.

7.7.2.2 Megatrends in container vessels

The financial pressures on shipping lines to remain competitive and realise profitability has seen radical rethinking in their operational structures and procedures. The three main outcomes from this are listed below and all are intrinsically linked:

- **Increasing vessel size** - Shipping lines continue their quest for economy of scale through purchase and deployment of ever increasing vessel sizes. 20,000 TEU vessels will be operational by 2017 on the primary trans-shipment routes and will get larger beyond then (recognising the top end rationalisation mentioned previously).
- **Improved vessel performance and reduced steaming speeds** - Fuelling of vessels remains one of the highest costs faced by shipping companies despite a current drop in prices. A primary undertaking towards sustainable profits is the improvement of vessel performance to reduce slot costs.
- **Development of strategic alliances** - In order to reduce operational overheads and to allow profitable deployment of larger vessel fleets, many of the large operators have formed global or trade route specific alliances and this continues to grow. Increasing the length of service strings and a subsequent increase of port calls per journey is allowing shipping companies to improve vessel utilisation.

As vessel sizes increase on primary shipping routes, those that were previously used on these routes are transitioned to secondary routes in a phenomenon known as cascading. As a result of cascading, the average size of vessels on many routes has increased over time, and this is related to some extent on alliancing.

The trend in increased vessel size is primarily driven by shipping companies looking to create efficiencies and increase profit on both primary and secondary routes. Supporting infrastructure is expected to be provided by ports authorities in the shipping destinations. As such, it is important for all ports to assess the affects that expected changes to fleets will have on their current infrastructure.

7.7.2.3 Container vessel application to New Zealand

The New Zealand shipping market is small relative to global markets due to its remote location and small population. Despite this, as trade volumes increase in New Zealand over time, it is likely that the shipping companies will continue to operate larger ships relative to current sizes. The largest vessels currently frequenting New Zealand are 4,100 TEU and typically 285 metres in length with a maximum draft of 12.5 metres.

The New Zealand shipping outlook concludes that the medium term fleet will include a maximum vessel capacity of 6,000 TEU and that, in the longer term, this could increase to 8,000 TEU.

Table 23: Current assumed largest containers vessels forecast for Auckland

	Capacity (TEU)	Length (m)	Beam (m)	Draft (Max)
Short-term Maximum Design Vessel	4,100	285	33	12.5m
Medium-term Maximum Design Vessel	6,000	304	42	14.2m
Long-term Maximum Design Vessel	8,000	320	43	14.5m

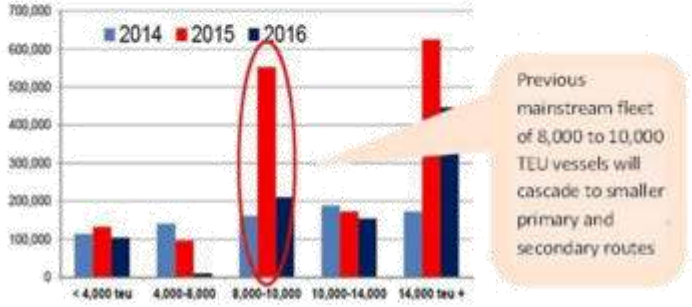
Our assessment is that with the trend in vessels size growth continuing, the above forecasts are not likely to represent the largest design vessel for the New Zealand market in the long-term. As previously discussed, cascading could result in the currently assumed medium term maximum vessel reach New Zealand shores within the short-term. . It is expected that the increase of 14,000+ TEU vessels on the main primary routes will result in cascading of 8,000 - 10,000 TEU vessels to many of the secondary routes, which is likely to include Australasia. The capacity of the global fleet to accommodate and drive this is illustrated in Figure 58.

Container vessels generally remain operational for between 15 and 20 years. Given this vessel tenure, it is likely that the 8,000 to 10,000 TEU vessels will be adopted on Australasian routes in the medium to long-term and possibly before. This projection matches the East Coast Australian long-term projections in which a 9,100 TEU vessel was proposed as the upper limit for vessels visiting Melbourne by 2050.[106]

[106] Black Quay, 2009

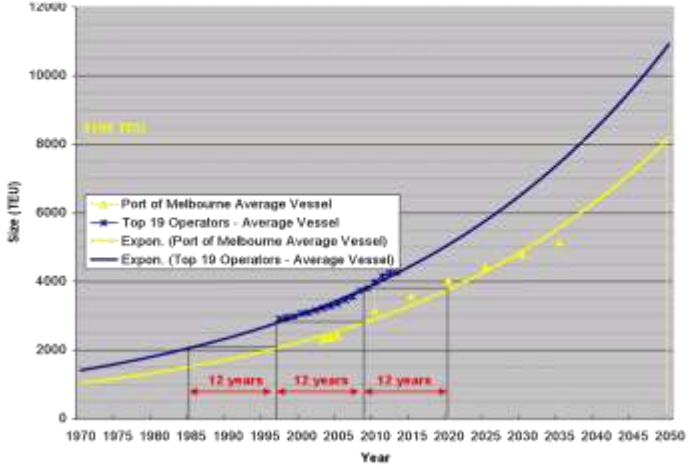
In terms of the median vessel, Figure 59 shows the relationship between growth in the global and Victorian fleets. It clearly shows that the size of the Oceanic fleet is closely linked with that of the global fleet, albeit at a much smaller scale. In addition, it highlights that by 2050, the projected average vessel size in Victoria is expected to be 8,100 TEU.

Figure 58: Global vessel size mix (2014 to 2016)



Source: Drewry, 2015

Figure 59: Statistical plotting of global and Victorian average vessel sizes showing linear growth patterns



Source: Black Quay, 2009

Item 16

Attachment B

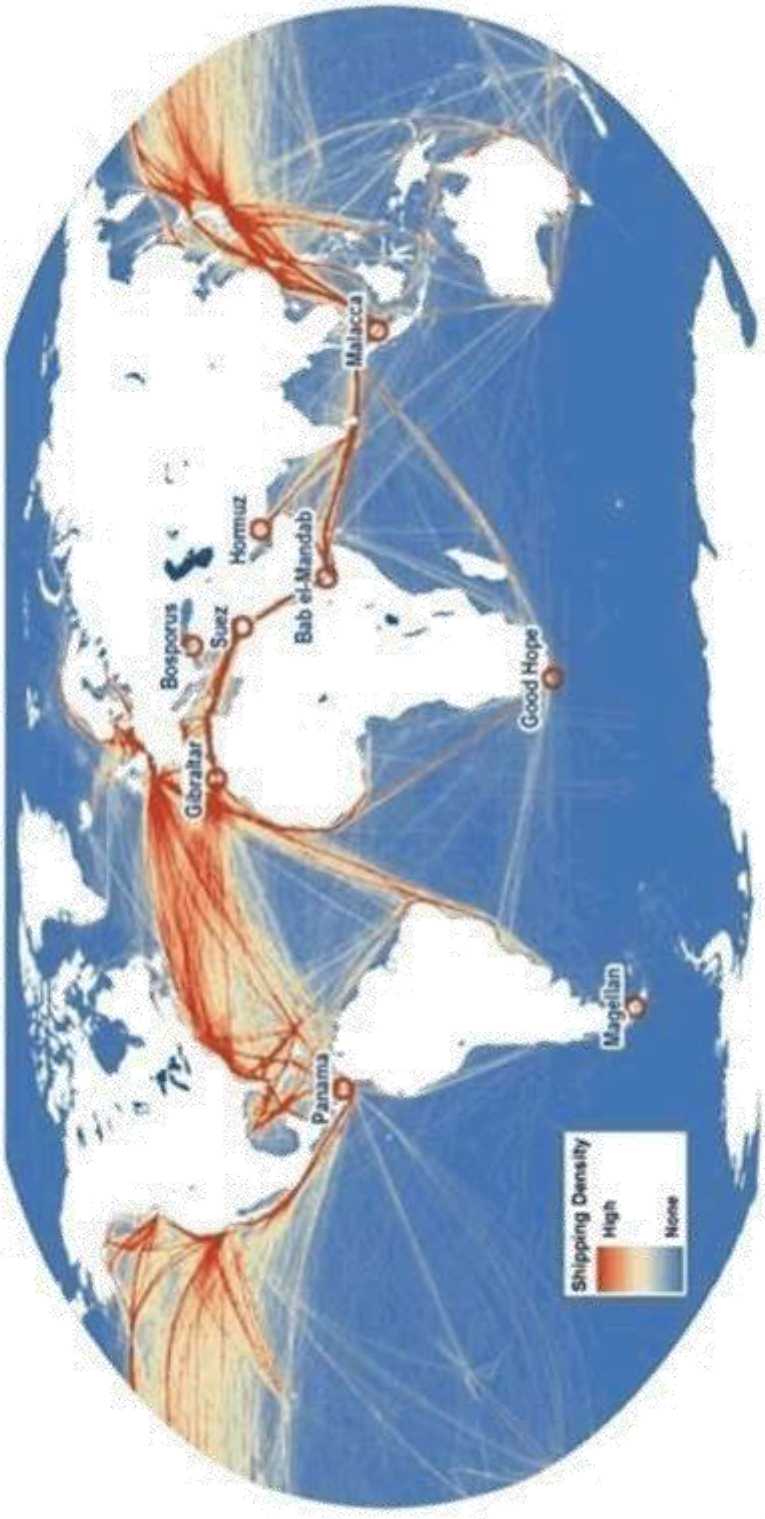


Figure 60: Primary global shipping routes by density showing the Asian context

Source: IMO, 2012

Depth considerations
The research undertaken as part of this study has indicated that the largest draft vessels across the terms will be container ships, which could be up to 14.5 metres. Accordingly, this can be considered as the planning vessel for the future (recognising that the industry continues to change towards larger ships but that drafts are showing signs of stabilising).

Whilst Tauranga has invested significantly in the provision of deeper water to handle next generation container vessels, Auckland currently lags behind it. The result is that Tauranga can handle larger ships at all states of tide, whereas Auckland must work within tidal windows.

Furthermore, Tauranga has resource consent to dredge an additional 1.3 metres, providing a total draft of 14.5 metres. Auckland's draft, on the other hand, is 11.4 metres.

Whilst Auckland can continue to work with the tide in the short term, it will require dredging in the future if it is to accommodate the larger ships. The following provides an overview of current conditions at both ports.

	POAL (m)	PoT (m)
Channel Depth (CD)	12.5	14.5*
Draft	11.4	13.2**

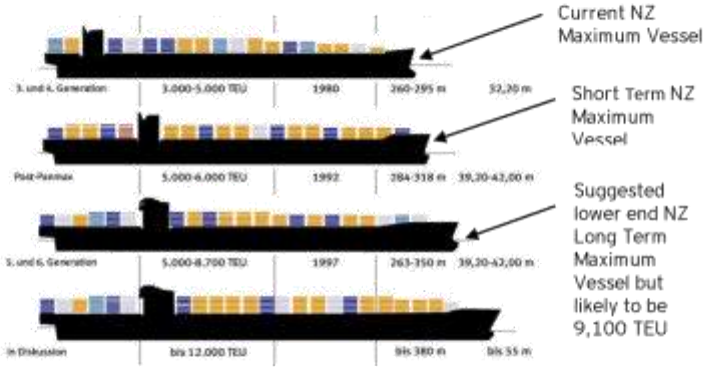
* Inside harbour depth (14.8 metres in approaches)

** Resource consent to increase to 14.5 metres

7.7.2.4 Broad effects on infrastructure

Increasing the long-term forecasted vessel size from 8,000 to 9,100 TEU would not necessarily change the physical capacity requirements of ports in terms of channel and berth depth, vessel dimensions vary considerably from vessel to vessel, regardless of their shared capacities. There is little difference in the draft, however[107] between 8,000 TEU and 10,000 TEU vessels, which are normally between 14.5 metres to 15.0 metres. Globally, there are natural water depth limits, as ports reach a point where they cannot dredge any further regardless of POAL's capacity and this has seen a rationalisation of vessel draft increases.

Figure 61: Suggested long-term vessel in comparison to current and short-term vessels



Source: Black Quay, 2016

In terms of New Zealand shipping, the Torres Strait is restricted to a maximum draft of 12.2 metres with a under keel clearance requirement of 10% of draft. There are a number of operational restrictions already in place, including speed reductions and the use of natural high tides. In addition, compulsory pilotage[108] was also put in place in 2006.

[107] Draft determines the minimum depth of water a ship can safely navigate

[108] Pilotage is when a pilot (with detailed local knowledge of waterways) maneuvers a ship through dangerous or congested waters, such as harbours or river mouths

Although the Torres Strait is not the only route used by the New Zealand fleet, it is an important link with many Asian Ports, meaning that utilisation of the Strait by New Zealand bound vessels is likely to increase in the future.

Overall, an increase to 9,100 TEU vessels from the currently estimated 8,000 TEU vessels will not present significant increased draft requirements as mentioned previously. Either way, these vessels will be forced to use the tidal fluctuations or other operational restrictions to pass the Torres Strait.

The most significant difference between an 8,000 TEU vessel and a 9,100 TEU vessel is length. Typically an 8,000 TEU vessel would be approximately 320 metres long, while 9,100 TEU vessels are approximately 340 metres to 345 metres. This could have a significant effect on infrastructure relating to port boundaries, berthing and channel infrastructure.

Vessel beam[109] varies considerably across the modern fleet. Beams of 8,000 TEU vessels are often in the region of 43 metres, whereas this increases to 45 metres for a typical 9,100 TEU vessel. Table 24 provides a breakdown of the recommended maximum design vessel over time and their respective characteristics:

Table 24: Recommended maximum New Zealand container vessel

	Capacity (TEU)	Length (m)	Beam (m)	Draft (Max)
Short-term Maximum Design Vessel	6,000 TEU	304	42	14.2m
Medium Term Maximum Design Vessel	8,000 TEU	320	43	14.5m
Long-term Maximum Design Vessel	9,100 TEU	340	45	14.5m

7.7.3 Multi-cargo fleet trends

7.7.3.1 Global car carrier fleet

As with most shipping types, car carriers are getting larger and tend to vary considerably from operator to operator.

Pure Car Carriers (PCC) and Pure Car and Truck Carriers (PCTC) are getting larger across all routes they serve, however the extents and dimensions vary considerably by route and by operator. Table 25 provides an overview of the general size brackets of the global car carrier fleet:

Table 25: General Car Carrier and Ro-Ro fleet bands (note variants are common)

Length (m)	Draft (m)	Beam (m)
< 191	5-8	20-28
191 - 210	8.8	32.2 *
211 - 230	9.5	32.2
231 - 250	11.3	32.2
251 - 270	11.5	32.2
>270	11.7	33 - 36

* Recent changes in fleet strategies have seen beams up to 36 meters in 199 metre LOA vessels.

The car carrying market tends to be dominated by a few large players who have driven up vessel lengths to approximately 270 metres and beams up to 36 metres. The result is that carrying capacities at the top end of global fleets have reached 8,000 to 8,500 car equivalent units (CEU) and are likely to increase further, potentially in the short-term. The largest operators are already examining potential for 10,000 CEU vessels.

It is not just cars handled by these vessels; they also bring in heavy machinery such as construction and agricultural plant, amongst other multi-cargo.

[109] Beam is the width at the widest point as measured at the ships nominal water line

7.7.3.2 Car carrier vessel application to New Zealand

Unlike the container fleet, Auckland is already receiving car carrier vessels at the upper end of the global fleet. Höegh's largest vessel (world's largest by capacity) the 'Trigger' has already visited Auckland. Similarly, WWL's has utilised several of its mid to top end vessels to service New Zealand. Therefore, it is reasonable to conclude that Auckland will continue to receive the upper end of vessels over time as these increase in size further. It is important to understand this in the context of the overall fleet. The upper end will always represent a small percentage of the fleet, and it is likely that vessels around the 191 metres in length mark will continue to represent the majority of the annual fleet.

In simple terms this would mean vessels with a typical length of between 191 metres and 241 metres frequenting Auckland in the short-term with the upper end potentially increasing to 265 metres over time. There is further potential for this to increase again, but it is only theoretical at this stage.

7.7.3.3 Other multi-cargo vessels at Auckland

Multi-cargo vessels visiting Auckland are also getting larger. They include self-loading container ships which are typically 220 metres in length. It is a similar situation with bulk ships which are typically between 200 metres and 220 metres in length.

7.7.3.4 Broad effects on infrastructure

In comparison to the suggested short, medium and long-term upper container vessels to visit Auckland, both the beam and length of the upper end PCTC's servicing New Zealand will remain relatively small. As a result, it is not necessarily the dimensions of the vessels visiting Bledisloe that will directly influence berth capacity over time. Rather, it is likely that the loading and unloading characteristics of car carriers and the frequency of vessel visits that will cause the most effect.

PCTC's (and other car carriers) with upper end capacities serve New Zealand on loops. That is, only part of their load is destined for Auckland.

The nature of automotive trade handling means that cars do and will continue to require individual loading and unloading. There is some discussion in the industry about automated transfer of cars to and from the ship in the future. Whilst this might improve efficiency and safety to some degree, it is unlikely to do much to improve turnaround times as each unit must still be transferred singularly.

This is coupled with the fact that larger ships will take longer to load and unload as their capacities increase.

Pressure on the multi-cargo wharves will also increase due to anticipated growth of multi-cargo and bulk vessels, both in terms of their size over time and visitation numbers.

7.7.4 Cruise fleet trends

7.7.4.1 Global cruise fleet

Two primary operators dominate the global cruise market, and accordingly both directly influence the servicing of the global cruise market. The Carnival Corporation (which operates several lines) accounts for approximately 40% of global market share. This is almost double the size of its closest competitor, Royal Caribbean Cruises (who also operate several lines). Of the rest, Star Cruises, Louis Cruise Lines and MSC Cruises complete the top 5.

In total there were a total of 426 active cruise vessels in 2014 and on average, another 12 to 16 ships are being built each year. Average vessel capacity is 4,000 passengers, but the growing top end of the global fleet can accommodate between 8,000 and 8,500 passengers. Carnival and Royal Caribbean influence the new build market and currently contribute entirely to the top end of the global fleet. Vessels of 360 metres in length are already in operation and there are plans for larger vessels in the short-term.

7.7.4.2 Cruise vessel application to New Zealand

New Zealand is already receiving cruise vessels that are amongst the world's largest, and 350 metres long ships are frequenting Auckland.

The growth of the Australian and Asian cruise markets are expected to result in demand for vessels visiting New Zealand, and Auckland in particular. From a shipping perspective, given the routes related to New Zealand and relative demand, Auckland is expected to continue to see visitation of the world's largest vessels and enjoy the benefits that this brings.

In 2015, POAL was forced to refuse future visitation of the 'Ovation of the Seas' which is one of the world's largest cruise ships, citing berth capacity issues. Similar to the multi-cargo task, the port is already facing critical capacity issues for cruise, and in some ways, these are interrelated and will be discussed further in the following capacity analysis.

7.7.4.3 Broad effects on infrastructure

Due to the lengths of cruise vessels, there are examples of berths at ports around the world struggling to accommodate them. This is often driven by scenarios where no dedicated cruise berths are available, and instead operators rely on cross-utilisation with cargo berths.

In addition to the berths themselves, there is generally demand from cruise patrons to have access to retail and food and beverage nearby the vessel berth. Depending on port of call, it is also increasingly important to have ready access to hotels and tour operations.

7.8 Port operational productivity and trends

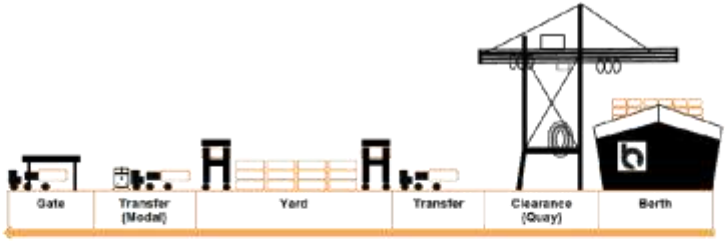
Operational productivity of the port in a general sense has significant impact to the capacity in question. Simply put, the more operationally productive a port is (i.e. turnaround time) the more land capacity is available. This section discusses the operational productivity trends in this space and assesses their importance when considering the capacity of Ports of Auckland.

7.8.1 Container terminals

Container terminal operating systems adopted in different ports around the world differ significantly depending on the port type, port task and the subsequent infrastructure regime employed. Infrastructure and operational regime trends in the world's major trans-shipment ports, for instance, are vastly different from secondary spoke ports such as those in Australasia.

However, the basic system of throughput can be generalised in order to understand the basic objective of a terminal. In port planning, the regime is often expressed as a terminal module. Figure 62 illustrates the basic container terminal module, based around imports:

Figure 62: Basic container terminal module - import focused



Source: Black Quay Consulting 2015

7.8.1.1 Global and regional trends

There are a number of technology and equipment systems currently available in the market. Although most have been around for some time, many have seen significant evolution that has increased their productivity considerably. Innovation in container terminal operating systems has continued to drive productivities, but generally speaking this has been based on adaption of existing operating regimes, both through plant automation and other efficiency measures such as electronic terminal operating systems (TOS). More detail on the extent of existing yard technologies can be found in Appendix 16 and Appendix 17.

It is generally the trend that smaller low density terminals adopt low cost-low productivity yard systems, while larger terminals are increasingly purchasing more expensive, higher productivity systems and tend to drive the global productivity frontiers through their necessity to do so. This trend is expected to continue.

Globally, the largest volume ports are trans-shipment ports and those serving cities with large populations. At the top end of global innovation in container yard handling are Automated Straddle Carriers (ASC) that utilise fixed route rail mounted gantries and are most prominently used in the large volume ports of European cities. ASC systems have been around for some time but they have been upgraded significantly, particularly over the last ten years, including measures such as end loading and increasing levels of periphery system automation. ASC systems are expected to remain as a top end system but will continue to be subjected to tweaking.

In contrast, Asian ports tend to prefer the use of Rubber Tired Gantry (RTG) systems. RTG systems are non-fixed route gantries and as such typically allow for more versatile terminal operations. Because of this, they are generally considered a more suitable solution for brownfield ports with sporadic layouts as opposed to more symmetrical modern trans-shipment ports.

It is expected that the Asian market will increase the adoption of ASC systems in the future due to increasing throughput demand and the tailored nature of new port layouts. It should be noted that it is not uncommon for ports to tailor their container terminal yard systems, including the use of multiple individual plant types. An example of this would be the use of RTG's in the yard and a straddle system as the transfer plant.

At the other end of the spectrum, small to medium size ports, particularly those in Australasia, continue to predominantly utilise manual straddle carrier fleets.

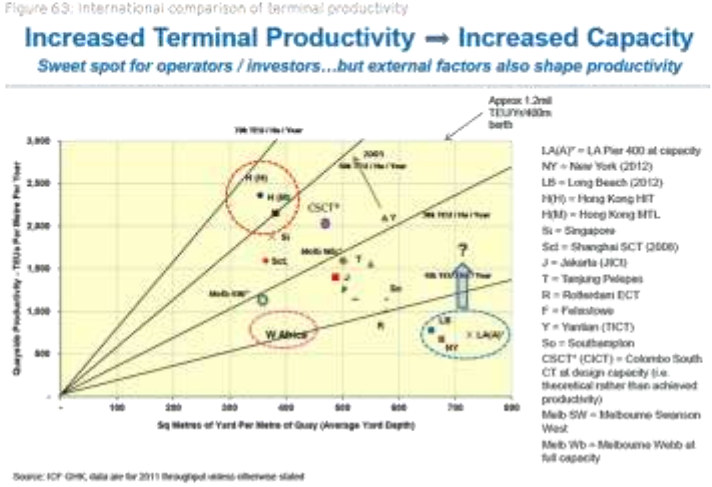
Growth in global container volumes will also affect small to medium size ports which will likely grow to sizes previously considered large on an international scale. The timeframes for this vary drastically from region to region, but as a general rule, ports serving growing cities of more than 1 million people are seeing demand double every 10 to 20 years. This is not driven exclusively by population growth, but also due to increasing TEU per head.

7.8.1.2 Port size/volumes and technology

There is a near linear relationship between technology improvements across both secondary and large container ports. As the larger ports drive technology innovation, the smaller ports adopt previously market leading technologies over time. Uptake of technologies does not happen simultaneously rather, it takes a number of years before technologies are cascaded to smaller ports.

Whilst our findings suggest these technology trends exist, there are however smaller ports who purchase whichever system they feel is required on depending on individual circumstances. The trade-off between the capital purchase and implementation costs associated with market leading yard technologies is often a deterrent given the limited extent of the trade task they are required to handle. Figure 63 shows a relationship between port productivity and capacity for major ports in the world.

Figure 63: International comparison of terminal productivity



Source: ICF GHK, data are for 2011 throughput unless otherwise stated

Although relatively modest in global terms, forecast throughputs for New Zealand ports will necessitate upgrades to the current terminal operating systems at New Zealand's larger ports.

Over time, this may include the introduction of ASC systems, but it is unlikely that this would include the latest and most innovative ASC system. Rather, it may include tried and tested ASC systems that have been used for some time at primary ports around the world which will have been made more cost-effective with the introduction of top end systems elsewhere.

In Auckland, POAL have proposed the introduction of a hybrid terminal system in the medium-term that includes some level of automation. This is based on the use of automated straddle carriers (auto-strads) to service the yard at Fergusson. Autostrads are not currently a well-established system and are only used at Patrick terminals in Brisbane and Sydney. POAL also propose the introduction of an ASC system in the longer term.

7.8.1.3 Application to Auckland

We have used Hong Kong as a case study comparison to POAL, to show the relationship between volumes size and operational technology. Hong Kong terminals perform at the top of the yard productivity range which is around 55,000 TEU/ha/per annum. They are considered one of the world's leaders in relation to port productivity and throughput. Table 26 shows a desktop benchmark comparison of POAL productivity and implied capacity with Hong Kong.

The size of the Auckland port relative to global ports means that the most advanced technologies in the world are not likely to be employed at Auckland as they are cost prohibitive and are unlikely to be sufficient on their own to answer Auckland's capacity requirements. However, the planned introduction of semi-automation in the medium-term and the possible future implementation of an ASC system would be in accordance with our suggestion that upper end technologies will cascade down to Auckland in the future.

However, a potentially cost effective ASC system for Auckland in the long-term will be unlikely to represent the world's highest performing terminal technology at a time. As is the case across most of the worlds' spoke ports, regardless of location, POAL is more likely to see modest and incremental improvements to its yard infrastructure.

Table 26: Comparison between Auckland and Hong Kong

	Hong Kong*	Auckland (current)	Auckland (proposed)
Total Throughput (TEU/Annum)	22 million (approx.)	870,000 (Fergusson only)	3 million (Fergusson and Freyberg)
Global Ranking (throughput)	4th	Outside top 100	Unknown
Terminal Area (ha)	279	32	43
Dwell Time (average days)	2 to 3	2	2
Yard Equipment	Mix of RTG and RMG	Manual straddle	ASC
Yard Productivity (TEU/ha/annum)	55,000 (approx.)	28,000 (approx.)	69,700
Berth Length (m)	8,617	610	1,405
Berth Productivity (TEU/m/annum)	2,360	1,426	2,135
Quay Cranes (no)	99	5	9 (presumed)
Quay Crane Performance (moves per hour)	35 (varies)	36.6	40 (presumed)
Quay Crane Productivity (TEU/QC/annum)	192,000 (varies)	174,000	333,000
Yard Backup to Berth (m^2 per m)	350	525	306

* Hong Kong Kwai Tsing – multiple terminals

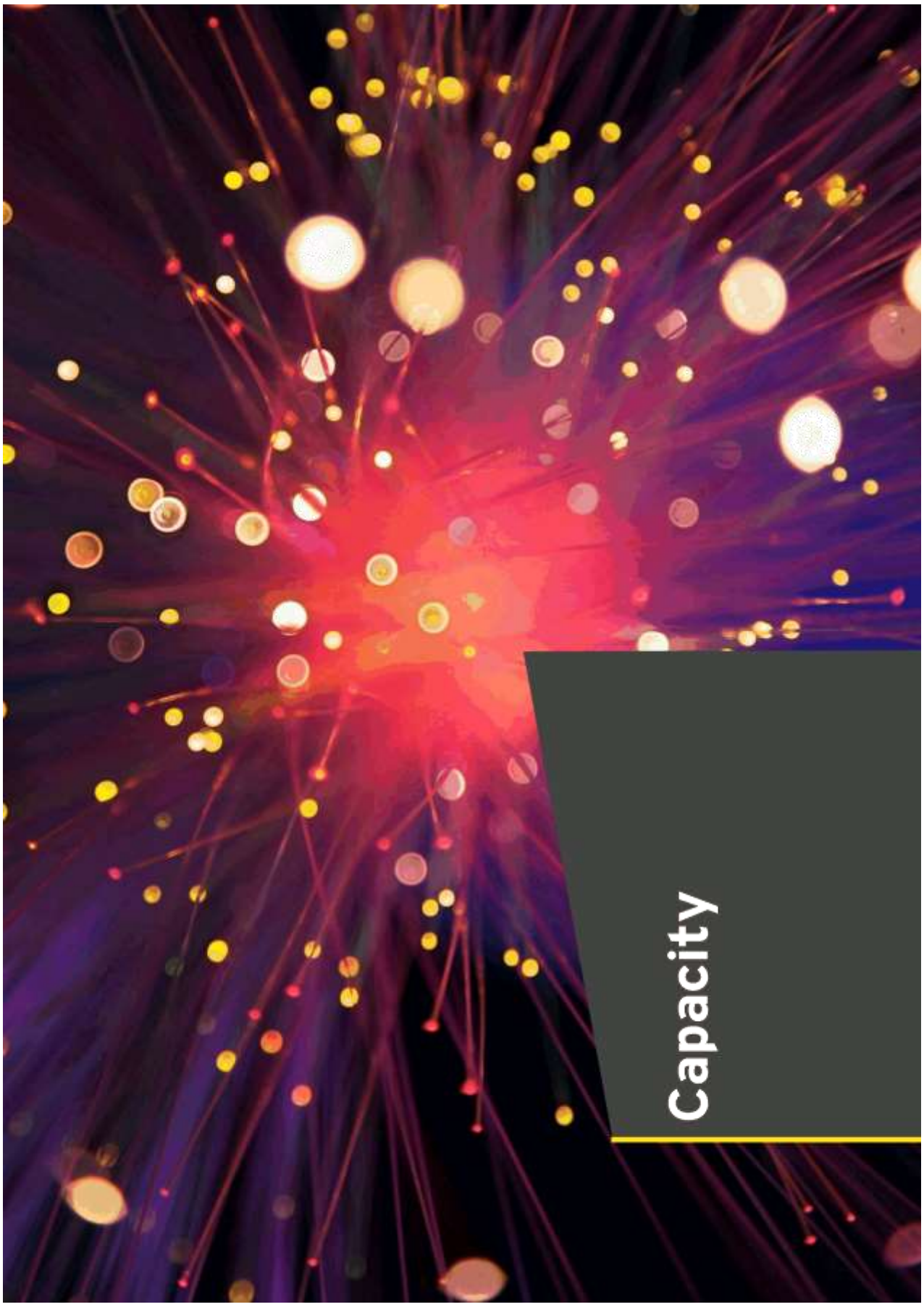
Source: Drewry, discussions with POAL, EY Analysis

Quick Summary- Future State

- POAL plays a crucial role in the handling of imports and exports for New Zealand.
- POAL trade activity appears to follow national GDP and world trade trends.
- There is general consensus that global trade (by weight) will continue to increase at a rate greater than GDP; however, the rate at which this is occurring will slow in the long-term.
- POAL's key trading nations are forecast to gain more share of global trade, directly influencing Auckland port trade volumes.
- Our findings suggest a long-term growth rate for containers to be between 2.1% and 5.0% TEU (median growth rate 2.9%).
- With respect to multi-cargo (excluding vehicles) our assessment suggests a long-term growth rate between 1.07% and 3.58%.
- Auckland is the central hub for vehicle imports in New Zealand.
- Vehicle import figures appear closely aligned to the New Zealand economy, but there is also a positive correlation between population and vehicle imports.
- We forecast the long term growth rates for vehicle imports to be in the range of 0.6% and 1.86%.
- Globally the cruise industry is growing, applying ATEED's growth rates, we forecast the long term growth rates for cruise ships to be in the range of 0.3% and 2.5% for ship visits of between 1.2% and 4.2% for cruise passengers.
- Trends in consumption can have pull and push factors to future state. Including technology and changes in what we consume and how much we consume.
- Ship vessel sizes are increasing globally, placing pressure on ports infrastructure
- Port operational technology that is more productive is naturally correlated to trade volumes.

Item 16

Attachment B



8 Capacity

The following section analyses the ports capacity to handle increasing trade volumes across trade types in the future. Although growth across all trade types is likely to continue, it is multi-cargo and containers that are expected to see the largest increases. In turn, these are expected to have the most significant effect on the ports capacity.

The effects of increased general cargo and container tasks on capacity over time have been assessed both separately and in combination to highlight long-term capacity, as well as to outline anticipated capacity limitations in the short and medium-term.

Alongside the growing trade task, new technologies and changes to operational regimes are expected to emerge that could have significant influence on how trade is handled at Auckland. These technologies are detailed in Section 7.7.1.4 and should be referred to when reading the following analysis.

8.1 Current capacity

8.1.1 Containers

Although general cargo is a prominent trade type at Auckland port, container trade is considered the primary task. This is based on the current volumes of trade and related footprint share at POAL, and the likelihood that containerisation will continue to grow at a faster pace than general cargo in the future. It is expected that a proportion of current bulk break products will be transported by containers in the future, and this contributed to the expected increase.

The proportion of POAL's footprint that is dedicated to containers has changed over time and is continuing to change through strategic development initiatives by POAL. As discussed in Section 4.8, the Fergusson Container Terminal is the primary container wharf, with other wharves used periodically for overflow capacity. In 2015, POAL handled 972,434 TEU[110] over the combined footprint of Fergusson and other wharves used for overflow capacity.

[110] POAL, 2015

Approximately 100,000 TEU[111] were handled at wharves other than Fergusson. This equated to yard productivity at Fergusson of approximately 28,000 TEU/ha/annum.[112] In global terms, this is relatively high productivity for a spoke port with modest throughput, using manual straddles as the primary yard plant.[113] Fergusson's current berth productivity is around 1,430 TEU/m,[114] which is already considerably higher than industry averages.[115]

8.1.2 Multi-cargo

Multi-cargo is primarily handled at the Bledisloe Terminal; however, other wharves are used to supplement overflow capacity including the Captain Cook and Marsden Wharves, both of which serve as automotive storage areas when required.

In 2015, POAL handled a total multi-cargo task of 5.9 million tonnes.[116] This included a mix of cement, general machinery, minerals and food products. However, the primary throughput has consistently been automotive trade, accounting for approximately 50% of all general cargo trade. It is estimated that at certain times, cars utilise 90% of the terminal footprint. In 2015, this equated to 243,801 car equivalent units (CEUs).[117]

POAL undertakes Pre-Delivery Inspection (PDI) services and storage of vehicles within the port gates, resulting in imported cars and other automotive plant staying at the port after vessel departure.

Although Auckland's operational regime of 'in terminal' PDI increases dwell time, it should be noted that to date, this has remained at an average of two days, which is relatively low by global standards.[118]

POAL have signaled that its capacity to handle general cargo is diminishing and that additional land and berth may be required to meet the growing trade task.

[111] POAL, 2015, *Annual Review*
[112] Calculated based on the above figures
[113] Manual straddle carriers are used to transport single containers around the terminal
[114] Calculated based on information provided by POAL, 2015
[115] Drewry, 2013, *Container Terminal Benchmark Review*
[116] POAL, 2015, *Annual Review*
[117] POAL, 2015, *Annual Review*
[118] POAL, 2015, *Annual Review*

This is of particular significance if Captain Cook Wharf is transformed for public use as currently outlined as a potential scenario under the Central Wharves Strategy.

The primary capacity pressure is expected to be caused by increasing automotive trade, compound by substantial growth in the other forms of multi-cargo. Multi-cargo throughput has increased significantly recently, and it has been noted that would be an imminent capacity shortfall if Captain Cook and Marsden Wharves are removed from port ownership. The primary factors that are already affecting the ports multi-cargo capacity can be summarised as follows:

- reduced port footprint as land is gentrified from the west
- relocation of cement from Onehunga to the main port
- the operational interaction with an increasing cruise shipping task including the reduced availability of Captain Cook Wharf due to spatial restrictions in the basin and prioritisation of cruise ships
- the re-purposing of the Freyberg berths for containers
- automotive vessels dominating berth utilisation and capacity at Bledisloe with pressures on both expected to increase over time as vessel sizes increase
- break bulk and multi-cargo container ships increasing in size and numbers, impacting berth capacity further.

8.1.3 Cruise

Currently, the Auckland cruise task is handled primarily between Queen's Wharf and Princes Wharf. Berth length is the primary consideration when assessing POAL's current cruise capacity. While there has been a steady increase in the number of cruise vessels visiting the city, the main factor effecting capacity has been berth length. Queens Wharf is currently limited to receiving 295 metre long vessels and Princes Wharf to a 320 metre long vessel.

In contrast to container and general cargo vessels, cruise ships visiting New Zealand are amongst the worlds' largest in terms of length. The current upper end length of the global cruise fleet is approximately 360 metres,[119] and there is already demand for 350 metre ships to access Auckland. As such, the longest vessels of any trade type visiting Auckland are cruise ships.

The need for berth capacity in appropriate locations is expected to become an increasingly critical issue in the near future. The cruise vessel fleet have sizeable beams that have an effect on POAL's operations, but berth depth is less of an issue as drafts are relatively modest. It is expected that the current cruise berth configurations will not be sufficient to accommodate the near term cruise fleet.

In 2015, POAL turned down a request for the 'Ovation of the Seas', one of the world's largest cruise ships to visit Auckland, citing berth capacity issues. The Jellicoe terminal has been used to berth larger cruise vessels such as the Queen Mary II in the past, but capacity issues at the wharf have meant that this is no longer able to be used on a regular and reliable basis. Both berths at Jellicoe are already at capacity and the alterations to support the cement trade will effectively mean that Jellicoe cannot be used for cruise activity. Bledisloe is also facing combined cruise and general cargo pressure due to increased visitation and vessel sizes across both trade types.

From a landside perspective, Auckland's general cargo terminals are becoming constrained in their potential to handle passenger movements given both the high utilisation of the terminal space for other trade, and the permanent equipment used on them, such as silos.

8.1.4 Liquid bulk

Liquid bulk is currently serviced from Wynyard Quarter, located to the west of Ports of Auckland. This area was traditionally known as the Tank Farm as it was the primary service area for Auckland's liquid bulk industries. In recent times, Wynyard Quarter has been subject to growing gentrification, being transformed in stages to residential, light commercial and public space.

The gentrification of Wynyard Point is effectively the final phase of the transformation. This will require liquid bulk operations to be transitioned out of this area. The final liquid bulk lease is at Wynyard Point is due to end in 2026 and many of the other leases are already reaching their termination.

There are two factors that need to be considered for future liquid bulk:

- Where does the liquid bulk industry relocate to and what does it require?
- Will Wynyard Point have a part to play in accommodating Ports of Auckland's long-term task, and in particular cruise?

Both the potential future location of liquid bulk and the potential for Wynyard to continue to be used for maritime related activity is discussed in Section 9.2.1.

[119] Royal Caribbean Oasis Class Cruise Vessels

8.2 Future container capacity

8.2.1 Future container task

Research suggests that in the short to medium-term, Ports of Auckland will be required to double its current capacity to approximately 2 million TEU per annum.[120] Forecasts also point to a long-term capacity need of approximately 4 million TEU per annum by as early as 2044 (high growth scenario).

Table 27: Scenario analysis extrapolated rates in which 2 million TEU is realised

Scenario Testing Rates in which 2million TEU is realised		
Rate	Year	Implied year
5.00%	15	2030
4.70%	16	2031
4.40%	17	2032
4.10%	18	2033
3.80%	20	2035
3.50%	21	2036
3.20%	23	2038
2.90%	**26**	**2041**
2.60%	29	2044
2.30%	32	2047
2.00%	37	2052
1.70%	43	2058
1.40%	52	2067
1.14%	64	2079
1.10%	66	2081
0.80%	91	2106
0.73%	100	2115

Table 28: Scenario analysis extrapolated growth rates in which 3 million TEU is realised

Scenario Testing Rates in which 3million TEU is realised		
Rate	Year	Implied year
5.00%	24	2039
4.70%	25	2040
4.40%	27	2042
4.10%	29	2044
3.80%	31	2046
3.50%	33	2048
2.90%	**40**	**2055**
2.60%	44	2059
2.30%	50	2065
2.00%	57	2072
1.70%	67	2082
1.40%	82	2097
1.14%	100	2115

Table 29: Scenario analysis extrapolated growth rates in which 4 million TEU is realised

Scenario Testing Rates in which 4million TEU is realised		
Rate	Year	Implied year
5.00%	29	2044
4.70%	31	2046
4.40%	33	2048
4.10%	36	2051
3.80%	38	2053
3.50%	42	2057
3.20%	45	2060
2.90%	**50**	**2065**
2.60%	56	2071
2.30%	63	2078
2.00%	72	2087
1.70%	84	2099
1.40%	102	2117

[120] Refer to trade growth projections in Future State

8.2.2 Yard capacity

Yard productivity at container terminals is complex and is a result of many different factors. Each port tends to present its own subtleties that can have significant effect on yard capacity. As a result of this, benchmarking against other ports needs to be done with caution.

In the case of Auckland, a primary factor is the limitation of available land, resulting in a need to perform well, not just in the yard, but across the entire port system. Auckland's small footprint becomes increasingly relevant in the long-term as the volumes and competing uses (e.g. cruise needing longer berths) grow significantly and pose increasing infrastructure challenges.

POAL has stated that they will reconfigure the current port layout so that Fergusson and Freyberg are the primary wharves dedicated solely to container trade. This repurposing will result in a total container terminal area of 43ha. Figure 64 below, outlines the proposed terminal layout:

Figure 64: POAL proposed port split: general cargo and containers

8.2.3 Yard technology

The current straddle fleet at Ports of Auckland delivers a productivity of between 20,000 TEU/ha/annum and 25,000 TEU/ha/annum. As stated previously, this is a relatively good performance for a manual straddle operation.

POAL are proposing the imminent introduction of an automated straddle fleet (autostrad), and plan to eventually upgrade to the Automated Stacking Crane (ASC) system.

The ASC system is considered to be leading technology currently; however, over time, today's market leading technologies will become more affordable and available for secondary ports. However, the performance being realised at the world's leading trans-shipment ports are not entirely due to yard technologies and their performances and rather is a product of specific modern port planning. These ports are designed to provide symmetry and consistency along the berth line, yard and port gate. Given the development history and subsequent layout of the Auckland port, achieving the same efficiencies would be relatively more challenging.

The following analysis outlines the expected productivity increases each technology option is expected to deliver and its effect on overall container yard capacity. We have developed productivity estimates based on average and world's best for each technology and have compared this to the productivity that POAL is expecting each system to deliver. For both technologies, POAL is predicting returns considerably higher than industry averages. They have stated that these high yard performance measures are underpinned by continued low dwell times and low peak factors and vessel size. We suggest that pressure on both these factors will grow over time as there is an increase in throughput.

Given POAL plans to optimise and achieve market leading performance, it is prudent to consider a downside risk scenario based on benchmarked figures across similar ports with similar development needs.

As mentioned previously, POAL's estimates for future yard productivity appear to rely heavily on a continuation of particularly low dwell times and peak factors, which will almost certainly come under pressure when dealing with three times the current trade volumes.

8.2.3.1 Automated straddle fleet

POAL is initiating the process of upgrading its yard technology to an automated straddle (autostrad) system to increase its current capacity. The table below outlines the performance POAL is expecting from the autostrad system compared to the industry benchmark, and the expected port capacity resulting from each:

Table 29: Capacity based on autostrad

Yard System	Source	Performance Overview (TEU/ha)	Terminal Size	Resulting Capacity (TEU)
Autostrad	Industry Benchmark	40,000	43ha	1,720,000
	POAL	51,200	43ha	2,201,600

In the short to medium-term, POAL's container trade task is projected to reach 2 million TEU. Given the expected capacities calculated above it is possible that in the downside scenario up to 7 hectares of additional land may be required.

8.2.3.2 Automated stacking crane

POAL has stated that they intend to introduce an automated stacking crane (ASC) system in the medium to long-term. The introduction of an ASC system represents a jump to the current upper end of port technology and therefore the cost/benefit implications of this upgrade would need to be considered in detail at the time.

Table 30 outlines the performance POAL is expecting from the ASC system compared to the industry benchmark, and the expected terminal capacity resulting from each. In addition, the table includes the analysis in the PwC *Upper North Island Ports Study* which stated an ASC performance figure of 50,000 TEU/ha/annum[121]. Whilst we think this is high in Auckland's context, applying this number suggests a capacity no greater than 2.2 million TEU.

Table 30: Capacity based on ASC

Yard System	Source	Performance Overview (TEU/ha)	Terminal Size	Resulting Capacity (TEU)
ASC	Industry Bench Mark	45,000	43ha	1,935,000
	Upper North Island Ports Study	50,000	43ha	2,200,000
	POAL	69,700	43ha	2,997,100

POAL has proposed that implementing an ASC system would increase their capacity to 3 million TEU. As previously mentioned, POAL estimates for future yard productivity appear to rely heavily on a continuation of particularly low dwell times and peak factors, which will almost certainly come under pressure when dealing with three times the current trade volumes.

Under all growth and productivity scenarios it is highly likely that a container task above 3 million TEU will require an expanded terminal footprint for containers.

8.2.4 Container berth capacity

POAL is facing looming berth capacity issues. Although this is predominately focused around the general cargo terminals, Fergusson is expected to face growing pressure as throughput increases and container vessels become larger.

POAL has recognised this and has attempted to address the issue through port planning. This has included the recent extension of the main berths by 50 metres and the construction of a third northern berth at Fergusson (310 metres), which is nearing completion. This will provide three dedicated container berths (total of 960 metres non-continuous berth line) and POAL consider this as being sufficient to meet 2.2 million TEU per annum. The productivity per berth metre proposed in this plan is 2,291 TEU/m.[122] This compares to the average global berth productivity in container terminals of approximately 1,100 TEU/m;[123] however, figures vary considerably depending on the port type, task and location.

[121] PWC, 2012, *Upper North Island port and port-related infrastructure supply and demand study*

[122] POAL, 2015
[123] POAL, 2015

Auckland is a good example of this with current berth productivity at the Fergusson terminal of 1,450 TEU/m (based on 870,000 TEU moving through Fergusson and the rest at Ports of Auckland's multi-cargo terminals).

POAL consider that the addition of the two smaller Freyberg berths (a total of five berths) will be sufficient to handle 3 million TEU per annum. This would result in a berth productivity of 2,135 TEU/m. [124]

As another broad measure, this equates to 600,000 TEU per berth [125] when considering a 3 million TEU scenario. This is also high by global standards, with secondary ports such as Auckland typically achieving around 300,000 TEU per berth, but again, this does vary considerably. Upper end global trans-shipment terminals are generally achieving berth productivities between 500,000 TEU and 1 million TEU per berth.

Although global productivity across the berth is improving, the size and capacity of the vessels is becoming larger, resulting in an increased task per vessel, and this is also the case at Ports of Auckland.

Under all scenarios, an increase beyond 3 million TEU will see the need for additional berths.

8.3 Future general cargo capacity

POAL has signaled that it is already facing general cargo capacity shortages. It is therefore expected that this will become increasingly critical over time without the development of suitable infrastructure.

POAL has put forward a number of development proposals aimed at addressing multi-cargo capacity shortages. Although these differ to a degree, in essence they propose land reclamation of between 3ha and 6ha and berth extensions (of various lengths) at the Bledisloe terminal.

In conjunction with this, it is proposed Marsden Wharf is removed and the southern section of Bledisloe's western berth line is dredged, effectively creating an additional berth. In addition, the proposals consider the possibility of transferring Captain Cook Wharf to be used for public use. Removing Marsden would reduce the ports footprint by approximately 1 ha, and repurposing Captain Cook would result in an additional 3 ha being removed from the footprint.

[124] POAL, 2015

[125] TEU per number of berths

Given POAL's proposed plans, we have assessed the capacity of the port's multi-cargo terminal with the view of determining:

- What is POAL's current multi-cargo capacity and utilisation?
- What are POAL's options for increasing multi-cargo capacity?
- What will the current Port proposal deliver and is it required?

It is extremely difficult to calculate multi-cargo terminal capacity due to the non-uniform nature of the trade and there is a lack of measurable data from POAL. Accordingly, we have attempted to calculate current terminal capacity in terms of cars and future capacity under various infrastructure scenarios using first principle calculations.

8.3.1 Yard capacity

Given that automotive trade is expected to be the most significant cause of capacity issues for POAL's general cargo operation, the following points should be noted:

- Storage of cars takes up the majority of space on a weekly basis at POAL's general cargo terminal (Bledisloe) and therefore typically determines yard capacity. Currently, cars are also stored at Marsden and Captain Cook Wharves, which may face closure in the short-term and will make this problem more acute.
- The car carrying fleet as it relates to Auckland tends to dominate berth utilisation and capacity at Bledisloe (recognising that other general cargo ships also occupy significant berth time at Auckland).

Currently, the large car carrier vessels can handle 8,000 CEU and above. [126] In Auckland, the discharge rate is approximately 2,000 cars per day resulting in 10,000 CEU per week. The landside clearance rate is up to 800 cars per day, resulting in an average dwell time of two days. As volumes increase over time, it is expected that the dwell time will be under pressure on the current footprint as the limitation on landside clearance beyond the port gates also increases.

In practical terms, it is not an option for car dwell times at POAL to increase on its current footprint with an increased trade task. This is an important point that must be recognised and it reduces options for POAL considerably.

[126] Large car carriers include pure car carriers (PCCs) and pure car truck carriers (PCTCs)

POAL has signalled that their multi-cargo capacity, at Bledisloe in particular, is approaching criticality. To determine POAL's capacity, we have calculated an estimated terminal utilisation on the basis of cars, recognising that it is automotive trade that demands most space at the multi-cargo terminal.

There is no standardised methodology for calculating the capacity of a typical yard block for car. This is largely due to the numerous options setting out yard car parking. For instance, some yards use a herringbone configuration for car parking and others use symmetrical blocks. The choice of configuration is made more complex by the shape of the yard itself and its orientation to the berth line.

The methodology we have used to calculate the Port's general cargo capacity is detailed in Figure 65 below:

Figure 65: Multi-cargo capacity methodology

8.3.2 Calculation assumptions

- We are basing our annual capacity figures on static capacity measures. We note that it is a dynamic environment with volatility. The purpose of this is to provide preliminary indication of potential capacity only and we note that there are limitations to its uses.
- We are basing our calculations on 30-car block configurations (2 rows of 15 cars). A caveat of this approach is that blocks are considered continuous and do not allow for internal transfer lanes, and are applied across the terminal area.
- The 30-car block equates to 365m^2 of footprint (or 0.0365ha) and is based on the cars being parked closely together. This is in general accordance with automotive terminals globally, and also corresponds to current operations at Bledisloe.
- Recognising that terminal yard utilisation is a constantly changing scenario at Bledisloe, we have calculated a useable car space of 10.25ha. This allows for transfer lanes, roadways and buildings as mentioned above (the total terminal space at Bledisloe is 14.5ha).
- Bledisloe currently caters for 70% of vehicle terminal capacity, with 30% being catered for at Marsden and Captain Cook.
- Bledisloe's current total available footprint for vehicle has been reduced by 10% to allow theoretical space for other multi-cargo not specifically catered for through specialised infrastructure. This is a crude estimate based on the visual reality at POAL.

8.3.3 Static capacity

Based on the above assumptions the table below outlines the current static yard capacity:

Table 31: Implied static weekly capacity

Wharf	Area	No. of Car Blocks (Area /365m^2)	Implied Weekly Capacity (Blocks * 30)	Rationalised Weekly Capacity (Capacity - 10%)
Bledisloe	10.25 ha	280.8	8,425CEU	7,582 CEU
Captain Cook and Marsden	4 ha	109.6	3,288 CEU	3,288 CEU[127]
Total	**14.25ha**	**390.4**	**11,712 CEU**	**10,870 CEU**

Given the above calculations, and for simplicity assuming weekly turnover of yard capacity, we have calculated POAL's current total static capacity as outlined in the table below:

Table 32: Implied static annual capacity

Wharf	Area	Rationalised Weekly Capacity	Total Annual Static Capacity (52 week operation)
Bledisloe	10.25 ha	7,582 CEU	394,264 CEU
Captain Cook and Marsden	4 ha	3,288 CEU	170,976 CEU
Total	**14.25ha**	**10,870 CEU**	**565,240 CEU**

However, static capacity does not provide us with a realistic view of the terminal's feasible throughput. As such, multi-cargo terminal utilisation is discussed in the following section.

[127] It is assumed that Captain Cook and Marsden are only used for vehicles and therefore there has been no rationalisation for alternate use.

8.3.3.1 Terminal utilisation

It is not realistic to assume that a terminal can be 100% utilised. Based on POAL's historical performance, we know that 10,000 TEU can theoretically be handled in one week using Bledisloe, Captain Cook and Marsden; however, this was regarded as a one-off event in that it required a huge amount of logistics planning, both inside and outside the port gate, and it is unlikely that this could be sustained on a regular basis.

Based on the assumption that POAL's static yard capacity at Bledisloe Wharf is 7,582 CEU per week, we have calculated the change in terminal utilisation at Bledisloe that would be caused by Captain Cook and Marsden being removed, based on the current trade task (243,801 CEU).

Table 33: Terminal utilisation

Scenario	Bledisloe Weekly Terminal Demand (52 weeks operational)	Bledisloe Weekly Terminal Demand (48 weeks operational)	Bledisloe Weekly Terminal Utilisation (52 weeks operational)	Bledisloe Weekly Terminal Utilisation (48 weeks operational)
Bledisloe, Captain Cook and Marsden (171,000 CEU handled at Bledisloe)	3,288 CEU	3,563 CEU	43%	47%
Bledisloe Only (243,801 CEU handled at Bledisloe)	4,688 CEU	5,079 CEU	62%	67%

Our calculations show that currently Bledisloe is between 43 and 47% percent utilised.[128] The removal of Captain Cook and Marsden would see this rise to between 62 and 67% based on the current trade task. The variance in these figures is caused by difference scenarios of the number of weeks of annual operation.

In comparison to global metrics for general cargo terminals, reducing the terminal to Bledisloe only results in very high utilisation. Anything above 60% is considered unsustainable and as such, additional multi-cargo capacity would likely be required should Captain Cook and Marsden wharves be handed over.

For the purpose of all further analysis we assume that 50% utilisation will continue to be achieved. Under this scenario, the current multi-cargo capacity is as follows:

Table 34: Terminal utilisation

Wharf	Area	Rationalised Weekly Capacity (50% utilisation)	Total Annual Capacity (52 week operation, 50% utilisation)
Bledisloe	10.25 ha	3,791 CEU	197,132 CEU
Captain Cook and Marsden	4 ha	1,644 CEU	85,488 CEU
Total	**14.25ha**	**5,435 CEU**	**282,620 CEU**

8.3.4 Increasing capacity

8.3.4.1 Reclamation

Based on our earlier assumptions for calculating vehicle capacity we have stated that each 30-car block requires 365m^2 of footprint (or 0.0365ha). As such, we have calculated the number of additional vehicles that could be accommodated per hectare of expansion as follows. We have calculated this based on the assumption that the additional land would be dedicated to vehicles and that POAL would continue to achieve 50% utilisation.

Table 35: Additional capacity per 1ha

Additional Footprint	Additional Weekly Capacity (100% Utilisation)	Additional Weekly Capacity (50% Utilisation)	Additional Annual Capacity (50% Utilisation)
1 ha	822 CEU	411 CEU	21,372 CEU (52 weeks operation)

[128] POAL have confirmed that their current utilisation is approximately 50%.

8.3.4.2 Port reclamation proposal

POAL is currently proposing between 3ha and 6ha of reclamation. The following analysis considers what a 3ha expansion would achieve in terms of theoretical additional terminal capacity. It is based on the assumption POAL would continue to achieve 50% utilisation and one week dwell times.

Table 36: Additional capacity per 3ha

Additional Footprint	Additional Weekly Capacity (100% Utilisation)	Additional Weekly Capacity (50% Utilisation)	Additional Annual Capacity (50% Utilisation)
3 ha	2,466 CEU	1,233 CEU	64,110 CEU (52 weeks operation)

The total increase in capacity that would be achieved depends on whether or not Marsden and Captain Cook continue to be used. The following table outlines the capacity under these two scenarios, and the expected year that this capacity will be reached based on a 1.8% growth rate.

Table 37: Implied capacity reached 3ha

Scenario	Original Annual Capacity (50% Utilisation)	Increased Annual Capacity with 3 ha (50% Utilisation)	Percentage Change in Capacity	Year Capacity Reached
Bledisloe	197,132 CEU	261,242 CEU	32.5%	2019
Bledisloe, Captain Cook and Marsden	282,620 CEU	346,730 CEU	22.7%	2035

Theoretically, 3 ha of reclamation would provide sufficient capacity to 2035 if Captain Cook and Marsden were retained or to 2019 if they are no longer used.

8.3.4.3 Vertical infrastructure

Vertical car parking has been effectively used to create additional terminal capacity in best practice terminals such in Southampton, United Kingdom.

In Southampton, car parks have five levels and this is believed to be the maximum height to ensure optimal efficiency when loading and unloading (i.e. any higher and operational inefficiencies occur that will have a detrimental effect on terminal productivity).

Building a five story carpark with a 1 ha footprint would provide 5ha of terminal footprint, accounting for the existing footprint that is lost to accommodate the carpark. For consistency, we have assumed that the car par would be 50% utilised but in reality, dwell time would be affected which would impact utilisation.

Table 38: Vertical infrastructure additional capacity per 1ha

Additional Land Per Carpark	Additional Weekly Capacity (100% Utilisation)	Additional Weekly Capacity (50% Utilisation)	Additional Annual Capacity (50% Utilisation)
5 ha	4,110 CEU	2,055 CEU	106,849 CEU (52 weeks operation)

Carpark option

Adding a 1ha carpark to POAL would increase the total terminal footprint by 5ha. As before, the total increase in capacity that would be achieved depends on whether or not Marsden and Captain Cook continue to be used. The following table outlines the capacity increase associated with adding a carpark under these two scenarios, and the expected year that this capacity will be reached based on a 1.8% growth rate.

Table 39: Vertical infrastructure implied capacity reached per 1ha

Scenario	Original Annual Capacity (50% Utilisation)	Increased Annual Capacity with Carpark (50% Utilisation)	Percentage Change in Capacity	Year Capacity Reached
Bledisloe	197,132 CEU	312,529 CEU	54%	2027
Bledisloe, Captain Cook and Marsden	282,620 CEU	389,479 CEU	38%	2041

Theoretically, building a five story carpark could provide sufficient capacity to 2041 if Captain Cook and Marsden were retained or to 2027 if they are no longer used. Further analysis is required in order to determine the optimal level of vertical infrastructure, for example, if multiple carparks could be accommodated.

8.3.4.4 Calculation limitations

The analysis we have conducted is based static capacity figures. We note that there are many dynamic factors could influence these calculations and the terminal's actual capacity including:

- **Dwell Time:** Current car dwell times are as low as two days and POAL believe dwell times at Ports of Auckland could drop further. Despite this, it is possible that they may rise given the increased demand on the logistics chain and pure volumes being discussed.
- **Peak Factor:** Peak factor is expected to worsen given the large vessels that will be berthing with increased frequency. This is exacerbated by the lack of options to improve productivity further. There is an argument that as yet undeveloped future technology could improve this with ideas such as driverless cars that would go straight from ships to dealer. Despite this possibility, cars would still need to spend time at the port for PDI and customs so it is realistically unlikely to improve the situation. Either way, it is prudent to account for the worst case scenario.
- **Multi-Cargo Breakdown:** We have assumed that cars take up 90% of the multi-cargo terminal footprint. However, this ratio may change impacting the ports automotive capacity.
- **Utilisation:** We have assumed the terminal utilisation rate is 50% however this may change. A greater utilisation would result in a larger terminal capacity and vice versa.
- **Car Park Inefficiency**: Creation of car parks would likely reduce efficiency due to the need for cars to be driven into and out of it.
- **Berth Productivity:** This is discussed further below.

Our calculations are based on a number of assumptions and are based on the data that was available. Further analysis could be undertaken with more detailed data.

8.3.4.5 Beyond the port gate

There is potential to utilise space outside POAL gate for the storage of cars. Whilst this should be investigated further beyond the scope of this study, the following points are made:

- Cars will still need to be put through customs within the port gate, thereby continuing to influence terminal capacity.
- The effects on handling costs are not well known. However, it can be assumed that the further the distance, the higher the cost. It also would put pressure on logistics companies who presumably would need to operate more trucks to accommodate the movement of cars between sites.

If a suitable site was found close enough to the port, this option could be considered. However, it is highly unlikely that this would suffice on its own as an approach to increase capacity. Globally, primary automotive ports are space intensive and largely rely on the immediate land around the port.

8.3.5 Benchmarking | Southampton

Port of Southampton is generally regarded as one of the world's most productive and innovative automotive import ports. The Southampton automotive capability is made up of several terminals, including the WWL terminal. This terminal includes multiple vertical car parks which it has developed these to great effect. This has allowed Southampton to outperform most global automotive import ports and even compete with large European hub ports, such as Antwerp in terms of productivity.

The following table highlights Southampton's WWL terminal performance versus Auckland:

Table 40: Benchmarking static capacity

Port	Area (ha)	Throughput (CEU/Annum)	Yard Productivity (CEU/ha/annum)	Static Capacity (CEU)
Auckland	10.25	243,801	23,785	7,582
Southampton (WWL Terminal)	16.60	450,000	27,108	10,800

As can be seen above, POAL already performs well in comparison to a market leading port in terms of static capacity, and does so without vertical car parking. There are several reasons for this, but the most significant is dwell time.

Southampton's average dwell time is estimated to be around twice as long as POAL. As stated earlier, we believe Auckland's dwell performance will come under pressure and could become closer to Southampton's over time.

Overall, it can be seen that Southampton's yard productivity is particularly high, and this has in part been enabled through vertical infrastructure.

8.3.6 Berth capacity

As described in 7.3.3, the dimensions of the car carrying fleet serving Auckland are likely to increase further over time despite POAL already handling the upper end of the current global fleet. While there is room for efficiency gains in transfer of cars, the turnaround times of car carrier vessels at POAL is expected to continue to take between 10 and 20 hours at berth, and possibly more as volumes increase.

Is it expected that the carrying capacity of automotive vessels will increase over time. While initially this may reduce the number of vessel visits, as the automotive task grows there would likely be considerable strain on Auckland's general cargo berths and yard to handle this.

Assuming that Marsden Wharf is removed, increasing vessel beams would be less of an issue as the beam to beam clearance of berthed vessels between Captain Cook and Bledisloe would be sufficient. This is not withstanding other issues associated with cruise vessel interaction as previously discussed.

Vessel length is a complex problem, particularly when considered in the context of increased vessel visitation numbers. Bledisloe already operates under a scenario where some vessel bows protrude beyond the wharf line, under tug assistance. Generally speaking, when any port is faced with this issue, there is a significant berth capacity problem, which often transfers back into the yard and so on (longer time at berth results in higher berth utilisation and more unpredictable effects on yard utilisation).

The removal of Marsden Wharf and creation of another berth at the southern end of Bledisloe west, as described earlier, would assist in improving berth length (recognising that the southern end of the Bledisloe berth alignment would need to be reconstructed and dredged).

POAL is also proposing to lengthen both Bledisloe berths (98 metres at B2, which is the eastern berth line and 92 metres at B3, which is the western berth line).

At full length, it is estimated that B3 could accommodate one upper end PCTC vessel and one mid-sized vessel. Under the POAL proposal, the extended B2 berth would also accommodate another mid-sized vessel. Jellicoe terminal would accommodate several smaller ships.

Should POAL lose their berth at Captain Cook, they would effectively lose a berth with the capacity to accommodate a mid-sized PCC vessel (220 metres LOA). Regardless of this, POAL has stated that their berth capacity is under pressure and they require an additional berth that is suitable for accommodating a large PCC (265 metres LOA).

POAL propose that the 92 metre extension of B3 accompanied with the reconstruction of southern B3 and the removal of Marsden wharf would accommodate one 265 metre PCC and one 199 metre PCC in additional to providing sufficient clearance for ramps (approximately 50 metres) and 30 metres of tug water. In addition, the B2 extension of 98 metres along with demolition works adjacent to its southern end would accommodate another mid-sized PCC (220 metres LOA) or general cargo vessels, which also reach up to 220 metres LOA.

8.3.6.1 Alternative options

Through high level analysis we have investigated an alternate option to extension and reclamation at Bledisloe which could create the required berth numbers and lengths. For the basis of this analysis we have assumed that vertical infrastructure would be developed to cover immediate yard capacity shortages.

Given this baseline capacity, this approach would include completely demolishing Marsden Wharf. Captain Cook Wharf would be extended in length by approximately 110 metres (in line with Queens Wharf) and the wharf narrowed by approximately 31 metres. The eastern Captain Cook berth would be used for large PCC vessels (265 metres LOA or smaller) and the western Captain Cook berth would be used for large cruise ships (340 metres LOA). Some dredging would be required to accommodate for ships in this area.

In addition, the southern section of B3 would be strengthened and dredged. B3 would therefore be capable of accommodating two 199 metre PCC vessels. Finally, a new 320 metre berth would be created running west to east along the northern end of Bledisloe, but in line with the outermost extents of the current B2 and B3 berths. This would cater for large multi-cargo vessels and any size of PCC, with smaller vessels continuing to use B2.

Overall this would result in Captain Cook Wharf being shared between vehicles and cruise; however, vehicles would not be parked on Captain Cook and instead be transferred straight to the vertical car parks (or Bledisloe yard). It is expected that creating a safe and secure distinction between cruise passengers and car transfer is a simple matter of terminal organisation and barriers.

In total, this option would provide three additional berths (and a primary cruise berth without the need for berth extensions and reclamation into the harbour. It is recommended that this alternate option is investigated further. Figure 66 on the following page outlines the proposed layout under this option:

Figure 66: Alternative options

8.3.7 General cargo conclusion

Based on our calculations, it is expected that the Bledisloe Terminal will come under increasing pressure to handle POAL's automotive task. Unlike container yard capacity, there is limited option to utilise technologies to improve productivity at the yard. Accordingly, and as discussed, options for increasing multi-cargo yard capacity are limited to:

- Increasing the terminal footprint though reclamation or vertical infrastructure.
- Move cars to an offsite location.

Similarly, there is expected to be growing pressure on berth capacity, especially in terms of berth length. POAL's options to create berth capacity include:

- Extending the berths at Bledisloe as proposed.
- Creating berths through extending Captain Cook, building a new berth at the end of Bledisloe, and reconfiguring the current berths.

8.4 Future cruise capacity

8.4.1 Cruise task overview

As with general cargo, Ports of Auckland's capacity to handle the growing cruise task is limited and already under some pressure. As suggested previously, there is a link between general cargo and cruise capacity at the port due to the fact that both tend to berth in proximity to each other when cruise ships visit Auckland.

In addition, the Queens Wharf berths (Queens Wharf East and Queens Wharf West) are only capable of accommodating vessels between 180 metres and 295 metres long respectively. Princes Wharf is limited to vessels of 320 metres in length, and this is its absolute upper limit.

With Auckland already receiving cruise vessels at the upper end of the global fleet, there will be growing pressure on the ports berths to cope with longer vessels, as well as more frequent visitation.

Without the provision of a longer berth, 350 metres long cruise vessels will need to be anchored offshore. The likelihood is that cruise operators will want access for ships longer than this in the future. When this might occur is unclear but potentially within the short-term and almost certainly in the medium-term.

Water depth is not expected to be an issue due to the relatively shallow drafts of cruise vessels. However, their considerable beams will approach those of the largest container ships expected at Auckland at 42 metres and beyond.

The basin width between Queens Wharf and Captain Cook Wharf is too narrow to safely accommodate large beam vessels at both locations (approximately 104 metres wide) and as larger vessels visit in the future, this will become unmanageable.

8.4.2 Long-term cruise capacity summary

The creation of additional berth length at Bledisloe would theoretically provide the capacity required to accommodate relocated general cargo vessels from Captain Cook Wharf, thereby alleviating beam clearance issues with cruise vessels berthed at Queens Wharf East. This also provides potential to berth larger cruise ships at Bledisloe when required.

POAL's development proposal for cruise is the creation of three berths (two 295 metres long and one 360 metres long). Whilst this might meet immediate capacity needs, given the potential for vessels over 350 metres in length visiting Auckland in the medium-term, this is unlikely to be sufficient to meet the long-term task.

The Central Wharves Strategy is yet to be completed, but it is suggested that there are only four options to provide sufficient berth length for upper end cruise vessels at Auckland which are as follows:

- Extend the length of Queens Wharf to provide sufficient berthage to its East. This would likely require relocation of general cargo ships from Captain Cook Wharf to provide sufficient beam clearance.
- Extend the length of Captain Cook Wharf to provide sufficient berthage to its west. This would also limit the eastern Queen's Wharf berth to smaller beam vessels and would still not provide sufficient clearance to allow bunker vessels to attend them.
- Extend the length of Captain Cook Wharf to provide sufficient berth length to its east. This would likely require relocation of general cargo from Captain Cook and assumes the removal of Marsden Wharf. This might also limit the western Bledisloe Wharf berth to smaller beam vessels.
- Utilise the Bledisloe west berth line to accommodate the largest cruise ships (assuming the removal of Marsden Wharf).

All these options assume the continued utilisation of Princes Wharf for medium size cruise vessels when required.

The extension (and thinning) of Captain Cook as discussed earlier, could provide a large cruise berth as well as accommodate PCC vessels to the east. Depending on how much Captain Cook is thinned, there is potential to berth another cruise ship adjacent at Queen's Wharf east and another on the other side of Queen's Wharf.

The basis for this is as follows:

- New 350 metre cruise berth at the extended western Captain Cook berth (capable of taking the upper end fleet vessel potentially).
- An extended Queens Wharf (symmetrical with Princes Wharf) provides berthing for cruise ships on both east and west sides (i.e. one cruise vessel berthed at Captain Cook West and another at Queens Wharf East. With an approximate 103 metre width, this would mean that two of the largest vessels could not berth simultaneously at Queens Wharf East and Captain Cook West (42 metre cruise beam). However, if Captain Cook was narrowed by 31 metres, this would mean that two of the largest vessels could possibly be berthed here without the need to accommodate them elsewhere (subject to detailed analysis and confirmation from the harbour pilots). Although this might seem like substantial work, the potential effects on the Auckland waterfront and capacity in the area could be substantial.
- Queens Wharf West, Princes Wharf East and Princes Wharf West can all still be used to berth cruise vessels of varying sizes.

The proposal to orientate the proposed new ferry terminal along the length of Queens Wharf West limits the potential to use the western berth line for smaller cruise vessels and also makes the maneuvering of ferries difficult if a cruise ship is berthed at Princes Wharf. We suggest that this should be reconsidered to position the ferries parallel to Quay Street.

In the longer term, Wynyard Point could potentially be used for large cruise ships. This is discussed below under the liquid bulk section.

8.4.3 Capacity of existing ports

One important factor in our option analysis is to assess if existing North Island ports could handle any of POAL's excess trade task if necessary. Northport and Port of Tauranga are considered to be the most viable options for taking on some of Auckland's long-term trade task for the purpose of Port Future Study. This is due to their locality and their currently services freight types, which generally match those at Auckland. It is important to note that should either of these ports accommodate any of Auckland's trade tasks in the future, they will do so in addition to their own growing tasks.

Based on discussions with Port of Tauranga and Northport, as well as initial high-level desktop research we have assumed that the total capacity of both these existing ports will not be able to cope with accommodating Ports of Auckland's long-term trade task in addition to their own.

Having said this, there is potential for both Tauranga and Northport to accommodate some of Auckland's freight over the short to medium-term, and may well form part of an overall solution.

In order to determine the existing ports' ability to cope with any excess trade task in addition to their own, we have employed the following assumptions:

- Both existing ports will have their own regions to serve with their own growing freight tasks.
- As a result of growing regional freight needs, there will be a limit to how much of POAL's excess trade task they can take.
- Both existing ports will have their own constraints in terms of how much expansion or additional berth space they can construct.
- There will be an associated cost for upgrades to infrastructure networks to and from these existing port sites.
- There will also be additional costs of handling the freight given the distances of each from Auckland.

It should be noted that substantive trade forecasts have only been completed for Ports of Auckland as part of this Port Future Study. The following sections provide some high-level analysis of trade forecasts and capacity at Northport and Port of Tauranga.

This analysis provides an indicative view of the potential for these ports to accommodate POAL's excess trade task in the medium-term and long-term.

8.4.3.1 Port of Tauranga

Currently, the Port of Tauranga terminal covers an area of 44.58 hectares and in 2015 it handled 851,106 TEU, resulting in a yard productivity of 19,091 TEU/ha/p.a. using manual straddle technology. An additional 31.4ha of land is available for expansion at Sulphur Point which would result in a total terminal size of 76 hectares.

Using the performance metric of their current technology, the expansion at Sulphur Point would allow Port of Tauranga to potentially accommodate 1.45 million TEU.

Similar to POAL, Port of Tauranga could invest in new yard technology to promote increased efficiency and yard productivity. The table below outlines the productivity that could theoretically be achieved by implementing different technologies on their current and expanded footprints in the medium-term and long-term.

Table 41: Port of Tauranga capacity scenarios

	Current Footprint	Expanded Footprint
Straddle (current)	0.85 million TEU	1.45 million TEU
RTG	1.78 million TEU	3 million TEU
ASC	2 million TEU	3.4 million TEU

These high level numbers are based on the same expected terminal productivity rates used to assess Auckland's ultimate capacity outlined earlier in this section.

Based on a 3% growth rate, Port of Tauranga's container task is expected to be 2.1 million TEU by 2046 (the medium-term) with an anticipated maximum capacity of 3.4 million TEU. This is on the basis of a full upgrade to an ASC terminal system (note that the rate used for an RTG system is similar to that suggested for autostrads).

Therefore, in the medium-term, there would be a maximum of 1.3 million TEU spare capacity at Port of Tauranga to accommodate POAL containers if it adopted the ASC system.

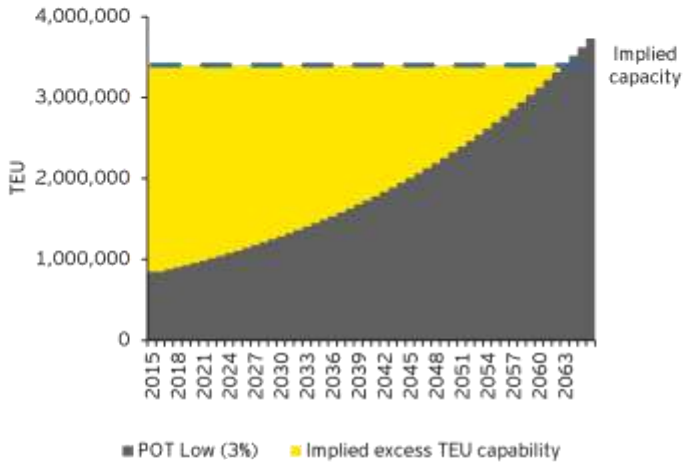
As a leading edge terminal technology, adaption to an ASC system would come with considerable capital cost.

However, Port of Tauranga will be unlikely to have sufficient berth capacity to handle additional trade that is repositioned from Auckland, even in the medium-term. Even if the existing berth line at Sulphur Point was doubled in length to the south, this would still struggle to cope and would require likely unachievable productivity rates.

Based on a 3% growth rate, by 2066 (the long-term), Port of Tauranga's container task is expected to be 3.8 million TEU which could mean that POAL would be facing its own capacity issues then. If this were the case, Port of Tauranga would be unable to accommodate any of Auckland's trade task and this would be made worse by expected chronic berth capacity by then.

Figure 67 below for estimated implied capability to take excess container trade based on high range of expanded footprint:

Figure 67: Port of Tauranga TEU forecast trade implied capacity and excess capability



8.4.3.2 Northport

Northport is effectively designed as a general cargo port. As such, it is potentially well suited to taking some of Auckland's task and they have expressed an interest in doing so.

In particular, there is some potential for Northport to take at least some of the automotive trade from Auckland.

In terms of its capacity to do so on its existing footprint, it is unlikely to be suitable. The terminal yard is already heavily utilised for logs, although there is some potential for rationalisation. A bigger constraint though is its existing berth length. At 570 metres, it would struggle to accommodate any PCTC vessels, for instance, without serious disruption to log carrying vessels.

However, Northport have prepared a master plan which includes considerable expansion. Although it may be possible for Northport to accommodate the automotive trade from Auckland, it would require considerable investment in implementing the plan. Furthermore, it is thought unlikely that Northport could accommodate Auckland's entire break-bulk and bulk trade Auckland in addition to the automotive task and its own growing trade.

Relocating multi-cargo to Northport would have a considerable impact on the supply chain for these goods, most of which would have to be transported back to the Auckland region and further south. The related transport infrastructure pressures and loss of economic activity to the Auckland region would also need to be considered.

8.5 Capacity conclusions

8.5.2 Short-term

There is potential for Ports of Auckland to manage a 2 million TEU container task on its existing footprint; however, this would require POAL to operate at production levels normally associated with the largest ports in the world.

Given the reliance on automation technology to achieve this, significant capital investment would be required and we feel that there is potential for a need for more land to accommodate containers. It is possible that this could be achieved without reclamation, but would require the full use of the Freyberg terminal in the short-term.

Multi-cargo capacity at POAL is already critical, both in terms of land space and berth availability. If POAL is to manage even the short-term task, it will require additional berth length and additional footprint.

We have identified potential to achieve this without the need for reclamation or extending the Bledisloe berths into the harbour.

To ensure sufficient yard space, vertical car parking would be required and possibly a relocation of stored cars to an offsite location. The alternative to this would be relocation of general cargo trade, at least in part, to another port.

To accommodate the growing cruise task, an urgent decision is required for the central wharves. This needs to be considered alongside the general cargo strategy. As an interim short-term measure, it may be possible to increase the length of Queens Wharf East using a dolphin[129] to accommodate the current largest ship. We suggest that this will not suffice for long as cruise visitation increases, and three dedicated berths are required to meet short-term trade.

Our proposed alternative of an extended Captain Cook would provide two working berths for large cruise ships, one at Captain Cook West and one at Queens Wharf East (assuming Queens Wharf East is extended as mentioned above).

8.5.3 Medium-term

Whilst POAL have suggested that the port could accommodate 3 million TEU on its current footprint, we feel that this would be challenging.

The capital expenditure required to implement a full ASC yard system would be considerable and a cost/benefit analysis is required. Even using an ASC system, we believe that a requirement for at least minor land reclamation would emerge.

Capacity at the general cargo wharves in the medium-term will be a function of decisions made in the short-term. In other words, using our proposed alternative would go some way to accommodating the medium-term task. On the other hand, POAL's proposal for berth extensions also appears to work from a capacity perspective. The alternative would be a relocation of general cargo to another existing port.

If cruise shipping increases at the upper end of medium-term forecasts, then it's likely that the three dedicated berths suggested for the short-term will be insufficient and one more berth will be required. Most likely, this berth would be required to accommodate vessels up to 360 metres in length.

In our proposed solution, this could be comfortably handled, subject to investment.

8.5.4 Long-term

POAL will not be able to handle the suggested long-term container task without significant land reclamation and creation of additional berth length. The land reclamation required at Fergusson would be between 50% and 150% of the current terminal size and a minimum berth length extension of approximately 470 metres.

The required Bledisloe footprint at the port in the long-term is likely to be double its current size if vertical car parking wasn't built. Even with this, based on growth projections, the facility is expected to struggle to meet the long-term task. Berth length to handle general cargo is also expected to struggle, even if current proposed plans are put in place.

It may be the case that multi-cargo is relocated entirely to another port by this stage. If this did occur, it may be possible for the port to continue serving container trade in the long-term, utilising all terminals for containers, but sizeable berth extensions into the harbour at both Fergusson and Bledisloe would still possibly be required. It is equally possible that general cargo is split up and cars move to Northport for instance, but there will be a logistical and industry cost implication if this did occur.

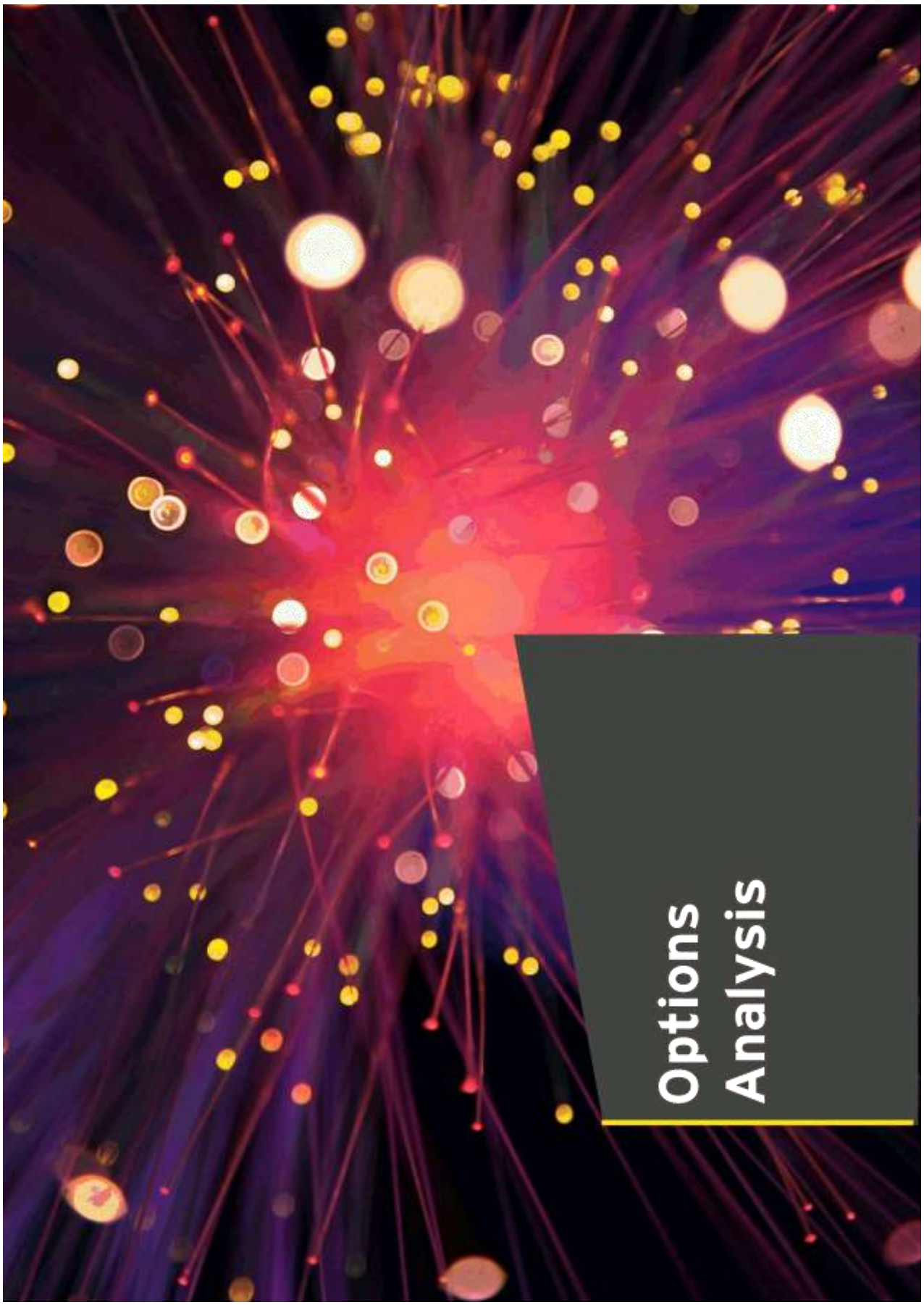
If multi-cargo did not relocate, it is estimated that a total of between 30 hectares and 80 hectares of land reclamation, and at least 650 metre of additional total berth length would be required at the port in the long-term.

In the future, it is expected that the central wharves will have become dedicated to cruise and waterfront related activity, and providing that four to five dedicated berths are in place, it is thought likely that this would be sufficient to meet the long-term cruise task. This may well include the use of Wynyard Point for a large cruise berth that could accommodate 360 metre vessels and above with only relatively minor upgrade works to the existing liquid bulk berth line.

[129] A dolphin is a standalone structure that extends above the water level and is not connected to shore or pier; they provide a structure to secure to when the ship is greater in length than the berth/pier.

Item 16

Attachment B



9 Options Analysis

The following section analyses each of the five Ports Future Study options outlining whether they meet the capacity requirements for Auckland's long-term trade task.

We have assessed the five port options on this basis because meeting the long-term trade task is an essential part of determining the long-term viability of the port in the future. This also reflects the ability of each of the options to address the issue of capacity that was highlighted through the ILM.

The five options we were asked to consider were:

1. Option 1: Constraining Auckland's port to its current footprint
2. Option 2: Downsize Auckland's port by shifting some of the operations to another location
3. Option 3: Relocating some or all volume or activity of Auckland's port
4. Option 4: Enabling growth of Auckland's port in its current location
5. Option 5: Build a new port in a new location

9.1 Key assumptions

9.1.1 Timing

The following options analysis is based on the timeframes outlined below in Table 42 and any reference to the short-term, medium term and long-term align to these timeframes:

Table 42: The Port Future Study timeframes

Short-term	Medium-term	Long-term
2015 - 2040	2040 - 2065	2065 onwards

9.1.2 Capacity

9.1.2.1 Container capacity

For the purposes of this assessment, we have assumed that in order to maximise the potential capacity of the current footprint, POAL would employ an improved yard technology system and fully utilise Freyberg Terminal for containers. Therefore, all capacity calculations are based on an assumed container terminal size of 43ha. The following technology performance ranges will be applied for container capacity future forecasts.

Table 43: Yard system productivity

Yard System	Productivity	Performance Overview (TEU/ha)	Terminal Size	Resulting Capacity (TEU)
Autostrad	Industry	40,000	43ha	1,720,000
	High	51,200	43ha	2,201,600
ASC	Industry	45,000	43ha	1,935,000
	High	69,700	43ha	2,997,100

9.1.2.2 Vehicle capacity

The following analysis is based on the assumption that the Port's current capacity is 282,620 CEU.

For the purposes of this assessment, we have assumed that increasing the terminal footprint is the key variable in determining future multi-cargo capacity. As such, the following incremental capacity increases will be applied to determine any additional land required:

Table 44: Additional footprint capacity

Additional Footprint	Additional Weekly Capacity (100% Utilisation)	Additional Weekly Capacity (50% Utilisation)	Additional Annual Capacity (50% Utilisation)
1 ha	822 CEU	411 CEU	21,372 CEU (52 weeks operation)

Similarly, vertical infrastructure (car parks) will be assumed to deliver the below capacity increases to multi-cargo:

Table 45: Vertical infrastructure capacity

Additional Land Per Carpark	Additional Weekly Capacity (100% Utilisation)	Additional Weekly Capacity (50% Utilisation)	Additional Annual Capacity (50% Utilisation)
5 ha	4110 CEU	2055 CEU	106,849 CEU (52 weeks operation)

For a detailed summary of how these measures were calculated, please refer to Section 8.4.4.2.

9.1.3 Future trade tasks

A key element of the Port Future Study is to assess Auckland's ability to accommodate increasing demand and trade volumes in the long-term. For the purpose of the Port Future Study, we have used forecast trade volumes to determine when certain capacity limits are predicted to be reached. This approach allows us to determine the point at which demand for berth and land side capacity will exceed supply.

9.1.3.1 Container trade

For the purposes of this assessment, we have applied an extrapolated growth rate of 2.9% per annum for TEU, based on the range of growth rates analysed in Section 7.4.1. This represents the mid-point in the range of growth rates for projected TEU volume growth.

Table 46: Forecasted TEU across the Port Future Study timeframes

Short-term	Medium-term	Long-term
Up to 2 million TEU	2-4 million TEU	4 million+ TEU

9.1.3.2 Multi-cargo trade

The land side capacity requirements for general cargo are more difficult to forecast given the irregular nature of components of general cargo. Vehicles will be used as the main consideration when assessing multi-cargo in this section. For the purposes of this assessment, we have forecasted the long-term vehicle trade task based on a 1.8% growth rate as outlined below.

Table 47: Vehicle Future trade task

Short-term	Medium-term	Long-term
Up to 386,500 vehicles	386,500 - 612,500 vehicles	612,500 vehicles+

9.1.4 Other existing ports

Options 2 and 3 involve the relocation of trade task and operations to another location. For this study, we have only looked at Northport and Port of Tauranga as the other existing port options where the trade task could be relocated. This is mainly due to their relative distance to Auckland compared to other New Zealand ports. It is assumed that any overflow trade task that is still destined for Auckland will now be travelling to Auckland from these new locations, and that distance would be a key factor in determining the feasibility of which port receives this overflow.

The capacity of alternate ports is based on current port development plans and does not speculate any terminal expansion that could be carried out beyond these plans unless specified by the ports. For a detailed breakdown of the capacity calculations for theses ports, please see Section 8.6.

9.2 Other considerations

9.2.1 Bulk liquid

Bulk Liquids is currently serviced from Wynyard Quarter. As the urbanisation and gentrification of Wynyard Quarter has transformed the area in stages to residential, light commercial and public space, it is likely that bulk liquid operations at the Wynyard site will soon be transitioned out. The final bulk liquid lease is due to end in 2026 and many of the other leases are also reaching the end of their terms.

There are two factors to be considered for the bulk liquid industry, namely:

1. Where will the bulk liquid industry relocate to and the requirements for such a move?
2. Whether Wynyard Quarter will have a part to play in accommodating cruise, as a result of the move of bulk liquids?

As the land use changes at Wynyard Quarter, bulk liquids will have to be relocated. Given the capacity constraints at Auckland port, an alternative location outside of Auckland will need to be found. The primary issue with relocation is the distance to and from Auckland, as this will have a flow-on impact on the cost to transport bulk liquids for the industry.

The majority of ship calling at the Port of Auckland is refueling, thus, having a reliable supply of fuel for shipping in Auckland is essential, both for freight and cruise ships. At the moment, refined product is piped from Marsden Point to a terminal at Wiri. The pipeline spans 170km and transports approximately 40% of New Zealand's fuel demand, including diesel, jet fuel and gasoline.

The current berth at Wynyard can accommodate liquid bulk vessels up to 226 metres LOA. If New Zealand changed to a full import regime for fuels, this would result in the visitation of LR1 vessels with approximate size of 80,000 DWT, 228 metres LOA and 13 metre draft. Further still, there is potential for the industry to bring in LR2 vessels with a typical size of 160,000 DWT, 244 metres LOA and 14 metre draft. Either way, the current berths at Wynyard could not accommodate these vessels and there is no capacity at Port of Auckland for them. Although they could theoretically come into a reconfigured Marsden Point import terminal, the clear message from the industry was that the cost effective solution was to build a new port within the vicinity of Auckland.

Representatives from the chemicals, paints and general liquid products industries that we spoke to stated that a location for bulk liquids closer to Auckland was preferable to a move of bulk liquids to the Port of Tauranga or Northport. As the further away the new location is from Auckland, the more unsustainable transport costs to market were. Additionally, all representatives suggested that they would require up to 30 hectares of land to accommodate their combined needs.

Given Port of Tauranga's future trade task and the required area of land for bulk liquids, coupled with the distance from Auckland, it is unlikely that the Port of Tauranga will be the new location for bulk liquids. Although, Marsden Point could theoretically accommodate the entire bulk liquid operation, this is not a preferred location due to its distance from Auckland.

Given the capacity constraints at Auckland port, it is important that further discussions with stakeholders are held to discuss where the bulk liquid industry should be relocated to. The future of bulk liquid, therefore, will be highly dependent on the chosen future port strategy.

9.2.2 Cruise

We have undertaken a broad assessment on cruise and its potential associated future infrastructure requirements. Our findings suggest that under all options considered, cruise is best served in the Auckland CBD[130] due to the following reasons:

- Auckland functions as New Zealand's 'exchange port' for cruise ships,[131] due to the international air links, and hotel capacity for in-between cruise stops.
- Auckland is a considered a well-established cruise hub, with close proximity to tourist attractions and infrastructure.
- The Auckland CBD area is well-served by the retail and hospitality industry, providing visitors with easy access to amenities by foot without having to travel long distances.
- Auckland is an established cruise hub for Oceania and is currently rated highly for its visitor's experience.
- Viable options are being considered by local government agencies including POAL to improve current infrastructure to cater for the future cruise vessels (i.e. increasing berth space to cater for larger vessels).
- The current location is well-established and recognised in the Oceania and South Pacific region.
- Auckland CBD as a growing vibrant destination providing a quality experience for visitors.

[130] Note that the CWG agreed on the 9th March that cruise should remain in the Waitemata Harbour.

[131] Exchange (turnaround) visits - where passengers and crew disembark the vessel having reached their final destination, or embark the vessel for the beginning of their cruise. Auckland is a key exchange point as it use for provisioning the ships (fuel and food) and for crew handover.

Hypothetically, a new cruise terminal could be located outside of the Auckland CBD area, which could provide the following benefits:

- Flow on effects from development of new area to cater specifically for cruise.
- Closer proximity to the airport to cater for exchange hub
- A degree of reduced people congestion in the city
- Moving away from a working port may be more attractive from an operating risk point of view for cruise ships.

Our preliminary assessment suggests these benefits would not outweigh the potential opportunity cost of the loss of economic activity from a change in location (further distance to attractions and infrastructure may mean that tourists when booking cruises are less likely to choose Auckland as a location to stop at in the future). Competition with Sydney and other central city cruise terminals in the Australasia region also means that if cruise was moved away from its central city location, this might mean that Auckland loses its competitive advantage.

Therefore, for the purpose of this assessment, the following options (unless specified) assume that cruise will continue to be serviced from the Auckland CBD.

9.2.3 Summary

Given the above analysis, cruise and liquid bulk will not be considered in the following options analysis. The following analysis will cover the future trade for containers and general cargo only.

9.3 Option 1 – constrain Auckland's port to its current footprint

9.3.1 Overview

Option 1 is the "Do Minimum" option and involves POAL remaining within its current footprint at the existing site in the Waitematā Harbour. Establishing the status quo is a critical part of our approach to understanding the opportunities related to the future of Auckland's port. It provides a benchmark against which all other options can be assessed and compared.

We have defined the "Do Minimum" option as the most realistic scenario for the port in terms of how it would continue to operate in the future within its existing physical parameters. It is important to note that the "Do-Minimum" is not a "Do Nothing" approach. The expectation of the "Do-Minimum" option is that POAL will continue to make investments that will promote improved productivity, and repurpose its current activities, including their location within the footprint, to get the best out of the site.

This footprint, as outlined in Figure 68, includes Fergusson Container Terminal, Freyberg Wharf, Jellicoe Wharf, Bledisloe Wharf, Marsden Wharf and Captain Cook Wharf. Option 1 allows for POAL to increase capacity and efficiency within its current area through technological advances, but does not allow for any expansion or land reclamation other than the areas that have already been consented (See Appendix 14 for further details). This option assumes that all trade types currently serviced (containers, multi-cargo and cruise) will all continue to be serviced at this site for as long as is possible.

9.3.1.1 Containers

There is currently 32 hectares of land allocated to containers at the Fergusson Terminal. POAL's manual straddle terminal system can produce a yard productivity of approximately 28,000 TEU/ha/annum, which is generally in line with expectations based on global manual straddle operations. Both an upgrade of this operating system, and an increase in container terminal area by utilising other existing terminals could increase yard productivity significantly.

Figure 68: Current POAL layout

Source: EY, POAL Annual Reports

As discussed in Section 8.2.3, POAL plan to upgrade their yard handing system initially to an autostrad system, and subsequently to an ASC system to increase productivity over time. As outlined in our assumption, the ports capacity, based on the assumed yard productivity ranges and a 43 hectare footprint, is between 1.7 and 2.7 million TEU/ha/annum for the autostrad system and between 1.9 and 2.9 million TEU/ha/annum for the ASC system.

Given these capacity measures, POAL would be able to meet container demand in the short-term if it could achieve the high yard productivity rate outlined above. If this productivity rate was achieved POAL would be able to meet its container task in the medium-term, but would reach capacity before 2065 and thus not be able to meet the trade task in the long-term.

9.3.1.2 General cargo

There are currently 14.25 hectares of land dedicated to multi-cargo across the Bledisloe, Captain Cook and Marsden Wharves. The capacity of this current footprint, based on our analysis is 282,620 CEU. Under Option 1, POAL cannot expand its foot print and therefore are limited in their approaches to increase multi-cargo capacity.

9.3.2 Short-term

POAL could potentially meet its short-term container task of up to 2 million TEU through investment in a new operating system in conjunction with the 3 hectare consented reclamation at Fergusson Wharf. This scenario is dependent on it achieving yard performance figures for yard systems that are substantially above the present international benchmarks. POAL will not be able to meet its short-term multi-cargo task under Option 1. Given the lack of multi-cargo capacity levers available under this scenario the excess multi-cargo task would need to be accommodated by another port.

9.3.3 Medium-term viability

In the medium-term, POAL is unlikely to be able to meet its increasing container trade task if constrained to its current footprint. This potential capacity constraint could lead to some of Auckland's trade task needing to be relocated to another North Island port. POAL's multi-cargo task would not be able to be met in the medium-term.

9.3.4 Long-term viability

The long-term container or multi-cargo tasks would not be able to be met if the port is constrained to its current footprint. The inability to meet its long-term trade task may have a material impact on the Auckland and wider New Zealand economy due to limited capacity across all New Zealand ports and having to transport the freight task across the longer distances will also result in increased supply chain costs.

9.3.5 Summary and next steps

This option should be advanced to the CBA: Option 1 is not viable in the even in the short-term as it does not meet the capacity requirements associated with the predicted future trade task. Despite this, Option 1 represents the status quo or the "Do-Minimum" scenario and is included in the CBA as the base case against which other options will be benchmarked and compared against.

9.4 Option 2 - downsize Auckland's port by shifting operations to another location

9.4.1 Overview

Option 2 would involve downsizing the POAL footprint to make areas of current port land available for alternative use. Downsizing the ports footprint would be achieved by some trade task being relocated to other New Zealand ports.

Figure 69: Options for downsizing

There are two potential options for downsizing the port, both of which would keep port operations for individual trade types connected. The two options are, as illustrated in Figure 69 above:

a. Downsize from the western boundary - Captain Cook, Marsden and Bledisloe are made available for alternative use over time; or

b. Downsize from the eastern Boundary - Fergusson is made available for alternative use.

The Eastern and Western sides of POAL have different purposes, as shown in Figure 70, and as such, the implications of downsizing would be different for each option. Downsizing from the centre of POAL is not considered to be a viable option as it would segregate port activities and result in operational inefficiencies.

Figure 70: Types of cargo by terminal (note that all of Freyberg would be configured for containers in POAL's long-term plan)

For the purposes of this assessment, relocation of trade types within the current POAL footprint, for example, moving container operations to Bledisloe Wharf or moving multi-cargo to the Fergusson Container terminal is not being considered. This is due to the fact that enduring capacity constraints remain and the associated costs of repurposing land is substantial.

9.4.1.1 Downsizing from the western boundary

Scenario A: Captain Cook, Marsden and Bledisloe Wharves are made available for alternative use over time

Downsizing from the western boundary builds on Auckland Council's existing Central Wharves Strategy,[132] which recommended:

- Marsden Wharf and Captain Cook Wharf to be made available for alternative use
- Captain Cook Wharf become a cruise terminal
- Queens Wharf transition to become public space
- Marsden Wharf to be removed creating increased berthing capacity at Bledisloe and Captain Cook wharves.

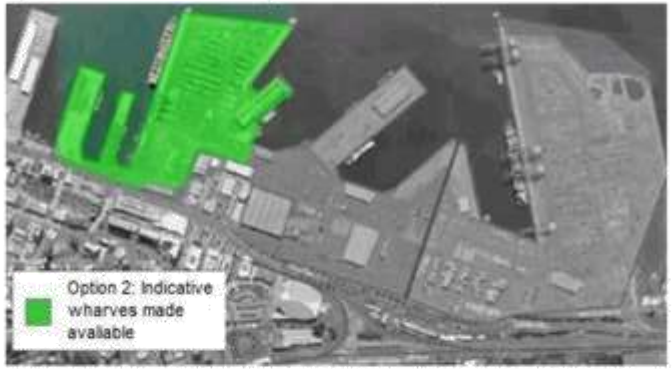
[132] Agenda and minutes of Auckland Development Committee, 12 February 2015.

Historically, gentrification of the Auckland waterfront has developed from the western side, including Wynyard Quarter, the Viaduct and Queens Wharf. Figure 71 provides an indicative view of this downsizing option (although determining final boundaries will require further analysis).

It is likely that if Bledisloe is made available for alternative use, both Captain Cook and Marsden Wharves would also be made available in order to prevent segregation of both public and port activities. This scenario assumes that if the Central Wharves Strategy were progressed Captain Cook and Marsden Wharves would be the first areas made available for alternative use in the short-term. Bledisloe would be the next area made available but this would likely not take effect until the medium-term.

Bledisloe Wharf covers a large area and hence has significant development potential. Further analysis of land value and its implications are discussed in more detail in the later CBA section.

Figure 71: Indicative view of downsizing from western boundary



Source: EY, 2017

9.4.1.2 Scenario discussion

Assuming Captain Cook and Marsden are made available in the short-term, POAL's general cargo terminal would be reduced to the 10.25 hectares at Bledisloe. This would put POAL under immediate capacity pressure to handle multi-cargo as the calculated terminal capacity of Bledisloe is less than the current trade task. In order to address this capacity issue, POAL could develop vertical infrastructure, or relocate the excess trade to another port.

As outlined in Section 8.4.4.2, the development of a five story carpark covering one hectare could increase Bledisloe's capacity by 106,849 CEU to approximately 389,479 CEU per annum. Under this scenario, the Port would have capacity up until the medium-term. Given that Bledisloe would be disestablished in the medium=term the feasibility of this would need to be further investigated.

Moving into the medium-term, the loss of Bledisloe would mean that general cargo would need to be relocated to another port or alternate location. In this case, POAL's excess multi-cargo trade would need to be relocated to another port.

In that case, POAL would exist as a container facility only, constrained to the Fergusson Container Terminal and Freyberg Terminal and limited in capacity to approximately between 2 - 3 million TEU. In isolation and constrained to its current footprint, Fergusson would struggle to meet the medium and long-term container tasks.

Berth space would also be an issue at Fergusson due to POAL's inability to extend into the harbour under this scenario. Without extending the berths at Fergusson, the port would likely not be able to accommodate the long-term container fleet.

9.4.1.3 Downsizing from the eastern boundary

Scenario B: Fergusson Wharf is made available for alternate use

Downsizing from the Eastern boundary would see Fergusson made available for further use. Figure 72 on the following page provides an indicative view of this downsizing option (although determining final boundaries will require further analysis):

Figure 72: Indicative view of downsizing from eastern boundary

Source: EY, 2016

9.4.1.4 Scenario discussion

It is anticipated that there would be less demand for the land at Fergusson as it is isolated from the natural clustering of waterfront public land to the west of the port, and the CBD. Therefore, as a scenario for downsizing, it is likely to be less appealing than the western boundary reclamation.

Under this scenario, as with Option 1, POAL would not be able to meet its full short-term multi-cargo trade task on Bledisloe, Captain Cook and Marsden Wharves with its current capacity. In order to accommodate this task, capacity would need to be increased through levers such as vertical infrastructure.

In addition, making Fergusson available for alternative use would mean that containers need to be relocated to another New Zealand port or alternate location. Under this scenario, making the land at Fergusson available for alternate use would effectively mean the end of container handling by POAL, leaving it with just general cargo and cruise. The loss of this trade type may have significant revenue implications for POAL, and a flow-on economic cost to Auckland as a whole.

9.4.1.5 Downsizing scenario summary

In both of the above scenarios, POAL would need to give up at least one trade type in order to make land available for alternate use. Both downsizing options will require the relocation of at least one trade type to another port.

For the basis of the following analysis we have assumed that Scenario A would be the downsizing option pursued.

9.4.2 Short-term viability

✓

Assuming that only Marsden and Captain Cook are handed over in the short-term, POAL would be able to handle its short-term task to some extent, but will become heavily pressured in terms of its automotive storage capacity, likely resulting in the short-term need for vertical storage capability at Bledisloe. The ability of POAL to handle a 2 million TEU container is dependent on the implementation of a new yard system and higher than expected productivity levels.

9.4.3 Medium-term viability

X

In the medium-term, POAL would not be able to meet its multi-cargo or container task if Captain Cook, Marsden and Bledisloe were made available for alternate use. This scenario would require all multi-cargo trade to be relocated to another port. It is possible that Northport could handle some of Auckland's medium-term general cargo trade task including automotive, notwithstanding potential constraints due to its location, well away from the primary markets in the Auckland vicinity.

9.4.4 Long-term viability

X

Downsizing would not be a viable option in the long-term. The excess multi-cargo trade would not be able to be met by Northport or Port of Tauranga. In addition, POAL would not be able to meet a projected 4 million TEU long-term container trade task if constrained to either Fergusson or Bledisloe and as discussed previously, Port of Tauranga does not have the capacity to accommodate the excess long-term container task.

9.4.5 Conclusion

This option was not advanced to the CBA: Downsizing would result in POAL's capacity being reduced and would require its multi-cargo trade task, or container task to be relocated to another location. The long-term trade task could not be met under this option due to potential long-term capacity constraints at both Northport and Port of Tauranga which mean they could not handle both their own growth and the excess POAL task. As this is unlikely to be a viable option in the long-term it did not progress to the CBA phase.

9.5 Option 3 – relocate some or all volume/activity of Auckland's port

9.5.1 Overview

Option 3 involves POAL remaining within its current footprint in the Waitematā Harbour and relocating volume/activity to other New Zealand ports when it reaches capacity triggers at this site. This option will be assessed in terms of the feasibility of relocating some or all of POAL's trade types. As outlined in our assumptions, Northport and Port of Tauranga are the only ports considered to be viable alternatives to accommodate some of POAL's excess multi-cargo and containers.

9.5.1.1 Containers

In terms of containers, as discussed in Section 8.6, Port of Tauranga will have less capacity to accommodate POAL's excess trade task as its own trade task grows. Table 48 and Table 49 outline the medium and long-term combined container capacity of the port and Port of Tauranga, based on the assumption that POAL's capacity is 2 million TEU. In this scenario, Port of Tauranga is expected to have the capacity to accommodate POAL's excess container task for most of the medium-term but would not have sufficient capacity to take on the excess volume in a long-term 4 million+ TEU scenario.

Table 48: Medium-term (2052) combined capacity (TEU)

	Port of Tauranga	Ports of Auckland	Total
Capacity	3.4 million	2.0 million	5.4 million
Container Task	2.5 million	2.8 million	5.3 million
Shortfall	**0.9 million**	**(0.8 million)**	**0.1 million**

Table 49: Long-term (2065) combined capacity (TEU)

	Port of Tauranga	Ports of Auckland	Total
Capacity	3.4 million	2.0 million	5.4 million
Container Task	3.7 million	4.0 million	7.7 million
Difference	**(0.3) million**	**(2.0) million**	**(2.3) million**

It is important to note, that even under a scenario where POAL is able to meet a 3 million TEU capacity there would still be a 1 million TEU shortfall that would not be able to be met by Port of Tauranga in the long-term.

9.5.1.2 Multi-cargo

It is a possibility that POAL could relocate some of its multi-cargo trade to Northport. As discussed in the Section 8.6, Northport has expressed interest in taking on some of Auckland's automotive trade task if required. Further analysis would be required to determine how much of Auckland's excess task it could accommodate.

9.5.2 Short-term viability ✓

Relocating POAL's container and/or multi-cargo trade to other New Zealand ports could be a viable option in the short-term. It may not be necessary though if, in line with Option 1, POAL invests in a new operating system and achieves yard performance figures substantially above the present international benchmarks.

9.5.3 Medium-term viability ✓

Relocating some of POAL's trade activity is a viable option throughout part of the medium-term. Port of Tauranga is expected to be able to accommodate POAL's excess container trade until at least 2052. However, it is expected that soon after this, the combined capacity of the two ports will not be enough to accommodate the expected container trade tasks for both regions.

9.5.4 Long-term viability X

Relocating POAL's excess trade task is not a viable long-term option as it is not expected that Port of Tauranga and Northport would have the capacity to accommodate POAL's excess container and general cargo tasks.

9.5.5 Summary

This option is not advanced to the CBA: This option will not proceed to the CBA phase as POAL's long-term trade task is not expected to be met under this scenario. However, it should be noted that utilisation of both Port of Tauranga and Northport could form part of a short to medium-term strategy for other options.

9.6 Option 4 – enable growth of Auckland's port in its current location

9.6.1 Overview

Option 4 involves POAL expanding its footprint in the Waitematā Harbour in order to accommodate growing trade volumes over the medium and long-term. The level of expansion required to meet the long-term trade task is dependent on the productivity of the land and berths (i.e. the technology being utilised and the operating regime).

9.6.1.1 Containers

As discussed in Option 1, for containers it is most likely that POAL will adopt an autostrad system in the short to medium-term and an ASC system in the long-term. When considering the amount of additional land required to accommodate POAL's trade task over time, there is a significant variance depending on whether a low or high yard performance figure is adopted.

As outlined in the assumptions, the autostrad yard system is expected to generate productivity of between 40,000 (low) and 51,200 (high) TEU/ha/annum. The ASC system is expected to generate yard productivity of between 45,000 (low) and 69,700 (high) TEU/ha/annum. Following this, Table 50 illustrates the estimated additional future land requirements over time:

Table 50: POAL additional land reclamation requirements

	Trade Task (TEU)	Required Terminal Area		Additional Land Needed
Short-term Auto Strad on 43ha	2 million	Low	50 ha	7 ha
		High	31 ha	0 ha
Medium-term Mid-point 2052 Auto Strad on 43ha	2.8 million	Low	70 ha	27 ha
		High	43 ha	0 ha
Long-term ASC system on 43ha	4 million	Low	89 ha	46 ha
		High	57 ha	14 ha

In terms of determining container berth capacity, it is assumed that POAL's berth productivity figures were in the range of 2,100 TEU/month.

This is well above industry benchmarks, with a global average of around 1,000 TEU/month. It should be noted that POAL is already performing well on this metric at approximately 1,450 TEU/month. If this option is pursued, it is possible that an additional berth could be constructed increasing the total number of berths to six.

9.6.1.2 Multi-cargo

Based on our assumptions, we consider POAL's current capacity to be approximately 282,620 CEU, and as such it is expected to start facing capacity constraints in the short-term. In order to increase the multi-cargo terminal capacity under Option 4, POAL can increase the terminal footprint. POAL's main levers for doing this are through reclamation and building vertical infrastructure. In Section 8.4.1 we presented a methodology for calculating the effect of additional land on this capacity and determined based on the assumption that 1 ha of additional footprint would increase the terminal capacity by 21,372 CEU to approximately 303,992 CEU.

We have used the above to assess the additional footprint required in the short, medium and long-term to meet ports trade task.

Table 51: Implied additional land requirements

	Trade Task (CEU)	Required Terminal Area	Additional Land Needed
Short-term	386,500	103,880 ha	4.9 ha
Medium-term Midpoint 2052	482,138	199,518 ha	9.3 ha
Long-term	612,500	329,880 ha	15.4 ha

9.6.2 Short-term viability

POAL would be able to meet its short-term container trade task without needing to expand its current container terminal footprint if yard technology is upgraded and POAL achieves yard performance figures substantially above the present international benchmarks. In the case that yard performance is not achieved, up to 7 hectares of additional land could be needed. To meet the short-term multi-cargo task, the Port would need to expand its footprint by 4.9 hectares.

This could be addressed through building a carpark which would result in no short-term reclamation being required.

9.6.3 Medium-term viability

POAL would be required to expand its current footprint in the medium-term under both high and low ASC performance expectations. The table above shows the mid-point in the medium-term period, at which point, low performance expectations would require a 27 hectare expansion, and high performance would be at total capacity.

In order to meet the medium-term multi-cargo task it is expected that over 9 hectares of additional terminal footprint would be required (based on the medium-term mid-point). As in the short-term, this could all or partially be vertical infrastructure. Further analysis would be required to determine the optimal layout. Expansion of the ports footprint would therefore be required past this point up until the long-term.

Overall, in the medium-term up to 36 hectares of additional footprint could be required to meet the container and multi-cargo trade tasks.

9.6.4 Long-term viability

In order to meet the long-term container task, POAL could be required to expand its current footprint by between 14 and 46 hectares. It is estimated that although still heavily under pressure at the berth, the terminal could potentially create enough new berth line under the 46 hectares expansion scenario to manage berth capacity pressures. This might not be the case, however, if adopting the high productivity figures which result in less expansion and therefore create less potential for extended berth lengths.

In order to meet the multi-cargo long-term task it is estimated that 15 hectares of additional land would be required. Overall, this means that up to 61 hectares additional land could be required to meet the Port's long-term task.

9.6.5 Summary

This option was advanced to the CBA: This option could theoretically meet long-term trade task with significant expansion of the ports footprint, which would create capacity and potentially berth length. Therefore, Option 4 is progressed to the CBA stage.

9.7 Option 5 – build a new port in a new location

9.7.1 Overview

As per the scope of this study, Option 5 is defined as a port being built in a new location to accommodate the long-term trade task. This option assumes that all port activity (with the exception for cruise, as discussed in Section 9.2.2) will be moved from the current Waitematā Harbour location to a new location over a period of time.

In order to determine new locations that had the ability to handle the long-term trade task, we adopted the process outlined below:

- **Step 1:** Identify potential new port sites (this involved looking at existing port sites, previous port location study sites and identifying new port sites).
- **Step 2:** Assess the sites against basic initial physical viability criteria. The physical viability rating was based only on the sites broad ability to potentially support a port or expansion and did not consider cultural, environmental or economic factors.
- **Step 3:** Develop a short-list of locations based on the physical viability criteria assessment to progress to the MCA phase.
- **Step 4:** Assess short-list against the MCA which includes the consideration of economic, environmental, social and cultural factors.
- **Step 5:** Based on the findings and conclusions of the MCA, develop a short-list of the top potential areas for a new port site to be assessed as part of the CBA.

Figure 73 and Figure 74 below show the overall process for identifying the potential new port sites for Option 5:

Figure 73: Assessment process for potential new sites

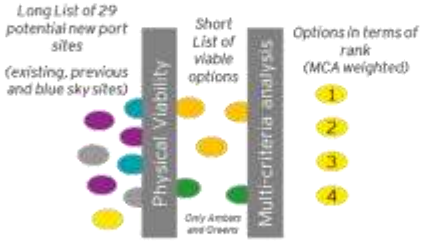
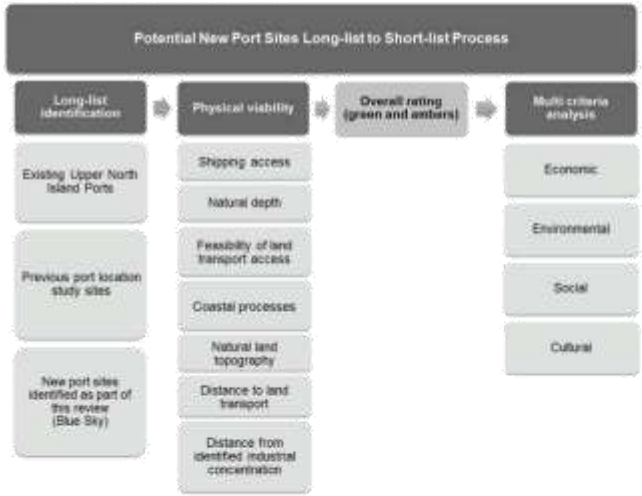


Figure 74: Process for arriving at short-list



9.7.1.1 Step 1: Identifying potential new port sites

Previous studies have considered potential new locations for a port. These generally considered the geographic location, coastal geography, surrounding ecology, hydrology and environmental impacts of potential port development at various sites, at a reasonably high level. As part of the evaluation of Option 5 it was prudent to reassess the findings of previous studies to see whether they are still relevant. The studies we have looked at are as follows:

- Development Plan for Auckland Report, POAL, 1989
- Port development options for the Auckland Region, POAL, June 1999
- Statement of Evidence of Stephen John Priestley for POAL, Hearing on the Proposed Auckland Unitary Plan, 2014

In addition to the sites already identified, we undertook a 'blue sky' approach to identifying additional new potential port sites Figure 75 presents a map of all the sites identified and assessed as part of this Port Future Study.

Whilst some of the long-list options might seem unworkable from certain perspectives, it was an important step in this study to ensure that all theoretical options were uncovered and reviewed.

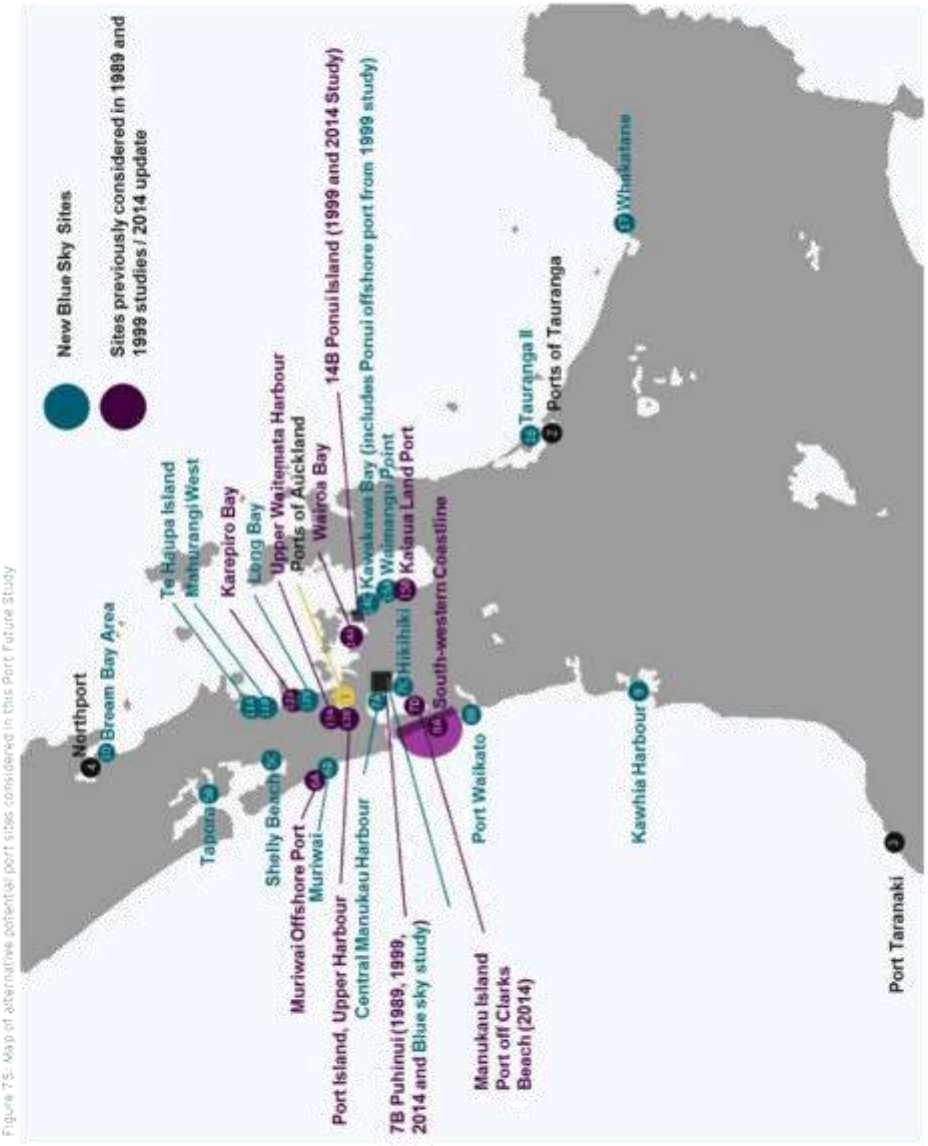


Figure 75: Map of alternative potential port sites considered in this Port Future Study

9.7.1.2 Step 2: Physical viability assessment

The next step was to provide an initial screening of each of the sites identified. This was to ensure that a more thorough and detailed assessment could be conducted on sites that offered greater potential, and fundamentally flawed options could be discounted and removed early.

The longlist of potential sites were rated against a number of theoretical physical viability criteria following the process outlined below in Figure 76 relating to whether they could potentially support a port, and handle future expansion or growth. The following factors were included in this assessment:

- Theoretical spatial potential for shipping access
- Natural water depth
- Coastal processes
- Natural land topography
- Distance from existing primary land transport
- Feasibility of land transport access
- Distance from identified industrial concentration.

Figure 76: Process for assessing physical viability

More detail on the assessment process and criteria can be found in Appendix 15. Each site was then given an overall rating based on an assessment of each of the physical viability criteria. The rating definitions were defined as in Figure 77 below:

Figure 77: Rating assessment for physical viability

	Explanation of Assessment		
Physical viability	Green	Amber	Red
Overall rating	Proceed	Investigate further	Stop

9.7.1.3 Step 3: Physical viability criteria findings

Locations that were rated as red overall were discounted and removed from the long-list.

A red rating overall was assigned due to the following reasons:

- Poor transport access, requiring complex upgrades or connections
- Poor natural depth that would require significant dredging
- Poor shipping access where a challenging coastal environment would make shipping potentially difficult
- Long distances from industrial concentration.

Table 52 on the following page presents a summary of the red rated sites. A detailed summary of the reasons that certain locations received a red rating can be found in Appendix 16.

Table 52: Physical viability - red rated sites

#	Site	Physical Viability							Overall Status
		Shipping access	Depth	Coastal processes	Natural land topography	Land transport	Land access	Distance	
3	Port Taranaki	R	A	A	R	G	A	R	R
5B	Tapora, Kaipara Harbour	A	A	R	A	R	A	R	R
5C	Shelly Beach, Kaipara Harbour	A	A	R	A	R	A	A	R
7D	Manukau Island Port, Clarks Beach	A	R	A	A	A	A	A	R
8B	Port Waikato, West Coast	A	R	R	R	A	A	A	R
9	Kawhia Harbour , West Coast	R	R	R	R	R	R	R	R
11A	Te Haupa Island, Mahurangi	A	G	A	R	R	A	A	R
12A	Karepiro Bay (North-eastern Coastline)	R	R	R	R	A	R	A	R
13A	Upper Harbour: Port Island	R	R	A	A	A	A	A	R
13B	Upper Waitemata Harbour	R	A	A	A	A	A	A	R
14A	Wairoa Bay (Central Eastern Coastline)	R	R	A	G	A	A	A	R
14B	Ponui Island Port (1999 and 2014)	G	A	A	R	R	A	A	R
17	Whakatane, Whakatane	G	G	A	R	R	R	R	R

Table 53: Physical viability - green and amber rated sites

#	Site	Physical Viability							Overall Status
		Shipping access	Depth	Coastal processes	Natural land topography	Land transport	Land access	Distance	
1	Ports of Auckland	G	A	A	R	G	A	G	G
2	Ports of Tauranga	A	A	A	A	G	A	R	A
4	Northport	A	A	G	A	A	A	R	A
6A	Muriwai Offshore Port (North-western Coastline)	A	A	A	R	A	R	A	A
6B	Muriwai, North West Coast	A	A	R	R	G	A	A	A
7A	Central Manukau Harbour	A	A	A	G	A	A	G	A
7B	Manukau Harbour: Puhinui (1989,1999, 2014, blue sky)	A	R	A	G	G	G	G	A
7C	Hikihiki, Manukau Harbour	A	A	A	G	A	A	G	A
10	Bream Bay area, Whangarei	G	G	A	A	A	A	R	A
11B	Mahurangi West, Mahurangi	G	A	A	A	A	A	A	A
12B	Long Bay, Long Bay	G	A	A	G	A	R	A	A

Locations that received amber and green statuses generally exhibited the following characteristics:

- Good natural depth without having to undertake significant amounts of dredging
- Good shipping access in terms of navigable feasibility and shipping alignment
- Good to average distance from transport connections
- Good to average distance to industrial concentration.

Table 53 presents a summary of the green and amber rated sites. A detailed summary of the reasons individual sites received amber and green ratings can be found in Appendix 17.

9.7.1.4 Step 4: Multi criteria analysis

The MCA was a significant milestone in the Port Future Study. It provided a key collaborative process to reduce a wide range of options, to a smaller number of options for more detailed assessment. The below is a summary of the MCA process and assessment outcomes.

The MCA assessment criteria were developed in conjunction with the CWG. The primary aim of the MCA was to assess potential options against a set of consistent criteria in order to determine optimal outcomes. The criteria of the MCA incorporate a diverse range of assessment criteria that is directly addresses the problems derived from the ILM as defined in the Case for Change section. Criteria was extensively developed and updated in collaboration with the CWG. The criteria considered covered the areas detailed below.

1. **Physical/ Operating Capacity:** Ensuring that any port option can handle future trade task is vital for Auckland to capitalise on potential growth. Ensuring physical capacity and ability to accommodate future port operations is critical. This criterion includes any geographical constraints, ability to accommodate future vessels, shipping access and navigable feasibility.
2. **Economic/Cost:** The broad economic implications including capital expenditure requirements, and cost implications to the consumer and supply chain. The criterion has a relatively small focus in the MCA; this is due to the further detailed analysis to avoid double counting of the assessment to be conducted in the CBA.
3. **Social:** This criterion examines Auckland's aspirations to be the world's most liveable city. The criteria have been developed to move towards Auckland's aspirations including waterfront and land connectivity, achieving best use of land, wider freight and transport implications, recreational use of areas and attractiveness of Auckland for residents.
4. **Cultural:** This criterion assesses the potential impact to mana whenua iwi and iwi values. If a new port location is considered, it is vital to understand high level implications on the particular sites.
5. **Environmental:** The port activities have environmental impacts, this criterion provides guidance on potential impacts to the environment, including noise and light, coastal processes, marine/biological impacts.

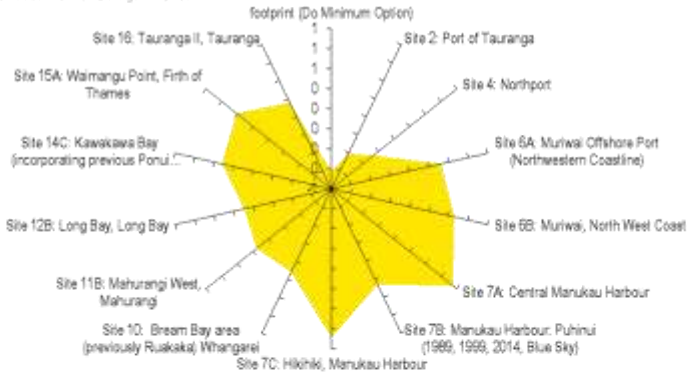
Each criteria was assigned a score from 2 to -2, depending on the scale in which they scored. The scores are based on a scale system, with more positive impacts scoring 2, neutral impacts a 0, and greater negative impacts scoring a 2.

The weighting of the each criteria was developed in conjunction with the CWG. These weightings were also cross checked and developed with the ILM findings initially established from the ILM workshops with the CWG. This provided a basis to ensure that the MCA weightings align with the weighting of the problems identified in the ILM workshop. The definitions of each score, their weighting and the scale of assessment can be found in Appendix 9.

Each existing and potential new port site was assessed against the MCA criteria scale and assigned a score. The weightings for each MCA criteria were then applied also to each score. The scores were then aggregated and sites were ranked based on the overall weighted scores they received, from highest score to lowest.

Figure 78 below shows the rank of all the sites. A detailed breakdown of the scores each site received for specific criteria can be found in Appendix 17.

Figure 78: MCA scores (weighted) total



9.7.1.5 Step 5: Short-list identification

The MCA findings suggested that out of the long-list of sites the three highest scoring potential areas for a new port to be developed, include:

1. Manukau - Central Manukau Harbour, Puhinui, Hikihiki
2. Western Firth of Thames - Kawakawa Bay, Waimango Point
3. Muriwai - North West Coast, Northwestern coastline

9.7.2 Viability

9.7.2.1 Short-term viability ☒

Building a new port is not a viable option in the short-term due to the time it takes to plan and build a new port.

9.7.2.2 Medium-term viability ☑

It is possible that a new port could be built the medium-term if planning and consent processes begin in soon.

9.7.2.3 Long-term viability ☑

As per the scope of this study, Option 5 is defined as a new port being built in a new location to accommodate the long-term trade task.

9.7.3 Conclusion

Proceed to CBA: Option 5 has highlighted a number of potential locations in which a new port could be located to accommodate Auckland's long-term trade task. The findings of the MCA highlighted three potential areas for a new port, which will all proceed to the CBA.

9.8 Short-listed options

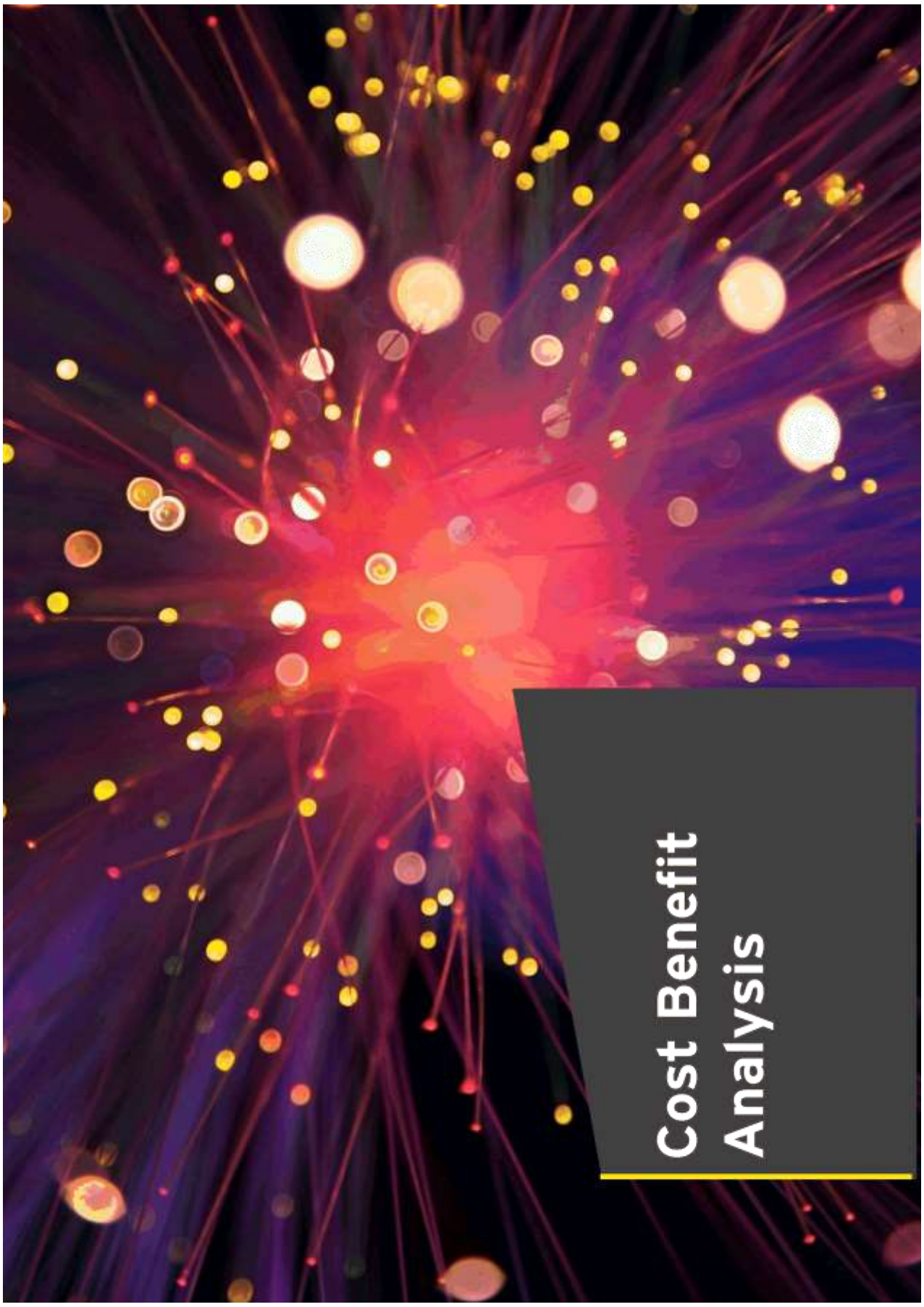
The following short-listed options were progressed to the CBA:

- Option 1: Constrain the port to its current footprint - this "Do-Minimum" option will form the base case against which all the other short-listed options will be benchmarked and compared against.
- Option 4: Enable growth of Auckland's Port in its current location
- Option 5: Build a new Port in a new location - this option includes building a new port in the following areas: Manukau, Western Firth of Thames and Muriwai.

All of these options will be subject to further analysis in the CBA where the costs and benefits for each of these options will be assessed quantitatively and qualitatively and compared against each other. The results of the CBA will then guide further decision-making by the CWG.

Item 16

Attachment B



10 Cost Benefit Analysis

10.1 Methodology adopted

The economic analysis technique used to assess the short-listed options is a Cost-Benefit Analysis (CBA).

CBA is a decision making tool that aims to assess the value of a project or competing projects on a consistent basis. This is done by quantifying all costs and benefits in monetary terms, where possible, and discounting them to a common point in time to determine the net benefits of each project. An economic CBA differs from a financial CBA in that it is performed from the view point of society, whereas a financial CBA looks at only the financial impacts from a project perspective.

CBA studies include both market and non-market impacts from an economic, social and environmental perspective. Non-market impacts are not typically included in economic impact studies as they are not transacted and therefore do not contribute to economic activity. Where it is not possible to quantify or monetise the benefits, they are assessed qualitatively (i.e. described).

10.1.1 General approach

One of the problematic issues surrounding CBA is that the value of non-market impacts is difficult to measure as they cannot be observed in market transactions.

In a full-scale CBA, transport modelling and primary research would be undertaken to derive the costings. However, as this study is intended to provide an initial understanding of the scale and relativity of costs and benefits between options, detailed transport modelling and primary research is outside the scope of this CBA. If any of the options are to proceed, more detailed transport modelling and primary research will need to be undertaken.

In view of these limitations, caution should be applied in the interpretation of the CBA results presented in this study.

In general, in identifying the costs and benefits of this CBA, we have taken into account the direct costs and benefits that will be incurred in each of the short-listed options, as well as the third party impacts, on the surrounding areas and to developers and freight operators. Where possible, we have monetised the costs and benefits subject to assumptions and where we have not monetised costs and benefits, we have undertaken a qualitative analysis of these impacts.

10.1.2 CBA timing

The UK Treasury suggests that the appraisal period of 60 years.[133] The New Zealand Treasury's suggested appraisal period is over the whole life of the project, usually with a lifetime of 50 years.[134] As this is a long-term study, a timeframe of 100 years was used to assess the options.

10.1.3 Real prices and inflation

The numbers represented in the CBA are in real prices. Where prices are expressed in pre-2016 values, we have used Statistics New Zealand's historical CPI index to convert the values to 2016 values.

10.1.4 Optimism bias

We have applied a 15% uplift to capital costs to reflect a contingency for construction risk.[135]

10.1.5 Capacity and trigger points

The planning timeframes for Option Five (new port locations) were decided based on when capacity points for the existing port would be reached and when a new port would be required.

Based on varying growth rates, the timing varied for when certain volumes would be reached. On this basis, we picked the following trigger points for the purposes of the CBA timing for capital costs and land release:

[133] UK Department of Transport (2014) Cost Benefit Analysis. Retrieved from: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/370854/TAG_Unit_A1.1_-_Cost_Benefit_Analysis_January2014.pdf

[134] New Zealand Treasury (2015) Guide to Social Cost Benefit Analysis. Retrieved from: http://www.treasury.govt.nz/publications/guidance/planning/costbenefitanalysis/guide

[135] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/427087/TAG_Unit_A1.2_-_Scheme_Costs_November2014.pdf

- **Option 1**: 3 million TEU is when capacity of the port is reached without further reclamation, apart from the reclamation already consented
- **Option 4**: The physical limit we have applied for port capacity for POAL on an expanded footprint is 4 million TEU, assuming that reclamation is possible up to its physical limits
- **Option 5**: The new port is assumed to be operational in tandem with the current port site, when trade volumes reach 2.2 million TEU, and the old port site ceases to be operational when 3 million TEU is reached. The new port has a theoretical capacity of 10 million TEU.

We have applied a range of costs and benefits to the options to represent the best and worst case scenario in terms of capacity and technology needed in terms of capital investment to allow the port to meet the future trade task.

This has also given us a timeframe range for when the existing port may need to be expanded, or a new port may need to be developed and when existing port land could be released for development.

The CBA model is driven by TEU capacity based on the assumed growth rate of 2.9% with a 0.5% growth rate after 50 years. The planning and consenting process for a new port is assumed to take up to five years, with construction spanning 10 years. Analysis completed by Black Quay Consulting showed that 2.2 million TEU is the maximum capacity based on a 64,700 TEU/ha (high) productivity rate that the Ports of Auckland can handle without further significant capital investment, of approximately $1 billion to increase capacity further (this includes terminal works, reclamation, dredging, berth works, pavement works, drainage and services, consents and approvals).

The current port site can handle a TEU capacity of up to 2.2 million TEU (in 2044) without significant additional capital investment; however, in order for the current port site to reach 3 million, approximately $1 billion of capital investment is required. Option 1 is modelled on the basis that with higher productivity rates per hectare and technology upgrades, the current port site's capacity will be able to reach 3 million TEU (in 2055). Of the $1 billion capital investment, the Auto-Strad to ASC upgrades will cost approximately $160 million; therefore, the remainder spent on increasing the current port's capacity will be a sunk cost that cannot be recovered when the new port is constructed (i.e. reclamation, dredging, berth works, pavement works, drainage and services, consents and approvals).

Based on the 2.9% growth rate, it is expected that 2.2 million TEU will be reached in 2044, and 3 million TEU will be reached in 2055. If a 2.2 million TEU trigger point is selected, then planning will start 15 years before 2044, in 2029. If a 3 million TEU trigger point is selected, then planning will start 15 years before 2055 in 2040. Currently, the CBA assumes a start date for planning and construction of a new port in 2029, 15 years before the current port site (Waitemata) reaches 2.2 million TEU capacity, in order to avoid the sunk cost of investing a further $1 billion to increase capacity of the current port site to a maximum of 3 million TEU.

In order to avoid the additional $1 billion capital costs, it is assumed that the Port will start moving to the new Port site in 2044, when 2.2 million TEU is reached. The new Port planning and development for Option 5 begins in 2029, 15 years before 2044.

The main driver for ranking and NPV will be capital costs and the land use values realised as all other factors (Revenue, Operating Costs and Freight Operating Costs) remain the same, regardless of when the capital costs are incurred. The trade-off between the increased capital costs due to an earlier construction date and the additional benefit of land use value realised if land is made available earlier, will ultimately determine the ranking between the top three options. If the additional benefit of the new development at an earlier date is lower than the additional capital costs to construct earlier, then the net value for Option 5 will be lower, and vice versa.

If the planning for a new port was to start earlier than 2029, for example, with planning starting in 2017 (the earliest possible start date for planning and design process for a new port to start), for a period of five years and construction for a new port beginning in 2022 for a period of 10 years (i.e. move in 2032). The cost to construct would be higher when brought forward because of the discount factors applied is higher in earlier years than later years. The impact of planning for a new port starting in 2017 is shown in the tables below.

The impacts of an earlier move on land values are shown in the table below:

Table 54: Impact on Land Use Values and Wider Economic Benefits when Port is moved earlier

Component	2044 Move Date	2032 Move Date
Land Use Values	$1.62	$2.02
Wider Economic Benefits	$0.13	$0.17

The Capital Costs have increased significantly for the new port sites as shown in the table below:

Table 55: Impact on Capital Costs for new Port sites when Port is moved earlier

Component	2044 Move Date	2032 Move Date
Option 5A: Central Manukau Harbour	-$4.06	-$5.46
Option 5B: Puhinui	-$4.73	-$6.37
Option 5C: Hikihiki	-$4.17	-$5.61
Option 5D: Western Firth of Thames - Kawakawa Bay	-$5.21	-$7.00
Option 5E: Western Firth of Thames - Waimango Point	-$5.38	-$7.24
Option 5F: Muriwai Offshore Port	-$5.36	-$7.20
Option 5G: Muriwai North West Coast	-$5.17	-$6.96

There is no change to the port construction costs for Options 1 and 4 because there is no volume trigger for capital investment until 2.2 million TEU and 3 million TEU are reached, respectively. As a result, in comparison, it becomes more costly to move the port earlier, thus changing the overall rankings of the options, as shown below:

Table 56: Change in ranking of Options when Port is moved earlier

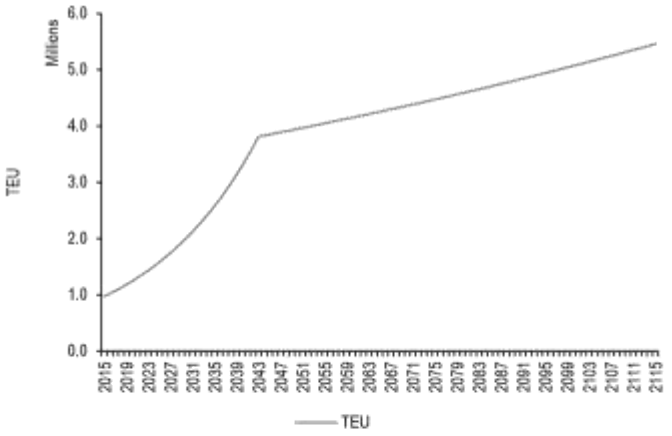
Rank	2044 Move Date	2032 Move Date
1	Option 5B: Puhinui	Option 5B: Puhinui
2	Option 5C: Hikihiki	Option 4: High Productivity
3	Option 5A: Central Manukau Harbour	Option 4: Low Productivity
4	Option 4: High Productivity	Option 1: Base Case
5	Option 4: Low Productivity	Option 5C: Hikihiki
6	Option 1: Base Case	Option 5A: Central Manukau Harbour

The rank for the Hikihiki and Central Manukau Harbour port sites drop from three to six and from two to five respectively. The higher capital costs incurred starting from 2017 is not offset by the higher land use value realised in 2032 The increase in land use value is approximately $400 million whereas capital costs have increased significantly by approximately $1.4 billion. This is also due to the fact that the discount factors applied for capital costs and land use values are different, with a higher discount factor for capital costs and a lower discount factor for land use value benefits.

10.1.5.1 Growth rates

We have applied a 2.9% CAGR for TEU volume growth until a peak of 4 million TEU is reached, with growth rates slowing to 0.5% post the 4 million TEU peak. Figure 79 below shows the growth in TEU volumes over the appraisal period.

Figure 79: TEU growth rate



Source: EY analysis

10.1.5.2 New port planning and construction timeframes

We have applied the following timeframes for timing for capital costs for new port design and construction:

- 5 years for planning, consent and design
- 10 years for construction

Development Timeframes and Release of Land

The release of land has been phased as follows:

- **Phase 1**: 5 hectares of land developed and released (GFA of 315,000 m^2)
- **Phase 2:** 14.375 hectares of land developed and released (GFA of 905,625 m^2)
- **Phase 3:** 14.375 hectares of land developed and released (GFA of 905,625 m^2)

The land use mix across the land will consist of public and private greenspace, retail, commercial and residential.

The construction for Phase 1 has been set to begin in the year after the port has moved from the existing site. Construction for each phase is set to occur in parallel with public land release, except for Phase 1 which is set to occur six years before the release of any land to the public. The take up for land is estimated to be 0.97 hectares per annum based on market demand, current annual take up rates and the percentage share that the land release will represent in the market.

10.2 Land valuation

10.2.1 Ports of Auckland land value

The land valuation analysis was undertaken by JLL based on the following assumptions:

- Total land area of 75 hectares.
- The total developable area of the total land area is set at 45%, or approximately 34.1 hectares based on benchmark analysis completed by Jasmax.
- The undeveloped land value is estimated to be $1,400 per m^2.
- The developed land value is estimated to be $5,500 per m^2 with an annual growth rate of 3% per annum. This is based on land sales on the periphery of the CBD that are similar which has sold for between $4,000 to $6,000 per m^2.

It is possible that the land value realised will vary depending on the supply and demand conditions of the market at the time is released. As the supply of land in the proposed development is of such a large scale, it is also possible that this might reduce the developed land value as prices fall as supply of land increases.

10.2.2 Wider economic benefits - agglomeration

We have applied a 12% land use uplift to reflect the net positive agglomeration benefits overall accruing to Option 5 where the existing port land is redeveloped.

The effective density measure was used to determine the 12% uplift, whereby the benefits of agglomeration will accrue to the redeveloped port site as it will add workers to the CBD which increases the effective density of businesses in the CBD. On the other hand, since we assume a fixed total number of workers within the region, there must be a reduction in workers elsewhere. Businesses in those regions, more specifically, the new port sites will now have lower effective density and there will be agglomeration dis-benefits. Overall, for this study, it is assumed that the redevelopment will move workers from less dense to more dense locations, thus generating net positive agglomeration benefits overall. Using this methodology, for a similar urban renewal project of an existing port site in Australia, the value of the uplift turned out to be 12% uplift on land value benefits.

For this study, this uplift is likely to overestimate or underestimate the net benefits of agglomeration for all the sites due to the different characteristics of each site. More detailed demographic modelling should be undertaken to determine the true net positive agglomeration benefits for each of the sites.

10.3 Discount rates

Discounting converts the dollar value of costs and benefits received in different time periods to present value. On this basis, the value of a future dollar is worth less than a dollar today. The value of future dollars relative to current dollars is expressed in terms of a discount rate and is usually expressed as a percentage rate for a period of one year.

There are two main methods for determining discount rates. The first method treats the discount rate as the rate of return an investor would expect from different opportunities that have equal risk. The second approach treats the discount rate as the change in value of consumption in different periods.

The first method of the rate of return represents the opportunity cost of capital which reflects the rate of return the capital must return to investors in order for them to invest,

The second method reflects a time preference for consumption where the discount rate is determined when the time preference of consumption is equal to the opportunity cost of capital.

These two approaches look at the discount rate through different perspectives, that of the investor and that of the consumer. Often times, these two approaches do not equate so there is a question on which approach should be used. The approach taken would depend on the type of infrastructure project. Therefore, we have chosen the discount rate based on the type of project this represents.

For example, the social opportunity cost rate of discount is the rate that reduces the net present value of the best alternative private use of the funds to zero. This is similar to a rate of return approach except that it takes into account the particular investments that would be displaced. This means that the social opportunity cost largely reflects the cost in financial market terms. This is an approach which takes into account what 'similar' projects would provide in returns if undertaken in the private sector. If this discount rate is used then this project would not displace higher value private sector projects. The social opportunity cost rate determines the "efficient" allocation of resources between the public and private sectors.

The choice of discount rate is a crucial determinant of the value of the project. The New Zealand Treasury adopts a real discount rate of 8% (as at 30 April 2016) which reflects the cost of capital for the Crown (an estimate of the expected return from alternative investments in the private sector, since that is likely to be a good proxy for the Crown's cost of capital. Whereas the UK Treasury uses a lower discount rate that it identifies as the 'social time preference rate'.

The social time preference rate is the value society attaches to the present as opposed to, future consumption. It is based on comparisons of utility across different points in time or different generations.

We have applied a range of discount rates for the purposes of sensitivity testing. The main basis for our chosen discount rates was based on guidance from the UK Treasury's Green Book, which has provided guidance on the appropriate discount rates to be applied depending on the project's timeframe, in particular, very long term projects (beyond 30 years), the main rationale for applying a lower discount rate, being the uncertainty about the future. This uncertainty can be shown to cause declining discount rates over time.[136] Table 57 shows the range of discount rates that are applicable to the respective appraisal periods. Based on this table, we have selected a discount rate of 2.5%.

Table 57: UK Treasury Green Book discount rates[137]

Years from current year	Discount rate
0-30	3.50%
31-75	3.00%
76-125	2.50%
126-200	2.00%
201-300	1.50%
301 and over	1.00%

For the sensitivity testing, we ran scenarios based on a 6% discount rate based on NZTA's recommended approach, with a higher discount rate of 8% recommended by the New Zealand Treasury.[138]

[136] UK Treasury (2011) The Green Book: Appraisal and Evaluation in Central Government. Retrieved from:
[137] UK Treasury (2011) The Green Book: Appraisal and Evaluation in Central Government. Retrieved from: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/220541/green_book_complete.pdf.
[138] New Zealand Treasury (2008) Public Sector Discount Rates for Cost Benefit Analysis. Retrieved from:

The New Zealand Treasury recommended discount rate is based on projects with a life span of a maximum of 50 years. However, the longer appraisal period adopted for this study means that using the New Zealand Treasury discount rate of 8% will result in lower present values, compared to using a lower discount rate of 2.5% as recommended by the UK Treasury. Note also that when the discount rate is higher, future costs and benefits count for less; a high discount rate favours projects with benefits that accrue early. On the other hand, lower discount rates encourage investors to adopt projects that offer returns at distant dates. When a project gives rise to a string of negative and positive net benefits over time, the issue is whether it is worth bearing the negative flows (costs) in order to reap the positive flows (benefits) at other time periods.

http://www.treasury.govt.nz/publications/guidance/planning/costbenefitanalysis/discountrates/discount-rates-jul08.pdf

10.4 Approach to identifying costs and benefits

The first step in conducting the appraisal was gathering data and identifying the costs and benefits. Key inputs to the CBA include the following costs and benefits, as identified in Table 58 below:

Table 58: Costs and benefits

	Proposed Use	Quantitative / Qualitative Assessment	Option 1 (Port remains on current footprint including consented reclamation (can reach 2-3 million TEU))	Option 4 (Port expands footprint with significant reclamation to be a 4 million TEU terminal)	Option 5 (Port moves to a new location - 5a: Manukau; 5b: Western Firth of Thames; 5c: Muriwai)
			Existing Port	Existing Port	New Port
Direct Impacts	Benefits	Quantitative	Port revenues	Port revenues	Port revenues
	Costs	Quantitative	Port operating costs	Port operating costs, capital costs for expanding the ports footprint	Port operating cost, capital costs of acquiring land for new port site and construction of new port infrastructure
Indirect Impacts	Transport infrastructure	Quantitative	Costs of additional road and rail infrastructure to meet the trade task up until 3 million TEU trade task	Costs of additional road and rail infrastructure to meet the 4 million TEU trade task	Cost of additional road and rail infrastructure to meet the future long-term trade task
	Freight operators	Quantitative	Cost to freight operators of meeting the additional trade task up until 3 million TEU trade task	Cost to freight operators of meeting the additional trade task up until 4 million TEU	Cost to freight operators of meeting the future trade long-term trade task from new port location
	Transport users	Qualitative	The impact of congestion from additional trucks on the road to meet the 3 million TEU trade task	The impact of congestion from additional trucks on the road to meet the 2 million TEU trade task	The impact of congestion from additional trucks on the road to meet future long-term trade task and the impact of congestion from new residents and workers commuting to and from the redeveloped port site
	Land use benefits	Quantitative	Not applicable	Not applicable	Land value of the old port site in highest and best use
	Land use costs	Quantitative and Qualitative	Qualitative discussion of impact of intensified port operations on surrounding residential areas; opportunity cost of land at Port (alternate land use)	Qualitative discussion of impact of intensified port operations on surrounding residential areas; opportunity cost of land at Port (alternate land use)	The cost of preparing the land at the existing port site for development and the costs of new developments (i.e. residential or commercial)
	Wider economic benefits (WEBs)	Quantitative	Not applicable as there is no displacement or changes in effective density	Not applicable as there is no displacement or changes in effective density	Agglomeration impacts - the impact of economic density at new port site and from redevelopment at previous port site
	Environment	Qualitative	The impact on the environment of port operations for the 2 million TEU trade task	The impact on the environment of port operations for the 4 million TEU trade task	The impact on the environment of a new port in the new location
	Social Impacts	Qualitative	Impact on liveability, employment, public access, recreational use, and community health and wellbeing as a result of port staying where it is.	Impact on liveability, employment, public access, recreational use, and community health and wellbeing as a result of port staying where it is and expanding.	Impact on liveability, employment, public access, recreational use, and community health and wellbeing at both new port site and existing port site, as a result of port moving to a new location.
	Cultural Impacts	Qualitative	Impact on Iwi of Port remaining at the current site	Impact on Iwi of Port remaining at the current site and expanding operations	Impact on Iwi of Port moving from current site and impacts on Iwi of constructing a new port at each of the sites

10.5 Methodology for inputs

10.5.1 Domestic freight volumes

The TEU volume that travels by domestic landside freight is 54% of the 2015 trade task based on data from the Freight Information Gathering System study published by the Ministry of Transport.[139] The rail and road split for the TEU is also available and is 11% and 89% respectively, with a view to increasing the rail percentage to 30% over the medium-term. We have applied an escalation percentage to rail to get to 30% by 2019.[140]

The freight operating costs for both modes are calculated based on those percentage splits for the whole 100 year period of the CBA.

10.5.2 Freight operating costs

This CBA only covers the cost of moving freight landside via road and rail. A qualitative discussion on the impact on shippers in section 10.5.4.

10.5.2.1 Road freight operating costs

In order to determine the impact moving the port would have on freight costs, we have used the following variables to drive costs for road transport of freight:

- Total distance travelled (km) by origin-destination to specified regions.[141]
- Number of TEU transported to specific regions each year (based on TEU volume and percentage splits for landside road movements for specific regions) provided in the 2009 Beca report.[142]

The following methodology for calculating the total cost is documented in Section 10.5.

Table 59: Methodology for road freight costs

Variable	Methodology
TEU Landside movements	The Freight Information Gathering System study by the Ministry of Transport showed the percentage of landside TEU movements as 54% of all TEU volume.
Distance travelled (km) by origin-destination	The 2009 Beca report showed the percentage of landside movements by region. Based on this percentage, and the total landside movements for TEU, we were able to break down the TEU volumes by region. As specific origin-destination data was not available, we used an estimate point within each region to map the start to finish distance for each of the sites to determine the average distance for each site.
Total distance travelled (km) by respective TEU volumes	The average distance for each site was then multiplied by the respective TEU volumes for each region to determine the total distance travelled (km) by origin-destination.
Unit cost per TEU per km ($)[143]	The Ministry of Transport has applied a minimum breakeven cost for any road haulage operator that carts freight (road and rail) between $3.00 and $4.00 per km travelled in 2011.[144] The UNISA Ports Study report applied this value to determine freight operating costs, with a 0.5% fuel adjustment factor to come to a cost of $3.68. We used a unit cost per TEU per km of $3.94 (adjusted for inflation).

[139] This is based on data from the Freight Information Gathering System and Container Handling Statistics by the Ministry of Transport - Ministry of Transport (2015) Freight Information Gathering System and Container Handling Statistics July 2014 - June 2015. Retrieved from: http://www.transport.govt.nz/assets/Uploads/Sea/Documents/FIGS-June-2015.pdf.

[140] Ports of Auckland (2015) Statement of Corporate Intent for the period from 1 July 2015 to 30 June 2018. Retrieved from: http://www.poal.co.nz/media-publications/Documents/Statement%20of%20Corporate%20Intent%201%20July%202015%20to%2030%20June%202018.pdf.

[141] Beca (2009) Truck movement and access time research for Ports of Auckland.

[142] Beca (2009) Truck movement and access time research for Ports of Auckland.

[143] Ministry of Transport, 2011 Freight Charge Comparison Report, July 2011); UNISA 2012 Ports Study report.

[144] The Ministry of Transport has applied a minimum breakeven cost for any road haulage operator that carts freight (road and rail) between $3.00 and $4.00 per km travelled. The methodology for reaching this price was through discussions with various freight and logistics companies who provided a range of pricing and offerings. This study questioned a total of eight large and mid-sized cartage contractors. The fuel pricing adjustment is labelled Fuel Adjustment Factor (FAF). The FAF's ranged from +0.5% - 9.8%.

10.5.2.2 Origin-destination data

The 2009 Beca report showed freight travelling by trucks to the following regions:

Table 60: Percentage of TEU travelling to regions

	Assumed point within the region	TEU % travelling to the region
North	Albany	8%
West	Te Atatu Peninsula	9%
East	Howick, East Tamaki	7%
Central	Auckland CBD	3%
South	Auckland Airport, Wiri Inland Port, Walmsley Road, Takanini	64%
Beyond South	Wellington	9%

Based on the regions specified by Beca, we have assumed points within each of the regions to determine the origin-destination distance for each of the port sites.

10.5.2.3 Rail freight costs

For rail, there are a number of methodologies to estimate rail costs. Bolland (2009)[145] analysed the variable, semi-variable and fixed costs of KiwiRail's freight operations, and estimated the short and long-run marginal costs by line of business. The short-run marginal cost includes appropriate variable costs and some semi-variable costs, whereas the long-run marginal cost includes all costs except the cost of capital.

Bolland estimated that the short-run marginal cost of rail freight for the year ended June 2009 was between $0.10 and $0.15 per net tonne-km for the majority of lines, with a long-run marginal cost of around $0.20. For the year to June 2009, the average freight rate is $0.072 per net tonne-km.

For our estimates of rail freight costs, we have used KiwiRail's freight revenue as an indication of rail freight costs. KiwiRail recorded $434 million in freight revenue for the year 2014/15 and 4.516 million net tonne-km travelled.

This provides an estimated cost of $96.10 per net tonne-km.[146] In order to get the cost per TEU, we divided KiwiRail's revenue by the recorded TEU movements by rail movements nationally (330,495 TEU from FIGS Study by the Ministry of Transport[147]). This provided us with a unit cost for rail of $1,318 per TEU.

As we did not have access to origin-destination data for rail movements of TEU volumes, we have had to assume a fixed cost per TEU for all the options. This cost is then driven by the volume of TEU moved. Therefore, it is likely that rail freight cost is underestimated or overestimated based on the different distances between all port sites.

10.5.3 Value of time and congestion costs

The freight operator costs are underestimated as they are based solely on distance. The freight operator cost does not reflect the true value of time or increasing congestion on the network. The cost of congestion will be discussed qualitatively in the CBA results.

The number of truck movements is driven by the volume of TEU that will have to be transported. Therefore, as truck movements increase, it is expected that this will put additional strain on current network capacity

As a whole, the cost of congestion will depend on the capacity of the network that freight will mostly travel on. The more capacity the network has, the less congestion cost there will be as a result of freight road movements increasing.

The network congestion impact will also have flow on impacts on reliability for freight operators, who will not be able to estimate accurately the time to port gate or freight destinations as increased congestion will mean that travel time estimations become less reliable.

[145] Bolland, J (2009) Independent Advice on the Economic Costs and Benefits of Rail Freight, a confidential report to the Ministry of Transport.

[146] Kiwi Rail Group (2015) Kiwi Rail Annual Report 2015.

[147] Freight Information Gathering System and Container Handling Statistics by the Ministry of Transport - Ministry of Transport (2015) Freight Information Gathering System and Container Handling Statistics July 2014 - June 2015. Retrieved from: http://www.transport.govt.nz/assets/Uploads/Sea/Documents/FIGS-June-2015.pdf

As each of the sites will have different truck movements based on the different volumes and as they will all be travelling on different networks, there is no one uniform congestion cost that can be applied across all the options. Congestion costs therefore are highly dependent on the following factors:

- Distance between respective port site and final freight destinations
- Freight volume transported dependent on trade volumes capacity at each respective site
- Capacity of existing networks for each specific port site that freight will travel on.

In order to accurately calculate the congestion costs for all options, detailed transport modelling as well as network capacity modelling will need to be undertaken.

10.5.4 Supply chain cost implications of East vs West Coast shipping

The new port sites within the Manukau Harbour are located on the West Coast of New Zealand; there is an associated supply chain cost for shipping companies as a result of the new port site being on the West Coast instead of where it is currently located on the East Coast.

We have provided a high-level analysis on the estimated additional costs that building a West Coast port will impose on shipping companies. The extra shipping costs have been calculated using the following inputs and assumptions.

These costs are not modelled within the CBA, however are discussed in this section qualitatively, with some indicative costs estimates. As the distance from the current port site would vary for all new port sites regardless of whether they are located, and as any trade volume overflow (beyond the 3 million TEU capacity and 4 million TEU capacity for Option 1 and 4 respectively) will be redirected to other existing ports, it is likely that there will be supply chain cost implications for all of the options (current and new port sites) and not only for the Manukau port sites.

As this analysis only looks at East Coast vs West Coast, it would be misleading to include these in the CBA without also including the supply chain cost implications for all other options.

10.5.4.1 Inputs

Inputs used for this analysis includes:

- Vessel movement data by cargo type from Ports of Auckland
- Average daily operating costs by vessel type from Black Quay Consulting
- High level shipping route lengths (in days) from EY analysis and desktop research.

10.5.4.2 Assumption

For the purposes of this analysis, the following assumptions were adopted:

- The size of vessels will not change, therefore, the multi-cargo or TEU carried per vessel or ship will remain constant.
- Onehunga Port in the Manukau harbour has been used as the proxy destination for a Manukau port in Option 5.
- Growth in the number of vessels and ships are directly linked to TEU and multi-cargo growth rates.
- Proportion of vessels that carry TEUs and multi-cargo remains constant throughout the appraisal period of 100 years.

10.5.4.3 Methodology

We calculated the additional cost based on the difference in days of travel for a range of vessels to two destinations - the base case being the current Ports of Auckland site and the other destination being the proxy site of Onehunga Port within the Manukau Harbour.

In this analysis we have used data obtained from POAL, this data sets out where all vessels have moved to and from for 2015. During the data cleaning process all internal port ship movements were filtered out as well as passenger cruise ships movements, this produced a total of 1,717 ship movements to analyse (departures only to avoid double-counting). It was also noted that during this process there were many incomplete data sets (approximately 33% after initial filtering). This is from POAL not recording where some ships have arrived from or their next destination. These have been pro-rated based on vessel type and the number of extra days taken to travel to the Manukau port based on the known data.

In order to project the number of vessels from 2015 onwards, the vessels were classified according to the type of cargo carried – TEU or multi-cargo. The drivers for the growth in the number of vessels used were TEU and multi-cargo volume growth over the course of the appraisal period for the CBA.

The cost of the additional distance is calculated as an average daily operating cost by vessel type multiplied by the number of additional days that each vessel would require if it was travelling to the West Coast as opposed to the current port site.

The additional number of days per vessel based on movement data was calculated as the difference between the number of days of travel for the current shipping route and the number of days of travel for the new shipping routes to the Manukau Harbour. The additional number of days was then multiplied by the average daily operating costs by vessel type and the number of vessels in that period to give an annual supply chain cost for the additional number of days for all vessels. This was then summed up as a total cost (after discounting at 2.5%) to be a total NPV of approximately $363 million for the period after the new port is operational, which is estimated in the model to be from 2044 onwards.

The additional cost to shippers from a port move from the East to the West Coast is insufficient to exchange the CBA rankings between the existing Waitemata site and the new port in the Manukau. As stated earlier, corresponding analysis has not been carried out for the Western Firth of Thames and Muriwai options. We recommend that further detailed technical work be undertaken to determine the exact magnitude of cost impacts for shipping lines.

10.5.5 Capital costs

The capital costs inputs covers the following:

- Cost of port infrastructure investment to enable the port to meet the required trade task for each option.
- Cost of transport infrastructure investment required to enable the port to meet the required trade task for each option.

10.5.5.1 Port infrastructure costs

Black Quay Consulting undertook analysis for cost estimates. These estimates were based on projects of a similar scale.

The capital expenditure for each option was based on either the needed infrastructure upgrades to meet the trade task or for constructing a new port for the new sites.

The costs included:

- Consulting and design
- Approvals or consenting
- Reclamation
- Infrastructure needed for the port structure and for access (caisson, bridges, pavement and drainage)
- Dredging
- Terminal works
- Berth
- Tug berths and slips.

For the existing port site, capital costs took into account the amount of investment needed for new technology (for example, Auto-Strad or ASC systems) and for Option 4, the additional cost of reclamation.

The new port sites differed in the amount of reclamation needed and dredging required for the construction of a new port.

10.5.5.2 Transport infrastructure costs

Indicative transport infrastructure costs were provided by Aurecon. The costs for each of the location are provided in below:

Table 61: Indicative transport infrastructure costs[148]

Site location	General Comments	Indicative Rail Cost ($m)	Indicative Road Cost ($m)
Option 1: Base case	This is based on upgrades to the port area and sidings and improvements to the Westfield junction a third main at Wiri. The indicative road costs include upgrades from SH16 to the port. This does not include full grade separation of the link to the port. As the freight task grows, any overflow volumes will be shipped from elsewhere, hence the full upgrade may actually not need to occur. It is more likely that the upgrade may be required for Option 4.	200	250
Option 4: Expand port footprint	With the freight task increasing generally, some of the increase in costs includes the addition of a fourth main between Wiri and Westfield to accommodate the increase in freight associated with inland ports, including a grade separation of Westfield. This could incur an additional $500 million in rail costs.	700	300
Option 5a: Central Manukau Harbour	Alignment over water landing on the Mangere Headland just north of the Airport. Then the route could join the any proposed Airport Link in the vicinity of Ascot Road. The rail route could turn to the east and link up to the existing track in the KiwiRail Southdown Yard.	400	250
Option 5b: Puhinui Manukau Harbour	Alignment over water possibly landing on the Otaimako Creek flat just east of the Airport. Route may join a proposed Airport Link parallel to Puhinui Road. The rail route could join the NIMT at Puhinui Station. Puhinui to Westfield junction could require a third track. The route is over a wildlife refuge.	250	200
Option 5c: Hikihiki, Manukau Harbour	This is similar to Puhinui but with additional over-water structures. The site could also use the route for the Central Manukau Harbour site	250	200

[148] Refer Appendix 19 for full description of transport costs for each of the options and sites.

Site location	General Comments	Indicative Rail Cost ($m)	Indicative Road Cost ($m)
Option 5d: Kawakawa Bay	The site is situated south east of Auckland, just off the Raukura Point. A major obstacle is the vertical alignment north of Mataitai Forest. Traversing this, the line could run on a relatively flat area of the Papakura / Clevedon Valley. The link could join the NIMT at Takanini Area and on to the Westfield junction where the proposed third track would be required.	500	300
Option 5e: Waimango Point, Thames	This option is similar to the Kawakawa Bay site with additional tunnel under the Orere Point Range. Duplication of East Coast Main Trunk may be required for Western Firth of Thames sites.	1,000	400
Option 5f: Muriwai Offshore	The site is located at the north western foothills of Waitakere Range. An inclined tunnel is required to allow the alignment to join the existing North Auckland Line at Waimauku. In order for this option to work, other infrastructure works could be required, which included: Waitakere Tunnel upgrade, implementation of Southdown Line, double tracking of Onehunga Line	700	400
Option 5g: Muriwai, North West Coast	The site is located at the north western foothill of Waitakere Range. A tunnel may be required to allow the alignment to join the existing North Auckland Line at Waimauku. Other existing infrastructure works could be required, including (but not limited to): Waitakere Tunnel upgrade, implementation of Southdown Line, possible double tracking of Onehunga Line. Depending on volumes a fourth main line may be required.	500	300

10.5.6 Operating revenue

POAL's revenue for operations has been calculated based on estimated revenue per unit of TEU revenue and revenue per tonne of multi-cargo.

The numbers for 2015 are actual revenue numbers based on 2015 volumes. The revenue per TEU and per tonne are calculated based on 2015 numbers using a 70% TEU and 30% multi-cargo split. The forecast numbers for revenue are driven by growth in TEU and multi-cargo volumes that is expected for each of the options.

For Option 1, port revenues are capped at when 3 million TEU is reached and for Option 4, port revenues are capped at when 4 million TEU is reached. For Option 5, operating revenue will grow as TEU volumes grow up to the capacity of 10 million TEU.

10.5.7 Operating cost

POAL's operating costs has been calculated based on an estimated cost per unit of TEU revenue and cost per tonne of multi-cargo.

The numbers for 2015 are actual revenue numbers based on 2015 volumes. The cost per TEU and per tonne are calculated based on 2015 numbers using a 70% TEU and 30% multi-cargo split. The forecast numbers for revenue are driven by growth in TEU and multi-cargo volumes that is expected for each of the options.

For Option 1, operating costs are capped at 3 million TEU is reached and for Option 4, operating costs are capped at 4 million TEU is reached. For Option 5, operating costs will grow as TEU volumes grow up to the capacity of 10 million TEU.

10.5.8 Maintenance costs

The maintenance costs were provided by Black Quay. The maintenance costs depend on the maritime environment within which each port operates. Therefore, some sites have higher maintenance costs than others. The main driver for maintenance costs is the amount of maintenance dredging required to maintain the necessary depth for the port to operate at each of their sites.

10.5.9 Land use values

A report was commissioned from JLL to provide an indication of the value of the land associated with the existing POAL based port, assuming the land could be developed in an alternative use in the future.

The following assumptions have been applied to the derivation of land value:

- Total land holding - based on 75 hectares, with a useable, developable area of 33.75 hectares.
- Development infrastructure costs, including private and public development costs.
- The ongoing value of the net land area suitable for intensive development. This is linked to development intensity typically measured through gross floor area (GFA) potential
- The land value growth assumptions over the total development time horizon.
- The applicable discount rate which should apply to relevant cashflows.

The methodology for calculating land use values are documented in Table 62 below:

Table 62: Methodology for land valuation

Variable	Methodology
Undeveloped land value	JLL have adopted a value of $1,400 per m^2 for the full 75 hectare site
End value of developable land and growth rates	JLL has adopted a value of $5,500 per m^2 for developed land, based on current sales of between $4,000 and $6,000 per m^2 for similar sites on the periphery of the CBD. This is based on a Floor Area Ratio (FAR) of 1:6.1 provided by Jasmax, whose analysis is influenced by the proposed Auckland Council Unitary Plan and the densities cited.
Growth rate for end value of developable land	The growth rate adopted for the end value is a key determinant of value for the site. JLL adopted a 3% long-term growth rate for land values in the Auckland CBD, based on long-term growth rate of commercial land values in the Auckland CBD. It is possible that the release of the land in the future might have an impact on the total supply of land in Auckland and thus affect market values, especially if there is existing capacity in the property market when the land is released.
Yield of the site	Jasmax have undertaken several benchmarking exercises and their analysis suggests a net yield of 34.1 hectares (45% of the total site of 75 hectares). No land use mix has been provided as this will ultimately depend on how the site is master planned, which is outside the scope of this study.
Annual uptake of floor area across the site	JLL's analysis concludes that total annual absorption of 0.97 hectares per annum, based on a FAR of 1:6.1. This is based on uptake for commercial land as a percentage of total commercial absorption in the Auckland CBD and residential absorption across the total Auckland residential market.

Variable	Methodology
Development costs for the site (including roads and demolition and clearance)	This value is based on CBRE's 2013 report on indicative alternative use land value analysis for the port of $251.7 million.
Private development costs	This value is estimated to be $834.50 per m^2.

10.5.10 Gross floor area

The total Gross Floor Area (GFA) for the existing Ports of Auckland site is based on the following assumptions:

- Total developable area of 33.75 hectares
- Average building height of 30 metres based on analysis by Jasmax on height allowed based on protected view shafts
- Average floor to ceiling height of 3.5 metres.

These assumptions underpin a total GFA of 2.162 million m^2.

Based on the development timeframes, the GFA for each phase of land release are as follows:

- Phase 1: 315,000 m^2
- Phase 2: 905,625 m^2
- Phase 3: 905,625 m^2

10.5.11 Land acquisition for new port sites

The new port sites require the acquisition of land within the respective areas. The methodology for calculating the cost is set out below.

10.5.11.1 Manukau area

The preliminary estimates for acquiring land and seabed in the Manukau area are:

- Seabed acquisition for new port development: provisional sum of $50 million.
- The estimated land side area needed to enable the new port development is approximately 50 hectares. This area will then be utilised as part of the new ports infrastructure. The cost of acquiring the land is estimated to be $200 per m^2. The land side cost of acquisition is a total of $100 million.
- Additional land will be required for expanded infrastructure to service the new port. This is estimated to be within 40 to 50 hectares at a cost of around $300 - $400 per m^2, this reflects a total cost of approximately $160 million.

The total land acquisition cost for sites within the Manukau area are approximately $310 million.

10.5.11.2 Western Firth of Thames and Muriwai areas

- Seabed acquisition for new port development: provisional sum of $50 million.
- The estimated land side area needed to enable the new port development is approximately 50 hectares.
  - The land in the Western Firth of Thames would be rural land, with an associated cost of $25 to $35 per m^2, contributing to a total cost of approximately $15 million.
  - A similar cost for land in Muriwai has been applied, contributing to a total cost of approximately $15 million.
- Additional land in both Western Firth of Thames and Muriwai will be required for expanded infrastructure to service the new port. This is estimated to be within 40 to 50 hectares at a cost of around $25 to $35 per m^2, this reflects a total cost of approximately $15 million.

The total land acquisition cost for sites within the Western Firth of Thames and Muriwai area are approximately $80 million.

10.5.12 Sensitivity testing

We ran scenarios based on a range of growth rates:

- 2.3%
- 2.9%
- 5.0%

We also ran scenarios based on a range of discount rates:

- 2.5% (UK Treasury)
- 6.0% (NZTA)
- 8.0% (New Zealand Treasury)

10.6 Cost benefit analysis assumptions for options

This section sets out the assumptions for all the short-listed options that were applied to the CBA modelling. Estimates of the costs and benefits of the short-listed options are based on information and assumptions as listed in in Appendix 19.

10.6.1 Option 1

The following CBA assumptions apply to Option 1:

1. **Capital costs** – As no further reclamation is allowed, the capital costs only relate to technology upgrades and therefore, Option 1 has the lowest capital costs.
2. **Port Operations:**
    a. **Port Revenues** – The revenues of the port in Option 1 will continue to grow as trade volumes grow until the port reaches maximum capacity at 3 million TEU. Revenue growth therefore does not grow post 3 million TEU peak. The loss of revenue to the port as a result of not being able to handle the overflow is considered an opportunity cost.
    b. **Port Operating Costs** – The operating costs of the port in Option 1 grows as trade volumes grow until the port reaches maximum capacity at 3 million TEU. Operating costs growth therefore does not grow post the 3 million TEU peak.
3. **Costs to Freight Operators** – The cost to freight operators are driven by trade volumes and the assumed fixed distance travelled between the port site and assumed destination points. As Auckland's demand for goods may exceed the 3 million TEU, it is assumed that the overflow TEU will be handled by other existing ports in New Zealand. Therefore, freight operators will face an increased cost of transporting the trade volumes to Auckland from other existing ports.
4. **Land Use Value** – As the port continues to operate at the Waitematā site, there is no alternative land use being realised at that site. Therefore, there is no land use value realisation of the existing port site or wider economic benefits applied to Option 1.

10.6.2 Option 4

The following CBA assumptions apply to Option 4:

1. **Capital Costs** – The capital costs for Option 4 encompass the additional reclamation needed and technology upgrades to enable the port to meet the 4 million TEU trade task. The capital costs differ depending on the level of productivity that the port is able to achieve. With a higher productivity rate, lesser reclamation is needed thus resulting in lower capital costs. If port productivity is lower, additional reclamation will be required, thus resulting in higher capital costs. In the CBA, two productivity states will be modelled, 40,000 TEU/ha per annum and 60,000+ TEU/ha per annum.
2. **Port Operations:**
    a. **Port Revenues** – The revenues of the port in Option 4 will continue to grow as trade volumes grow until the port reaches maximum capacity at 4 million TEU. Revenue growth therefore does not grow post 4 million TEU peak. The loss of revenue to the port as a result of not being able to handle the overflow is considered an opportunity cost.
    b. **Port Operating Costs** – The operating costs of the port in Option 4 grows as trade volumes grow until the port reaches maximum capacity at 4 million TEU. Operating costs growth therefore does not grow post the 4 million TEU peak.
3. **Costs to Freight Operators** – The cost to freight operators are driven by trade volumes and the assumed fixed distance travelled between the port site and assumed destination points. As Auckland's demand for goods may exceed 4 million TEU, it is assumed that the overflow TEU will be handled by other existing ports in New Zealand. Therefore, freight operators will face an increased cost of transporting the trade volumes to Auckland from other existing ports.
4. **Land Use Value** – as the port continues to operate at the Waitematā site, there is no alternative land use being realised at that site. Therefore, there is no land use value realisation of the existing port site or wider economic benefits applied to Option 4.

10.6.3 Option 5

The following CBA assumptions apply to Option 5:

1. **Capital Costs** – The capital costs for Option 5 encompass the costs of building a new port in each of the specific sites and the transport infrastructure required to service the new port. The capital costs differ for all the sites because of the natural characteristics that are unique to each site and the location of where the sites are based. This has implications for the following aspects of the capital costs:
    a. **Port Infrastructure** – The natural depth at each site has implications for the amount of dredging required, the coastal environment also has implications for the amount of protection infrastructure required for the new ports.
    b. **Transport Infrastructure** – The location of the port site from existing infrastructure, and whether the port is offshore or land based has implications for the amount of transport infrastructure needed. The surrounding terrain for each site also has implications for any new transport links that need to be built and the complexity of this construction.
2. **Port Revenues** – The revenues of the port in Option 5 will continue to grow as trade volumes grow until the port reaches maximum capacity at 10 million TEU.
3. **Port Operating Costs** – The operating costs of the port in Option 5 grows as trade volumes grow until the port reaches maximum capacity at 10 million TEU.
4. **Costs to Freight Operators** – The cost to freight operators are driven by trade volumes and the assumed fixed distance travelled between the specific port site and assumed destination points. As the new port is able to handle a trade task of up to 10 million TEU, there is no overflow that will need to be taken by other existing ports, thus lowering freight operator cost.
5. **Land Use Value** – The realised land value across all sites are the same. As the port will have moved its operations from the existing port site to the new port location, the value of the land at Waitematā Harbour will be redeveloped. The land use value takes into account the:

a. Initial sale of the port land as super lots to be developed

b. The development costs phased over three periods

c. The value realised from sale of developed lots over three periods.

Wider Economic Benefits - The wider economic benefits from agglomeration for all sites is assumed to be the same. As the land has been redeveloped, the effective density at the CBD will have increased thus leading to agglomeration benefits; this benefit is netted off against the dis-benefit to businesses whose effective densities are affected by workers moving to the CBD. The uplift percentage that we have applied across land values post-land release to the market is 12% based on similar urban renewal projects in Australia.

Further demographic testing should be undertaken for each of the specific port sites to determine the true uplift factor for each of the site. The characteristics of whether the new site is industrial or rural will have an impact on the size of this factor

10.6.3.1 Manukau

There are three potential sites under the Manukau option.

Figure 80: Manukau

Option 5A: Central Manukau Harbour (Site 7A)

This site proposed for the central Manukau Harbour which is located east of Puponga Point and adjacent the offshore margin of Karore Bank within the Purakau Channel. This location would be an reclaimed island in the middle of the harbour. The central site option requires a 9 km causeway to the port reclamation, and it is located on the Karore Bank adjacent to the main harbour channel. Due to proximity to the second runway, future flight paths would need to be taken into account.

Option 5B: Puhinui (Site 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. This site was considered in the 1989, 1999 and 2014 studies of potential port locations. Theses studies noted the excellent connectivity to all infrastructure and good proximity to the exisiting industrial area. Issues highlighted included potenially difficult harbour access due to the sandbar, significant maintenance dredging, high energy coastline and potential issues with its proximity to the airport.

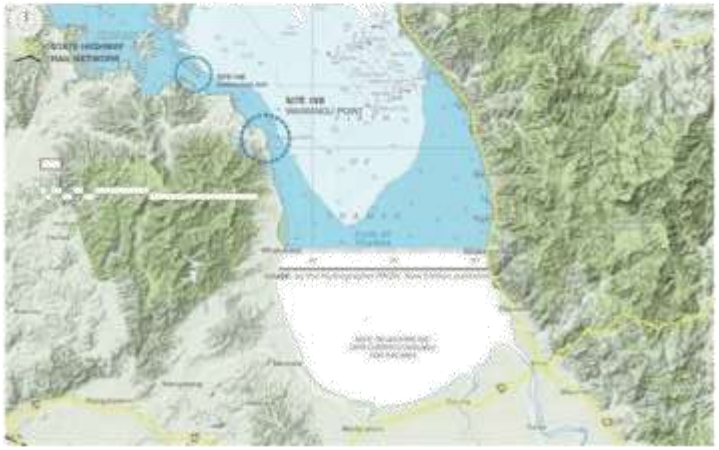
Option 5C: Hikihiki (Site 7C)

Site 7C is located within the Papakura Channel west of the Hikihiki Bank. This is a blue sky site that would be located against the Hikihiki bank and would be accessed through the channel basin. The site would be offshore and would need to be accessed via a bridge. This location would require significant dredging to for the shipping channel to be maintained.

10.6.3.2 Western Firth of Thames

There are two sites that are being considered within the Western Firth of Thames area; Waimango Point and Kawakawa Bay. The actual name for site 15A is Waimango Point and Waimangu Point is a historical typographical error.

Figure 81: Western Firth of Thames



Both sites would require transport access to be developed around the Hunua ranges and would likely be linked to Auckland through the Clevedon Valley.

Option 5D: Kawakawa Bay (Site 14C)

Kawakawa Bay is located below Chamberlins Island and was looked at in the 1999 study. This site would be an offshore port which is connected to the mainland by a 6km long bridge. There would be limited dredging required at this site but would require substantial protective infrastructure.

Option 5E: Waimango Point (Site 15A)

Waimango Point is located just 10 km southeast of Kawakawa Bay. This is a blue sky location which would be accessed via shipping routes to the east of Chamberlins Island. This site would be an offshore port which could either be reclaimed from the coastline or seperated as an island.

10.6.3.3 Muriwai

The Muriwai option includes two potential sites for offshore ports.

Figure 82: Muriwai

Option 5F: Muriwai Offshore Port (Site 6A)

This site, highlighted in purple in the above diagram, would be an offshore port located 7km from Muriwai. This site was assessed as part of the 1999 study which noted wave swells frequently reached 4 metres, with 11metre swells expected in extreme events.

Option 5G: Muriwai North West Coast (Site 6B)

This site, highlighted in blue in the above diagram, would also be an offshore port. It is expected that there is deep water approximately 2km offshore near a small island.

10.7 Overview of CBA results

The top five ranked options for the CBA are as follows:

Table 63: Ranked CBA by net value

Rank	Option	Cumulative Net Value (NPV - $ billion)
1	Option 5B: Puhinui	-$30.67
2	Option 5C: Hikihiki	-$32.48
3	Option 5A: Central Manukau Harbour	-$32.67
4	Option 4: High Productivity	-$33.26
5	Option 4: Low Productivity	-$33.39

The ranking is based on options ranked by the lowest net loss across the appraisal period. The option with the highest cumulative net loss is Option 5: Muriwai North West Coast with a net loss of $50.73 billion.

Option 1 is ranked number six with a net loss of $33.41 billion. The variance between Options 1and the top five options range between $2.6 billion to $150 million.

Table 64: Comparison of the top five options to the do-minimum option

Rank	Option	Cumulative Net Value (NPV - $ billion)
1	Option 5B: Puhinui	$2.74
2	Option 5C: Hikihiki	$0.93
3	Option 5A: Central Manukau Harbour	$0.74
4	Option 4: High Productivity	$0.15
5	Option 4: Low Productivity	$0.02

For Option 5, the higher capital and operating costs compared to Option 1 has been offset by higher Port operating surpluses, lower freight operating costs and the realised land value from redevelopment at the Waitematā site.

For Option 4, the higher capital and operating costs compared to Option 1 has been offset by higher port revenues and lower freight operating costs due to less trade overflow having to travel to Auckland from other existing ports, thus there is a lesser volume travelling a lesser distance. The next stage of assessment is to compare the quantifiable economic, environmental, social, and cultural implications of each of the short-listed options. The cost benefit analysis quantifies options on a real basis to determine the costs and benefits associated with the option. Each option will be compared against the Option 1 as the do-minimum scenario where applicable.

10.7.1 Overall quantitative analysis

This section presents the results of the CBA analysis, including monetised and non-monetised costs and benefits of each option. Using the methodology discussed in Section 11.5, we have estimated the monetary costs and benefits associated with the short-listed options. Some costs and benefits are not able to be quantified and consequently a qualitative assessment has been undertaken for each option to demonstrate the full range and scale of costs and benefits. The NPV for all the options are summarised in table below:

Table 65: CBA of the short-listed options

Component	Option 1 Base Case - Do minimum	Option 4 Reclaim more		Option 5 Move to a new port location						
		High Productivity	Low Productivity	Option 5A Central Manukau Harbour	Option 5B Puhinui	Option 5C Hikihiki	Option 5D Western Firth of Thames - Kawakawa Bay	Option 5E Western Firth of Thames - Waimango Point	Option 5F Muriwai Offshore Port	Option 5E Muriwai North West Coast
Benefits - Net Present Value ($ Billion)										
Port Revenues	$16.40	$18.38	$18.38	$19.06	$19.06	$19.06	$19.06	$19.06	$19.06	$19.06
Land Use Values	$0.00	$0.00	$0.00	$1.62	$1.62	$1.62	$1.62	$1.62	$1.62	$1.62
Wider Economic Benefits[149]	Not applicable	Not applicable	Not applicable	$0.13	$0.13	$0.13	$0.13	$0.13	$0.13	$0.13
Costs - Net Present Value ($ Billion)										
Port Capital Costs	-$0.59	-$1.23	-$1.37	-$4.06	-$4.73	-$4.17	-$5.21	-$5.38	-$5.36	-$5.17
Port Operating Costs	-$12.56	-$14.08	-$14.08	-$14.61	-$14.77	-$14.69	-$14.61	-$14.61	-$14.60	-$14.60
Cost to Freight Operators	-$36.67	-$36.32	-$36.32	-$34.81	-$31.98	-$34.43	-$45.07	-$48.41	-$50.17	-$51.64
Total Net Value (with no Wider Economic Benefits)	-$33.41	-$33.26	-$33.39	-$32.55	-$30.55	-$32.35	-$44.07	-$47.59	-$49.32	-$50.61
Total Net Value (with Wider Economic Benefits)	-$33.41	-$33.26	-$33.39	-$32.67	-$30.67	-$32.48	-$44.07	-$47.59	-$49.32	-$50.61
Rank (with no Wider Economic Benefits)	6	4	5	3	1	2	7	8	9	10
Rank (with Wider Economic Benefits)	6	4	5	3	1	2	7	8	9	10
Qualitative Costs and Benefits										
The impact of changes in land use for new port options and for ports remaining in and expanding in its current location	▸ If the port remains in the Waitematā Harbour in long-term, the highest value for the land is unlikely to be realised given that it is located on prime city waterfront area that is already largely gentrified. There will be a negative impact on the quality of urban form and design for Auckland as a growing city that has emphasis around its waterfront.	▸ If the port remains in the Waitematā Harbour in 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 be an increased negative impact compared to Option 1 on the quality of urban form and design for Auckland as the port operations and footprint grows with additional reclamation.		▸ There is expected to be a significant positive impact for Auckland if the existing port land was redeveloped as a high quality mixed use environment including residential use and open space, with improved access to the water's edge. This would allow Auckland to maximise the highest value land use for the waterfront land, and provide commercial growth opportunities. ▸ For all Option 5 sites, building a new port in a different location will lead to the port land being returned for redevelopment. This would increase opportunities for recreational access to and use of the CBD Waterfront and remove current constraints relating to the use of shipping lanes and ship berthage. Opportunities for changes in land use, development of the harbour waterfront space and creation of new public spaces create amenity enhancement opportunities within the CBD waterfront.					

[149] This is a 12% uplift applied to developed land value to reflect agglomeration benefits accruing to the urban renewal of the existing port site owing to increased effective density.

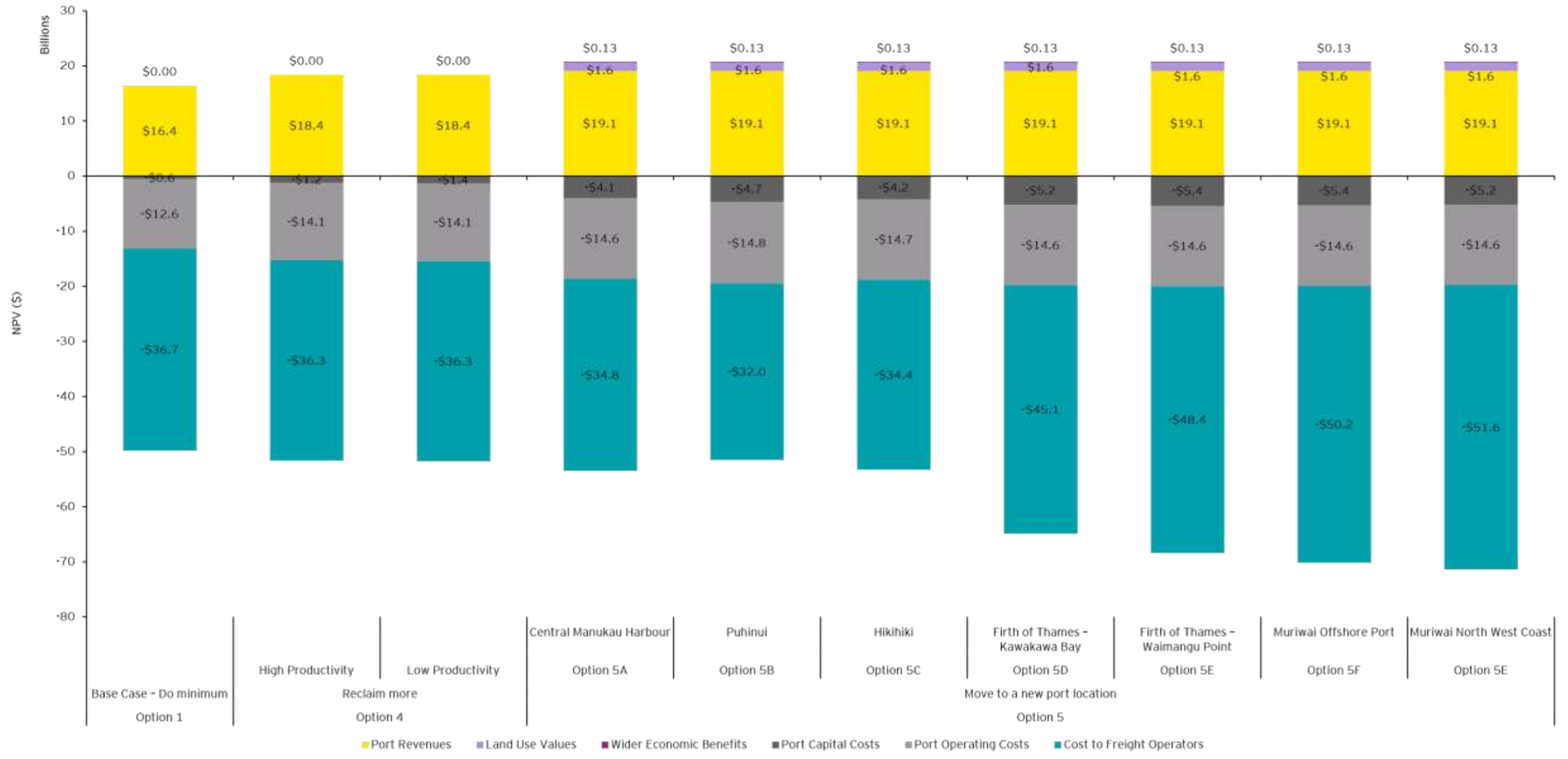
Component	Option 1 Base Case - Do minimum	Option 4 Reclaim more		Option 5 Move to a new port location						
		High Productivity	Low Productivity	Option 5A Central Manukau Harbour	Option 5B Puhinui	Option 5C Hikihiki	Option 5D Western Firth of Thames - Kawakawa Bay	Option 5E Western Firth of Thames - Waimango Point	Option 5F Muriwai Offshore Port	Option 5E Muriwai North West Coast
Environmental Impacts	► No change to coastal processes as port maintains the same footprint. ► Impact on Auckland Harbour traffic will remain the same, albeit with an increased number of vessels, however at a constrained footprint, will not increase by a degree readily quantifiable ► No additional impact on marine ecology ► No material change in carbon footprint is anticipated if the port remains within its current physical footprint without any change to operational capacity. However, should operational efficiencies be achieved and throughput increase, a steady increase in carbon footprint over time is anticipated. ► Increased noise effects may occur in line with throughput increases and in particular additional machinery, equipment and truck movements. ► Constraining the port to its existing physical footprint would confine the light spill effects to the current footprint, on the assumption that no additional light sources and no change to the location and orientation of the existing light source(s) within the existing Port would be required.	► The reclamation is unlikely to impact on coastal processes to any extent, since it does not encroach out into the main channel and since the foreshore is already highly modified by various reclamations and jetties. ► The increased throughput handled in Option 4 impacts on the carbon footprint of the port. ► Increased noise effects may occur in line with Port expansion, the proximity of any expanded footprint to residential areas will determine the scale and potential of noise impacts. There will also be associated noise and probably congestion impacts along key transport corridors. ► Increased light spill may occur subject to the location and orientation of any reclamation.		► The building of a new port in the Central Manukau Harbour is not expected to have major impacts on sediment transport. However Puhinui and Hikihiki will be more likely to cause large changes to circulation, currents and consequent sediment transport. ► A reduction in carbon footprint may be achieved subject to the location of a new Port within the harbour and proximity to land. If a new port can be located without the need for a substantial causeway, the carbon footprint would be less than expanding the existing port footprint. ► A new site within the harbour located close to land would see a reduction in carbon footprint and have a lower overall carbon footprint in comparison to other options. A new port located in Central Manukau Harbour would see an increased carbon footprint compared to Puhinui and Hikihiki, but would be less than the Western Firth of Thames and Muriwai options. ► Any significant environmental benefits in the CBD need to be offset by environmental impact at the proposed alternative sites			► A new Port in the Western Firth of Thames would result in an increased carbon footprint. Whilst accessible to SH1 and the south and east of the North Island, the travel distance from SH1 to the port landside activities increases the carbon footprint. Whilst the increase is not as high as the Muriwai option, it represents a material increase from the Manukau and the existing site options. ► Given the relatively quiet rural nature of this location the change in noise environment will be noticeable. There are a number of residences along the coastline that may be impacted by the change in noise environment, subject to the location of the port and the landside activities ► The existing night time environment would also change with the presence of a 24 hour operating port, associated landside activities and causeway all creating a potential night time illumination into the sky and adjacent viewpoints. ► Any significant environmental benefits in the CBD need to be offset by environmental impact at the proposed alternative sites	► This option will have the greatest increase in carbon footprint given its distance from industrial centres where freight travels to and from existing motorway links. ► As Muriwai is a relatively rural location, there will be a significant change in the noise impact in the area and along the transport route. ► There are also likely to be significant visual effects of increased traffic and access infrastructure (earthworks, road and rail) through Huapai/Kumeu which is an attractive rural landscape. Although population figures are currently low in this area, further residential growth is expected, but of a character to reinforce and enhance the rural characteristics. ► The existing night time environment would also change with the presence of a 24 hour operating port, associated landside activities and causeway all creating a potential night time illumination into the sky and adjacent viewpoints.	

Component	Option 1 Base Case - Do minimum	Option 4 Reclaim more		Option 5 Move to a new port location						
		High Productivity	Low Productivity	Option 5A Central Manukau Harbour	Option 5B Puhinui	Option 5C Hikihiki	Option 5D Western Firth of Thames - Kawakawa Bay	Option 5E Western Firth of Thames - Waimango Point	Option 5F Muriwai Offshore Port	Option 5E Muriwai North West Coast
Congestion Impacts	▸ For Option 1, as TEU volumes are capped at 3 million, the main congestion impact will be on the overflow of freight volumes that need to travel to Auckland thus placing strain on other networks outside of Auckland. This might result in a large cost if the capacities of those networks are less than the forecasted increase in freight movements.	▸ The increased number of truck movements for Option 4 will put strain on the network and will require extensive upgrades / investment (taken into account in the capital costs for transport infrastructure) which may not pay off if the trade volumes are capped at 4 million TEU (i.e. the marginal gain in trade volume transported is minimal and will reduce based on capacity limits when compared to the significant marginal cost of transport investment to expand capacity on the network). ▸ In addition, any trade overflow that is now travelling from other port locations to Auckland will place additional strain on other networks outside of Auckland. This might result in a large cost if the capacities of those networks are less than the forecasted increase in freight movements.		▸ The freight movements at the Manukau sites will place strain on the surrounding networks on which freight will travel. As the capacities of the networks are unknown, the cost of increased freight movements on this network cannot be calculated. ▸ If there is no spare capacity, this will result in upgrades to existing transport infrastructure (part of which is taken into account in the capital costs for transport infrastructure). The costs will be less if there is spare capacity in the network. ▸ As trade volumes in the new port scenario are not capped, it is likely that any investment in transport infrastructure will be justified if it can increase reliability for freight operators in terms of time savings.			▸ The freight movements at the Western Firth of Thames sites will place strain on the surrounding networks on which freight will travel. ▸ As the capacities of the networks are unknown, the cost of increased freight movements on this network cannot be calculated. The costs will be less if there is spare capacity in the network. ▸ If there is no spare capacity, this will result in upgrades to existing transport infrastructure (part of which is taken into account in the capital costs for transport infrastructure). ▸ As trade volumes in the new port scenario are not capped, it is likely that any investment in transport infrastructure will be justified if it can increase reliability for freight operators in terms of time savings.		▸ The freight movements at the Muriwai sites will place strain on the surrounding networks on which freight will travel. ▸ As the capacities of the networks are unknown, the cost of increased freight movements on this network cannot be calculated. The costs will be less if there is spare capacity in the network. ▸ If there is no spare capacity, this will result in upgrades to existing transport infrastructure (part of which is taken into account in the capital costs for transport infrastructure). ▸ As trade volumes in the new port scenario are not capped, it is likely that any investment in transport infrastructure will be justified if it can increase reliability for freight operators in terms of time savings.	
Social Impacts	▸ Opportunities for enhanced public access to the waterfront and recreation opportunities are constrained should the port remain in its current location albeit within its existing footprint. ▸ If the port remained where it was there would be significantly less opportunity for Auckland to make its waterfront more accessible to the population for recreational activities	▸ Expanding the ports footprint would have significant impact on the Auckland population and city. The existing footprint would increase further reducing opportunities for public access to and use of the waterfront. ▸ Increased use of the shipping lanes would occur alongside expansion with impacts on recreational uses of the water space within the harbour and could potentially constrain and reduce recreational opportunities. Potential increased conflict between commercial and recreational use of the harbour.		▸ Building a new port in the Manukau area has wider implications for increased economic activity in the area, including increasing business activity and demand for commercial/industrial land and to a smaller degree of residential surrounding the area. ▸ As the area surrounding the proposed sites is largely zoned industrial, building a new port in the area is unlikely to have the same adverse effects on community and social amenity as the other options would have.			▸ The social impacts of a new port within the Western Firth of Thames would need to be comprehensively assessed as part of a Social impact Assessment, should this option be carried forward for further evaluation. The effect on amenity of communities that overlook the proposed site and those who are affected by the rail and road access corridors through the Clevedon valley would need to be a key focus of any assessment. ▸ This assessment should also include the impact on recreational opportunities within the harbour and how the port location might impact existing access to and use of the coast. In addition, community aspirations around the use and protection of the Western Firth of Thames and the Clevedon Valley, both coastal and landside and community and stakeholder values associated with the area of impact would need to be defined and considered. The area of social impact is expected to be relatively stretched given the length of the new access corridor and the communities located along the route.		▸ There will be associated adverse social impacts of the new port at Muriwai on the amenity of communities that overlook the proposed site, and the impact on recreational opportunities on the water and along the Muriwai beachfront. ▸ Despite the area being sparsely population, it is a highly popular destination for Aucklanders and visitors and a new port in this location might impact existing access to and use of the coast and community aspirations around the use and protection of Muriwai beach, both coastal and landside and community and stakeholder values associated with the area of impact. This will need to be further defined and considered in a more detailed Social Impact Assessment study.	

Component	Option 1 Base Case - Do minimum	Option 4 Reclaim more		Option 5 Move to a new port location						
		High Productivity	Low Productivity	Option 5A Central Manukau Harbour	Option 5B Puhinui	Option 5C Hikihiki	Option 5D Western Firth of Thames - Kawakawa Bay	Option 5E Western Firth of Thames - Waimango Point	Option 5F Muriwai Offshore Port	Option 5E Muriwai North West Coast
Cultural Impacts	▸ The Crown's acquisition of title to the foreshore and harbour for the port undermined the rangatiratanga of mana whenua iwi and negatively impacted upon their ability to contribute to city developments in appropriate and meaningful ways. ▸ The main developments of interest were the reclamations which have prevented mana whenua iwi from returning intermittently to their traditional areas around the port site and from actively retaining an association with their wider rohe. ▸ There remain outstanding Treaty of Waitangi questions concerning title, foreshore and harbour management and the appropriate recognition of rights and responsibilities stemming from the interests and relationships held by mana whenua iwi. Resolving these questions are extant matters for consideration as part of the Waitematā harbour settlements.	▸ Reclamations in the past have prevented mana whenua iwi from returning intermittently to their traditional areas around the port site and from actively retaining an association with their wider rohe. The proposed additional reclamation under this option would only increase the degree of alienation experienced by mana whenua iwi to the existing site and wider area.		▸ Auckland Council identifies at least 17 mana whenua groups who may hold differing interests and relationships in the Manukau harbour. ▸ There remain outstanding Treaty of Waitangi questions concerning title, foreshore and harbour management and the appropriate recognition of rights and responsibilities stemming from the interests and relationships held by mana whenua iwi. Resolving these questions are extant matters for consideration as part of the extant Manukau harbour settlements. ▸ There is no definitive list of the extent to which each mana whenua group holds mana whenua in the Manukau harbour and to what areas. This identification process takes significant time and most usually occurs as part of the Treaty Settlement process with the Crown. ▸ It is possible that any future settlement in the Manukau will include elements of co-management and co-governance, for example with respect to elements such as water quality and decision making powers. ▸ Large public infrastructure projects in the Manukau have negatively impacted on taonga species in the harbour and the mana and kaitiakitanga of mana whenua iwi. It is against this background that mana whenua support for options across the Manukau has been low. ▸ A full Cultural Impact Assessment is required should any of these sites progress.			▸ There are a number of mana whenua iwi who hold interests in the Hauraki Gulf and would consider themselves affected by a new port being built in the Western Firth of Thames including the members of the Marutuahu confederation of iwi and Waikato Tainui. ▸ No Deed of Settlement has been executed in regard to the Firth of Thames or with the Hauraki Collective yet. Any future settlement negotiations could include co-management and co-governance over the Firth of Thames and/or co-ownership interests in the proposed sites. ▸ The Hauraki Gulf area holds significant historical, cultural and spiritual meaning for tangata whenua within the area. The proposed Western Firth of Thames sites will have an impact on the tangata whenua relationship with the Hauraki Gulf. This impact will require consideration by the Hauraki Gulf Forum. ▸ The proposed Waimango Point location is in close proximity to an area of high Māori conservation value, cultural significance which is one of the few areas of Māori land ownership in this area. A land bridge may mitigate this impact however reclamation is unlikely to be supported by mana whenua iwi or the local Māori land owners. ▸ Impacts on commercial and non-commercial fisheries activities will need further exploration. ▸ Some of the mana whenua iwi in this area are open to having a discussion about the building of a new port provided they are involved in the design, implementation and governance of the process over time. ▸ A full Cultural Impact Assessment is required should any of these sites progress.	▸ Muriwai is of significant importance for mana whenua iwi that hold interests and relationships to this area. ▸ Mana whenua iwi continue to exercise kaitiaktitanga over this area. For example mana whenua iwi continue to contest the road designation placed over Muriwai beach and the impact that this designation has on shellfish reproduction and local wildlife. ▸ The creation of a new port will need to consider the impacts upon the ability of the mana whenua iwi to continue to exercise kaitiakitanga. ▸ The ability to gather food from the area may also be impacted which would diminish the standing and mana of the mana whenua iwi. ▸ Important tribal taonga are still being found in the Muriwai beach area (a kauri waka was rediscovered in 2009 at Muriwai beach) ▸ A full Cultural Impact Assessment is required should this site progress.	

The figure below summarises the NPV for all the options over the 100 year model period. The CBA results are presented in Net Present Value (NPV) using a real discount rate of 2.5%.

Figure 83: NPV for all Options



In comparison to Option 1, the options that are returning the highest benefits compared to the base case are the options in the Manukau - Option 5A, B and C. This reflects the port dealing with a higher trade volume than in the base case. There is a higher cost for these options because of the cost of constructing a new port and the associated transport infrastructure. There is a freight operating cost saving for the Manukau options as well due to the more favourable distance to freight destinations when compared to the port site. Within the Manukau options, although Puhinui and Hikihiki have higher benefits than Central Manukau Harbour, in the long run, these ports will be more expensive to operate due to the amount of maintenance dredging required each year.

Building a port in the Western Firth of Thames and Muriwai compare poorly to the Option 1, due to the higher freight operating costs, driven by the less favourable distance when compared to the other sites (POAL and Manukau). The cost of constructing a port and associated transport infrastructure is also higher for these options due to the natural environment and terrain of the sites.

The realised land value and wider economic benefits from Option 5 is the additional benefit gained from releasing the land at Waitematā Harbour for redevelopment. This value does not include the value of the full sell-down of the land after development, due to the size of the development and annual take-up rates being spread beyond the 100 year appraisal period. The value of the realised land value is lower than the other benefits because of the discount factor applied to bring all numbers to a present value. The discount rate decreases the value of benefits that happen in future years as a result.

In terms of Option 4, benefits are higher than the base case due to POAL being able to take the higher trade task which means that there is a savings on freight operator costs as less of the volume is routed away from Auckland therefore, cost to move freight is lower and the higher revenue figures reflect the larger trade task that an expanded port can take.

10.7.2 Interpreting the results

The following points aid in the interpretation of the results:

- **Port analysis** - much of the ports analysis is based on a synthesis of prior research (including research papers of previous port studies produced by NZIER, PwC, and Rockpoint), separate discussions with POAL, Port of Tauranga and Northport, as well as industry experience of Black Quay Consulting. A high-level review of the capacity of the port was also undertaken by Black Quay Consulting.
- **Port timing for moving the port in Option 5 –** We have assumed that POAL ceases to operate when 2.2 million TEU is reached and the additional capital investment that would increase capacity to 3 million TEU is not carried out but invested in the new port construction instead.
- **Sensitivity of timing to discount rates and growth rates -** Delay in port movement or acceleration in port movement is highly dependent on growth rates. If growth rates are less than the 2.9%, this will delay urban renewal (and hence delay movement of the port as capacity would not be reached as fast, and vice versa for if growth rates were higher than 2.9%.
- A delay in port movement would reduce the costs associated with moving the port in present value terms, since the costs would be incurred later and hence be more heavily discounted. However, it would also reduce the benefits of urban renewal, which would take place further in the future, and vice versa for if a port movement was brought forward. The net impact of a delay with a slower growth rate or acceleration with a higher growth rate is tested in the sensitivity analysis.
- **Pricing –** We assume that operating cost per TEU/tonne and revenue per TEU/tonne do not vary from 2015 numbers. In practice, it is likely there will be pricing fluctuations driven by changes in demand. A historical analysis of price per TEU/tonne has remained at similar levels with no material price fluctuations.
- **Trade Volume** – We acknowledge that there are a range of views across the participating agencies as to the potential of the port terminal to handle the long-term trade task. However, for Option 1 and 4, our analysis adopted the most optimistic view of capacity and throughput as a means of maximising the opportunity of the ports activities. Specifically, we modelled the scenario of a maximum of trade volume growth up until 4 million TEU per annum based on advice from POAL and Black Quay.
- **Freight Costs** - We have conservatively assumed that the rail freight costs are the same in Option 1, 4 and 5. We have also assumed that congestion and time costs caused by intra-Auckland truck movements will be driven by distance travelled and volumes transported.

  This is likely to be different across all options as distances vary by port site. This is discussed qualitatively in each of the Option assessment of the CBA results. Based on Beca's 2009 origin/destination report, under Option 1, the origin-destination is based on the average kms between Ports of Auckland and the destinations where TEU is travelling. As most of the freight travels south of Auckland, the distance travelled by trucks in Option 1 will be more than those Options which have a lesser distance travelling south. As freight costs are also driven by TEU volume, and there is a cap on Option 4's trade capacity, it is assumed that the overflow trade destined for Auckland will now have to travel from other existing ports to arrive in Auckland. This places an additional economic burden on freight operators. However, this is likely to be less than Option 1 because of the lesser overflow that has to travel to Auckland as the port has expanded capacity.

10.7.3 Defining the base case

The base case scenario for the CBA analysis is based on the following parameters:

1. 2.9% growth rate with a 0.5% growth rate applied post 4 million TEU peak
2. 2.5% discount rate as recommended by the UK Treasury for long-term projects.

10.7.4 Option 1 assessment

The expectation in Option 1 is that the Waitematā site would continue to be dedicated to port and maritime use.

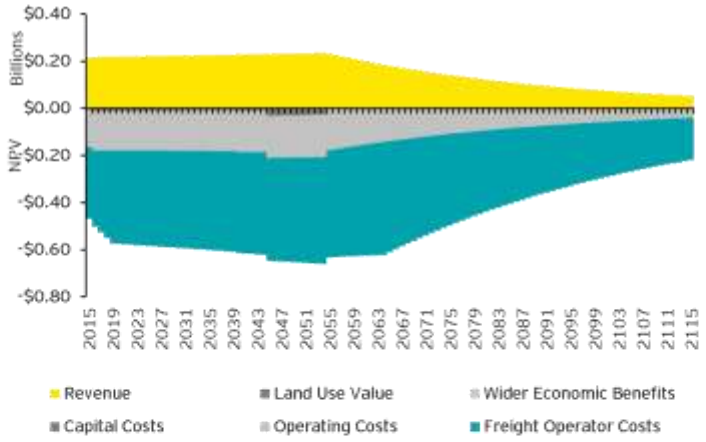
Quantitative assessment

Option 1 does not cater for growth in trade volumes due to the capacity of the port when constrained to its current footprint. Therefore, there is an economic loss to Auckland for Option 1 on the following factors:

- Constrained revenue growth due to capped TEU volume growth, there is a loss of revenue to POAL
- Loss of overflow trade task due to capped TEU volume growth, this represents an economic loss to freight operators who now have to transport overflow trade task destined for Auckland from other existing ports.

Figure 84 shows the whole-of-life costs and benefits for Option 1. In the earlier years before the 3 million TEU capacity is reached, the growth rates for revenue and operating costs offset the discount factor applied to values in those years. Therefore, the profile for revenue and operating costs remain fairly flat. However, once 3 million TEU capacity is reached, both revenues and operating costs will no longer increase, thus a discount factor applied to the capped value of revenue and operating costs will reduce the present value of revenue and costs in those future years.

Figure 84: Option 1 do-minimum - total benefits and costs



10.7.4.1 Qualitative assessment

10.7.4.1.1 Land use and strategic urban planning

Alignment with Auckland Plan (a compact city) and appropriateness of urban growth surrounding the port site.

This option, (effectively maintaining the status quo) would reinforce the intent of the Auckland Plan to maintain the port in its 'default' location within the city centre. The Auckland Plan describes the importance of the port which includes the three locations of the city centre, Onehunga and Wiri (inland port) as being of national and regional significance.

Urban growth in general would be appropriate surrounding the port site based on the compact city approach encouraging intensification in centre based development.

Potential for industrial and employment growth adjacent to port site

Land supply surrounding the port is very limited with most capacity available in the redevelopment of existing sites. In general capacity in the city centre resides within vertical multi-story development rather than low rise new build development generally associated with industrial uses. Quay Street and the rail corridor to the south of the site further reduce the availability of land in close proximity to the port site.

Industrial and employment growth associated with port activity would be in competition with high demand for other city centre uses. It is more likely that residential and commercial development which can take advantage of the vertical development capacity will most likely be more viable than port related industrial development.

Therefore due to the lack of land supply and competition with city centre residential and commercial development the potential for port related industrial and business growth is considered minimal.

Adjacency to established industrial and employment areas

The existing port site is not adjacent to any significant areas of industry or employment with direct relationship with port activity or requirement for port access.

There are existing good motorway, road and rail connections to industrial areas within Penrose, Mount Wellington and East Tamaki (approximately 10km via the road network).

However, the existing city centre port location is generally a significant distance from south Auckland where most of Auckland's industrial growth is currently taking place and where it is anticipated to continue in the future.

The existing port has little relationship with the business and corporate employment sector located in the city centre, and is relatively disconnected from secondary industries such as those in the technology and manufacturing sectors which are generally located in the south of Auckland.

Adjacency to established residential areas (access to employment opportunities)

The city centre provides a range of residential offerings in close proximity to the port theoretically reducing the commuting distances for port employees or port related industrial employees. However, residential land values and rental prices as well as limited supply of 'family homes' in the city centre maybe restrictive for some of these employees.

Residential areas outside of the city centre provide greater choice for employees however these locations can require large commute distances to the port.

Land use

The current industrial land use of the port is arguably not the most efficient and best use of the site. JLL have valued the land based on a higher and better alternative mixed residential, commercial office and retail use which is deferred until a future date when freight growth makes the existing port footprint no longer sustainable to meet Auckland's freight handling needs.

This current land value analysis includes provision for medium-term holding income to be derived from existing port activities until a transition into alternative uses can be achieved.

Further Land Use Effects

Flow-on costs and benefits of Option 1 on surround land have been considered, including the CBD:

- Negative impact of increasing traffic congestion with increasing freight volumes
- Confined CBD resulting in future land shortages (particularly as Viaduct Harbour and Wynyard Quarter reach maturity)
- Lost proximity gains for adjacent land through loss of quality development of the waterfront.

10.7.4.1.2 Environmental

Coastal

There will be no change to the physical or biological environment. By maintaining the same footprint, there will be no change to coastal processes, and even though there will be an increased numbers of vessels, the Auckland Harbour is already very busy, and so impacts such as those that can be caused by boat wakes have been occurring for decades. In terms of marine ecology, it is already a highly modified environment with no significant biota or communities present in the fine muddy/silts in the wharf area.

Carbon footprint

No material change in carbon footprint is anticipated if the port remains within its current physical footprint without any change to operational capacity. However, should operational efficiencies be achieved and throughput increase, a steady increase in carbon footprint over time is anticipated.

As the overflow trade will also now be travelling to Auckland from locations outside of Auckland, it is likely that that additional travel will incur an increased carbon footprint. This will be larger than in Option 4 because of the smaller capacity of Option 1 when compared to the capacity of the expanded port in Option 4.

Noise and vibration

Increased noise and vibration effects may occur in line with increased throughput and in particular additional machinery, equipment, truck volumes, and rail carriage movements. Whilst technological advances together with acoustic considerations in any changes to the port site layout, design and operations including noise reduction measures for in ship generators which may enable a reduction or mitigation of on-site noise generating sources. Control of noise impacts along key transport corridors will be more challenging and subject to the sensitivity of adjoining land uses. The hours of operation and consistency of the noise generating activities such as duration, route and intensity of transport movements to and from the port will be key considerations.

Given that a 50% increase in operational throughput is expected, a comprehensive evaluation of the noise generation and mitigation opportunities is recommended. This should be part of any further detailed evaluation of the port remaining within its current footprint, including an assessment of marine and terrestrial fauna residing or frequenting the area.

There is an existing port generated noise and vibration baseline against which any future change to the existing port capacity can be assessed (current operations). In addition existing Operative District Plan (ODP) noise controls that currently apply to Port Activities include:

- Auckland District Plan Central Area Section Rule (14.8.8).
- Auckland Regional Coastal Plan (Rule 35.5.3).

Rule 14.8.8 sets out the existing noise controls applicable to the entire port precinct as defined in the ODP. The ODP Port Precinct encompasses Ferguson Wharf, Freyberg Wharf, Jellicoe Wharf, Bledisloe Wharf and Wynyard Wharf. The operative noise rules are set out below:

Noise arising from any activity (except construction or blasting activities) within the Port Precinct shall not exceed the following levels:

a) Measured noise levels shall not exceed the following:

i. when measured 1m from the facade of any building on the southern side of Quay Street:

On All Days 11pm to 7am	L_{10} 60 dBA L_{max} 85 dBA

ii. when measured at or within the boundary of any property subject to the Auckland City Operative District Plan 1999 (Isthmus Section) with a residential activity zoning:

On all days 7am to 11pm	L_{10} 55 dBA
On All Days 11pm to 7am	L_{10} 50 dBA L_{max} 75 dBA

b) In determining compliance with these noise levels the following shall apply:

i. The long-term average sound level, averaged over any 7 days (i.e. 7 days of short-term average sound levels) shall not exceed the specified levels by more than 3 dBA due to statistical variation over those days.

ii. There shall be no exceedance of the specified short-term average levels by more than 5dBA. The short-term average sound level shall be the average of any four L_{10} (15 minute) values obtained during a single night or day, when the wind speed at the site where the measurement is taken is less than 2 metres per second.

iii. Care shall be taken to ensure that the short-term average sound level represents noise from port activities, and is not influenced by noise from other sources. The time period between 3.00am and 5.00am daily shall be the preferred time for noise measurements. If the short-term average level is wholly or partly determined from measurements at other times, then records shall be adequate to demonstrate that the short-term average sound level was not influenced by noise from non-port sources.

The Operative Regional Coastal Plan Noise Rules (Rule 35.5.3) set out the controls applicable to the (Coastal Marine Area), in addition to the District Plan noise rules. These rules apply to the CMA from the eastern side of Ferguson Wharf to the western side of Wynyard Wharf. The port is identified as being included within Port Management Areas 1A and 1C. Separate noise controls apply to each Port Management Area. The noise controls within Port Management Area 1A are the same as those set out in the District Plan. Within area 1C the following rules apply:

Noise generated within the Port Management Areas:

a) Within Port Management Area 1C the noise level shall not exceed:

i. when measured 1m from the façade of an occupied building on the southern side of Quay Street, or within the Wynyard Quarter, or within the Viaduct Harbour Precinct as defined in the Auckland City District Plan (Central Area Section) shall not exceed:

On All Days 11pm to 7am	L_{10} 65 dBA
On all days 7am to 11pm	L_{10} 60 dBA L_{10} 70 dBA at 63Hz L_{10} 65 dBA at 125Hz L_{max} 75 dBA

In addition to these noise levels there are additional controls related to noise events of which there are to be no more than 15 per annum.

Changes to these existing rules and noise standards are proposed through the current Proposed Auckland Unitary Plan (PAUP) Hearing process. The decisions on those changes are not anticipated until post July 2016.

We would recommend that an acoustic assessment of the existing noise and vibration baseline is undertaken as a benchmark to assessing and evaluating any potential change to noise and vibration levels at sensitive receiver locations from increased operational capacity within the existing footprint. That assessment would need to consider changes to equipment and machinery; reversing beeper noise, hours of operation; site management plans, increases in traffic volumes to and from the port; size, location and frequency of ships and their noise generating capacity (including potential for on board acoustic treatment). The assessment should also consider the proximity of the increased port operations to sensitive land uses, in particular residential land uses.

Light spill

Constraining the port to its existing physical footprint would confine the light spill effects to the current footprint, on the assumption that no additional light sources and no change to the location and orientation of the existing light source(s) within the existing port would be required.

Again, the hours of operation will be key considerations. Any changes to the road corridor such as new or upgraded networks requiring additional lighting would potentially impact adjoining land uses.

A comprehensive evaluation of the of the potential light spill impact and mitigation opportunities is recommended as part of any further detailed evaluation of the port remaining within its current footprint, including an assessment of how the port is managed to achieve increased throughput and the need for additional light sources. The design and orientation of any new light sources and proximity to sensitive land uses would require assessment in order to determine the light spill effects and whether there would be any change in comparison to the existing operations.

Air quality

Air quality within the port surrounds would require further consideration. Air quality impacts from port operations can be separated into amenity impacts such as odour and nuisance dust and health impacts from pollutants such as noxious gases and fine particulates.

Air quality within New Zealand is governed through a number of legislative acts, plans and guidelines including:

- The Clean Air Act 1972 (CAA) which imposes a general obligation to adopt the best practicable means to reduce air pollution.
- The Health Act 1956 which contains provisions applicable for the control of nuisance and offensive trades.
- The Resource Management Act 1991 (the RMA) which looks to avoid, remedy, or mitigate any adverse effects of activities on the environment.
- The Resource Management (National Environmental Standards for Air Quality) Regulations 2004 which provides in Schedule 1, national ambient air quality standards for contaminants that must not be exceeded in an airshed within New Zealand.
- Auckland Council Regional Plan: Air, Land and Water 2013 which is an instrument of the RMA and controls discharges to air within the coastal marine area of the Auckland region (amenity only), and provides Auckland regional air quality targets, policies, rules and a schedule of hazardous air pollutants, refer to Table 66 for Auckland air quality targets under the Plan.
- The Ministry for the Environment guidelines which provide guidance on air quality, dust, odour, and air dispersion modelling throughout New Zealand.

Table 66: Auckland Regional air quality targets

All Areas	Contaminant	Target	Averaging Time
Auckland Regional Air Quality Targets	Particles ($PM_{2.5}$)	25µg/m^3	24 hour
	Particles (PM_{10})	20µg/m^3	Annual
	Nitrogen dioxide (NO_2)	100µg/m^3	24 hour
	Carbon monoxide (CO)	30µg/m^3	1 hour
	Sulphur dioxide (SO_2)	120µg/m^3	24 hour
	Ozone	100µg/m^3	8 hour
	Lead	0.2µg/m^3	3 month moving average
	Benzene (year 2002)	10 µg/m^3	Annual
	Benzene (year 2010)	3.6 µg/m^3	Annual
	1,3-Butadiene	2.4 µg/m^3	Annual
	Formaldehyde	100 µg/m^3	30 minutes
	Acetaldehyde	30 µg/m^3	Annual
	Benzo(a)pyrene	0.0003 µg/m^3	Annual
	Mercury (inorganic)	0.33 µg/m^3	Annual
	Mercury (organic)	0.13 µg/m^3	Annual
	Chromium VI	0.0011 µg/m^3	Annual
	Chromium metal and Chromium III	0.11 µg/m^3	Annual
	Arsenic (inorganic)	0.0055 µg/m^3	Annual
	Arsine	0.055 µg/m^3	Annual

An assessment of the impacts on air quality associated with increased port capacity albeit within the existing foot print is recommended. The potential amenity and health effects on identified sensitive land use activities would need to be quantified. Environmental baselines would need to be established for future comparisons, including such parameters as vehicle emission gases and particulates, such as NO_x, SO_x, $PM_{2.5}$ and PM_{10}. As part of the baseline study at least 12 months of validated site specific meteorological data would need to be collected and analysed. It is recommended that background air quality monitoring be undertaken for a minimum period of 12 months to coincide with meteorological data collection.

Visual sensitivity

There will be some minor adverse visual change associated with reclamation and intensification of the port activity, given there will be a change of use from water/harbour to port land. Recent reclamation activity by POAL has demonstrated how significant this issue is to the people of Auckland, even for "minor" reclamation.

As POAL continues operations where it is, the contrast between the industrial uses of the land to the urban city means that the port and its related infrastructure will be less visually attractive. One of the most prized assets of the central city is the views out to the waterfront and the port to some extent blocks these views, and therefore has an impact on the amenity of the city.

Mitigation – existing environmental effects

Whilst the do-minimum option avoids the need for further reclamation by utilising the existing port footprint, local resident perceptions are that the port operation is at capacity and that any operational change, even within the existing physical footprint, will lead to additional adverse effects arising for increased intensity of use of the port site. Particularly in terms of potential noise and light spill from within the existing footprint and along the transport corridors.

We note that a comprehensive Assessment of Environmental Effects (AEE) has not been undertaken for the existing port and for any of the short-listed options. An AEE will be required to quantify the actual and potential effects, determine the consentability of each option and identify mitigation opportunities.

The actual and potential landside effects of noise, vibration and lighting associated with any change to the existing port operation can only be determined against a detailed assessment of any proposed physical changes on site including operational changes to throughput capacity and/or changes to transport networks.

That assessment would need to take into account changes to the site layout including storage volume, location, duration and changes to location and intensity of light and noise sources. Whilst increased container storage on site in terms of height and breadth of storage across the existing footprint, could change the visual appearance of the site in comparison to the existing operation, it doesn't necessarily follow that the potential noise and lighting effects would negatively increase. An understanding of potential noise, vibration and light buffers, location and orientation of the light and noise sources on site is necessary to determine whether operational changes would result in adverse noise and lighting effects particularly in relation to nearby sensitive residential receivers. It is possible that physical on site changes to the light and noise sources could reduce and further mitigate noise and light impacts. Detailed technical evaluations are required in order to determine the scale and intensity of the potential environmental effects of any change to the existing operation, albeit within the existing footprint.

Whilst there is a higher urban population within proximity to the existing port facility potentially impacted by changes to the existing operation in comparison to the lower density, rural and coastal communities in proximity to the new port options, only a marginal change in impact may be experienced against the existing port operating baseline, when compared against the 'new' impact experienced at the new port options. The actual and potential effects can only be determined with accuracy when assessed against a comprehensive understanding of any proposed operational changes at the existing port site.

10.7.4.1.3 Social

Opportunities for enhanced public access to the waterfront and recreation opportunities are constrained should the port remain in its current location, albeit within its existing footprint. If the port remains in the Waitematā Harbour in 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 be a negative impact on the quality of urban form and design for Auckland as a growing city that has emphasis around its waterfront.

If the port remained where it was there would be significantly less opportunity for Auckland to make its waterfront more accessible to the population for recreational activities. Increased use of the shipping lanes may occur if efficiency improvements result in increased throughput and ship movements. Release of some of the existing port waterfront space would be required to facilitate public access and to enhance opportunities for recreation activities along the CBD waterfront.

10.7.4.1.4 Cultural

Mana whenua involvement and future engagement

Mana whenua participated in a broad discovery process in respect of their perspectives of the proposed short-list sites. This discovery process was not 'consultation' with affected iwi or a formal 'engagement process' with mana whenua because any formal recommendations from the CWG or any formal position on the part of Auckland Council has yet to be made.

Whilst these mana whenua perspectives informed the preparation of this Study, they should not be viewed as categorical or formally representative of the respective mana whenua groups' mandated positions.

Formal, coordinated and appropriately structured future engagement is required as this process continues. Undertaking formal engagement is critical to the future success of this long-term initiative. This is particularly important in light of the potential for co-governance and co-management Settlement options over potential and current port sites.

Historical Perspective

The name for the harbour where the port is located is Wai-te-matā which means 'obsidian waters' – the glassy surface resembled volcanic obsidian rock. In Te Arawa tradition, the harbour was named by their ancestor Tamatekapua, when he placed a volcanic stone as a mauri (talisman) in its waters near Birkenhead. The Ngāpuhi people called it Te Wai-o-te-mate (the waters of death) – a reference to the battles to control the Tāmaki isthmus.

The Waitematā harbour is an important and common geographic reference point for many iwi upon first arriving to Aotearoa as part their migration histories. But, it is the local mana whenua who were and remain the most affected by the current port location.

The Crown's acquisition of title to the foreshore and harbour for the port undermined the rangātiratanga of mana whenua iwi. This negatively impacted upon their ability to contribute to city developments in appropriate and meaningful ways that benefited both Auckland and mana whenua. The mana and ability of mana whenua iwi to give effect to their kaitiakitanga responsibilities and obligations was in their opinion significantly impacted by the establishment of the port and its ongoing operations. Mana whenua iwi spoken to in preparing this study talked of a persistent theme of disempowerment in relation to the conduct of the port toward them.

Overtime the water quality of the Waitematā has deteriorated significantly. This has impacted on taonga kai species which were provided to visitors to Ngāti Whātua and members of the Marutuahu confederation of iwi as sign of not only their ability to manaaki (sustain) guests but also a display of their mana and prosperity. This has also impacted upon the degree and nature of interaction which mana whenua iwi have with their natural environment in which they have lived for hundreds of years.

Interests and Relationships

Mana whenua iwi claim a customary relationship to the land and waterways in Auckland including to the Waitematā harbour. Since 1850 when Ports of Auckland was established, mana whenua have contested the taking of their customary interests and the impact of the port upon their relationships to this area.

While constraining the port to its current footprint might be considered the least intrusive option for mana whenua iwi, it represents a troubled past and a challenging future.

The main developments of interest were the reclamations which have prevented mana whenua iwi from returning intermittently to their traditional areas around the port site and from actively retaining an association with their wider rohe.

As noted earlier, Ngāti Whātua is also unable to fully unlock the commercial value of strategic land assets held by the tribe due to the proximity of existing port operations.

While generally supportive of continuing cruise operations as a platform for greater cultural interaction mana whenua iwi were not supportive of the port continuing in its present location. There is support for transferring some of the cargo load to Northport as a form of economic stimulus for the northland region in line with a reduction in operations at the current port site.

Treaty Settlement

There remain outstanding Treaty of Waitangi questions concerning title, foreshore and harbour management and the appropriate recognition of rights and responsibilities stemming from the interests and relationships held by mana whenua iwi. Resolving these questions are extant matters for consideration as part of the Waitematā harbour settlements.

A harbour settlement over the Waitematā harbour has a high likelihood of occurring sometime in the next 10 years. Any such settlement could likely include co-governance and co-management aspects in relation to the harbour.

While any Settlement will involve Auckland Council, the Crown would negotiate the Settlement in good faith independently of other interested parties positions. Environmental impacts from the port have affected the degree and quality of interaction that mana whenua are able to achieve and have negatively impacted upon the culture and way of life of mana whenua iwi including Ngāti Whātua.

Ordinarily co-governance and co-management Treaty Settlements include elements that relate to water quality, decision making powers, management roles and responsibilities and other relevant factors.

10.7.5 Option 4 assessment

10.7.5.1 Quantitative assessment

Option 4 does not cater for growth in trade volumes due to the capacity of the port when constrained to its current footprint. Therefore, there is an economic loss to Auckland for Option 4 on the following factors:

- Constrained revenue growth due to capped TEU volume growth, there is a loss of revenue to POAL once the 4 million TEU peak is reached
- Loss of overflow trade task due to capped TEU volume growth, this represents an economic loss to freight operators who now have to transport overflow trade task destined for Auckland from other existing ports.

Figure 85 and Figure 86 on the next page shows the whole-of-life costs and benefits for Option 4. In the earlier years before the 4 million TEU capacity is reached, the growth rates for revenue and operating costs offset the discount factor applied to values in those years. Therefore, the profile for revenue and operating costs remain fairly flat. However, once 4 million TEU capacity is reached, both revenues and operating costs no longer increase, thus a discount factor applied to the capped value of revenue and operating costs reduce the present value of revenue and costs in the future years.

The difference for the high productivity and low productivity scenario is the capital investment required for POAL to meet the 4 million TEU trade task. If the port is highly productive, the amount needed for reclamation is less than if the port was less productive. The difference in the capital costs for both these scenarios is a difference of approximately $100 million (based on NPV of capital costs). All other costs and benefits for the two productivity scenarios for Option 4 are assumed to remain the same.

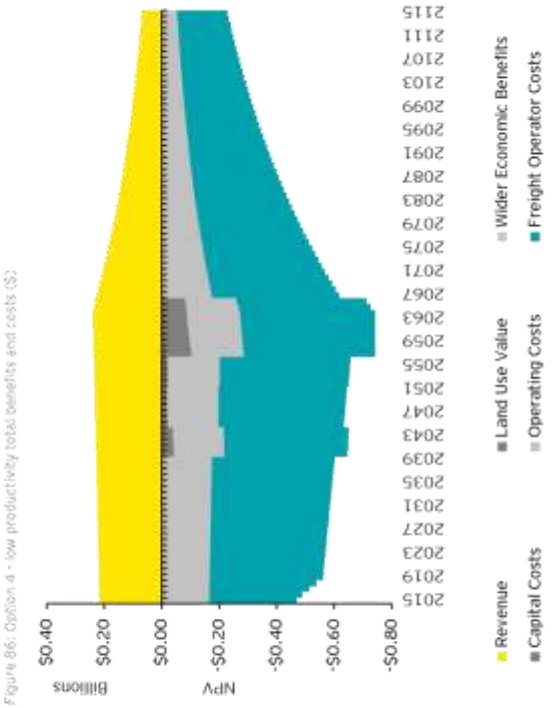


Figure 86: Option 4 - low productivity total benefits and costs ($)

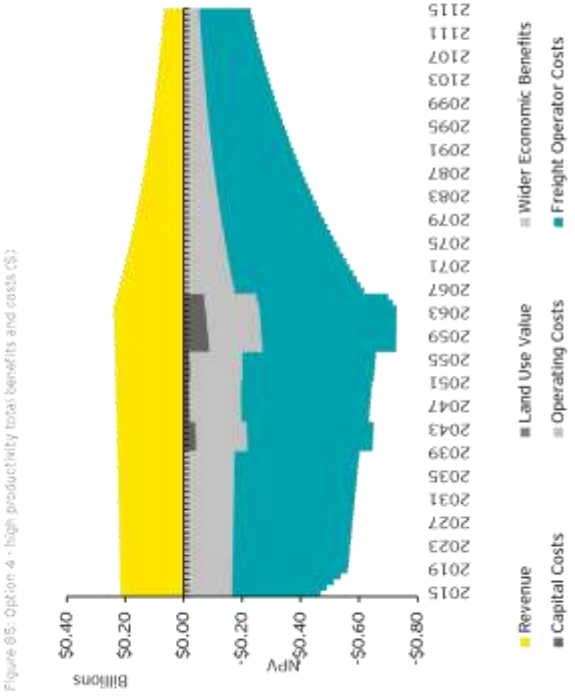


Figure 85: Option 4 - high productivity total benefits and costs ($)

10.7.5.2 Qualitative assessment

10.7.5.2.1 Land use and strategic urban planning

Alignment with Auckland Plan (a compact city) and appropriateness of urban growth surrounding the port site

The Auckland Plan does not specifically state support or otherwise for an enlarged city centre port location. However, the location of the port does reinforce the intent of the Auckland Plan to maintain the port in its 'default' location within the city centre. The Auckland Plan describes the importance of the port which includes the three locations of the city centre, Onehunga and Wiri (inland port) as being of national and regional significance.

Urban growth in general would be appropriate surrounding the port site based on the compact city approach encouraging intensification in centre based development.

Potential for industrial and employment growth adjacent to port site

Land supply surrounding the port is very limited with most capacity available in the redevelopment of existing sites. In general capacity in the city centre resides within vertical multistory development rather than low rise new build development generally associated with industrial uses. Quay Street and the rail corridor to the south of the site further reduce the availability of land in close proximity to the port site.

Industrial and employment growth associated with port activity would be in competition with high demand for other city centre uses. It is more likely that residential and commercial development which can take advantage of the vertical development capacity will most likely be more viable than port related industrial development.

Therefore due to the lack of land supply and competition with city centre residential and commercial development the potential for port related industrial and business growth is considered minimal.

Adjacency to established industrial and employment areas

The existing port site is not adjacent to any significant areas of industry or employment with direct relationship with port activity or requirement for port access.

There are existing good motorway, road and rail connections to industrial areas within Penrose and Mount Wellington (approximately 10km via the road network).

However, the existing city centre port location is generally a significant distance from south Auckland where most of Auckland's industrial growth is currently taking place and where it is anticipated to continue in the future.

The existing port has little relationship with the business and corporate employment sector located in the city centre, and is relatively disconnected from secondary industries such as those in the technology and manufacturing sectors which are generally located in the south of Auckland.

Adjacency to established residential areas (access to employment opportunities)

The city centre provides a range of residential offerings in close proximity to the port theoretically reducing the commuting distances for port employees or port related industrial employees. However, residential land values and rental prices as well as limited supply of 'family homes' in the city centre maybe restrictive for some of these employees.

Residential areas outside of the city centre provide greater choice for employees; however, these locations can require large commute distances to the port.

Land use

As with Option 1 above, the highest and best use for the land is in an alternative mixed use form. Even with expansion of the port footprint, there is the expectation that freight volumes will exceed the future capacity of the port. This would be expected to occur further into the future.

Further land use effects

The costs and benefits of Option 4 on surrounding land have been considered, including the CBD. These are similar to Option 1 above.

- Negative impact of increasing traffic congestion with increasing freight volumes
- Confined CBD resulting in future land shortages (particularly as Viaduct Harbour and Wynyard Quarter reach maturity)
- Lost proximity gains for adjacent land through loss of quality development of the waterfront
- Increased reverse sensitivity issues on surrounding properties.

10.7.5.2.2 Environmental

Coastal

The reclamation is unlikely to impact on coastal processes to any extent, since it does not encroach out into the main channel and since the foreshore is already highly modified by various reclamations and jetties.

Any impacts on coastal processes would be reduced if the new areas are built on piles (rather than reclamation). In terms of marine ecology, it is already a highly modified environment with no significant biota or communities present in the fine muddy/silts in the wharf area or the adjacent harbour seabed. However, increased reclamation out into the harbour will have an increased negative impact on the coastal processes.

Carbon Footprint

Whether the port remains within its existing footprint or expands in its current location no variation in carbon footprint between these two options (Option 1 and Option 4) is predicted.

As the port operations and throughput handled is increasing, the carbon footprint for the port is expected to increase as truck movements will increase based on the additional amount of TEU they will need to transport.

As the overflow trade will also now be travelling to Auckland from locations outside of Auckland, it is likely that that additional travel will incur an increased carbon footprint. This is less than in Option 1 because of the larger capacity of the expanded port compared to Option 1.

Landside transport will also be increasingly congested as an enlarged port would bring increasing transport demands to both road and rail in a part of the city already heavily congested. Whilst the planned CRL will bring relief to rail users, increasing demand for rail space could undermine such improvement, although the addition of a "third" or dedicated freight line may help to mitigate this issue.

Noise and vibration

Increased noise and vibration effects may occur in line with port expansion associated both with expansion of the operating footprint and throughput increases in particular additional machinery, equipment, truck volumes, and rail carriage movements. The proximity of any expanded footprint area to sensitive land uses such as residential apartments and dwellings will determine the scale of potential noise impact.

It is anticipated that an expansion of the port footprint will extend the area of potential noise impact but the actual degree of impact would need to be determined and assessed within the context of a detailed understanding of the capacity increase and port operations. Whilst technological advances may enable reduction or mitigation of on-site noise generating sources, the control of noise impacts along key transport corridors will be more challenging and subject to the sensitivity of adjoining land uses.

The hours of operation and consistency of the noise generating activities will be key considerations. Given that a 50% increase in operational throughput is expected a comprehensive evaluation of the noise generation and mitigation opportunities is recommended as part of any further detailed evaluation of this option.

The existing noise standards applicable to the port are set out in Option 1 above. Again an assessment of the existing baseline is recommended as a starting point for comparison of the potential noise and vibration impacts of an increased port foot print on sensitive land uses. In a similar manner to the approach outlined in Option 1 above, the assessment would need to consider changes to equipment and machinery; reversing beeper noise, hours of operation; site management plans, traffic volumes, ship frequency and size, and location of sensitive land uses.

The assessment would also need to assess construction noise and vibration for both sensitive land uses and marine and terrestrial fauna potentially impacted from both construction and future operational activities. Construction noise and vibration may need to be assessed as a staged approach dependent on construction schedules and would need to take into account both mobile and stationary equipment, and assess all noise and vibration generating activities proposed such as rock breaking, vibratory roller activities, pile driving activities and the location of haul routes and construction hours and delivery schedules.

Light spill

Increased light spill may occur subject to the location and orientation of any reclamations and associated equipment and machinery, lighting technology and proximity to sensitive land uses. An increased port footprint will increase the potential for a wider impact from light spill, subject to the location orientation and intensity of the light sources. Again the hours of operation and site intensity will be key considerations together with port operations including changes to the height of containers and in turn the height and potential spill from the light sources.

Any changes required to the road corridor such as new or upgraded networks requiring additional lighting would potentially impact adjoining land uses. A comprehensive evaluation of the of the potential light spill impact and mitigation opportunities is recommended as part of any further detailed evaluation of this option. Any expansion of the port to the east will increase proximity of port activities and potential light spill to sensitive neighbouring residential land uses.

Air quality

An assessment of the impacts on air quality associated with increased port capacity is recommended. The potential effects on identified sensitive land use activities would need to be quantified. Environmental baselines would need to be established for future comparisons and both construction and operation air quality impacts would require assessment in a similar manner to that outlined in Option 1 above.

Visual sensitivity

There will be potential significant adverse visual effects from either side of the harbour and from the water itself due to significant reclamation and potential for views from sites in the city centre to the harbour mouth and Rangitoto obstructed by port intensification and reclamation. Recent reclamation activity by POAL has demonstrated how significant this issue is to the people of Auckland even for minor reclamation. Major reclamation would be a very serious issue.

The introduction of further buildings on the port land, particularly five storey car parks, could raise further concerns over the compatibility of an industrial use within the central city that is aspiring to be one of the world's best cities, and attract more businesses, residents and tourists.

Further reclamation and extension of the port land into the harbour would further reduce the views from the central city out towards the harbour mouth and Rangitoto Island, more so than for Option 1.

Mitigation – environmental effects

The local residential community has been vocal in opposition to further reclamation to facilitate port growth. As is the case for Option 1 we note that a comprehensive AEE has not been undertaken for the reclamation option. An AEE will be required to quantify the actual and potential effects, determine the consentability of this option and identify mitigation opportunities.

The actual and potential landside effects of noise, vibration and lighting associated with any reclamation and accompanying change to the port operation can only be determined against a detailed assessment of any proposed physical changes on site including site layout, location of noise and light sources, operational changes to throughput capacity and/or changes to transport networks. The proximity of the reclamation (in combination with the proposed site layout and operations) to sensitive receivers including residential activities and the placement/replacement and orientation of any additional lighting and/or noise generating activities will need to be assessed.

Whilst the reclamation will increase the port footprint, detailed technical assessments are required to determine the effects of that change on sensitive landside receivers. Such an assessment could be accompanied with an environmental management plan that includes a detailed evaluation of the effects of the reclamation and site operations targeted at assessing the feasibility of mitigating the landside effects of noise, vibration and light spill.

10.7.5.2.3 Social

Expanding the ports footprint would have significant impact on the Auckland population and city. The existing footprint would increase further reducing opportunities for public access to and use of the waterfront. The Council's vision, as set out in the Auckland Plan states the desire for Auckland to be green and beautiful for its population and visitors. Expanding into the harbour would undermine these visions, in particular the desire to minimise pollution along coastlines and to develop coastal areas that thrive in recreational opportunities.

A vibrant waterfront would be a 'pull' factor for Auckland residents, businesses and tourists. The waterfront plays a unique role in Auckland's city centre due its access to water-based recreation, trade and transport.

Release of some of the existing port waterfront space would be required to facilitate public access and to enhance opportunities for recreation activities along the CBD waterfront in parallel with any proposed expansion of the port in its current location. Increased use of the shipping lanes would occur alongside expansion with impacts on recreational uses of the water space within the harbour which would lead to conflict between commercial and recreational uses, potentially constraining and reducing recreational opportunities.

This impact will be even more pronounced than that of Option 1 due to the additional expansion and reclamation. Further reclamation and extension of port land into the harbour would further reduce how the harbour is used. The channel between the port and the Devonport peninsula has already been narrowed significantly over the last century through various reclamation projects.

At its narrowest, the channel is just below 900 metres, compared to the original historical width of almost 2km. Recreational use of the channel is already constrained at times of high demand, and a further reduction could jeopardise the ability of this channel to function for such use.

10.7.5.2.4 Cultural

Mana Whenua involvement and future engagement

Mana whenua participated in a broad discovery process in respect of their perspectives of the proposed short list sites. This discovery process was not 'consultation' with affected iwi or a formal 'engagement process' with mana whenua because any formal recommendations from the CWG or any formal position on the part of Auckland Council has yet to be made.

Whilst these mana whenua perspectives informed the preparation of this Study, they should not be viewed as categorical or formally representative of the respective mana whenua groups' mandated positions.

Expanding the existing footprint would require consent from Auckland Council and mana whenua iwi that we spoke with would not support the expansion of the existing footprint. There is insufficient space in this study to properly document the compelling reasons upon which mana whenua iwi would oppose expansion of the existing site. However some preliminary indications were provided in the preceding section.

If this option is progressed, formal, coordinated and appropriately structured future engagement is required with mana whenua iwi. Undertaking formal engagement is critical to the future success of this long-term initiative. This is particularly important in light of the potential for co-governance and co-management Settlement options over the current port sites.

10.7.6 Option 5 assessment

10.7.6.1 Creating a liveable city

For all of the Option 5 sites, moving the port to a new location would allow Auckland to maximise highest value land use for the waterfront land, and provide commercial growth opportunities. At approximately 75 hectares, the site would be the largest contiguous site, in single ownership in the city centre by some margin. To put this into perspective, Wynyard Quarter is 45 hectares, and the current Barangaroo redevelopment in central Sydney is 22 hectares.

Returning the land to Auckland city for redevelopment would represent a huge opportunity to provide an extension to the existing city centre with valuable waterfront property. This would be a long-term project, due to the time taken to release this land, but also because such a large area would take a long time to be occupied. The opportunity for comprehensive master planning is one where Auckland City can truly create a world-class urban environment.

This would sit comfortably with the high level aims and aspirations of Auckland city to be the world's most liveable city. Opportunities for the redevelopment to contribute to Auckland's mission of being the world's most liveable city include:

- The opportunity to create a new focal point or destination
- Significant provision of large amounts of high quality open space, which could be used as relatively passive open space, or for large organised and programmed events
- Water or maritime related recreation and tourism facilities
- Recognising maritime heritage through the retention of buildings, structures, cranes etc.
- Providing large amounts of residential accommodation, including affordable elements, in a central city and therefore sustainable location. Although, a long-term proposition, Auckland is predicted to continue growing for some time, and such a large opportunity for residential development in the central city would reduce the need for housing on the edge of the city, and the attendant infrastructure required to support further edge of city growth
- Opportunity to provide for new land uses not currently known at present

- Opportunity to re-connect or further connect the city to the water. Despite being known as a 'waterfront' city, there has been little opportunity for Aucklanders to interact with the actual water's edge in the city centre
- Opportunity to enhance adjacent areas as releasing the port land, and allowing more typical central city urban development and other immediate adjacent areas, providing further property uplift
- The removal of port related freight vehicles from streets such as Beach Road and Quay Street will also provide the opportunity to create much better street environments, without the need for the wide lanes and large turning radii that characterise these streets at present.

Most notably, a change in the use of the port land to a more typical urban environment with public access along its length would release an additional 6km of publicly accessible water's edge, which would be of huge benefit to the city.

10.7.6.2 Mitigation – environmental effects

No community engagement has been undertaken on the potential new site options and as such no feedback on perceptions around the scale and intensity of the potential landside effects of noise and lighting have been put forward by the local community. An AEE will be required to quantify the actual and potential effects, determine the consentability of each new site option and identify mitigation opportunities.

Whilst the population density within the immediate landside locations for the new port options is less than the population density within proximity of the existing port, the anticipated environmental change (particularly in terms of noise, vibration and light effects) has the potential to be more noticeable than a change at the existing port facility, given the degree of change. However, the actual and potential noise, vibration and lighting effects of a new port in comparison with growth at the existing port cannot be quantified until detailed technical assessments are undertaken at both the existing port facility and the alternative site options.

Whilst a new port would result in the establishment of a new environmental footprint, the detailed design and site selection process may have the potential to avoid or mitigate adverse noise, vibration and lighting effects through technology, site operations and management.

10.7.6.3 Manukau

10.7.6.3.1 Quantitative Analysis

Figure 87, Figure 88 and Figure 89 shows the whole-of-life costs and benefits for Options 5A: Central Manukau Harbour, 5B: Puhinui and 5C: Hikihiki.

The whole-of-life costs shows that for the three options, there is a large capital investment upfront to build the new port and associated transport infrastructure. This capital cost is spread out over a period of 15 years prior to the new port commencing operations.

Option 5B: Puhinui has the highest capital cost for constructing a new port due to the extensive dredging required as there is poor natural depth in the area. The ongoing operating costs for this option are also the highest due to the amount of maintenance dredging required annually.

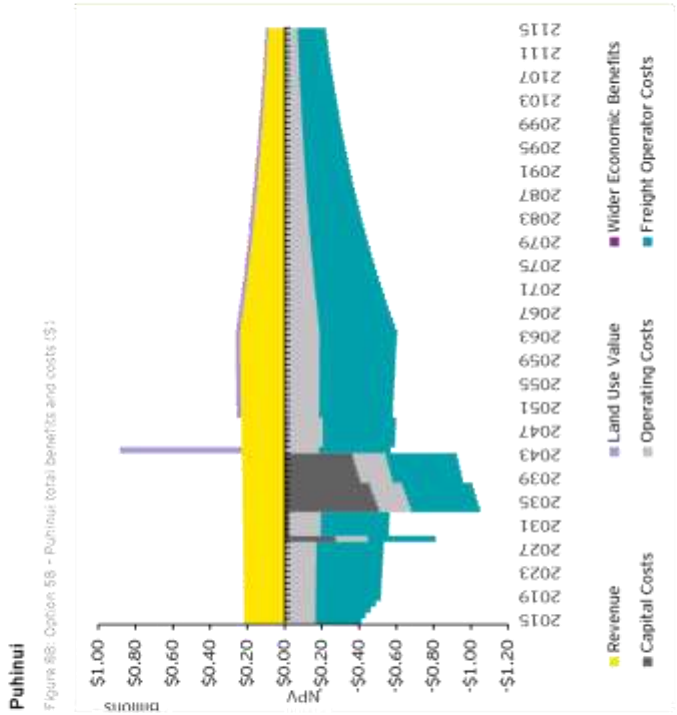
Option 5C: Hikihiki has the second highest capital cost for constructing a new port for similar reasons as Option 5B: Puhinui of poor natural depth, although not to the extent as that of the Puhinui site. The maintenance cost of dredging for Hikihiki is also not as high for this reason.

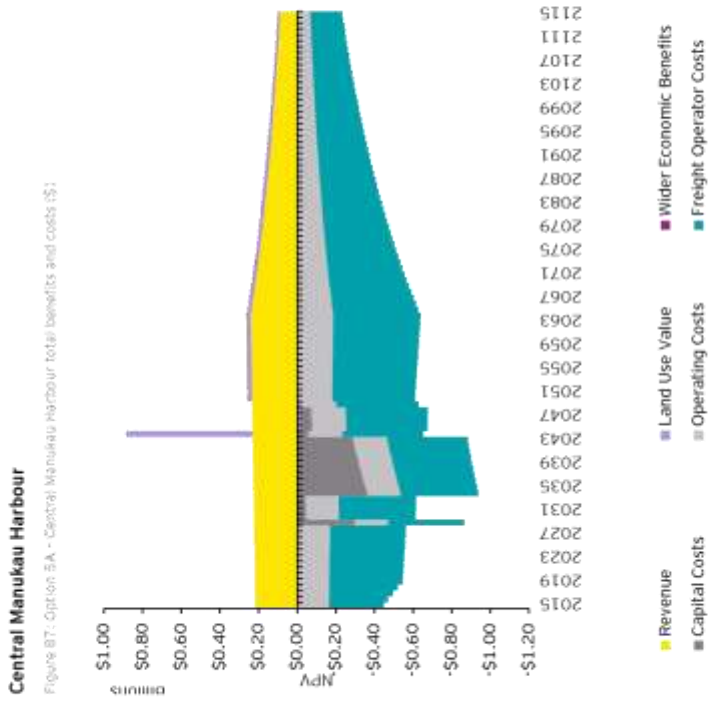
Central Manukau Harbour has the lowest capital costs out of the new port options due to the favourable natural depth requiring less dredging and is less costly to maintain compared to the other Manukau options.

In the year following the port movement, it is expected that the site at Waitematā Harbour will be sold as a super lot for development, leading to an upfront land value realisation of approximately $1 billion, with associated development costs and release of the land phased over three periods.

The land use value is the net developed land value after taking into account development costs. The land use value benefit here does not represent the full developed land value as the release of land is ongoing beyond the 100 year appraisal period.

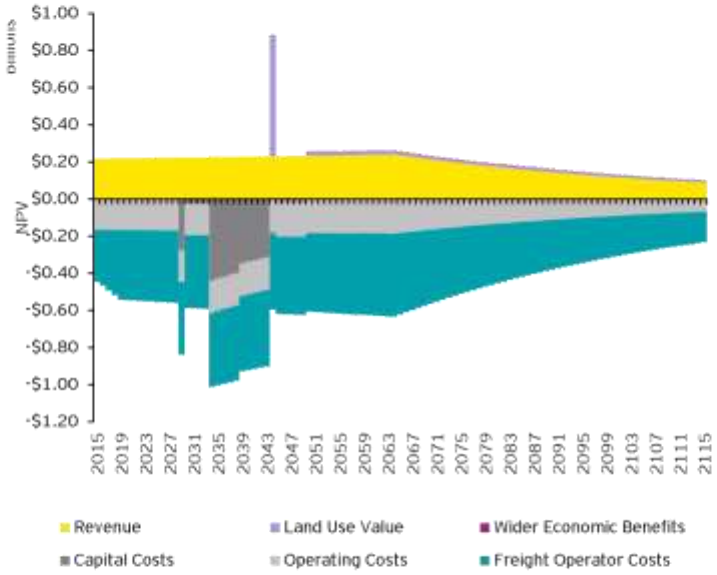
The costs and benefits taper off towards the end of the appraisal period due to the discount factor reducing any benefits and costs that happen later in the appraisal period.


Puhinui
Figure 88: Option 5B – Puhinui total benefits and costs ($)
billions
$1.00
$0.80
$0.60
$0.40
$0.20
$0.00
$0.20
-$0.40
-$0.60
-$0.80
-$1.00
-$1.20
NPV
2015
2019
2023
2027
2031
2035
2039
2043
2047
2051
2055
2059
2063
2067
2071
2075
2079
2083
2087
2091
2095
2099
2103
2107
2111
2115
Revenue
Capital Costs
Land Use Value
Operating Costs
Wider Economic Benefits
Freight Operator Costs


Central Manukau Harbour
Figure 87: Option 5A – Central Manukau Harbour total benefits and costs ($)
billions
$1.00
$0.80
$0.60
$0.40
$0.20
$0.00
$0.20
-$0.40
-$0.60
-$0.80
-$1.00
-$1.20
NPV
2015
2019
2023
2027
2031
2035
2039
2043
2047
2051
2055
2059
2063
2067
2071
2075
2079
2083
2087
2091
2095
2099
2103
2107
2111
2115
Revenue
Capital Costs
Land Use Value
Operating Costs
Wider Economic Benefits
Freight Operator Costs

Hikihiki

Figure 89: Option 5C – Hikihiki total benefits and costs ($)



10.7.6.3.2 Qualitative analysis

Land use and strategic urban planning

Alignment with Auckland Plan (a compact city) and appropriateness of urban growth surrounding the port site

The Auckland Plan did not consider alternative locations of the port activities within the wider Auckland region and instead relied on their current 'default' locations of the city centre, Onehunga and Wiri (inland port) and described them in terms of national and regional significance.

However, this option would be in general accordance with the aspirations of the Auckland Plan, which sees Auckland's industrial concentration and intensification of growth in the south of the city.

Although a port in this location may be outside the Rural Urban Boundary (RUB) itself, the access to such a port would spring from within the urban limits, and thus any associated growth would be inside the RUB. These areas including the airport surrounds and areas to the west of Mangere are identified in the Auckland Plan as areas of high employment density and in general as a major business centre.

Potential for industrial and employment growth adjacent to port site (opportunity)

There is significant potential for industrial and employment growth surrounding the site and land supply is not constrained in the same way as the current city centre port. Growth is currently anticipated on the land north of the airport (already largely zoned for industrial) and the location of the port will support this growth pattern.

These areas are well connected within the motorway network to south and west Auckland and potential for future rapid transport along the SH20A corridor between the airport and Onehunga.

The additional benefit of industrial growth in this area will be the potential employment opportunities for nearby residential communities.

Much of the land around the connection point to any off-shore port is predominantly industrial land use, so impact on existing land would be less, and the planning process would be simpler.

Adjacency to established industrial and employment areas

The site location is ideally suited to complement existing employment areas in the south of Auckland. A port in this location would benefit from good connections to the airport, Wiri, Otahuhu and Penrose industrial and employment areas, especially if the East West Connection between SH20 and SH1 is established.

Adjacency to established residential areas (access to employment opportunities)

The site is in close proximity to established residential areas. A port in this location would be well located in respect to the residential suburbs of south west Auckland including Mangere and Manukau, and hence would provide potential for local employment opportunities.

The location of the port within the harbour would somewhat restrict walkable catchments for employees as residential areas will remain some distance from the port itself. However, the growth in employment areas around the airport will be ideally located for existing residential neighborhoods in Mangere and Mangere Bridge.

Future rapid transport along SH20A will also provide an opportunity for dedicated public transport access to the port from surrounding residential areas.

Land use

The development of a new port at Manukau impacts on land use as follows:

1. Seabed acquisition for new port development.
2. Land side areas adjacent to the new port which would be required for initial enabling of the new port development and then utilised as part of the new ports infrastructure.
3. Land required for expanded infrastructure to service the new port.
4. The vacated existing port is able to be redeveloped in the alternative use.
5. Immediately adjacent land currently used for infrastructure servicing the port could also be released for alternative use (e.g. existing rail and roading corridors no longer required to handle heavy vehicle movements).
6. Once developed land side areas adjacent to the new port (acquired for new port development) would have a value as developed land (serviced with roading).
7. Agglomeration benefits to surrounding land including betterment to surrounding land uses of improved infrastructure.

The above factors exclude an allowance for costs associated with reclamation of the new port and associated causeway etc. The cost of acquiring the seabed is uncertain but could be compulsorily acquired under the Public Works Act subject of course to any foreshore or seabed applications under the Marine and Coastal Area (Takutai Moana) Act 2011.

The quantum of value change for Items 3 - 7 above are highly subjective as to degree of benefit (% value uplift or rate $ per m^2 adopted) and also the amount of land that might be impacted is not readily identified at this stage of the study.

Environmental

Coastal

A new port in the Manukau Harbour will require the development of a 4km long channel through the ebb-tidal delta of the south west channel. 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.

Analysis of the coastal environment in the Manukau Harbour was commissioned from eCoast. eCoast's review of the West Coast's physical environment (from Taranaki to Dargaville) noted the Manukau Heads represented 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. eCoast found that the mean significant wave height from 1997-2007 was 2.1 metres, with a mean period of 11-13 seconds. The maximum wave height from 1997-2007 was 7.2 metres and 6.7 metres for locations A and B respectively, with a maximum period of 18-19 seconds.

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.

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 sediment transport volumes, 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 per annum. It is likely that volumes of the order of 200,000-250,000m^3 per annum will require dredging. Dredging would be required through the terminal lobe of the ebb-tidal bar, a distance of approximately 4 km.

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. A 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 (i.e. for the potential port sites), eCoast's research showed that the 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 2 metres during sustained winds of 30.5m/s.

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 docking area to the south of the proposed central site 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. eCoast's analysis and research showed 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).

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.

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 port across 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 massive 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 as each cross the harbour channels and current directions, run east-west.

At the Puhinui site adjacent to the airport, there are presently low currents in the area which is mudflat, although the southeastern corner of the port extends into Pukaki Creek, is likely to have 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.

Carbon footprint

A reduction in carbon footprint may be achieved subject to the location of a new Port within the harbour and proximity to land. If a new port can be located without the need for a substantial causeway, the carbon footprint would be less than expanding the existing port footprint. This is because of the proximity of the Manukau sites to the final destinations for freight meaning that the travel distance for trucks has been reduced. This would see an improvement in the carbon footprint over the existing port sites and the Western Firth of Thames and Muriwai sites whose distances are not as favourable.

Noise and vibration

A new port in the Manukau Harbour may result in direct noise impacts on immediately adjoining land uses. A port located close to land will have a higher risk of generating adverse noise effects in comparison to a port in the Central Manukau Harbour; however, periods of calm water conditions may accentuate noise from the proposed option through direct line of sight and 'skip' across the water. In any event the noise environment will change from that currently existing. A detailed evaluation of the significance of that change and the mitigation opportunities is recommended. The noise impact assessment would need to take into account the various site options within the Harbour together with the land based transport routes, in particular the location of sensitive receivers along any new transport corridors.

Background noise testing would be required in order to understand the existing condition and quantify the potential impact at sensitive land use locations. The assessment would also need to assess construction noise and vibration for both sensitive land uses and marine and terrestrial fauna that may be impacted from the activities.

The Manukau option has the advantage of the landside port activities being located within proximity to an already established business activity center, being close to Wiri. The proximity of any noise sensitive landside activities to the access causeways would also require careful consideration.

Light spill

A new port within the Manukau Harbour would change the existing night time environment with the presence of a 24 hour operating port. The effects of the new activity and lighting would be dependent on proximity to and visibility of the port structures from existing urban and rural residential environments.

The extent and duration of the lighting, it's orientation on the ships and port structures would also be material in determining the significance of the light spill effects.

A comprehensive evaluation of the of the potential light spill and mitigation opportunities is required as part of any further detailed evaluation of this option, including an assessment of the various port site options within the Manukau Harbour.

Air quality

An assessment of the impacts on air quality associated with a newly established report is recommended. The potential effects on urban and rural land use activities and identified sensitive habitats would need to be quantified. Environmental baselines would need to be established for future comparisons and as a base for assessing the proposed port options.

Visual sensitivity

There is potential for adverse visual effects of both the port and the infrastructure required to reach any new port across the harbour from residential areas surrounding harbour although this is determined by the size and scale of any port and the distance to residential areas (actual visibility of the site).

The Central Manukau Harbour option would have the most visual impact on residential areas of Cornwallis Point / Titirangi / Blockhouse Bay and the northern portion of Awhitu peninsula, although population numbers are not particularly high.

Social

Building a new port in the Manukau and relocating the existing port to that site, opens up opportunities to redevelop the current Waitematā Harbour land. There is expected to be a significant positive impact for Auckland if the existing port land was redeveloped as a high quality mixed use environment including residential use and open space, with improved access to the water's edge. This would allow Auckland to maximise the highest value land use for the waterfront land, and provide commercial growth opportunities.

This option would increase opportunities for recreational access to and use of the Auckland waterfront and remove current constraints relating to the use of shipping lanes and ship berthage.

Opportunities for changes in land use, development of the harbour waterfront space and creation of new public spaces in that area create amenity enhancement opportunities within the CBD waterfront. These opportunities include creating a vibrant mix of residential, commercial and recreational land use activities. 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.

However, the social impacts of the new port within the Manukau would need to be comprehensively assessed as part of a Social Impact Assessment, should this option be carried forward for further evaluation. The effect on amenity of communities that overlook the proposed site, and the impact on recreational opportunities within the harbour would need to be a key focus of any assessment. This should include how the port location might impact existing access to and use of the coast and community aspirations around the use and protection of the Manukau harbor. Both coastal and landside community and stakeholder values associated with the area of impact would need to be defined and considered.

Cultural

Mana whenua involvement and future engagement

Mana whenua participated in a broad discovery process in respect of their perspectives of the proposed short list sites. This discovery process was not 'consultation' with affected iwi or a formal 'engagement process' with mana whenua because any formal recommendations from the CWG or any formal position on the part of Auckland Council has yet to be made.

Whilst these mana whenua perspectives informed the preparation of this Study, they should not be viewed as categorical or formally representative of the respective mana whenua groups' mandated positions.

Formal, coordinated and appropriately structured future engagement if this process continues is required. Undertaking formal engagement is critical to the future success of this long-term initiative. This is particularly important in light of the potential for co-governance or co-management Settlement options over potential and current port sites.

Historical perspective

The Manukau is the second largest estuary on the West Coast of the North Island. It occupies about 375 square kilometres and has a coastline length of about 520 kilometres. It is more than three times the size of the Waitematā Harbour. To mana whenua iwi, its shallow nature provides an abundant seafood resource.

Historically, there were a large number of Pā built close to the shore line for ready access to this resource and physically illustrate their relationship to the harbour and its waters. There are several marae all in close proximity to the shores including:

- Te Puea, near Mangere bridge
- Makaurau at Ihumatao, Mangere
- Pukaki at Pukaki, Mangere
- Whatapaka near Clarkes Beach opposite Seagrove
- Tahunakaitoto near Glenbrook, the oldest of the current marae
- Reretewhioi on the Waiuku estuary, and
- Huarau near Maioro

The recent history of mana whenua in respect of the Manukau Harbour could best be characterised as a battle for the restoration of tribal mana and kaitiakitanga over this important area. One of the first Waitangi Tribunal claims ever taken was Wai8; which was a claim by Dame Nganeko Minhinnick over the treatment of the Manukau Harbour and Waikato Tainui lodged Wai 30 over the Manukau harbour in the 1980s.

All mana whenua participants spoken with about the potential Manukau sites raised concerns regarding the impact of the Manukau options on the health and well-being of the harbour. The Manukau Harbour is the traditional "food basket" of mana whenua in the area, and their recent history speaks of denigration to that resource. They referred to a time in living memory prior to the airport development (1952), the sewerage plant at Ihumatao (1960s) and bridges at Puhinui (1980s-1990s) when the harbour was full of flounder, snapper, eel, mussels, scallops however the developments seriously impacted those taonga species. In recent years, some of the species have returned due in no small part to the role of mana whenua iwi insisting that proper protections be put in place.

In particular mana whenua participants spoke of the Manukau being a 'dumping ground' (raw sewerage, storm-water run-off, industrial waste/pollution, farming run-off and wake damage to the shoreline etc.) that has negatively impacted on their food resources, their relationships and associations to this area and their ability to exercise kaitiakitanga.

The Puhinui site is immediately adjacent to the Pukaki marae and there was strong opposition to this proposed site. Promises of economic development and employment opportunities have been made in the past, when both the airport and sewer plant were constructed, but then no jobs were offered.

These experiences do not support discussion around potential economic development and much work would be required to change these deeply held views from prominent mana whenua community members.

Interests and relationships

Auckland Council identifies at least 19 mana whenua groups or interests who contend to having a stake/interest and relationships in the Manukau Harbour. The majority of these mana whenua groups have not yet settled their historical Treaty of Waitangi claims.

The experience of mana whenua in the Manukau Harbour in respect of previous large infrastructure builds has not been positive.

Indeed mana whenua in the Manukau have a distrust and reluctance toward large public infrastructure being built in their area noting that past experiences has left them feeling badly treated. While relationships are mending it is against this back drop that any future port options in the Manukau appear.

Mana whenua spoke of the loss of mana with each development, the consequent impacts on their food sources and the hurt that this causes them. Their aspiration is to ensure that their mokopuna (grandchildren) don't have to suffer the same treatment that they went through. If more seabed is acquired, they will continue to lose mana. Some spoke of the degree of confiscation already experienced and keen desire to not see reclamations taking more of their whenua.

The kaitiakitanga of mana whenua has been seriously impacted in the Manukau. Mana whenua spoke of their inability to be proper kaitiaki over our tribal domain due to external forces which consequently diminishes our mana. Tapu areas in the harbour are almost all gone. The airport, sewer and Puhinui bridges have trampled all over the tapu areas with some mana whenua iwi saying there is virtually no tapu left.

Treaty settlement

A harbour settlement over the Manukau Harbour has a high likelihood of occurring sometime in the next 10 years. Any such settlement is also highly likely to include co-governance and co-management aspects in relation to how the harbour is governed and managed. While any settlement will involve the Auckland Council the Crown will negotiate the Settlement independent of Auckland Council and any future port. Any such co-governance settlement will include elements that relate to water quality, decision making powers etc.

For example, water quality at the Manukau Puhinui site has been identified with freshwater discharge into this area stagnating and degrading this area due to low tidal flows and poor water circulation.

Mana whenua representatives have indicated they do not want this Study to cut across settlement options, but rather to support and assist where possible.

Other

The Māori Fisheries Act 2004 provides for particular iwi specified within Schedule 3 of the Act who held mana whenua over coastline and harbours listed (in Schedule 2) with the ability to claim that coastline under a process stipulated in the Act. Under the Māori Fisheries Act 2004, mandated iwi organisations, organisations who represent the Schedule 3 iwi, were able to claim coastline provided they received the agreement and consent of neighbouring iwi. These coastline agreements were then used by Te Ohu Kai Moana Trustee Limited to determine the amount of settlement quota that mandated iwi organisations were entitled to receive on behalf of their iwi.

Settlement quota carries a commercial fishing interest to harvest fish within the limits of the total allowable commercial catch as set each year by the Ministry of Fisheries. In relation to the short-list sites Manukau Harbour is classified as a harbour for which harbour settlement quota was allocated.

In addition, iwi and hapū can take seafood under a customary fishing permit. Should this site progress an assessment on the impact of shipping vessels and the port activity on Māori commercial and customary fishing interests will need to be conducted.

10.7.6.4 Western Firth of Thames

10.7.6.4.1 Quantitative Analysis

Figure 90 and Figure 91 shows the whole-of-life costs and benefits for Options 5D: Kawakawa Bay and 5E: Waimango Point for the two Western Firth of Thames sites.

The whole-of-life costs shows that for the two options, there is a large capital investment upfront to build the new port and associated transport infrastructure. This upfront investment is higher than the Manukau options due to the higher cost of transport infrastructure required to service the port in this area. The need for a connection through the terrain adds complexity to the construction and thus increases the cost. This capital cost is spread out over a period of 15 years prior to the new port commencing operations.

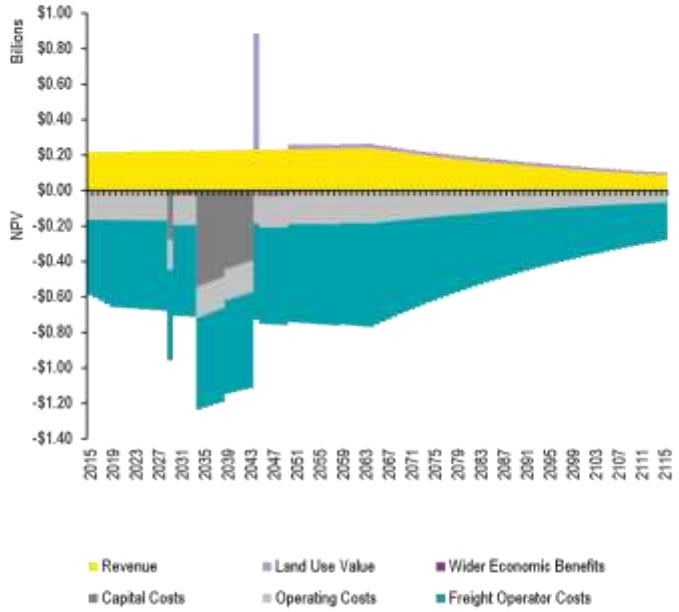
In the year following the port movement, it is expected that the site at Waitematā Harbour will be sold as a super lot for development, leading to an upfront land value realisation of approximately $1 billion, with associated development costs and release of the land phased over three periods.

The land use value is the net developed land value after taking into account development costs. The land use value benefit here does not represent the full developed land value as the release of land is ongoing beyond the 100 year appraisal period.

The costs and benefits taper off towards the end of the appraisal period due to the discount factor reducing any benefits and costs that happen later in the appraisal period.

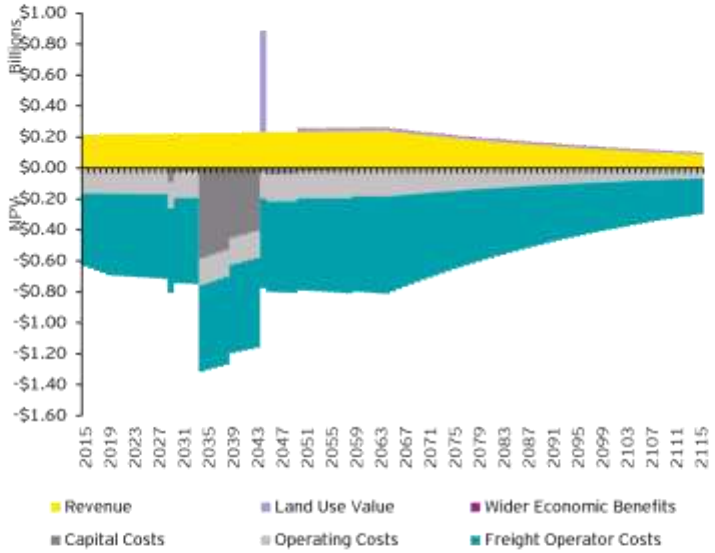
Kawakawa Bay

Figure 90: Option 5D - Kawakawa Bay total benefits and costs ($)



Waimango Point

Figure 91: Option 5E - Waimango Point Total benefits and costs ($)



10.7.6.4.2 Qualitative analysis

Land use and strategic urban planning

Alignment with Auckland Plan (a compact city) and appropriateness of urban growth surrounding the port site

This option would be in general accordance with the aspirations of the Auckland Plan, which sees Auckland's industrial concentration growing to the south of the city, although a location in the Firth of Thames and any associated development would be beyond the existing RUB.

Potential for industrial and employment growth adjacent to port site (opportunity)

There would be limited scope for growth of employment and industry in close proximity to a new port in this location. The land form and rural character would be generally prohibitive to such a change in land use.

However, this option may encourage growth of primary industry in Papakura / Takanini as well as in North Waikato, which is generally in accordance with wider regional growth objectives.

Adjacency to established industrial and employment areas

This option would not be well connected to any significant industrial areas, freight routes or other associated employment areas, and would require significant new transport infrastructure through rural and sensitive landscapes.

Adjacency to established residential areas (access to employment opportunities)

This area is also not connected to any significant residential areas and would therefore require significant commuter movement.

Land use

The development of a new port at Western Firth of Thames impacts on land use as follows:

1. Seabed acquisition for new port development.
2. Land side areas adjacent to the new port which would be required for initial enabling of the new port development and then utilised as part of the new ports infrastructure.
3. Land required for expanded infrastructure to service the new port.
4. The vacated existing port is able to be redeveloped in the alternative use.
5. Immediately adjacent land currently used for infrastructure servicing the port could also be released for alternative use. (e.g. existing rail and roading corridors no longer required to handle heavy vehicle movements).
6. Once developed land side areas adjacent to the new port would have added value as developed land (serviced with roading).

The above analysis excludes allowance for costs associated with reclamation of the new port and associated causeway etc. Please note the land acquisition cost of expanding infrastructure to remotes sites has yet to be determined and allowance is therefore provisional. Further, infrastructure construction and development costs are to be provided by others.

The cost of acquiring the seabed is uncertain but could be compulsorily acquired under the Public Works Act.

The quantum of value change for Items 3 – 7 above are highly subjective as to degree of benefit (% value uplift and / or rate $ per m^2 adopted) and also the amount of land that might be impacted is not readily identified at this stage of the study.

Environmental

Coastal

The two sites in the Western Firth of Thames are in semi-sheltered locations, which are 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 Kawakawa Bay are up to 1.5 metres (east-west) 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) with the Kawakawa Bay site. However, the port and breakwaters do not extend into the 'swell corridor' for the break, so it is unlikely to be an issue.

Waimango Point site is located just 10km southeast of Kawakawa Bay, and so are exposed to very similar wave conditions and has relatively low sediment transport rates. Tidal currents are up to 1.0 metre (north-south) 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 Bay site).

Carbon footprint

A new port in the Western Firth of Thames would result in an increased carbon footprint. Whilst accessible to SH1 and the south and east of the North Island, the travel distance from SH1 to the port landside activities increases the carbon footprint. Whilst the increase in carbon footprint is not as high as the Muriwai option, it represents a material increase from the Manukau and the existing site options.

Noise and vibration

Given the relatively quiet rural nature of this location the change in noise environment is expected to be noticeable. There are a number of residences along the coastline that may be impacted by the change in noise environment, subject to the location of the port and the landside activities. Both this option and the Muriwai option have the potential to generate the widest noise and vibration impact footprint given the need to establish a new road corridor through existing rural and urban neighborhoods.

A detailed evaluation of the scope and significance of the potential noise impacts and the mitigation opportunities is recommended should any further analysis of this option be carried out. The analysis would need to identify all sensitive receivers including any sensitive underwater and terrestrial receivers. Both the construction noise and vibration and ongoing long-term noise impacts would need to be assessed.

The port activities would introduce potential for new noise impact on marine life within in the harbour. Whilst the existing volume and intensity of residential populations and sensitive land use activities impacted by the change to the acoustic environment may not be as high as the number of sensitive land use activities within proximity to the existing port, the potential change in comparison to the existing environment could be more noticeable.

Light spill

The existing night time environment would change with the presence of a 24 hour operating port, associated landside activities and causeway all creating a potential night time illumination into the sky and adjacent viewpoints.

A comprehensive evaluation of the potential light spill impact and mitigation opportunities is recommended as part of any further detailed evaluation of this option, including an assessment of the difference between site options within the Western Firth of Thames and whether the light spill impact would extend as far as the Coromandel. The evaluation would need to consider sensitive received both on the coast and along the proposed transport corridor.

Air quality

An assessment of the impacts on air quality associated with a newly established report is recommended. The potential effects on urban and rural land use activities and identified sensitive habitats would need to be quantified.

Environmental baselines would need to be established for future comparisons. The cumulative effects on air quality would need to be considered including the impact of other existing activities within proximity to the port that impact air quality.

Visual sensitivity

This option would result in significant adverse visual effects of both the port, and the infrastructure required to reach any new offshore port, with the hosting environment currently undeveloped and relatively free from the elements associated with the urban environment of nearby Auckland. There are also likely to be significant visual effects of increased traffic and access infrastructure (earthworks, road and rail) through the Clevedon valley which is an attractive rural landscape.

Although population figures are currently low in this area, further residential growth is expected, but of a character to reinforce and enhance the rural character.

Social

Building a new port in the Western Firth of Thames and relocating the existing port to that site, opens up opportunities to redevelop the current Waitematā Harbour land. There is expected to be a significant positive impact for Auckland if the existing port land was redeveloped as a high quality mixed use environment including residential use and open space, with improved access to the water's edge. This would allow Auckland to maximise the highest value land use for the waterfront land, and provide commercial growth opportunities.

This option would increase opportunities for recreational access to and use of the CBD waterfront. It would also remove current constraints relating to the use of shipping lanes and ship berthage.

Opportunities for changes in land use, development of the harbour waterfront space and creation of new public spaces in that area create amenity enhancement opportunities within the CBD waterfront. These opportunities include creating a vibrant mix of residential, commercial and recreational land use activities. 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.

However, the social impacts of the new port within the Western Firth of Thames would need to be comprehensively assessed as part of a Social Impact Assessment, should this option be carried forward for further evaluation.

The effect on amenity of communities that overlook the proposed site and those who are affected by the rail and road access corridors through the Clevedon valley would need to be a key focus of any assessment.

This assessment should also include the impact on recreational opportunities within the harbour and how the port location might impact existing access to and use of the coast. In addition, community aspirations around the use and protection of the Firth of Thames and the Clevedon Valley, both coastal and landside and community and stakeholder values associated with the area of impact would need to be defined and considered. The area of social impact is expected to be relatively stretched given the length of the new access corridor and the communities located along the route.

Cultural

Mana whenua participated in a broad discovery process in respect of their perspectives of the proposed short list sites. This discovery process was not 'consultation' with affected iwi or a formal 'engagement process' with mana whenua because any formal recommendations from the CWG or any formal position on the part of Auckland Council has yet to be made.

Whilst these mana whenua perspectives informed the preparation of this Study, they should not be viewed as categorical or formally representative of the respective mana whenua groups' mandated positions.

Formal, coordinated and appropriately structured future engagement if this process continues is required. Undertaking formal engagement is critical to the future success of this long-term initiative. This is particularly important in light of the potential for co-governance and co-management Settlement options over this potential port site.

Historical perspective

The mana whenua of the Marutuahu iwi confederation were historically traders of their extracted resources into Auckland, Australia and further abroad. They owned ships and were actively involved in trade. The Firth of Thames was an area that had an abundance of natural resources; native timber, cultivated crops, fish, flax and gold. It was the rights held by mana whenua iwi to this resource base, not dissimilar to many areas of New Zealand at that time, which provided the platform for entrepreneurial endeavor. The process of colonisation and the actions of successive settler governments overtime took those resources from the control and ownership of mana whenua iwi.

Interests and relationships

The proposed sites are within the Western Firth of Thames) being part of the Hauraki Gulf; an area that holds national significance under section 7 of the Hauraki Gulf Marine Park Act 2000. This Act also establishes the Hauraki Gulf Forum to recognise the historic, traditional, cultural, and spiritual relationship of tangata whenua with the Hauraki Gulf, its islands, and, where appropriate, its catchments as per section 15 of the Act.

Any proposed site in the Western Firth of Thames will need to be considered by the Forum in terms of the effect of the proposed port will have on the relationship of tangata whenua to the Hauraki Gulf. This approach should be factored into any further site assessments that might be required.

The mana whenua iwi we spoke with were open to having further discussions about the proposed sites in the Western Firth of Thames provided they are involved in the design, implementation and governance of the process over time. They noted the potential social and economic stimulus and benefits that might flow into the region. However, any further discussion would need comprehensive environmental and cultural assessments before progressing so as to not negatively impact existing and proposed marine farming near Waimango and other tribal interests.

Treaty settlement

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. Any future settlement negotiations could include co-governance over the Western Firth of Thames and/or co-ownership interests in the proposed site.

Other

Potential Foreshore and Seabed applications could be raised in Settlement negotiations or under the Marine and Coastal Area (Takutai Moana) Act 2011. These interests or rights remain unaffected by the Hauraki Gulf Marine Park Act 2000.

Furthermore, the proposed Waimango Point location is in close proximity to an area of high Māori conservation values, cultural significance and Māori land ownership. It is unlikely to receive to mana whenua support given this proximity and the need for potential public works delegations. Furthermore it would be unlikely that the Māori Land Court would support any Public Works Act takings of Māori land in order to support the necessary port infrastructure.

Hauraki iwi and Waikato Tainui (who also have interests and associations to the Firth of Thames) have a long history in the seafood industry – specifically in the fishing and aquaculture sectors.

The Māori Fisheries Act 2004 provides for particular iwi specified within Schedule 3 of the Act who held mana whenua over coastline and harbours listed (in Schedule 2) with the ability to claim that coastline under a process stipulated in the Act. Under the Māori Fisheries Act 2004, mandated iwi organisations, organisations who represent the Schedule 3 iwi, were able to claim coastline provided they received the agreement and consent of neighbouring iwi.

These coastline agreements were then used by Te Ohu Kai Moana Trustee Limited to determine the amount of settlement quota that mandated iwi organisations were entitled to receive on behalf of their iwi.

Settlement quota carries a commercial fishing interest to harvest fish within the limits of the total allowable commercial catch as set each year by the Ministry of Fisheries. In addition, iwi also have a customary fishing take and iwi and hapū members can take seafood under a customary fishing permit.

Should this site progress an assessment on the impact of shipping vessels and port activity on Māori commercial and customary fishing interests will need to be conducted. The Hauraki Māori Trust Board is currently the joint mandated iwi organisation for the iwi of Hauraki.

10.7.6.5 Muriwai

10.7.6.5.1 Quantitative analysis

Figure 92 and Figure 93 shows the whole-of-life costs and benefits for Options 5F: Muriwai Offshore Port and 5G: Muriwai North West Coast.

The whole-of-life costs shows that for the two options, there is a large capital investment upfront to build the new port and associated transport infrastructure. This upfront investment is the highest out of all the new port options, due to the high energy coastal environment at Muriwai, and port infrastructure requiring more protective infrastructure than the others. This capital cost is spread out over a period of 15 years prior to the new port commencing operations.

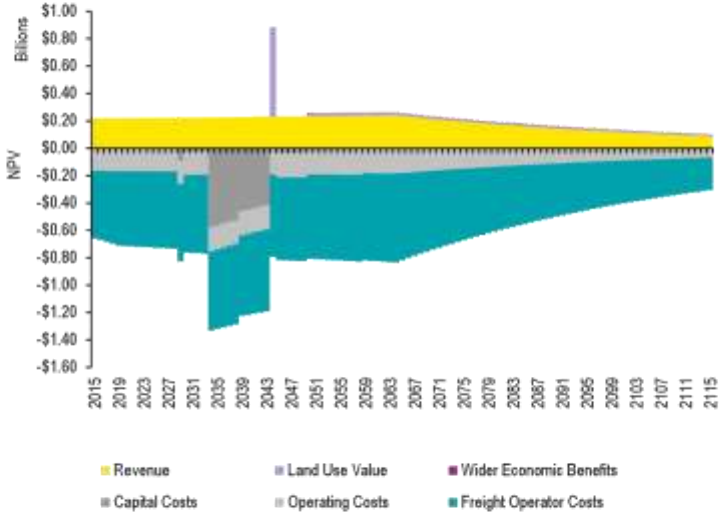
In the year following the port movement, it is expected that the site at Waitematā Harbour will be sold as a super lot for development, leading to an upfront land value realisation of approximately $1 billion, with associated development costs and release of the land phased over three periods.

The land use value is the net developed land value after taking into account development costs. The land use value benefit here does not represent the full developed land value as the release of land is ongoing beyond the 100 year appraisal period.

The costs and benefits taper off towards the end of the appraisal period due to the discount factor reducing any benefits and costs that happen later in the appraisal period.

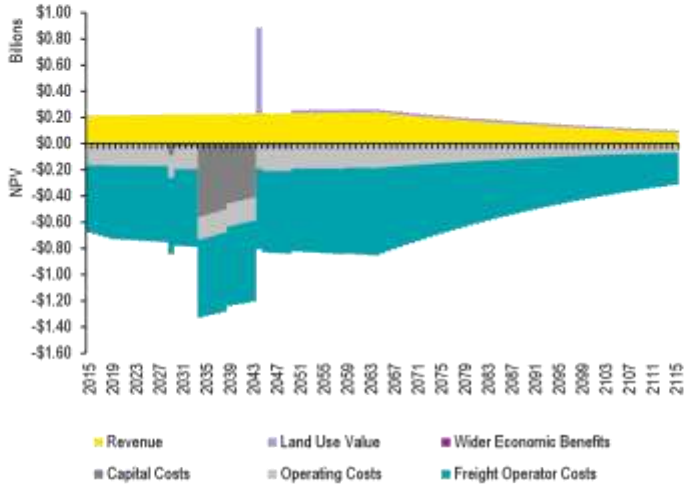
Muriwai Offshore Port

Figure 92: Option 5F – Muriwai Offshore Port total benefits and costs ($)



Muriwai – North West Coast

Figure 93: Option 5G Muriwai North West Coast total benefits and costs ($)



10.7.6.5.2 Qualitative analysis

Land use and strategic urban planning

Alignment with Auckland Plan (a compact city) and appropriateness of urban growth surrounding the port site

This option would not align with the Auckland plan or regional development strategy, as it results in placing a significant generator of employment and traffic, and potentially associated urban growth beyond the current urban limits. This would result in the transport made up of large amounts of freight travelling through the isthmus area of Auckland.

Potential for industrial and employment growth adjacent to port site (opportunity)

This option may put indirect pressure on land use in northwest Auckland with the likes of Huapai becoming more industrial/primary industry focused, which may not be appropriate given the existing rural character.

Adjacency to established industrial and employment areas

A port in this location would not be connected to any significant industrial area or freight route. SH16 is a rural road and major freight movement will affect its character and use.

A port in this location would also not be connected to any significant area of employment.

Adjacency to established residential areas (access to employment opportunities)

A port in this location would not be connected to any significant residential area and would require significant commuter movement.

Land use

The land use and resulting value impacts on the Muriwai Option are likely to be materially similar to those applying to the Western Firth of Thames Option outlined above.

Environmental

Coastal

This site is just north of the Manukau Harbour Entrance, and so also is exposed to an extremely high energy wave environment as analysed by eCoast. Any site in this area would require extensive protection infrastructure, and a piled access to the offshore port to minimise impacts on alongshore sediment transport. There are high sediment transport rates, a telecommunication cable landing site, two Regionally Significant surf breaks and Regionally Significant Ecology to be aware of in this area.

Carbon footprint

This option has the greatest increase in carbon footprint given the length of the required off shore causeway and the distance from SH1, Wiri, other business centres and the southern motorway. This area is likely to have the highest carbon footprint out of all the potential new site options due to its distance from the majority of final freight destinations.

Noise and vibration

Given the relatively quiet rural nature of this location there may be a noticeable change in the existing noise environment subject to the location of the port, the landside activities and proximity to sensitive land uses. A change would also be anticipated to the existing noise environment along the necessary transport route.

Both this option and the Kawakawa Bay option have the potential to generate the widest noise impact footprint given the need to establish a new road corridor through existing rural and urban neighborhoods.

A detailed evaluation of the scope and significance of the potential noise impacts and the mitigation opportunities is recommended should any further analysis of this option be carried out. The analysis would need to identify all sensitive receivers including any sensitive underwater and terrestrial receivers. Both the construction noise and vibration and ongoing long-term noise impacts would need to be assessed.

The port activities would introduce potential for new noise impact on marine life within the harbour. Whilst the existing volume and intensity of residential populations and sensitive land use activities impacted by the change to the acoustic environment may not be as high as the number of sensitive land use activities within proximity to the existing port, the potential change in comparison to the existing environment could be more noticeable.

Light spill

The existing night time environment would change with the presence of a 24 hour operating port, associated landside activities and causeway all creating a potential night time illumination into the sky and adjacent viewpoints.

A comprehensive evaluation of the potential light spill impact and mitigation opportunities is recommended as part of any further detailed evaluation of this option, including an assessment of the difference between site options within Muriwai. The evaluation would need to consider sensitive received both on the coast and along the proposed transport corridor.

Air quality

An assessment of the impacts on air quality associated with a newly established report is recommended. The potential effects on urban and rural land use activities and identified sensitive habitats would need to be quantified.

Visual sensitivity

This option would result in significant adverse visual effects of both the port, and the infrastructure required to reach any new offshore port, with the hosting environment currently undeveloped and relatively free from the elements associated with the urban environment of nearby Auckland. There are also likely to be significant visual effects of increased traffic and access infrastructure (earthworks, road and rail) through Huapai/Kumeu which is an attractive rural landscape. Although population figures are currently low in this area, further residential growth is expected, but of a character to reinforce and enhance the rural character.

Recreational use of this coastline is high, although the local resident population is currently low. The effects would be reduced the further north the port would be located, as visual receptors are reduced as one moves away from the settlement of Muriwai.

Social

Building a new port in Muriwai and relocating the existing port to that site, opens up opportunities to redevelop the current Waitematā Harbour land. There is expected to be a significant positive impact for Auckland if the existing port land was redeveloped as a high quality mixed use environment including residential use and open space, with improved access to the water's edge. This would allow Auckland to maximise the highest value land use for the waterfront land, and provide commercial growth opportunities.

This option would increase opportunities for recreational access to and use of the CBD waterfront and remove current constraints relating to the use of shipping lanes and ship berthage. Opportunities for changes in land use, development of the harbour waterfront space and creation of new public spaces in that area create amenity enhancement opportunities within the CBD waterfront. These opportunities include creating a vibrant mix of residential, commercial and recreational land use activities. Having increased waterfront land could potentially make Auckland more attractive to visitors and have a positive impact on the quality of urban form and design for Auckland.

However, the social impacts of the new port at Muriwai would need to be comprehensively assessed as part of a Social Impact Assessment, should this option be carried forward for further evaluation. The effect on amenity of communities that overlook the proposed site, and the impact on recreational opportunities on the water and along the Muriwai beachfront would need to be a key focus of any assessment.

Despite the area being sparsely population, it is a highly popular destination for Aucklanders and visitors and therefore the assessment should include how the port location might impact existing access to and use of the coast and community aspirations around the use and protection of Muriwai beach, both coastal and landside and community and stakeholder values associated with the area of impact would need to be defined and considered.

Cultural

Mana whenua involvement and future engagement

Mana whenua, where they were able and timing permitted, participated in a broad discovery process in respect of their perspectives of the proposed short list sites. This discovery process was not 'consultation' with affected iwi or a formal 'engagement process' with mana whenua because any formal recommendations from the CWG or any formal position on the part of Auckland Council has yet to be made.

Whilst these mana whenua perspectives informed the preparation of this Study, they should not be viewed as categorical or formally representative of the respective mana whenua groups' mandated positions.

Formal, coordinated and appropriately structured future engagement if this process continues is required. Undertaking formal engagement is critical to the future success of this long-term initiative. This is particularly important in light of the potential for co-governance or co-management Settlement options over potential and current port sites.

Historical perspective

Mana whenua continue to claim interests and relationships to the Muriwai area. There are a number of sites of significance in the Muriwai and important tribal taonga are still being found in and Muriwai area (note a kauri waka was rediscovered in 2009 at Muriwai beach). Mana whenua have for many years contested the road designation placed over Muriwai beach and the impact this designation has on shellfish reproduction.

Should this site progress a site specific assessment should be carried out as a part of any further feasibility studies.

Treaty Settlement

Ngāti Whātua o Kaipara and Te Kawerau ā 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.

Interests and relationships

Under the Te Kawerau ā Maki settlement, lands at Muriwai will be vested in Te Kawerau ā Maki. Some of these areas are Department of Conservation lands and will come with covenants or reserve status. Recognition of the traditional, historical, cultural and spiritual associations of Te Kawerau ā Maki has places and sites owned by the Crown within their area of interest. This allows Te Kawerau ā Maki and the Crown to protect and enhance the conservation values associated with these sites.

Other

The Māori Fisheries Act 2004 provides for particular iwi specified within Schedule 3 of the Act who held mana whenua over coastline of the Act with the ability to claim that coastline under a process stipulated in the Act. Under the Māori Fisheries Act 2004, mandated iwi organisations, organisations who represent the Schedule 3 iwi, were able to claim coastline provided they received the agreement and consent of neighbouring iwi. These coastline agreements were then used by Te Ohu Kai Moana Trustee Limited to determine the amount of settlement quota that a mandated iwi organisations were was entitled to receive on behalf of their iwi.

Settlement quota carries a commercial fishing interest to harvest fish within the limits of the total allowable commercial catch as set each year by the Ministry of Fisheries. In addition, iwi also have a customary fishing take which has a defined limit within the limit also set each year by the Ministry of Fisheries.

Should this site progress an assessment on the impact of shipping vessels and the port activity on the commercial and customary fishing interests will need to be conducted. Te Rûnanga o Ngāti Whātua is the mandated iwi organisation that represents the interests of Ngāti Whātua in fisheries related matters.

10.8 Comparison to the base case

Growth rate at 2.9% (2.5% discount rate)

The difference to the base case is represented in Figure 94 below:

Figure 94: Net present value comparison to the base case

Item 16

Attachment B

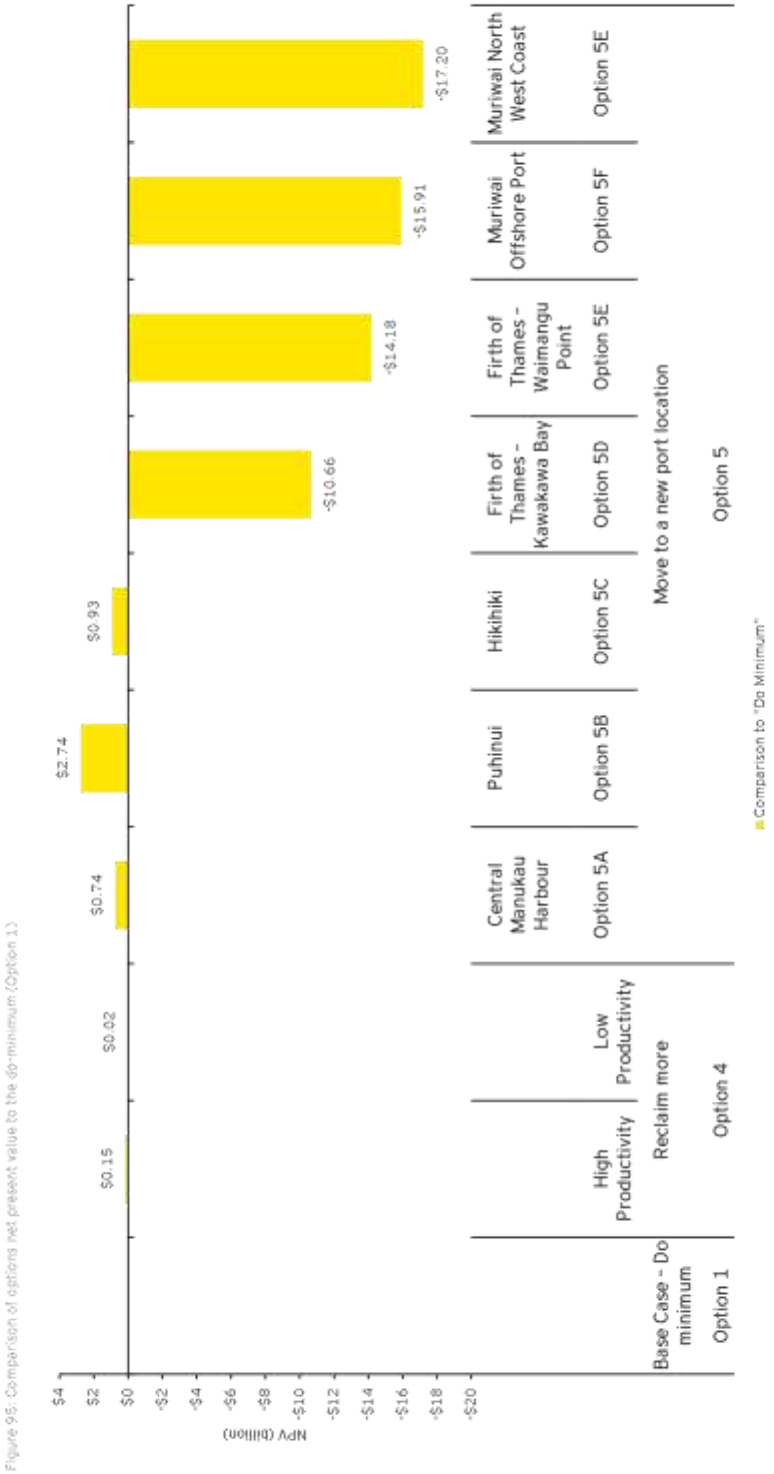


Figure 95: Comparison of options net present value to the do-minimum (Option 1)

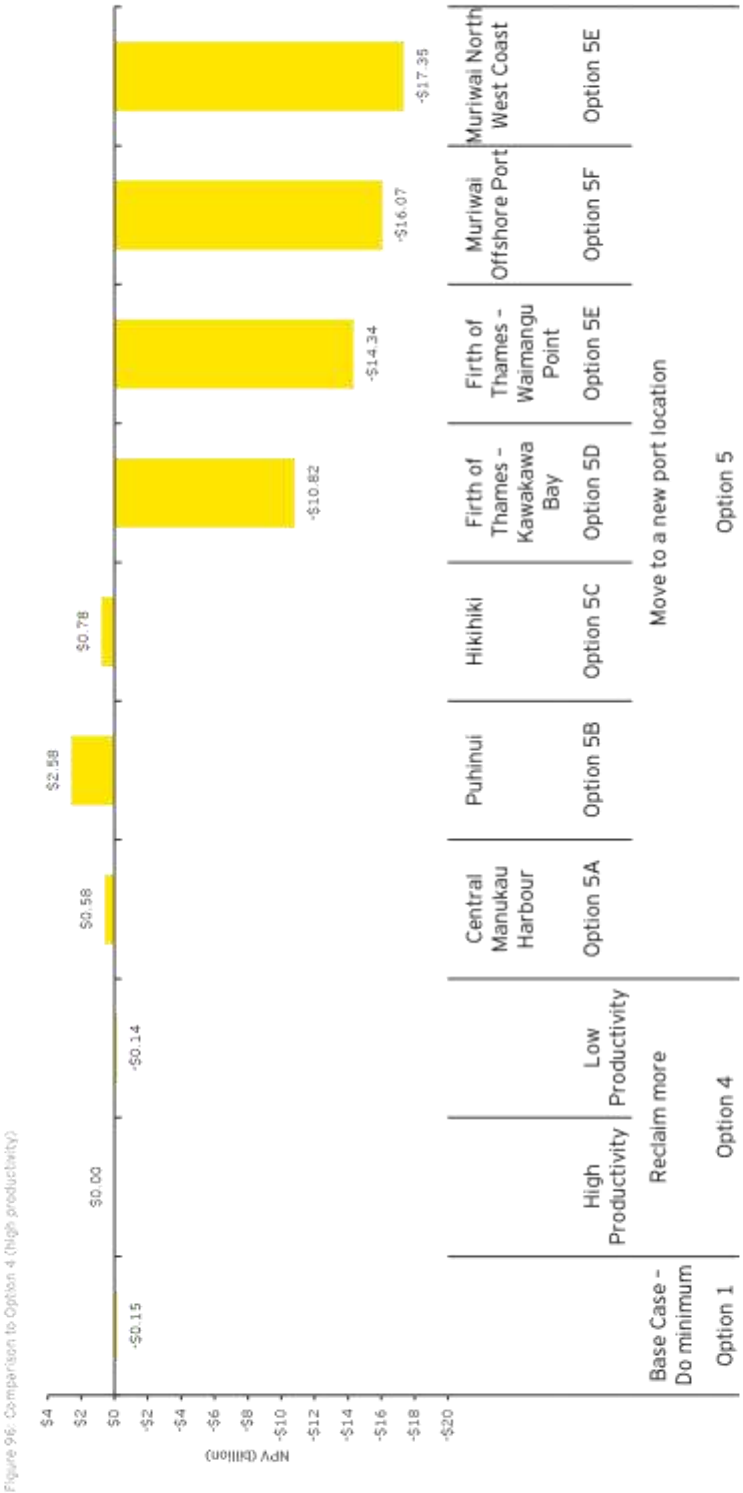


Figure 96: Comparison to Option 4 (High productivity)

Item 16

Attachment B

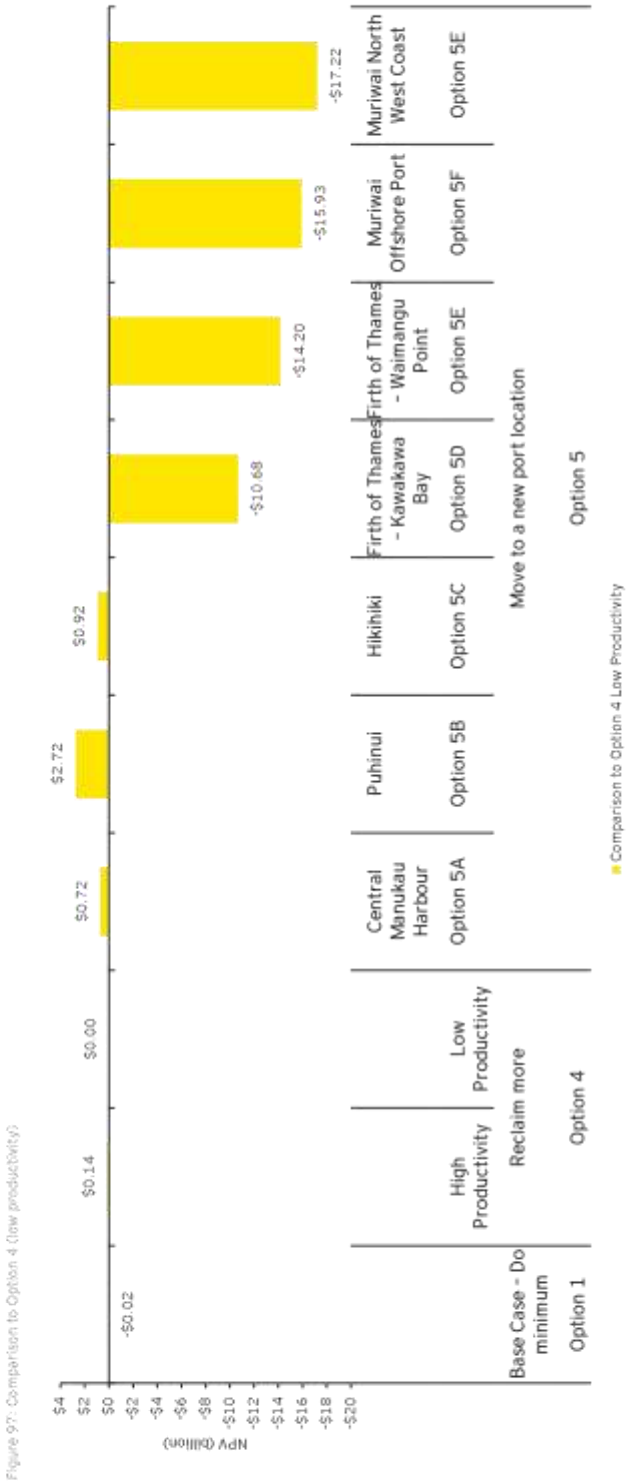


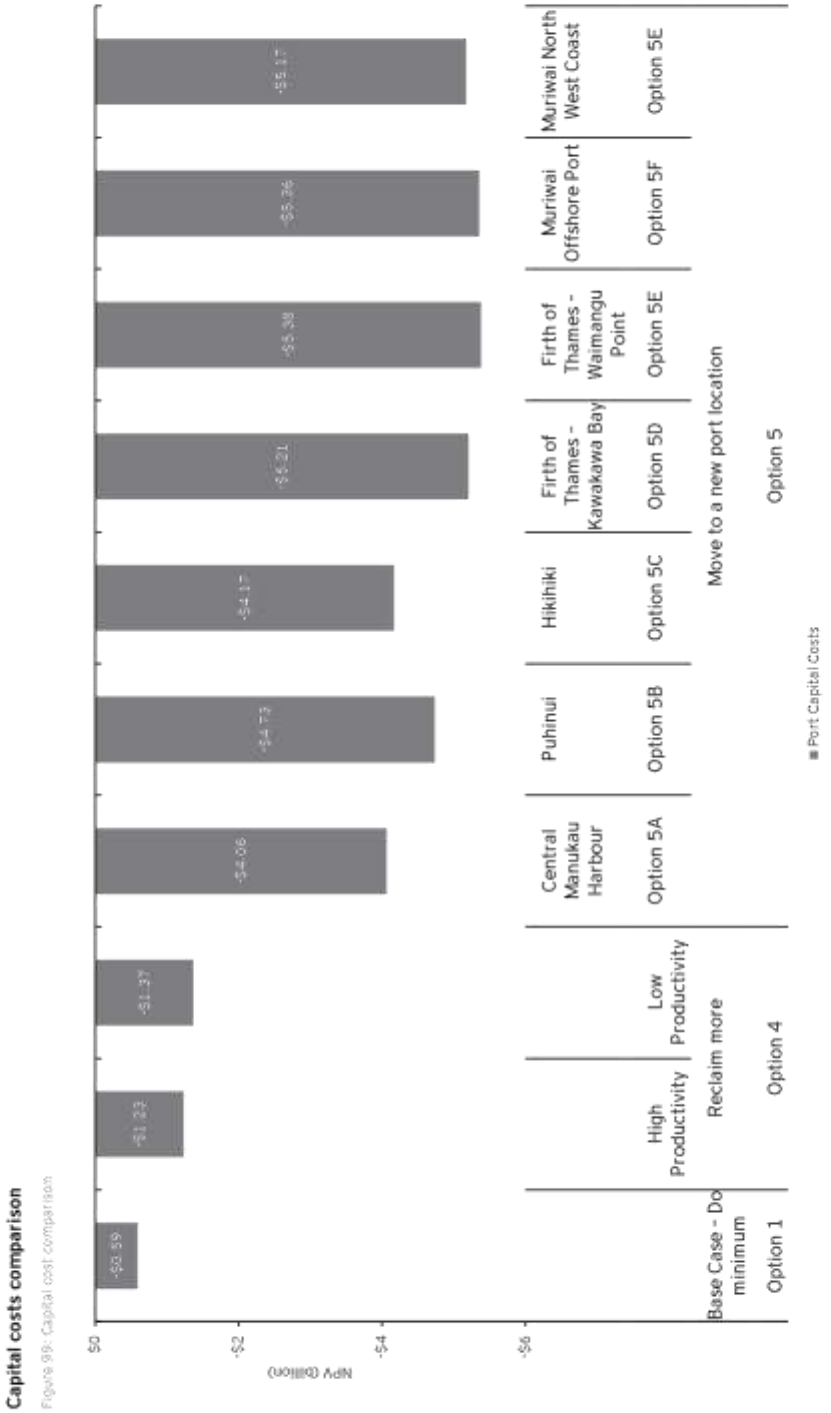
Figure 97: Comparison to Option 4 (low productivity)

Port revenues and operating costs comparison

Figure 98: Revenue and operating cost comparison

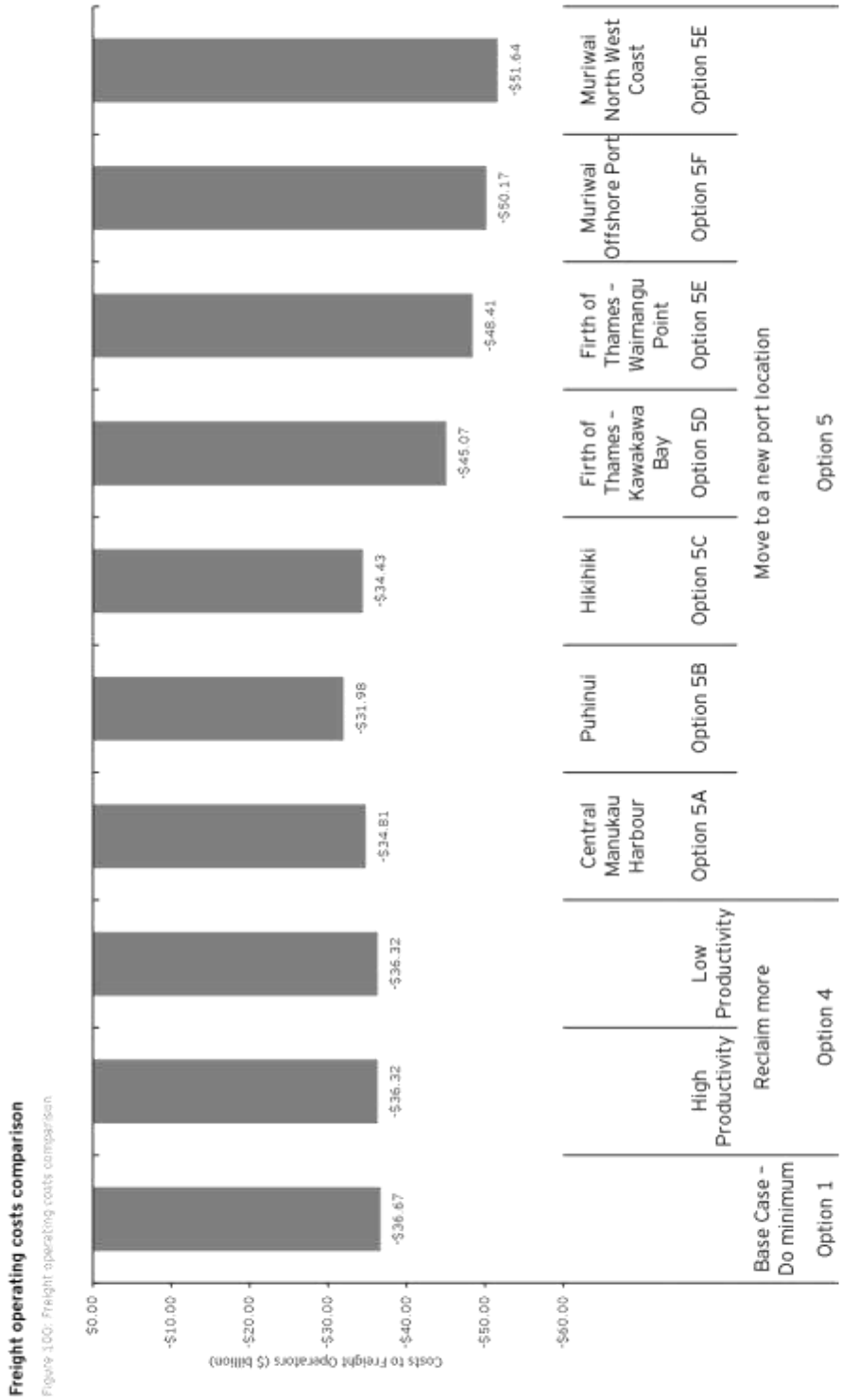
Item 16

Attachment B



Freight operating costs comparison

Figure 100: Freight operating costs comparison



10.9 Sensitivity testing analysis

We examined the sensitivity of the NPV for all options to the following parameters of discount rate and growth rates.

Table 69: Rank of options at varying growth rates

Rank	Base Case	Low Growth Rate	High Growth Rate
1	Option 5B: Puhinui	Option 5B: Puhinui	Option 5B: Puhinui
2	Option 5C: Hikihiki	Option 5C: Hikihiki	Option 5C: Hikihiki
3	Option 5A: Central Manukau Harbour	Option 5A: Central Manukau Harbour	Option 5A: Central Manukau Harbour
4	Option 4: High Productivity	Option 4: High Productivity	Option 4: High Productivity
5	Option 4: Low Productivity	Option 4: Low Productivity	Option 4: Low Productivity

The results were not sensitive to growth rates; changing the growth rates to a low scenario (2.3%) and high scenario (5%) did not change the ranking of the overall results. However, changing the discount rates for the base case at 6 and 8% resulted in a change in ranking for the options.

Table 70: Rank of options at varying discount rates

Rank	Base Case	6% Discount Rate	8% Discount Rate
1	Option 5B: Puhinui	Option 4: High Productivity	Option 4: High Productivity
2	Option 5C: Hikihiki	Option 4: Low Productivity	Option 4: Low Productivity
3	Option 5A: Central Manukau Harbour	Option 1: Do Minimum	Option 1: Do Minimum
4	Option 4: High Productivity	Option 5B: Puhinui	Option 5B: Puhinui
5	Option 4: Low Productivity	Option 5C: Hikihiki	Option 5C: Hikihiki

For Option 5, increasing the discount rate reduces the NPV of costs and benefits more than for Options 1 and 4, thus resulting in a change in ranking. This is because the increase in the discount rate decreases the value of land development, which occurs later in the appraisal period relative to the upfront capital cost of constructing a new port.

Given that the sensitivity analysis reveals that the choice of discount rate is important (changes the project's ranking against alternative projects), in this indicative CBA, more consideration should be given to the choice of an appropriate rate in the detailed CBA for the next stage of this Study.

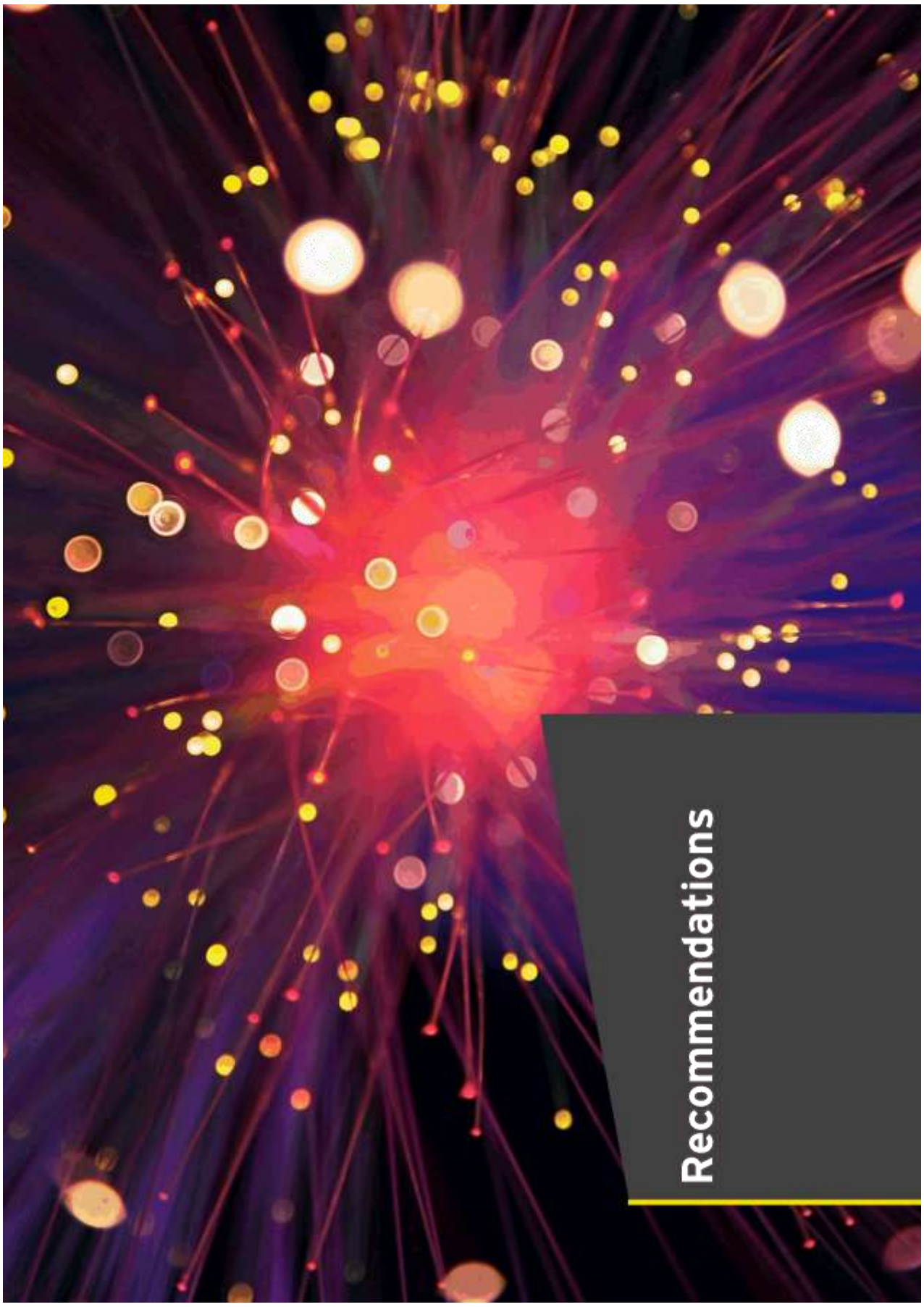
We have also conducted sensitivity analysis on the minimum and maximum dredging costs required for the Manukau site options. We found that the rankings for the options were not affected by the difference in dredging costs, as shown in the table below:

Table 71: Rank of options at minimum and maximum dredging costs

Rank	Base Case (Minimum Dredging Costs	Maximum Dredging Costs
1	Option 5B: Puhinui	Option 5B: Puhinui
2	Option 5C: Hikihiki	Option 5C: Hikihiki
3	Option 5A: Central Manukau Harbour	Option 5A: Central Manukau Harbour
4	Option 4: High Productivity	Option 4: High Productivity
5	Option 4: Low Productivity	Option 4: Low Productivity

Item 16

Attachment B



11 Recommendations

Our study recommends a future strategy for the accommodation of Auckland's trade. Based on our findings, we have made the following recommendations:

1. Implement a monitoring regime to help identify with clarity when triggers are reached that confirm the burning platform.
2. There are a variety of roadmaps to reach any long-term strategy. Determining the short and medium-term roadmap will be critical once a long-term strategy is agreed.
3. Protecting the "next best alternative" option.
4. There are further complex issues requiring more CWG consideration to determine how fast to implement change or whether change should be implemented (i.e. even if you disagree that there is a burning platform).

11.1 Monitoring regime

Our forecasts suggest that container trade, multi-cargo trade and cruise will meet capacity within the study time frame. It should be noted that there is always a degree of uncertainty when forecasting, as the actual results may vary year on year.

Given that the results of the analysis suggest that the port can work on its current footprint in the medium-term, the creation of a "burning platform" for change depends mainly on two factors: the degree to which the port will meet its productivity targets and the rate of actual trade growth compared to our forecasted growth rates. For example, if productivity numbers are less than expected, the ability of the port to handle additional capacity will be compromised. This shortens the timeframe for decision making on the future of the port. If growth rates for trade volumes are higher than our forecasted numbers, this shortens the timeframe for when capacity limits are reached and thus leads to shorter timeframes for decision-making.

Implementing a monitoring regime is a way of mitigating the risk of the above scenarios. The regime would determine when points are triggered indicating the need for a new port (or further expansion of the port) occur based on how capacity and trade growth develops over the short to medium-term.

The rate at which changes in these two key variables will intensify or postpone the need to move elsewhere (or expand) is critical in considering the long-term plan for the port and the city.

It is important that Auckland is well-prepared to make decisions when it needs to, and with a coherent strategy underpinning those decisions.

An ongoing monitoring framework that reports on the efficiency and performance of the port against the required benchmark efficiency gains necessary to operate on the present site. This, combined with monitoring of trade growth, will ensure that there are built-in time buffers for decision making and will also ensure that any subsequent decision is informed and robust.

A key benefit of the performance monitoring regime is that it will provide key information and updates on when specified trigger points will be reached. How the trigger points are set up will depend on a set growth and port productivity rate, against which actual performance of the port and trade task growth will be measured. These two variables are critical as they determine the timing of the capacity trigger points. If performance expectations are not met or exceeded, the monitoring regime will notify key decision-makers on whether there is a need to accelerate or postpone the need to expand or move the port.

This framework will provide a more proactive approach to planning and decision making rather than making reactive decisions. It is important that Auckland is well-prepared to make decisions when it needs to, and with a coherent strategy and robust evidence underpinning those decisions.

This monitoring approach will ensure that disruptive changes (e.g. 3D printing), as well as ongoing megatrends (e.g. urbanisation, increased consumption trends) can be reflected progressively in planning for the port future over the next 20-50 years, and future port strategy updated accordingly.

11.2 Roadmaps

The Port Future 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 this long-term trade task is complicated. It will require a detailed transition strategy, high levels of co-ordination, and continuous stakeholder consultation.

The Port Future Study does not make a recommendation about transition, and decisions around the timing and nature of short-to-medium term decisions required to achieve the long-term strategy, as this decision rests with the CWG and Auckland Council.

As this Study cannot pre-empt the long-term strategy, nor can it advise on transition we have identified advantages and disadvantages of different roadmap variables in Table 66 below and have provided a procedural anchor to the 'actual' timing of decisions in Appendix 23.

11.3 Roadmap variables

Our roadmap scenarios suggest that there a number of key factors which would determine what optimal path is chosen. We make no judgment on what the optimal path is at this particular stage but provide discussion on the key variables that should be considered when determining the roadmap to a long-term solution.

Table 68: Roadmap variables

Variable	Description	Advantages	Disadvantages
Reclamation of some land	Reclaiming additional land in the harbour would allow POAL to temporarily continue to handle its trade task for both containers and multi-cargo for longer, without the need to relocate excess trade task to another port. Reclamation would be limited to only accommodate the medium-term trade task.	POAL is able to accommodate its trade task in the interim period. Less disruption to current operations and supply chain. Potentially provides additional port land for future alternative use.	The Auckland community have traditionally had a very negative perception of reclamation further into the harbour There are capital costs associated with reclamation in the harbour which could potentially be viewed as a sunk cost if there was a need for simultaneous investment. For example into a new port.
Relocation of All/Part of Trade Type	Relocating some/all of POAL's multi-cargo or container trade tasks would allow for shortfalls in capacity to be accommodated by other existing ports.	Relocating all of POAL's multi-cargo trade task would allow for the land that is currently used for these activities to be repurposed to handle containers. This would allow for some of the container/multi-cargo task to remain at the port in the medium-term. Similarly, relocating all of POAL's container trade would allow for the land that is currently used to be repurposed for multi-cargo use in the medium-term.	There is a risk that if either trade type is relocated to another port these customers may not return to POAL when there is capacity to accommodate their demand. There are infrastructure and capacity implications at existing ports. There may be other supply chain disruption impacts such as cost and time of logistics, congestion and other transport related costs, which can also impact the profitability of relocated task.
Reducing the current port footprint - Port land for alternative use	Reducing the current port footprint would make land available for alternative uses.	Making land available for alternative uses would promote the continued gentrification of the Auckland waterfront. Development proceeds or capital could then be recycled to fund the long-term solution.	Reducing the current footprint would directly reduce POAL's capacity to accommodate its trade task. The implications of this have already been discussed Option 2 in the options assessment.

11.4 Roadmap scenarios

The roadmap scenarios are intended to provide a preliminary indication on the possible paths to handle the medium-term TEU forecast in the process of reaching the long-term solution. That is focused on providing a temporary solution to accommodate the medium-term or excess trade task whilst the process for a long-term solution is underway.

We have identified a number of roadmap scenarios illustrated in Figure 101 and examples provided in Table 69.

Note that this is not an exhaustive list, there are other combinations or sub options that could alter outcomes, further analysis would be required to determine the optimal option.

Figure 101: Roadmap variables scenarios

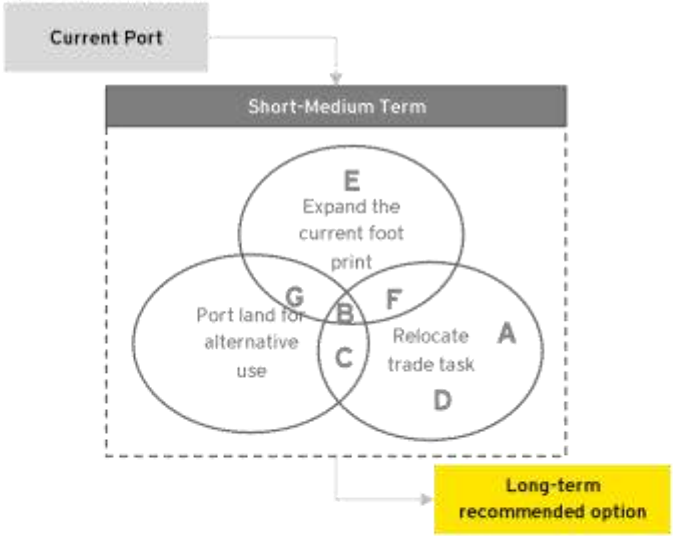


Table 69: Roadmap scenarios examples

Roadmap A	Temporarily relocate all multi-cargo to Northport, and convert Bledisloe to a temporary container terminal to accommodate growth in container task.
Roadmap B	Temporarily relocate all multi-cargo to Northport, make Bledisloe available for alternate use, conduct some reclamation at Fergusson to temporary accommodate (excess) container task.
Roadmap C	Temporarily relocate all multi-cargo to Northport, make Bledisloe available for alternate use, and temporarily relocate excess containers to Port of Tauranga.
Roadmap D	Maintain current port footprint, and temporarily relocate excess multi-cargo task to Northport, and temporarily relocate excess container task to Port of Tauranga.
Roadmap E	Conduct some reclamation/expansion at Bledisloe and Fergusson to temporarily accommodate excess multi-cargo and excess container trade task.
Roadmap F	Conduct some reclamation/expansion at Bledisloe and Fergusson to temporarily accommodate some excess multi-cargo and container trade task and temporarily relocate some excess container/multi-cargo task to Port of Tauranga and/or Northport.
Roadmap G	Conduct some reclamation/expansion to temporarily accommodate some excess multi-cargo and container trade task and make some port land for alternative use. Including extension at Bledisloe to meet multi-cargo trade task, and Captain Cook is made for alternative use. This is consistent with the Central Wharves Strategy.

11.5 Protecting the option

It is vitally important to note that we live in a dynamic environment and that this study shows preferred alternatives at this current time. It does not reflect how alternate sites might evolve and land use at these sites might change. It is likely that the metrics around each site will fundamentally change if development in the alternate site areas is allowed to occur. Potentially this will lessen the availability of land or restrict future land use for any potential new port option.

The indicative CBA results show that building a new port in the Manukau area will generate higher benefits as the capacity of a new port will not be constrained, compared to, if the port were to remain where it is.

If the appropriate planning or option protection does not occur in the short-term with regard to the new sites, it is likely that the metrics around each site will fundamentally change, as new developments at the alternate sites will occur and thus lessens the availability of land or restricts future land use.

Option protection is particularly crucial in the case of the Manukau options, where development plans in the areas surrounding the new proposed port sites could make the site uneconomic in the future in the absence of Notices of Requirement and incorporation into Regional Plans. For example, if surrounding land was zoned for residential as opposed to industrial use. If the desired future state is to have the land at the port site returned to the city for redevelopment, then a decision in the short to medium-term would be how POAL's existing and future trade task should be handled. As such, we recommend that, if Option 5 is chosen as the preferred long-term option to handle the long-term trade task, it is critical that the preferred site is protected in the short to medium-term to maintain its value as a new port site.

This would mean that if the CWG decides that a new port should be built, planning for this should start immediately, in order to protect the option value.

This will mean that in the short-term, further investigation into the possible new sites, such as detailed engineering and design, environmental impact assessments, and consultation with transport agencies including NZTA, KiwiRail and Auckland Transport will have to be undertaken immediately.

Another consideration is the flow-on impacts this decision will have on any existing and future planned transport infrastructure investment projects. In order for both the new port option and transport projects to realise their full benefits, the planning processes for both will need to be integrated and any port planning must be coordinated with any existing infrastructure plans and initiatives.

11.6 Conclusion

Any decisions made today and in the medium-term will have significant impacts on the future of Auckland. There will be a need to make difficult decisions regarding the future of the port and the city, with trade-offs to be considered for all options. The chosen future state of Auckland may require some bold decisions today. Therefore, the next steps will be critical to enabling that future.

There are also significant short/medium-term consequences of the long-term decision that might result in significant land area being available to the city (or not) within this shorter time horizon. There are flow-on impacts for both these options that will have a long-term impact on Auckland's economy, society and urban form.

This study and its findings are part of the wider the Port Future Study initiative. This initiative is a collaborative, stakeholder and mana whenua focus study, with emphasis given on wider community involvement in the decisions about the ports future. A process for consultation and engagement with both mana whenua and the wider public should continue to ensure that the project retains community involvement and that any agreed future port will have all stakeholders' buy-in.

12 Other Considerations

This section discusses other strategic considerations that are not directly within the scope of this study, but that will have important implications on the feasibility of future options.

12.1 Governance/ ownership structure

Currently, Auckland Council is the main shareholder of POAL. There are a number of ownership considerations that may have feasibility impacts on the recommended long-term solution.

It can be argued that there is a potential for conflict between Auckland Council's role as public voice, its regulatory functions and as an owner of the port.

For example, it is difficult to determine whether there is a return on investment of the underlying land asset, or if the return on investment is currently only based on port performance and operations. Arguably, the current dividend Auckland Council receives per year includes a portion of rental/or return for the land asset; however, as dividends are dependent on operating profit, the rental proportion would not be accurately represented and/or dividends could be misstated and could vary with port profitability.

For discussion and illustrative purposes, we deliberate the scenario of separating the operating aspects and asset ownership of POAL in to two separate companies, port operations company (OpCo) and a land holding company (LandCo). A contract would outline and govern the land use between OpCo and LandCo. Separating operating asset and land assets can provide independent and more robust decision-making that will optimise outcomes for both companies.

12.2 Private sector involvement

With respect to the trends in recent Asia Pacific port transactions, there also may be scope for private sector involvement to support a recommended long-term option. We note there are a number of possible ownership models available, and feasibility impacts would vary. Table 70 provides a summary of advantages and disadvantages of alternative ownership structures. Refer Appendix 21 for case studies.

Table 70: Advantages and disadvantages of OpCo and LandCo structure

Advantages	Disadvantages
▶ A potential lease agreement could obligate the private sector to co-ordinate and execute the preferred long-term solution. ▶ Proceeds from a potential lease could provide some funding for long-term solution. ▶ Ongoing capital development of the port is funded by the lessee. ▶ Land decisions could be made outside or operating to accommodate best use of land assets. ▶ Operating risks could be transferred to operating company. ▶ Operating company will be responsible for port infrastructure development and investment.	▶ Potential loss of dividends and income, however note any upfront transaction proceeds would represent and positive cash flows including dividends and generally would not proceed if net worse for the shareholder. ▶ Loss of operating control; however, mitigated to an extent by other regulatory controls and mechanisms. ▶ Accounting and taxation implications will need to be explored.

12.3 National port strategy

A National Port Strategy is a national/regional master plan for ports to drive greater supply chain efficiencies. Integration of planning can provide (as a whole) a more efficient capital planning regime.

There are previous studies that have focused on a holistic ports strategy among New Zealand ports. This section discusses the strategic and feasibility implications on the long-term recommendations if a National Port Strategy was considered.

Overall, there are 14 major ports in New Zealand, most having a container terminal to account for imports, exports and inter-trade.

The latest Ministry of Transport (MOT) data suggests that there is currently a large number of intra-North Island empty container movements due to the current trade imbalance (Ports of Auckland is New Zealand's largest container import port, and Port of Tauranga is the largest port for container exports). This imbalance requires a large movement of empty containers around the country, which is costly and inefficient.

A discussion paper by Auckland Regional Holdings in 2010 outlined a number of recommendations to the New Zealand Government, indicating a need for participation and involvement at a national level. We have found this consistent with other literature and international ports. Appendix 22 contains an extract of the ports and freight sector challenges and how international governments have approached these challenges.

In Australia, the National Ports Strategy was developed in 2011. It considers container and bulk ports with the strategy aimed to improve governance, land planning and future infrastructure requirements to drive development of efficient sustainable ports and related freight logistics to boost export performance and economic productivity.

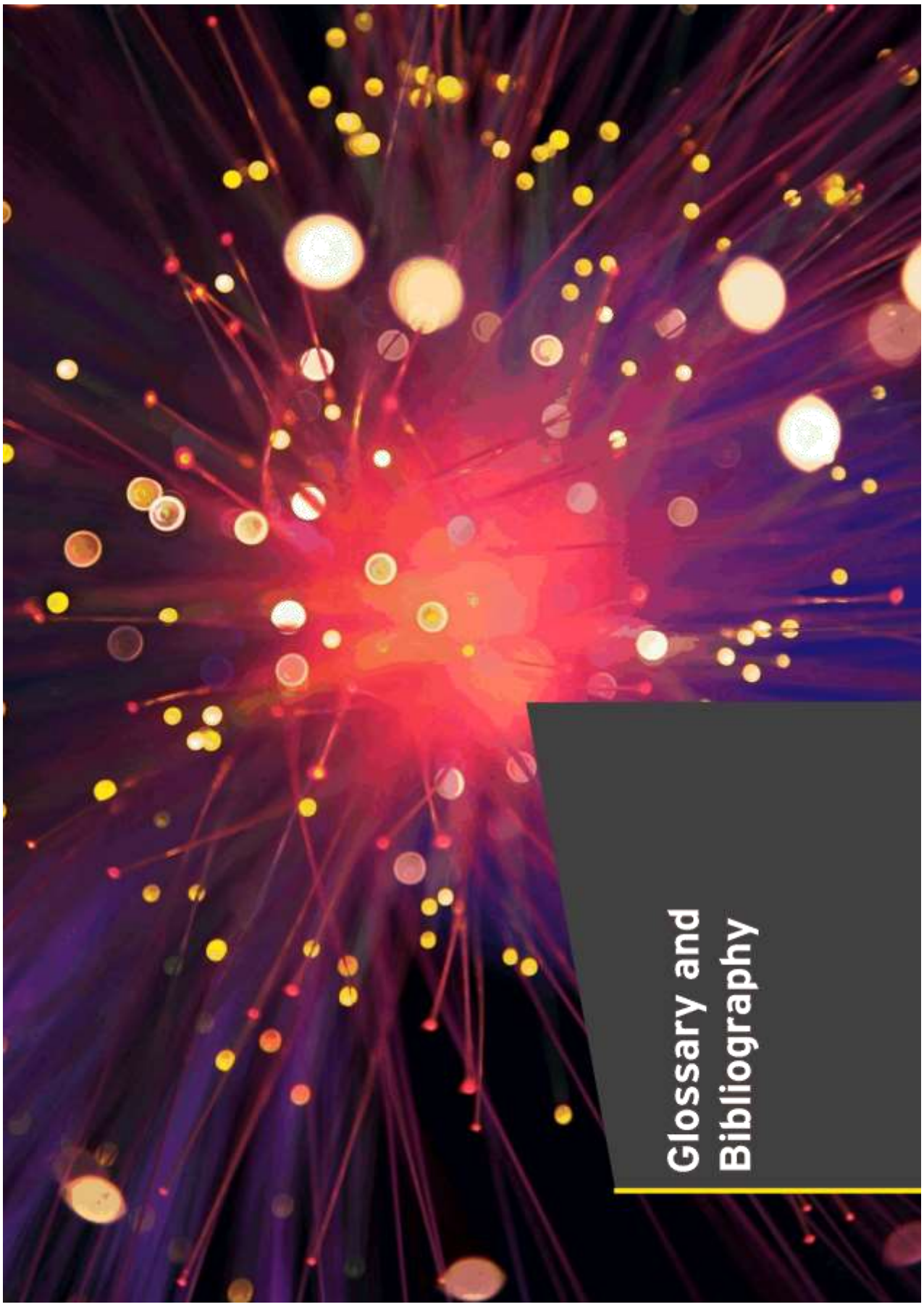
The NSW Government also has a "Freight and Ports Strategy" which aims to provide a strategy for the transport network in NSW that will allow for the efficient flow of goods to market, whilst working with industry to improve the overall supply chain.

Table 71: Advantages and disadvantages of a National Port Strategy

Advantages	Disadvantages
▸ Greater co-ordination for planning for both wider freight infrastructure and port infrastructure. ▸ Potential for specialisation in ports trade task. ▸ Enables planning for peak trade task events amongst ports. ▸ Enable best practice policies.	▸ Other ports provide an effective competitive control on POAL, restraining prices and encouraging efficiency. Any further merger between ports may see this competitive influence diminished to the detriment of Auckland importers and exporters. ▸ A degree of costs for implementation and consideration for different ownership structures for different ports. ▸ Potentially requires legislative change. ▸ Potential administrative burden to organising.

Item 16

Attachment B



13 Glossary

1-over-2	Type of straddle carrier, 12.5m high
1-over-3	Type of straddle carrier, 15.5m high
ACIL	Auckland Council Investments Limited : A major CCO the manages Auckland Councils major equity investments
ADC	Auckland Development Committee
ASC	Automated Straddle Carriers (Auto Strads): Vehicle used for moving containers
AT	Auckland Transport: Organisation responsible for all the regions' transport services (excluding state highways).
ATEED	Auckland Tourism Events and Economic Development: A CCO and Auckland's economic growth agency
ATEED's Cruise Action Plan	Report that address the economics of the cruise ship industry to Auckland
Auckland Economic Development Strategy	Sets out how Auckland will achieve its economic goals
Auckland Plan	Sets down the vision for the Auckland region
Auckland Regional Holdings	Set up to provide funds to Auckland Council and manage its long-term interests and for the benefit of New Zealand
Auckland Unitary Plan (Unitary Plan)	The proposed plan for Auckland's future
Bedforms	A morphological feature formed by the interaction between a flow and cohesion less sediment on a bed
Berthage	Space at wharf for vessels to park
Berthing	Action when vessel parks at the wharf
Blue Sky	New option used in option analysis
Break Bulk	Variety of goods that must be loaded onto the ship individually i.e. not in containers or in bulk, sometimes on pallets, in boxes or other storage means
Brownfield	Development on an already developed site
Bulk Cargo	Commodity Cargo
CAGR	Compound Annual Growth Rate
Caisson	A structure used for under water ground work

CBA	Cost Benefit Analysis
CBD	Central Business District
CCO	Council Controlled Organisation
CEU	Car Equivalent Units
Conlinxx	Subsidiary company of POAL which managed the Wiri Inland Port in South Auckland
Containerised Cargo	Goods shipped within containers
Cruise New Zealand	New Zealand's Industry Body for the cruise sector
Customs	Government border protection agency
CWG	Consensus Working Group
Docking Area	Body of water next to the structures used in handling vessels
Dolphin	A standalone structure that extends above the water level and is not connected to shore or pier, they provide a structure to secure to when the ship is greater than in length of the berth/pier.
Dredging	A process used for excavating the sediment at the bottom of a body of water
East West Link	Planned motorway extension linking the Southern and South Western motorways
Ebb Tide	Period when water level is falling
ECMT	East Coast Main Trunk
ENGO	Environmental Non-Government Organisations
Exchange Hub	Location where passengers or crew have reached their final destination or embark as the start of their cruise
FIGS	Freight Information Gathering System
Flow Tide	Period when water level is rising
Future Urban Land Supply Strategy	This plans out how land is supplied for development in the Future Urban Zones
Future Urban Zone	Land that will be urbanised within the next 30 years
GDP	Gross Domestic Product
GFA	Ground Floor Area
GFC	Global Financial Crisis

ILM	Investment Logic Map: Structured workshops with stakeholders
Land Reclamation	The process of creating land from existing bodies of water such as oceans, harbours, rivers etc
Light Spill	Light that reaches area beyond the intended lighted area
LOA	Length Overall, dimension of the overall vessel length
Local Government Act 2002 Amendment Act 2014	The purpose of this Act is to provide for democratic and effective local government that recognises the diversity of New Zealand communities.
Lo-Lo	Lift-on lift-off: A type of port operation used when loading or unloading vessels
MAF	Ministry of Agriculture and Forestry was a state sector organisation which dealt with matters relating to agriculture, horticulture and forestry.
Mana Whenua Iwi	The customary tribes of Auckland
MBIE	Ministry of Business Innovation and Employment
MCA	Multi Criteria Analysis
MOT	Ministry of Transport
Multi-cargo	Break cargo and bulk cargo
NAL	North Auckland Line: Section of the rail trunk line north of Auckland
National Port Strategy	Plan for all of New Zealand ports
Ngā Mana Whenua o Tāmaki Makaurau and Crown Framework	Sets out structure and function of Ngā Mana Whenua o Tāmaki Makaurau , crowns proposals for recognitions of interests and right of refusal over surplus crown land and the process for resolving claims
NIMT	North Island Main Trunk Line
NSW	New South Wales
NZIER	New Zealand Institute of Economic Research
NZTA	New Zealand Transport Agency
OECD	Organisation for Economic Co-operation and Development
PCC	Pure Car Carriers : Vessels that carry only cars
PCTC	Pure Car and Truck Carriers : Vessels that carry only cars and trucks
PDI	Pre-Delivery Inspection

Pilotage	When a pilot (with detailed local knowledge of waterways) manoeuvres a ships through dangerous or congested waters, such as harbours or river mouths,
POAL	Ports of Auckland Limited
POT	Port of Tauranga
Public Works Act	New Zealand Legislation which provides the Crown with the right to acquire land for government and local works
PwC	PricewaterhouseCoopers
Rangatiratanga	Self determination
RG	Reference Group
RMA	Resource Management Act: New Zealand's main piece of legislation that sets out how the environment should be managed
Ro-Ro	Roll-on roll-off: A type of port operation used when loading or unloading vessels
RTG	Rubber Tied Gantry is a mobile gantry crane used to stack and move containers
RUB	Rural Urban Boundary defines the extent of urban development to 2041 and areas to be kept rural
SH1	State Highway 1
SH16	State Highway 16
SH20	State Highway 20
Statistics New Zealand	Government body that collects and analyses national statistics
Surficial Sediment	Sediment that collects on a surface
Tāmaki Collective	Collection of local Auckland iwi's
Tamaki Makaurau iwi	Local Auckland iwi
Te Tiriti o Waitangi/ Treaty of Waitangi	New Zealand founding document between the British Crown and signing Māori Iwis
TEU	Twenty-foot Equivalent Unit
The Treasury	New Zealand Treasury is the governments lead advisor on economic, financial and regulatory policy
TOS	Terminal Operating System: Aims to control the movement of cargo in and around the container terminal
ULCV	Ultra Large Carrying Vessel

Under Keel Clearance	Distance from the very bottom of the keel to the highest point on the seafloor
UNISA	Upper North Island Strategic Alliance: A long-term collaboration between the Auckland Council, Bay of Plenty Regional Council, Northland Regional Council, Waikato Regional Council, Hamilton City Council, Tauranga City Council and Whangarei District Council for responding to and managing a range of inter-regional and inter-metropolitan issues
Vessel Beam	Width at the widest point of the vessel as measured at the nominal water line
Vessel Draft	Vertical distance between the waterline and the bottom of the keel
Waikato-Tainui	Large Iwi based in the Waikato region
World Customs Organisation	Independent intergovernmental body whose mission is to improve the administration of customs
World Trade Organisation	Global organisation that deals with global rules and trade between nations.

14 Bibliography

Infometrics (2015) Annual Auckland Economic Profile. Retrieved from: https://ecoprofile.infometrics.co.nz/Auckland/PDFProfile

Ministry of Transport (2014), Annual Fleet Statistics. Retrieved from: http://www.transport.govt.nz/assets/Uploads/Research/Documents/New-Zealand-Vehicle-fleet-stats-final-2013.pdf

Davidson, A. (2003). Reverse Sensitivity-Are No-Complaints Instruments a Solution. *NZJ Envtl. L.*, 7, 203.

ATEED (2016) Discover Central Auckland. Retrieved from: http://www.aucklandnz.com/discover/areas/central-auckland

New Zealand Institute for Economic Research (2015) Port Study 2: NZIER Report to Auckland Council. Retrieved from: http://nzier.org.nz/static/media/filer_public/3b/65/3b652ac8-ab9d-42be-bdcc-4a56905d40fe/nzier_port_report__4_february_2015.pdf

Fontein, P. (2014) Auckland Industrial Land Fine Grained Analysis Retrieved from: http://static1.squarespace.com/static/546d47b8e4b07b4ef0db4b25/t/547bd278e4b0680f8d6df54c/1417400952977/PAUP+Appendix+5+2014+12+01.pdf

Auckland Council (2012) Auckland Plan Retrieved from: http://www.aucklandcouncil.govt.nz/EN/planspoliciesprojects/plansstrategies/theaucklandplan/Pages/theaucklandplan.aspx

New Zealand Herald - Bernard Orsman (2012) Auckland Port Expansion Put on Hold Retrieved from: http://www.nzherald.co.nz/business/news/article.cfm?c_id=3&objectid=10790332

New Zealand Treasury (2015) Half Year Economic and Fiscal Update: Average of Total Imports and Exports Retrieved from: http://www.treasury.govt.nz/budget/forecasts/hyefu2015/hyefu15.pdf

Auckland Council (2013) Capacity for Growth Study 2013 (Proposed Auckland Unitary Plan): Results (2013). Retrieved from: http://www.aucklandcouncil.govt.nz/EN/planspoliciesprojects/reports/technicalpublications/Documents/tr2014010capacityforgrowthstudy2013results.pdf

World Bank (2015) Competitive Cities for Jobs and Growth: What, Who, and How. Retrieved from: http://www.wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2015/12/08/090224b083c371d5/2_0/Rendered/PDF/Competitive0ci000what00who00and0how.pdf?bcsi_scan_01d939382f6c0b14=0&bcsi_scan_filename=Competitive0ci000what00who00and0how.pdf

Merk, O. (2013). The competitiveness of global port-cities: synthesis report.

Ministry of Transport (2015) Freight Information Gathering System. Retrieved from: http://www.transport.govt.nz/sea/figs/

ATEED (2015). Cruise Action Plan for Auckland. Retrieved from: http://www.aucklandnz.com/downloads/ATEED_Cruise_Action_Plan_110515.pdf

Cruise New Zealand (2015), Cruise New Zealand. Retrieved from: http://cruisenewzealand.org.nz/about/

Market Economics (2014) Economic Impact of the New Zealand Cruise Sector. Retrieved from: http://www.tourism2025.org.nz/assets/Uploads/Cruise-Report-2014.pdf

Ministry of Transport (2014) Future Demand: New Zealand Transport and Society – Trends and Projections. Retrieved from: http://www.transport.govt.nz/assets/Uploads/Our-Work/Documents/fd-trends-and-projections.pdf

Cruise New Zealand (2015) Economic Impact of the 2014-2015 Cruise Sector in New Zealand and Forecasts to 2017. Retrieved from: http://cruisenewzealand.org.nz/wp-content/uploads/2015/01/Cruise-New-Zealand-Economic-Impact-Report-Summary1.pdf

Statistics New Zealand (2015) Export and Import Value by Region. Retrieved from: http://www.stats.govt.nz/browse_for_stats/industry_sectors/imports_and_exports.aspx

Erkök, F. (2009) Waterfronts: Potentials for Improving the Quality of Urban Life. Retrieved from: http://www.az.itu.edu.tr/azvol6no1/11erkok0601.pdf

Ministry of Transport (2014) National Freight Demand Study. Retrieved from: http://www.transport.govt.nz/assets/Uploads/Research/Documents/National-Freight-Demand-Study-Mar-2014.pdf

New Zealand Trade Agency (2014) Ongoing Domestic Freight Volume Information Study. Retrieved from:

https://www.nzta.govt.nz/assets/resources/research/reports/542/docs/542.pdf

Ministry of Transport (2015) Freight Information Gathering System & Container Handling Statistics October 2014 – September 2015. Retrieved from: http://www.transport.govt.nz/assets/Uploads/Sea/Documents/FIGS-Report-September-2015.pdf

Ministry of Transport (2015) Freight Information Gathering System & Container Handling Statistics January – December 2014. Retrieved from: http://www.transport.govt.nz/assets/Uploads/Sea/Documents/FIGS-December-2014.pdf

Auckland Council (2015) Final Future Urban Land Supply Strategy Plan. Retrieved from: http://www.aucklandcouncil.govt.nz/EN/planspoliciesprojects/plansstrategies/Councilstrategies/Documents/finalfutureurbanlandsupplystrategyplan.pdf

Ministry of Transport (2011) Freight Charge Comparison Report. Retrieved from: http://www.transport.govt.nz/assets/Import/Documents/UTCC-2011-Freight-Charge-Comparison-Report-Aug-2011.pdf

Ministry of Transport (2015) Freight Information Gathering System and Container Handling Statistics. Retrieved from: http://www.transport.govt.nz/assets/Uploads/Sea/Documents/FIGS-June-2015.pdf

Auckland Council (2015) Future Urban Land Supply. Retrieved from: http://www.aucklandcouncil.govt.nz/EN/planspoliciesprojects/plansstrategies/Councilstrategies/Pages/futureurbanlandsupplystrategy.aspx

UNCTAD (2015) Review of Maritime Transport. Retrieved from: http://unctad.org/en/PublicationsLibrary/rmt2015_en.pdf?bcsi_scan_01d939382f6c0b14=O+z/MOUQ2KSbVmcgjrRXV0NbgfA/AAAAxU/2Eg==&bcsi_scan_filename=rmt2015_en.pdf

International Maritime Organisation (2012) International Shipping Facts and Figures: Information Resources on Trade, Safety, Security, Environment. Retrieved from: http://www.imo.org/en/KnowledgeCentre/ShipsAndShippingFactsAndFigures/TheRoleandImportanceofInternationalShipping/Documents/International%20Shipping%20-%20Facts%20and%20Figures.pdf?bcsi_scan_01d939382f6c0b14=+gUDjoOZAlzqe9sCJHt+55HdJcY/AAAA0U/2Eg==&bcsi_scan_filename=International%20Shipping%20-%20Facts%20and%20Figures.pdf

Statistics New Zealand (2015) Goods and Services Trade by Country: Year ended December 2015. Retrieved from: http://www.stats.govt.nz/browse_for_stats/industry_sectors/imports_and_exports/GoodsServicesTradeCountry_HOTPYeDec15.aspx

OECD (2015) Governing the City Retrieved from: http://www.oecd-ilibrary.org/urban-rural-and-regional-development/governing-the-city_9789264226500-en

New Zealand Treasury (2015) Half Year Economic and Fiscal Update. Retrieved from: http://www.treasury.govt.nz/budget/forecasts/hyefu2015/hyefu15.pdf

Statistics New Zealand (2015) Mapping Trends in the Auckland Region. Retrieved from: http://www.stats.govt.nz/browse_for_stats/Maps_and_geography/Geographic-areas/mapping-trends-in-the-auckland-region/population-growth.aspx

Statistics New Zealand (2016) Historic Population Estimates. Retrieved from: http://www.stats.govt.nz/browse_for_stats/population/estimates_and_projections/historical-population-tables.aspx

Ports of Auckland (2016) History of the Ports of Auckland. Retrieved from: http://www.poal.co.nz/our-story/

Statistics New Zealand (2015) Imports & Exports 1989-2015. Retrieved from: http://www.stats.govt.nz/tools_and_services/nzdotstat/tables-by-subject/imports-and-exports-tables.aspx

Bolland, J. (2010). Independent Advice on the Economic Costs and Benefits of Rail Freight Stage 3. *Final Report from Ministry of Transport*.

Ministry of Transport (2011) Container Productivity at New Zealand Ports. Retrieved from: http://www.transport.govt.nz/assets/Import/Documents/Container-Port-Productivity-report-final.pdf

Statistics New Zealand (2016) Regional Gross Domestic Product: Year ended March 2015. Retrieved from: http://www.stats.govt.nz/browse_for_stats/economic_indicators/NationalAccounts/RegionalGDP_MRYeMar15.aspx

Auckland Council (2016) Innovation Hub of the Asia Pacific Rim. Retrieved from: http://eds.aucklandcouncil.govt.nz/develop-an-innovation-hub-of-the-asia-pacific-rim/#p2-6-action-2-2

Attachment B **Item 16**

Beard J, Helbing, H. & Dobilas, G. (2014) North American Port Productivity – Lessons from Asia & Europe? Retrieved from: http://www.joc.com/sites/default/files/u48502/PDFs/TPM%20Long%20Beach%20Terminal%20Productivity%20J%20Beard%20ICF%202014-03-04%20FINALv3%20(1)%20(1).pdf?bcsi_scan_01d939382f6c0b14=0&bcsi_scan_filename=TPM%20Long%20Beach%20Terminal%20Productivity%20J%20Beard%20ICF%202014-03-04%20FINALv3%20(1)%20(1).pdf

Kiwi Rail (2015) Kiwi Rail Annual Report 2015. Retrieved from: http://www.kiwirail.co.nz/uploads/Publications/KiwiRail%20Annual%20Report%202014-2015.pdf

Auckland Regional Holdings (2009) Long term Optimisation of the Port Sector

Tourism New Zealand (2015) Market Statistics Cruise Sector. Retrieved from: http://www.tourismnewzealand.com/markets-stats/sectors/cruise-sector/

Tourism New Zealand (2015) Market Trends - Tourism NZ Forecasts. Retrieved from: http://www.tourismnewzealand.com/markets-stats/markets/australia/market-trends/

Ministry of Business, Innovation and Employment (2015) Regional Economic Activity Report. Retrieved from: http://www.mbie.govt.nz/info-services/business/business-growth-agenda/regions/documents-image-library/rear-2015/min-a003-rear-report-lr-optimised.pdf

OECD (2015) Economic Surveys: New Zealand. Retrieved from: https://www.oecd.org/eco/surveys/New-Zealand-2015-overview.pdf

Statistics New Zealand (2014) National Population Projections: 2014 (base) - 2068. Retrieved from: http://www.stats.govt.nz/browse_for_stats/population/estimates_and_projections/NationalPopulationProjections_HOTP2014.aspx

Infrastructure Australia (2011) National Ports Strategy. Retrieved from: https://www.coag.gov.au/sites/default/files/National%20Ports%20Strategy.pdf.

Colliers (2015) New Zealand CBD Office Report. Retrieved from: http://www.colliers.co.nz/find%20research/office/nz%20cbd%20office%20report%202015/

New Zealand Treasury (2013) Long term Fiscal Model. Retrieved from: http://www.treasury.govt.nz/government/longterm/fiscalmodel

Ministry of Transport (2014) Future Demand New Zealand Transport and Society: Trends and Projections. Retrieved from: http://www.transport.govt.nz/assets/Uploads/Our-Work/Documents/fd-trends-and-projections.pdf

Statistics New Zealand (2015) Gross Domestic Product: June 2015 Quarter. Retrieved from: http://www.stats.govt.nz/browse_for_stats/economic_indicators/GDP/GrossDomesticProduct_HOTPJun15qtr.aspx

Rockpoint (2015) New Zealand Ports and Freight Yearbook 2015. Retrieved from: http://www.rockpoint.co.nz/pdfs/NZ_Ports_and_Freight_Yearbook_2015.pdf?bcsi_scan_01d939382f6c0b14=0&bcsi_scan_filename=NZ_Ports_and_Freight_Yearbook_2015.pdf

OECD (2014) New Zealand Indicators. Retrieved from: https://data.oecd.org/new-zealand.htm t

Tisch C, Pearson A, Kingham S, Borman B, Briggs D. 2013. Environmental health indicators: a review of initiatives worldwide. *Management of Environmental Quality An International Journal* 01/2014; 25:446-466. doi: 10.1108/MEQ-11-2012-0075

Statistics New Zealand (2015) International Visitor Arrivals to New Zealand. Retrieved from: http://www.stats.govt.nz/iva

Cruise New Zealand (2015) Data Retrieved from: http://cruisenewzealand.org.nz/data/#

Mare, D. and Coleman A. (2011) Patterns of Business Location in Auckland. Retrieved from: http://nzae.org.nz/wp-content/uploads/2011/Session6/62_Mare.pdf

Brooks, M., Pallis, T., Perkins, S. (2014) Port Investment and Container Shipping Markets. Retrieved from: http://www19.iadb.org/intal/intalcdi/PE/2014/13917.pdf?bcsi_scan_01d939382f6c0b14=0&bcsi_scan_filename=13917.pdf

Ports of Auckland (2015) Ports of Auckland Annual Review. Retrieved from: http://2015annualreview.poal.co.nz/

KiwiRail (2014) Rail set to Play Larger Role at Ports of Auckland. Retrieved from: http://www.kiwirail.co.nz/news/292/78/Rail-set-to-play-larger-role-at-Ports-of-Auckland.html

Ports of Auckland (2015) Ports of Auckland Summary Financials. Retrieved from: https://www.poal.co.nz/about-

us/Documents/POAL%20and%20Subsidiaries%20Summary%20Financials%202015.pdf

Drewry (2014) Global Container Terminal Operators Review. Retrieved from: http://www.drewry.co.uk/news.php?id=293

Drewry (2015) Container Market Annual Review and Forecast 2015/16. Retrieved from: http://www.drewry.co.uk/publications/view_publication.php?id=442

PwC (2012) Upper North Island Port and Port-Related Infrastructure Supply and Demand Study. Retrieved from: https://www.poal.co.nz/about-us/Documents/2012UNISA_ExecutiveSummary.pdf

Ports of Auckland (2014) Looking Forward to Another Great Year. Retrieved from: https://www.poal.co.nz/about-us/Documents/Latest_PortBooklet.pdf

POT Annual Report (2015), Ports of Tauranga. Retrieved from: http://www.port-tauranga.co.nz/Investors/Financial-Information/Download-Annual-Report/

Auckland Transport (2016) Presentation to CWG

Public Sector Discount Rates for Cost Benefit Analysis (2008), New Zealand Treasury,http://www.treasury.govt.nz/publications/guidance/planning/costbenefitanalysis/discountrates/discount-rates-jul08.pdf

JLL (2016) Pulse Auckland CBD. Retrieved from: http://www.jll.nz/new-zealand/en-gb/Research/Auckland%20CBD%20Office%20Q1%202016.pdf?ee4d8e73-7b18-4be2-a1d5-616632750ec8%20

Ports of Auckland (2015) Consolidation enables Ports of Auckland to open up Onehunga Wharf land to Aucklanders. Retrieved from: http://www.poal.co.nz/media/releases/consolidation-enables-ports-of-auckland-to-open-up-onehunga-wharf-land-to-aucklanders

Wilson, J. (2010) Short History of Post-Privatisation in New Zealand. Retrieved from: http://www.treasury.govt.nz/downloads/commercial/mixed-ownership-model/mom-shppnz-wilson-dec10.pdf

Grimes, A. and Liang, Y. (2009) Spatial Determinants of Land Prices in Auckland: Does the Metropolitan Urban Limit Have an Effect? Retrieved from: http://motu-www.motu.org.nz/wpapers/07_09.pdf

New Zealand Transport Agency (2015) State Highway Traffic Data Booklet 2010-2014. Retrieved from: https://www.nzta.govt.nz/assets/resources/state-highway-traffic-volumes/docs/SHTV-2010-2014.pdf

New Zealand Transport Agency (2015) State Highway AADT Data Booklet. Retrieved from: https://www.nzta.govt.nz/assets/resources/state-highway-traffic-volumes/docs/2011-2015-AADT-Booklet2.pdf

ATEED (2014) Supporting Auckland Growth and Competiveness Retrieved from: http://www.aucklandnz.com/images/uploads/page_images/Supporting_Auckland_Growth_and_Competitiveness.pdf

OECD (2014) The Competitiveness of Global Port-Cities: Synthesis Report. Retrieved from: http://www.keepeek.com/Digital-Asset-Management/oecd/urban-rural-and-regional-development/the-competitiveness-of-global-port-cities_9789264205277-en#page52

UK Treasury (2011) The Green Book: Appraisal and Evaluation in Central Government. Retrieved from: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/220541/green_book_complete.pdf.

OECD (2015) The Impact of Mega-Ships. Retrieved from: http://www.itf-oecd.org/sites/default/files/docs/15cspa_mega-ships.pdf

Dadush, U. and Shimelse, A. (2010) The Transformation of World Trade. Retrieved from: http://carnegieendowment.org/files/Transformation_of_World_Trade.pdf

HSBC (2015) Trade Winds: Shaping the Future of International Business Retrieved from: https://globalconnections.hsbc.com/grid/uploads/trade_wind_report.pdf

Auckland Transport (2016) Transport for Growth in North West Auckland. Retrieved from: https://at.govt.nz/projects-roadworks/transport-for-future-urban-growth/transport-for-growth-in-north-west-auckland/#networks

Auckland Transport (2016) Transport for Growth in South Auckland. Retrieved from: https://at.govt.nz/projects-roadworks/transport-for-future-urban-growth/transport-for-growth-in-southern-auckland/

Beca (2009) Truck Movement and Access Time Research for Ports of Auckland

Aurecon (2013) Project: Research into freight hub/inland port development in the Waikato Region. Retrieved from: http://www.waikatoregion.govt.nz/PageFiles/19549/Appendix%20iii%20(Item%203)-%20%20Freight%20Hub%20Inland%20Port%20Research%20Doc%20%232382462.pdf?bcsi_scan_01d939382f6c0b14=0&bcsi_scan_filename=Appendix%20iii%20(Item%203)-

%20%20Freight%20Hub%20Inland%20Port%20Research%20Doc%20%232382462.pdf

World Shipping Council (2016) Ports. Retrieved from: http://www.worldshipping.org/about-the-industry/global-trade/ports

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

United Nations Department of Economic and Social Affairs (2014) Population Division World Urbanization Prospects: The 2014 Revision. Retrieved from: http://esa.un.org/unpd/wup/Publications/Files/WUP2014-Highlights.pdf?bcsi_scan_01d939382f6c0b14=0&bcsi_scan_filename=WUP2014-Highlights.pdf

EY | Assurance | Tax | Transactions | Advisory

About EY
EY is a global leader in assurance, tax, transaction and advisory services. The insights and quality services we deliver help build trust and confidence in the capital markets and in economies the world over. We develop outstanding leaders who team to deliver on our promises to all of our stakeholders. In so doing, we play a critical role in building a better working world for our people, for our clients and for our communities.

EY refers to the global organisation and may refer to one or more of the member firms of Ernst & Young Global Limited, each of which is a separate legal entity. Ernst & Young Global Limited, a UK company limited by guarantee, does not provide services to clients. For more information about our organisation, please visit ey.com.

© 2016 Ernst & Young, New Zealand.
All Rights Reserved.

28 06 16

ey.com

Appendix

Contents

1. Governance 4
   1.1 Consensus working group 4
   1.2 Reference group 6
2. Port of Auckland Layout 7
3. Location of Wider POAL Infrastructure 8
4. Historic Relinquishment/Sale of Land 9
5. Auckland Business Land Zoning 10
   5.1 City centre fringe zoning 10
   5.2 Geographic location of different land use typologies 11
6. Future Land Release Strategy to 2041 12
   6.1 Future urban zones outside the 2010 Metropolitan Urban Limit (MUL) 13
7. Supporting Plans Summary 14
8. Investment Logic Mapping 18
   8.1 Overview 18
   8.2 CWG ILM workshop output 19
9. Case Studies of Port Redevelopments 20
10. Unpicking the cargo growth forecasts – futurist thinking 22
    10.1 Detailed future state projection assumptions 22
    10.2 Putting the disruption of the last 30 years into context 24
    10.3 Testing the future freight forecasts 26
    10.4 Digital future – negative pressure, but not as much as you'd expect 26
    10.5 Entrepreneurship rising – more imports, more exports 27
    10.6 Global marketplace – more imports, more exports 27
    10.7 Urban world – marginally more imports 27
    10.8 Resourceful planet – neutral 27
    10.9 Health reimagined – marginally more imports 28
    10.10 Forecast of historic TEU per capita and forecast TEU 29
11. Examples of container yard technology 30
12. Container Terminal Future Technology – Discussion paper – Black Quay 35

12.1 Computerised terminal management 36
12.2 Ship to shore cranes 36
12.3 Terminal systems 36
12.4 Container Security 37
12.5 Intelligent Containers 37
13. POAL areas of consent 38
13.1 Fergusson Container Terminal extension 39
14. Physical Viability Assessment Criteria 40
14.1 Physical viability assessment – findings extract 41
15. Physical Viability - Red Sites - Reasons for Disqualification 70
16. Amber and Green sites – Physical viability findings and Multiple Criteria Analysis Findings ... 74
17. MCA Results 91
17.1 Multi Criteria Analysis, Weighting and Scoring 91
17.2 MCA Results – Unweighted 94
17.3 MCA Results - Weighted 96
17.4 MCA – Weighted (Rank) 98
17.5 MCA Unweighted scores (Rank) 99
18. CBA – Transport Costs Description 100
18.1 Freight Flows (Import and Export) 105
19. CBA – Detailed Assumptions 106
20. Private Sector Involvement Case Study 111
21. Extract from Auckland Regional Council 112
22. Implementation Roadmap 113
23. Coastal Processes and Biological Communities 122
23.1 Coastal Processes 123
23.2 Sites 126
23.3 Marine Ecology 128
23.4 Fish Species 132
23.5 Areas of significance for coastal birds 133
24. Manukau Harbour Dredge Volumes 135
25. Maori Values Framework 140

Item 16

Attachment C

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	

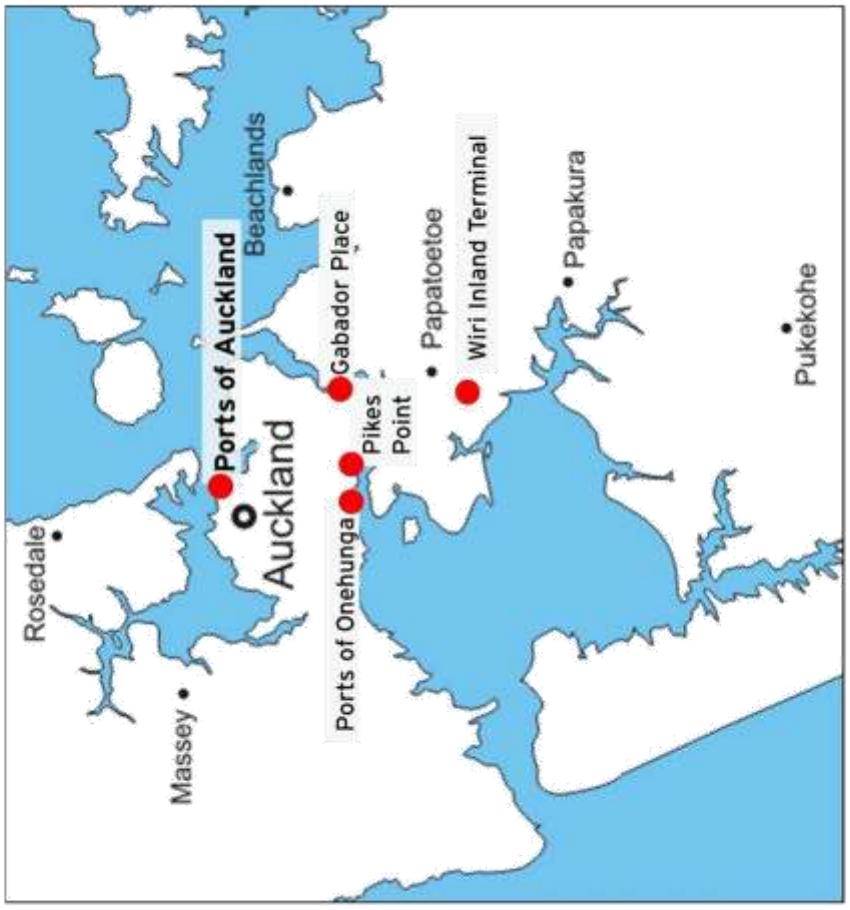
2. Port of Auckland Layout

Source: Port of Auckland

Item 16

Attachment C

3. Location of Wider POAL Infrastructure

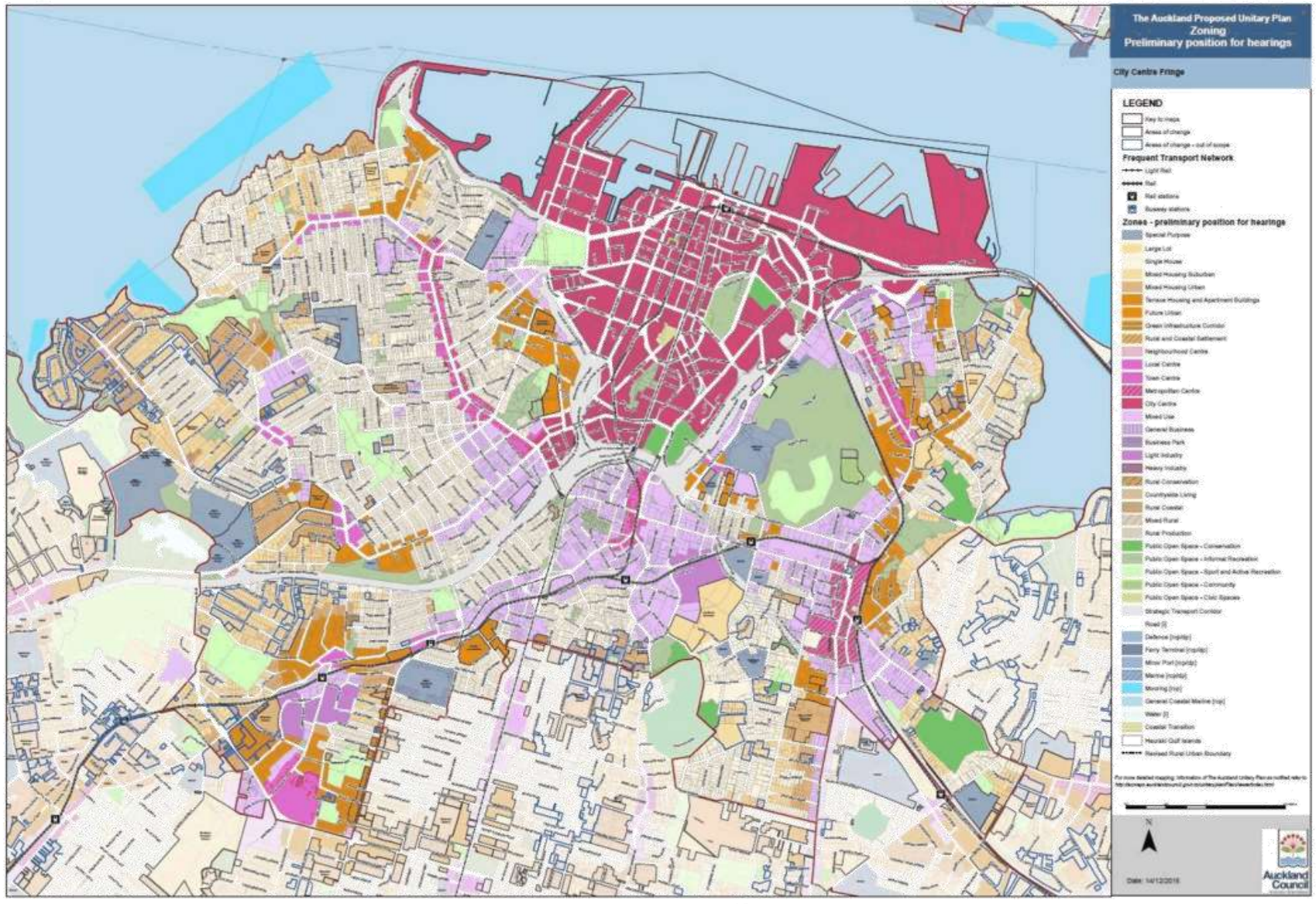


8

4. Historic Relinquishment/Sale of Land

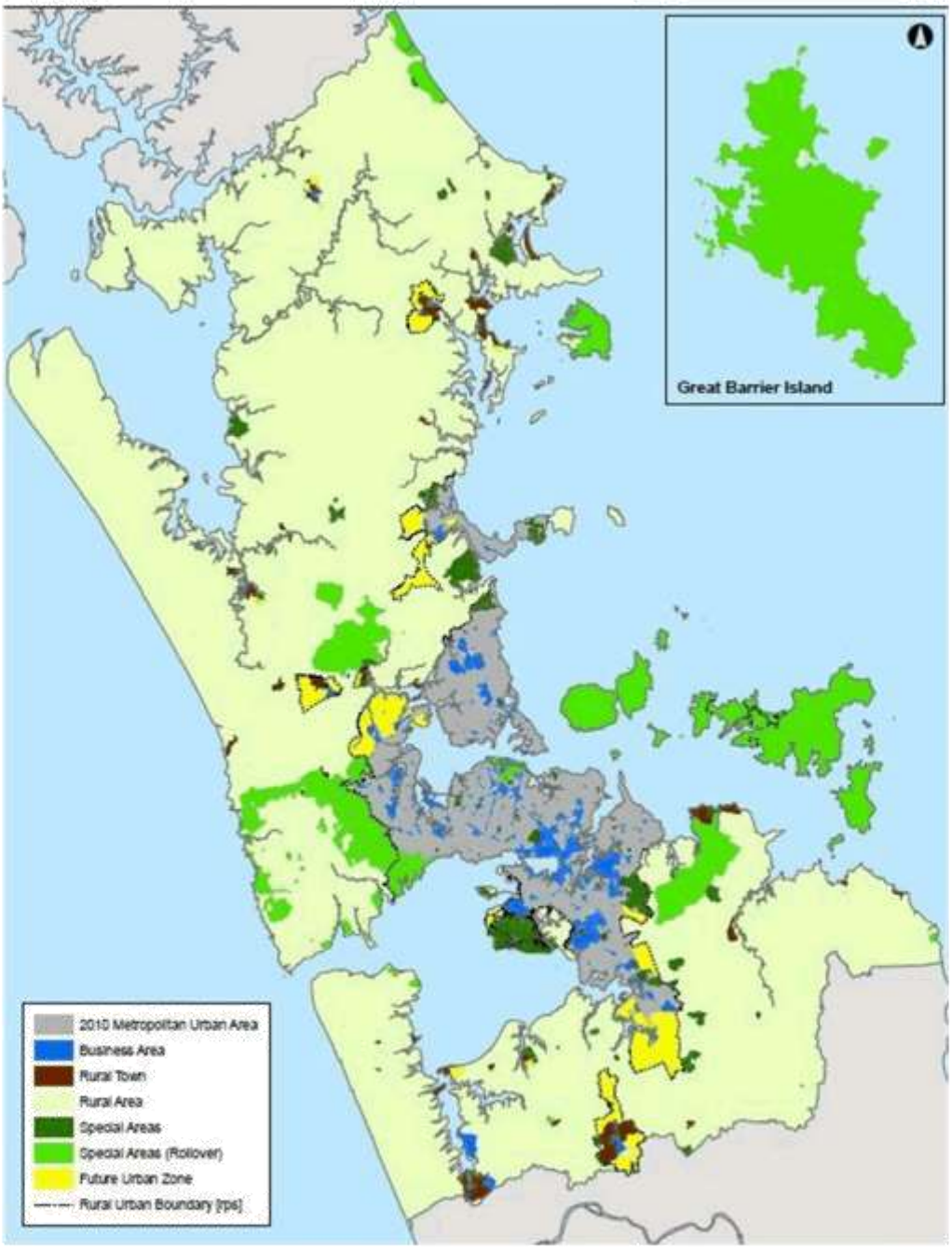
5. Auckland Business Land Zoning

5.1 City centre fringe zoning



10

5.2 Geographic location of different land use typologies



Item 16

Attachment C

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?

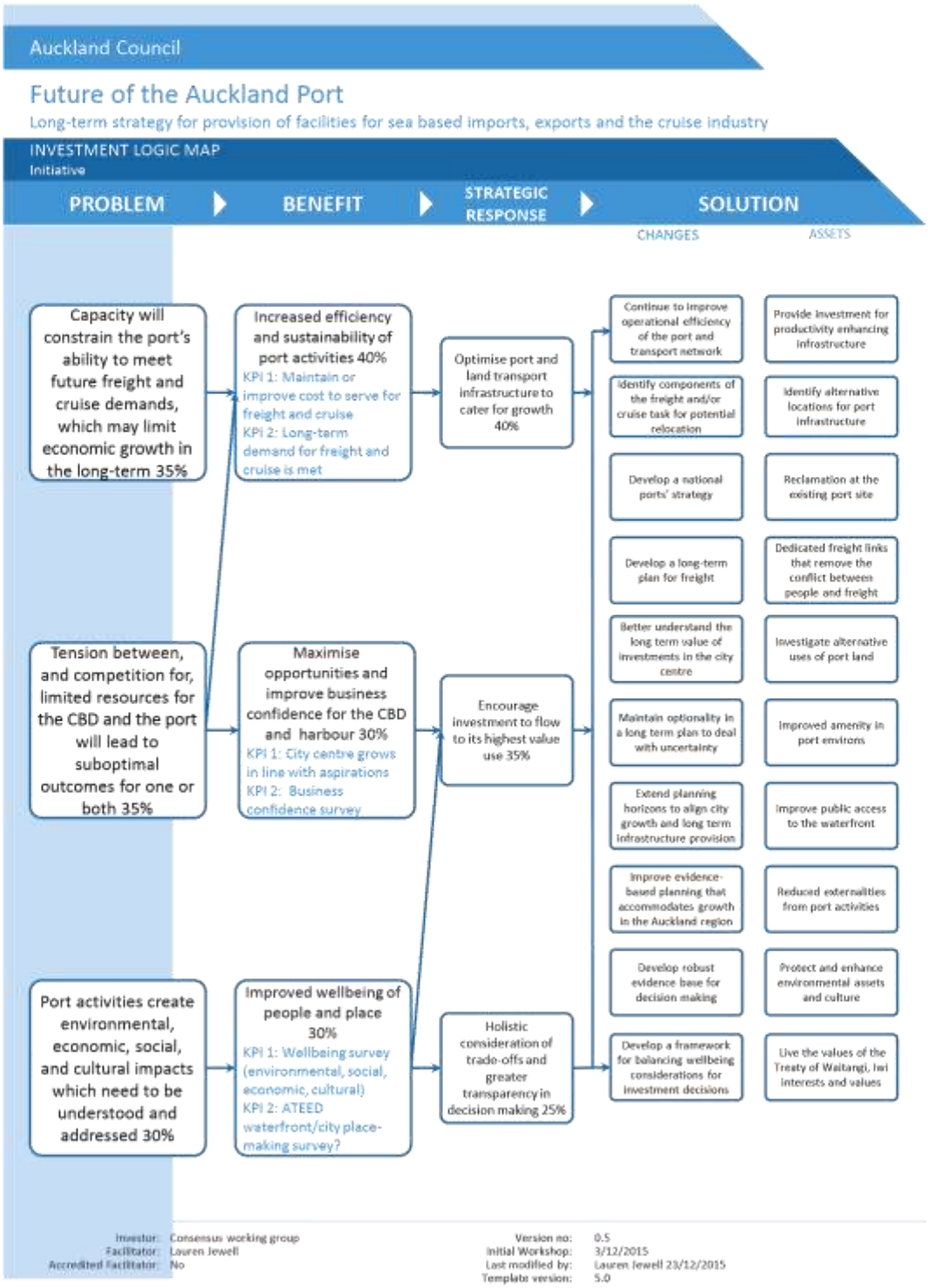
ILM workshops are normally carried out at the beginning of the development of the strategic case, and less formally, at the beginning of the development of the indicative business case as a scoping exercise to inform the IBC. There may also be other points during the project development lifecycle when 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.

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.

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

8.2 CWG ILM workshop output



19

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%.

[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%

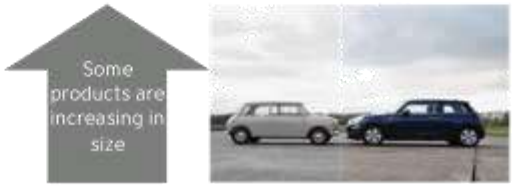
Other notes:

- 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.

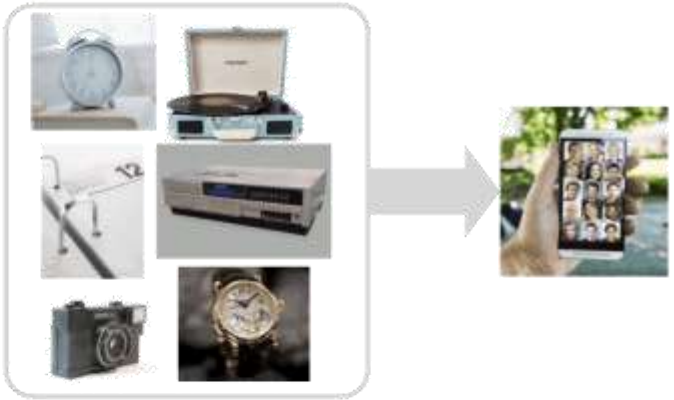
[6] NZIER, 2014

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



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

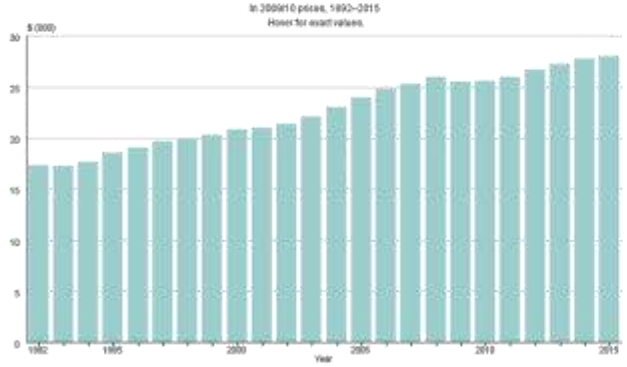
We have consciously picked 1995 as a benchmark date as this comes after the most significant reorientations of the New Zealand economy, particularly the largest impacts on the domestic manufacturing sector.

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).

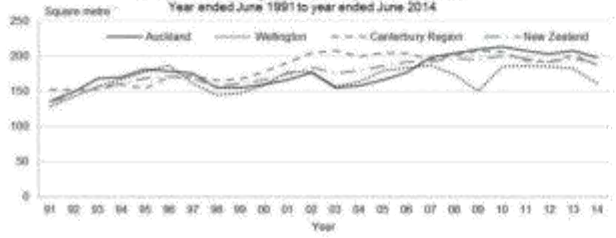
Real household consumption expenditure per person



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:

Average floor area (square metre) for new residential dwellings
For Auckland, Wellington, Canterbury and New Zealand
Year ended June 1991 to year ended June 2014

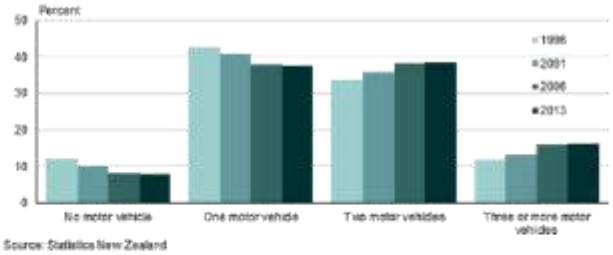


Source: Statistics New Zealand

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:

Number of motor vehicles
1996, 2001, 2006, and 2013 Censuses



Source: Statistics New Zealand

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.

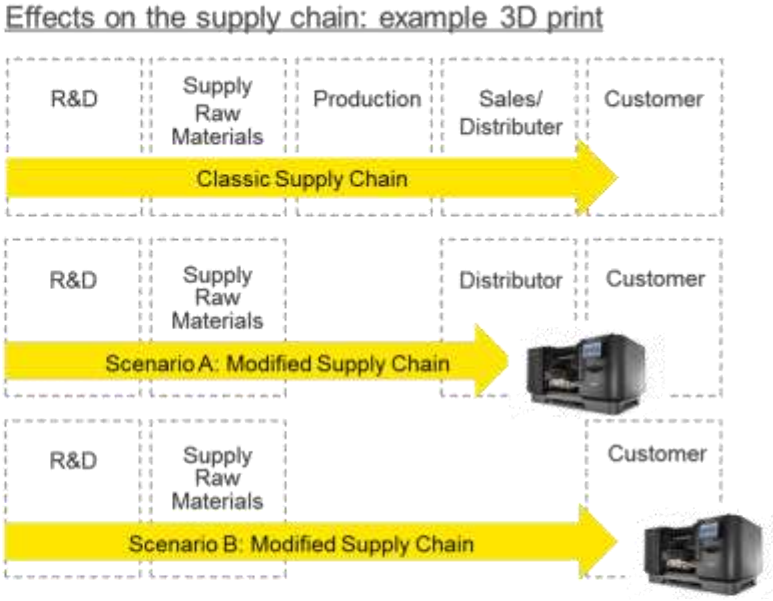
Megatrends are major drivers of social, economic or environmental transformation with formative influence on the underlying structure, ways of life and value systems of a society. The number of megatrends and what is in, and out of each), but general consensus on their categorisation. There are multiple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

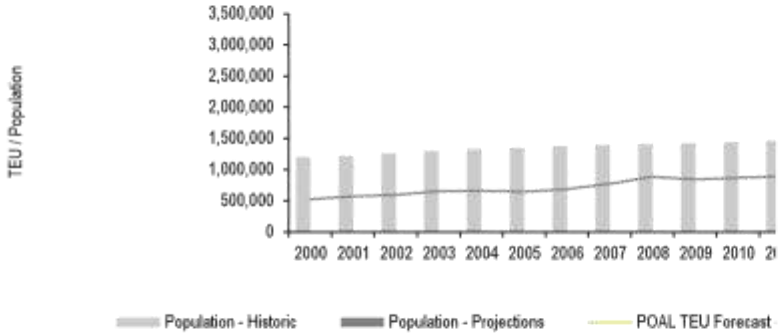
10.9 Health reimagined – marginally more imports

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)

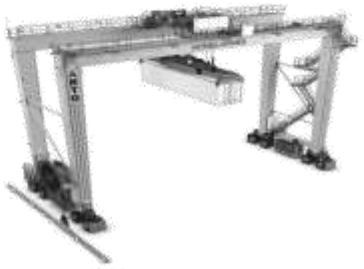
Description	▸ Rubber tyred single container mobile straddle vehicle ▸ Automated ▸ Automation can be applied to a manual straddle carrier over time ▸ Represent approximately 20% of global ports (manual and auto). ▸ Second most popular system currently behind RTGs ▸ Highly manoeuvrable
Performance	▸ Can 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

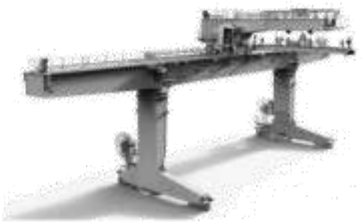
RMG (Automated)

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

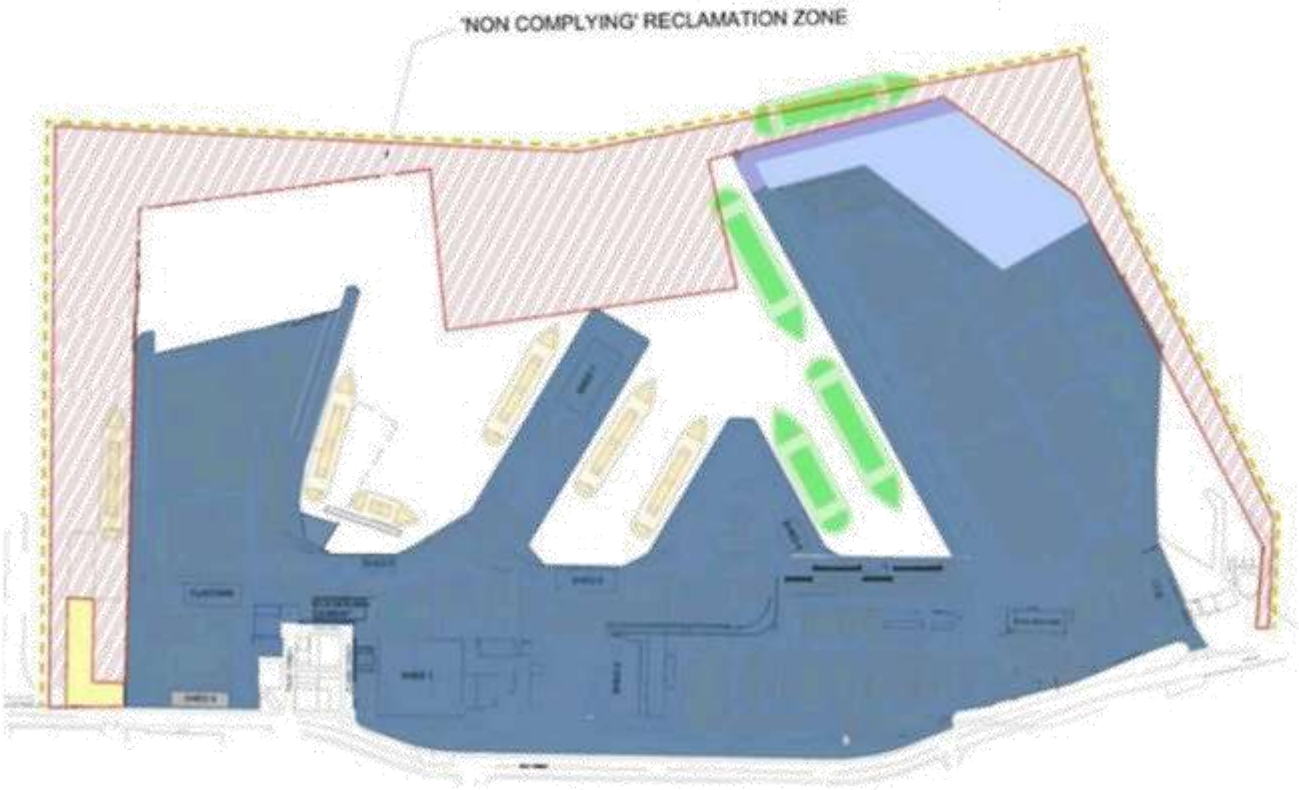
To some extent, containers are already becoming intelligent based on tracking systems and the like. However, there is potential for this to increase significantly including real time internet connectivity allowing comprehensive origin to destination tracking. Additionally, there is potential for container 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 | Further investigation | R Stop

Overall	G = Automatic proceed
Physical Viability	**Comments**
Shipping access	✓ Very good but will become constrained
Natural depth	✓ Maintained 12.5m. Existing berth depths vary X Would require some dredging for the long term fleet but achievable
Coastal processes	✓ Potentially good subject to further study X Requires further study to assess impact of reclamation in harbour
Natural land topography	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	✓ Good. Established road and rail links
Feasibility of land transport access	✓ 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	✓ 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	✓ Good but could become constrained in the long term
Natural depth	✓ Maximum draft is 13m X Would require dredging for future fleet based on visitation allowance
Coastal processes	✓ Potentially good with little new impacts on coastal processes expected. X Will likely require additional reclamation which requires future study
Natural land topography	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	✓ Good. Established road and rail links
Feasibility of land transport access	✓ Good access to road and rail connections. X Road to Auckland will require capacity upgrade.
Distance from identified industrial concentration	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	✓ 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	✓ Maintained 12.5m depth X Reasonably significant dredge required to accommodate future fleet
Coastal processes	✓ 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	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	✓ Good access to SH3 and SH45
Feasibility of land transport access	✓ 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	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	
Physical Viability	Comments
Shipping access	✓ 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	✓ Maintained 12.8m to 14.8m (one berth) X Would require some dredging for the long term fleet X Would require major work for long term fleet
Coastal processes	✓ Inside sheltered harbour X Potential surging hazard
Natural land topography	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	✓ Good access to SH1 X Currently no rail access. Significant undertaking to connect to rail network
Feasibility of land transport access	X Would require major road and rail construction if port activities expand X New rail connection required, approximately 18 km to the nearest rail route X Current rail tunnels will not be able to cope with container sizes
Distance from identified industrial concentration	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.

45

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	✓ Relatively complex but not unachievable
Natural depth	✓ 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	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	✓ Flat plains towards Tapora
Distance from existing primary land transport	✓ 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	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	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	✓ Relatively complex but not unachievable
Natural depth	✓ Good natural depth well into main harbour X Bolts 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	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	✓ Flat plains around Glorit but would need to be built offshore anyway
Distance from existing primary land transport	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	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	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 Waimauu – 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		
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 Ausecon] 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 - 60km

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		
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 1969, 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		X Potential issue around harbour access due to sandbar. X Would require significant maintenance dredging X Difficult marine environment and high energy coastline X Site could be exposed to extreme storms X 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	X Complex and less viable than 7A X Sandbar at the entrance must be dealt with through engineering undertakings
Natural depth	R	X Depth there around 2m to 5m so would require extensive channel dredging X Significant dredging required to create approach and turning zones compared to 7A X Harbour entrance faced with same issues as 7A
Coastal processes	A	X Spring tide currents up to 1.2 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 X Potentially increased sediment issues in comparison to 7A
Natural land topography	G	✓ Some availability of land, however likely more constrained than 7A X 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) X Complex to reach shore with a bridge although less complex than 7A ✓ Railway connections look complex but feasible
Feasibility of land transport access	G	X Requires bridge access infrastructure X New road and rail connections will be less complex and likely achievable in order to connect to existing network compared to 7A ✓ AT is proposing to extend the rail network to Auckland Airport. ✓ Close proximity to major state highway network. X 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	
Physical Viability	Comments
Shipping access	✓ Complex but achievable X Sandbar at the entrance must be dealt with through engineering undertakings
Natural depth	X Significant effort required to reach the Papakura Channel over the flats X 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 X Harbour approach also requires dredging
Coastal processes	✓ Spring tide currents up to 1.6 knots 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	✓ Creates isolated land and opportunity for expansion over time ✓ Sand flats are at 0m approximately X Would be more difficult to expand than Central Manukau Harbour
Distance from existing primary land transport	✓ Close to motorway and rail corridors – able to leverage off significant current and planned infrastructure spend (Hobsonville, East West Connection) ✓ Approximately 3 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	X Requires bridge access infrastructure X New road and rail connections will be less complex and likely achievable in order to connect to existing network compared to TA. Rail access would be more complex than T9 but possible ✓ AT is proposing to extend the rail network to Auckland Airport. ✓ Close proximity to major state highway network. X 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	✓ Excellent – 14km

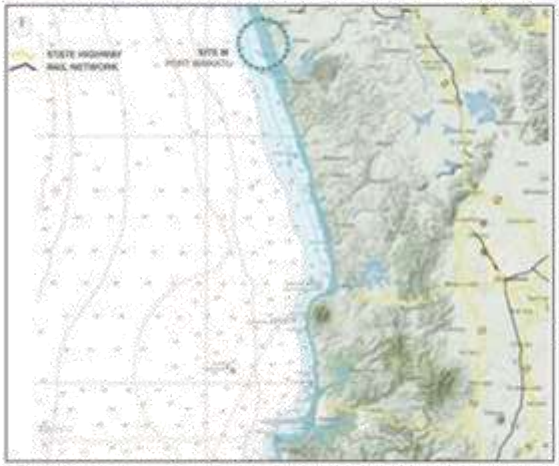
Site 7D – Manukau Island Port, Clarks Beach (2014)

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		X. Expected significant technical issues with channel maintenance including high cost and volume. X. Anticipated negative effects associated with port construction in the harbour including on ecology. ✓ Strong location in terms of transport links X. Significant transport infrastructure required including new rail, road and bridge. X. Excellent proximity to freight distribution centres
Overall		
Physical Viability		Comments
Shipping access		X. Complex and less viable than TA. X. Sandbar at the entrance must be dealt with through engineering undertakings. X. Significant undertaking to align new channel for large port.
Natural depth		X. Depth there around 2m (-3m approximately) so would require extensive channel dredging. X. Significant dredging required to create approach and turning zones compared to TA. X. Harbour entrance faced with same issues as TA.
Coastal processes		X. Spring tidal currents up to 1.2 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. X. Potentially increased sediment issues in comparison to TA.
Natural land topography		✓ Some availability of land, however likely more constrained than TA. X. Lay of the land unlikely to be as feasible as TB.
Distance from existing primary land transport		✓ Reasonable proximity to motorway and rail corridors. X. Complex to reach shore with a bridge although less complex than TA. ✓ Railway connections look complex but feasible.
Feasibility of land transport access		X. Requires bridge access infrastructure. X. Significant new road and rail connections required and reasonably complex to connect.
Distance from identified industrial concentration		X. Average - 50km

Site 8 – Port Waikato (Blue Sky)

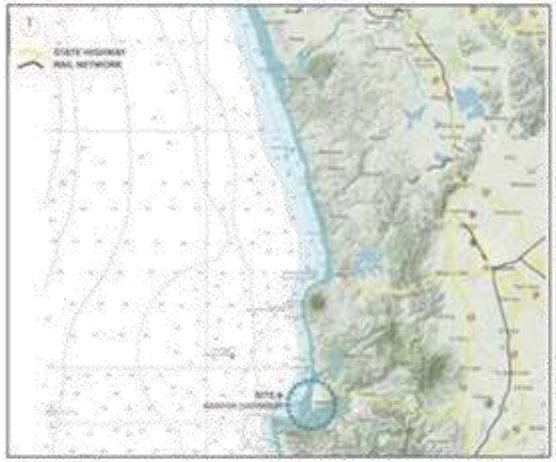


Overview:

- 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 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	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	✓ Natural water depth up to the heads ✓ Accessible natural depth of 13m to 15m only for the outside coastline of the island
Coastal processes	X Semi-exposed to local winds (Southeast long fetch) X Would require extensive protection infrastructure X Significant sedimentation issues expected
Natural land topography	X Island makes available land restricted X Would require connection back to land
Distance from existing primary land transport	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	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	✓ Average ~79.5km

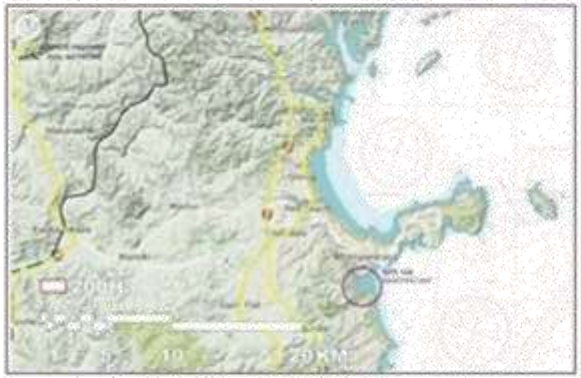
Site 11B – Mahurangi West (Blue Sky)

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		
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)

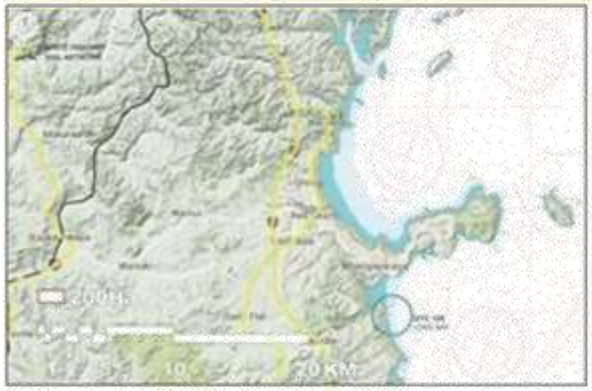


Overview:

- 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+ TEU/EQ 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	✓ 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		
Physical Viability		**Comments**
Shipping access		X If substantial channel and basin were created, then navigation lines are reasonable
Natural depth		X Poor natural depth as this is beyond the deep water zone X Major dredging required to gain access
Coastal processes		X Would require extensive protection infrastructure X Open to northerly wind and swell X effect of large-scale channel dredging unknown
Natural land topography		✓ Some availability of supporting land ✓ Reasonably level topography in localised area
Distance from existing primary land transport		X 23 km road connection to SH2 required X 13 km rail connection required
Feasibility of land transport access		X Significant construction and upgrade of road and rail network required X Potential duplication of transport connection required
Distance from identified industrial concentration		X Average ~ 66.6km

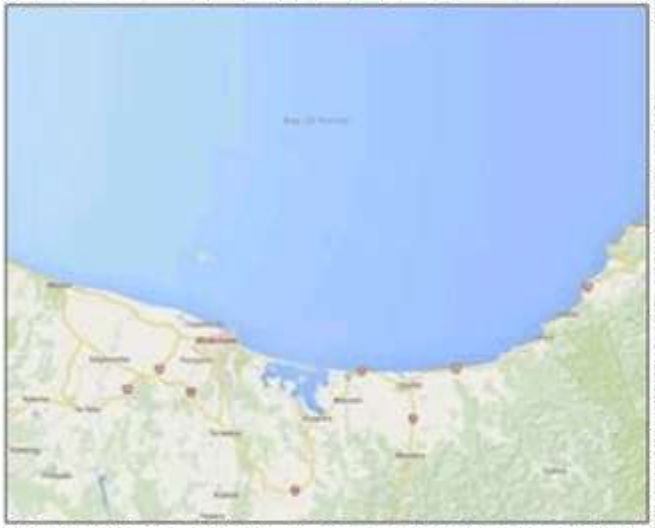
Site 16 – Tauranga II

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

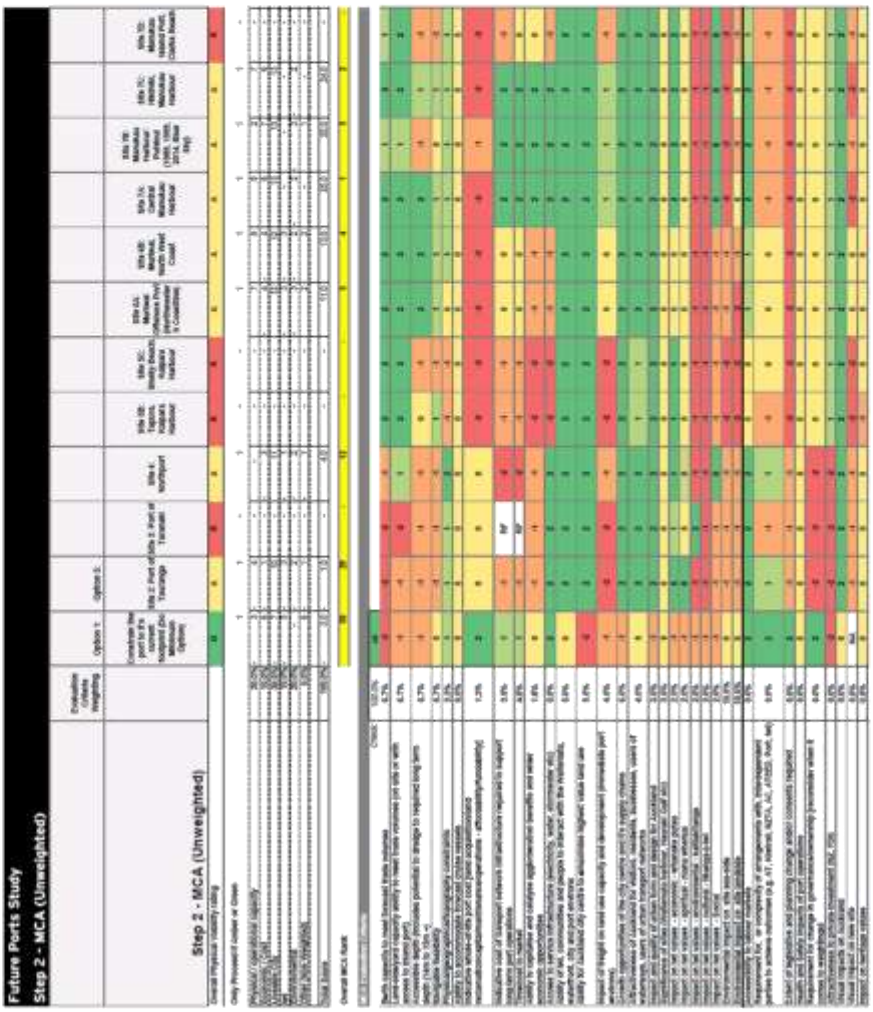
Criteria	Weighting	-2	-1	0	1	2	Comment
Accessibility to labour markets	0.00%	very poor	poor	average	good	excellent	
Requirement for, or complexity of arrangements with, interdependent parties to achieve outcomes (e.g. AT, Kiwirail, NZTA, AC, ATEED, Port, iwi)	0.00%	very poor	poor	average	good	excellent	
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

Item 16

Attachment C

17.2 MCA Results - Unweighted



Future Ports Study

Step 2 - MCA (Unweighted)

Step 2 - MCA (Unweighted)	Evaluation Criteria Weighting	Site M: Port Waikato, West Coast	Site S: Kawhia Harbour, West Coast	Site 10: Dream Bay area (previously Raahotui), Whangarei	Site 11b: Te Haupa Island, Mahurangi	Site 11D: Mahurangi West, Mahurangi	Site 12A: Kaipara Bay (Northwestern Coastline)	Site 12B: Long Bay, Long Bay	Site 13A: Upper Harbour, Port Island	Site 13D: Upper Waitemata Harbour	Site 14A: Waitoa Bay (Central Eastern Coastline)	Site 14D: Ponui Island port (1969 & 2014)	Site 14C: Kawakawa Bay (incorporating previous Ponui (Mitchers Port) (1909 & Blue Sky)	Site 15A: Wainangu Point, Firth of Thames	Site 15B: Kaiaua Land Port (Firth of Thames – western shore north of Kaiaua	Site 16: Tauranga ki 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	-
Port Capacity / Capability	25.0%	-	-	1	-	1	-	1	-	-	-	-	1	1	1	1	-
Economic / CBA	25.0%	-	-	1	-	1	-	1	-	-	-	-	1	1	1	1	-
Transport Cost	25.0%	-	-	1	-	1	-	1	-	-	-	-	1	1	1	1	-
Risk	15.0%	-	-	1	-	1	-	1	-	-	-	-	1	1	1	1	-
Environmental	10.0%	-	-	1	-	1	-	1	-	-	-	-	1	1	1	1	-
Other (Non Weighted)	0.0%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Score	100.0%	-	-	6.0	-	10.0	-	8.0	-	-	-	-	7.0	6.0	RF	6.0	-
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-wideyard 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 (indicative 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/unaffordability)	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	3.8%	-1	1	-2	-1	0	0	0	0	0	-1	-1	-1	-2	-1	-2	-2
Time/cost to market	0.0%	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	1	-2	-1	1	1	2	1
Ability of rail, communities and people to interact with the Waitemata, waterfront, city and port environs	5.6%	2	2	2	2	2	2	2	0	0	2	2	2	2	2	2	2
Ability for Auckland city centre to maximise highest value land use	5.6%	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 (brownfields port environs)	4.6%	-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	5.6%	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	4.6%	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	3.8%	2	2	2	2	2	2	2	0	0	2	2	2	2	2	2	2
Significance of sites (Waitemata harbour, maunas (cultural))	3.8%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Impact on iwi values - economic - whanake potea	2.8%	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0
Impact on iwi values - spiritual - mana whenua	2.8%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Impact on iwi values - environmental - kaitiakitanga	2.8%	-2	-1	-1	-1	-1	-1	-1	-2	-2	-1	-1	-1	-1	-1	-1	-1
Impact on iwi values - cultural - tikanga-a-iwi	2.8%	-2	0	-1	-1	-1	-1	-1	-2	-2	0	0	0	0	0	-1	-1
Impact on iwi values - social	2.8%	-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	-2	-2	-2	-2	-2	-2	-2	-2	-2
Environmental impact on site landside	10.0%	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	RF	-1	-1
Accessibility to labour markets	0.0%	1	1	2	1	1	1	1	0	0	1	1	-1	-1	-1	2	1
Requirement for, or complexity of arrangements with, interdependent parties to achieve outcomes (e.g. AT, Watercare, 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 changes to governance/ownership (vulnerable when it comes to weed traps)	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 landscape	0.0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Visual impact on river 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	Rationalising areas or all activity at Auckland's port	Enabling growth of the port to it's current location	Site 2: Port of Tauranga	Site 2: Port of Taranaki	Site 4: Northport	Site 5A: Tamaki, Kaipara Harbour	Site 5C: Manukau Harbour	Site 5D: Auckland Offshore Port (Kaukapakapa & Coastline)	Site 6B: Auckland North Shore Coast	Site 7A: Central Waitemata Harbour	Site 7B: Waitemata Harbour Portfolio (Clark, Stage, Jones, Hobsonville Stage)	Site 7C: Manukau Harbour	Site 7D: Manukau Harbour Grand Port, Clarks Beach
		R				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	20.0%	0	-	-	-	0	-	0	-	-	0	0	0	0	0	-
Economic Case	15.0%	0	-	-	-	0	-	0	-	-	0	0	0	0	0	-
Liveable City	20.0%	0	-	-	-	0	-	0	-	-	0	0	0	0	0	-
Iwi	10.0%	0	-	-	-	0	-	0	-	-	0	0	0	0	0	-
Environmental	20.0%	0	-	-	-	0	-	0	-	-	0	0	0	0	0	-
Other (non weighted)	0.0%															
Total Score	100.0%	0.0	-	-	-	0.3	-	0.0	-	-	0.0	0.1	1.0	0.0	0.0	-
Overall MCA Rank		10	-	-	-	11	-	10	-	-	5	3	1	7	2	-
	Weighting															
Berth capacity to meet forecast trade volumes	7.7%	-0.15	0.00	0.00	0.00	-0.15	-0.15	-0.07	0.15	0.15	0.15	0.15	0.15	0.07	0.15	0.07
Land-endeyard 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	0.03	-0.03	-0.03	0.00	-0.03	0.03	0.03	0.03	0.03
Indicative whole of life port cost (and acquisition/land reclamation/capital/maintenance/operations - affordability/sustainability)	1.3%	0.03	0.00	0.00	0.00	0.00	0.00	0.00	-0.05	-0.05	-0.05	-0.05	-0.05	-0.01	-0.05	-0.05
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	-0.03	-0.03	-0.03	0.00	0.00	0.00	0.00	0.00	-0.03
Proximity to market	4.0%	0.04	0.00	0.00	0.00	-0.04	RF	-0.04	-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	0.0%	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 maximise highest value land use	0.0%	-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	4.0%	-0.08	0.20	-0.04	-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	3.3%	-0.03	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
Significance of sites (Waitemata harbour, Hauraki Gulf etc)	3.3%	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 pohe	2.5%	-0.03	0.00	0.00	0.00	0.00	0.03	0.03	0.03	0.03	0.00	0.00	0.04	0.04	0.04	0.04
Impact on iwi values - spiritual - mana whenua	2.5%	-0.03	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	2.5%	-0.03	0.00	0.00	0.00	-0.03	0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03
Impact on iwi values - cultural - tikanga o iwi	2.5%	-0.03	0.00	0.00	0.00	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03
Impact on iwi values - social	2.5%	-0.03	0.00	0.00	0.00	-0.03	-0.03	0.00	-0.03	-0.03	-0.03	-0.03	0.00	0.00	0.00	0.00
Cognisant and compliant with Treaty and relevant Settlements	5.0%	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 less-ebbs	16.3%	0.00	0.00	0.00	-0.16	-0.16	-0.16	-0.16	-0.26	-0.26	-0.16	-0.16	-0.03	-0.26	-0.26	-0.26
Environmental impact on site landside	16.3%	0.00	0.00	0.00	-0.16	-0.16	-0.16	-0.16	-0.26	-0.26	-0.26	-0.16	0.00	-0.16	0.00	-0.16
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, AFEED, 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 government/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, POI)	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 6D: Port (Kaipara, West Coast	Site 9: Kaipara Harbour, west coast	Site 10: Omaha Bay area (potentially Kawakawa, Mangaroa	Site 11A: Te Arapo Harbour, Matakana	Site 11B: Matakana West, Matakana	Site 12A: Kawakawa Bay (Kawakawa Bay shoreline and Pukekawa Channel)	Site 12B: Long Bay, Long Bay	Site 13A: Upper Harbour, Hobsonville	Site 13B: Upper Waitemata Harbour	Site 14A: Weiroa Bay (Hamilton Point to Cowes Bay)	Site 14B: Pierce Island port (1000's of ha)	Site 14C: Hawkshaw Bay (Incorporating a proposed Piraki Offshore Port (2000 & 3000 ha))	Site 15A: Whitmore Point, north of Waiheke	Site 15B: Kawau Land (Port points of Thumer - western shore north of Kawau	Site 16: Tauranga & Rotorua	Site 17: Whangarei & Whitianga
		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%	-	-	0	-	0	-	0	-	-	-	-	0	0	0	0	-
[illegible]	15.0%	-	-	0	-	0	-	0	-	-	-	-	0	0	0	0	-
[illegible]	15.0%	-	-	0	-	0	-	0	-	-	-	-	0	0	0	0	-
[illegible]	10.0%	-	-	0	-	0	-	0	-	-	-	-	0	0	0	0	-
Environmental	20.0%	-	-	0	-	0	-	0	-	-	-	-	0	0	0	0	-
Other (incl. resilience)	10.0%	-	-	0	-	0	-	0	-	-	-	-	0	0	0	0	-
Total Score	100.0%	-	-	0.1	-	0.2	-	0.2	-	-	-	-	0.5	0.5	RF	0.4	-
Overall MCA Rank		7	7	10	7	9	7	11	7	7	7	7	6	6	7	8	7
	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-sea/port 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 (16m to 18m +)	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%	0.00	-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	0.03	0.07	-0.07	-0.03	-0.03	0.03	-0.07	-0.07
Indicative whole-of-life port cost (land acquisition and reclamation/capital/maintenance/operations - affordability/flexibility)	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	-0.01	-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
Historical 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)	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
Ability of iwi, communities and people to interact with the waterfront, 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 consolidate 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 (remainder port options)	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	6.0%	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%	0.00	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 and equity of urban form and design for Auckland	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
Identification of sites (brownfield's harbour, marginal port 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 - whakaiki (ahu)	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 - 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 - kaitiaki tikanga	2.0%	-0.04	-0.03	-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	5.0%	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 and wider	15.0%	-0.30	-0.30	-0.30	-0.30	-0.30	-0.30	-0.30	0.00	0.00	-0.30	-0.30	-0.30	-0.30	-0.30	-0.30	-0.30
Environmental impact on site variables	15.0%	-0.15	-0.15	-0.30	-0.15	-0.30	-0.30	-0.30	0.00	0.00	-0.30	-0.30	-0.15	-0.15	RF	-0.15	-0.30
Accessibility to labour markets	8.0%	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, Waitemata, NZTA, AC, ATEED, Port, iwi)	8.0%	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	8.0%	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 weighting)	8.0%	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)	8.0%	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	8.0%	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	8.0%	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	8.0%	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

Item 16

Attachment C

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.
Option 5b: Puhinui Manukau Harbour	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.
Option 5c: Hikihiki, Manukau Harbour	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 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.
Option 5e: Waimango Point, Thames	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.

[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/

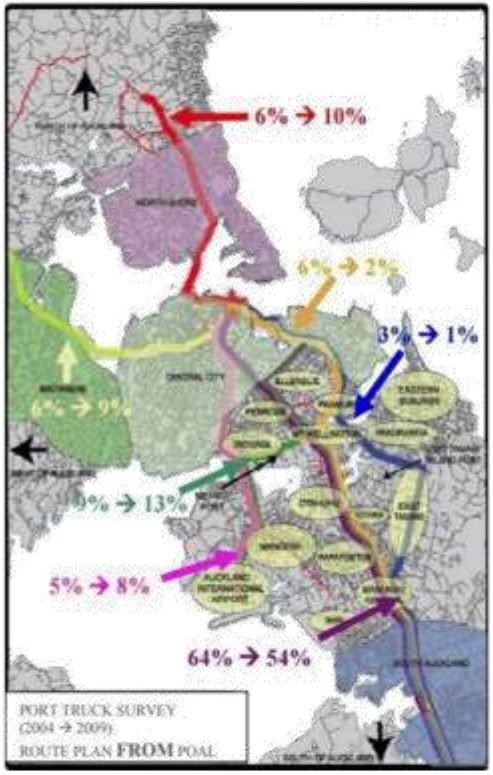
Site location	General Comments
	Strengthened east-west links would allow for the connection of the proposed freight route in to the strategic road network. Furthermore, our estimates indicate that between 20% and 30% of domestic TEU's are destined for central Auckland, and areas to the east, north and 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.

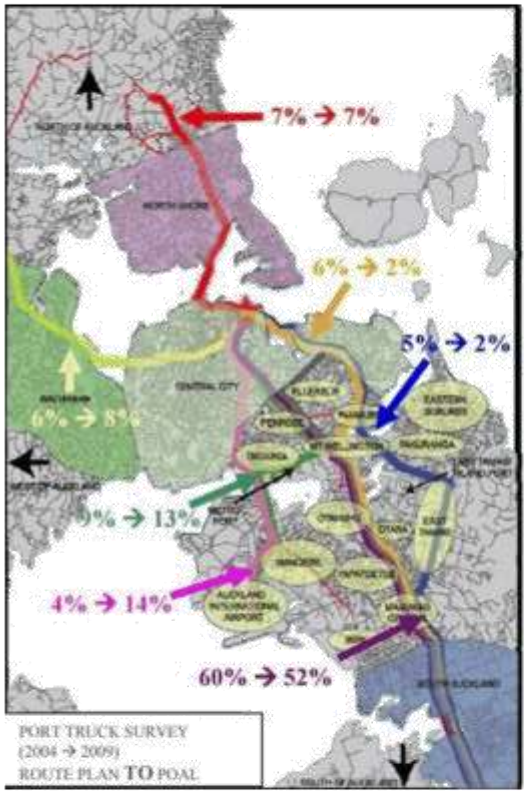
18.1 Freight Flows (Import and Export)

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

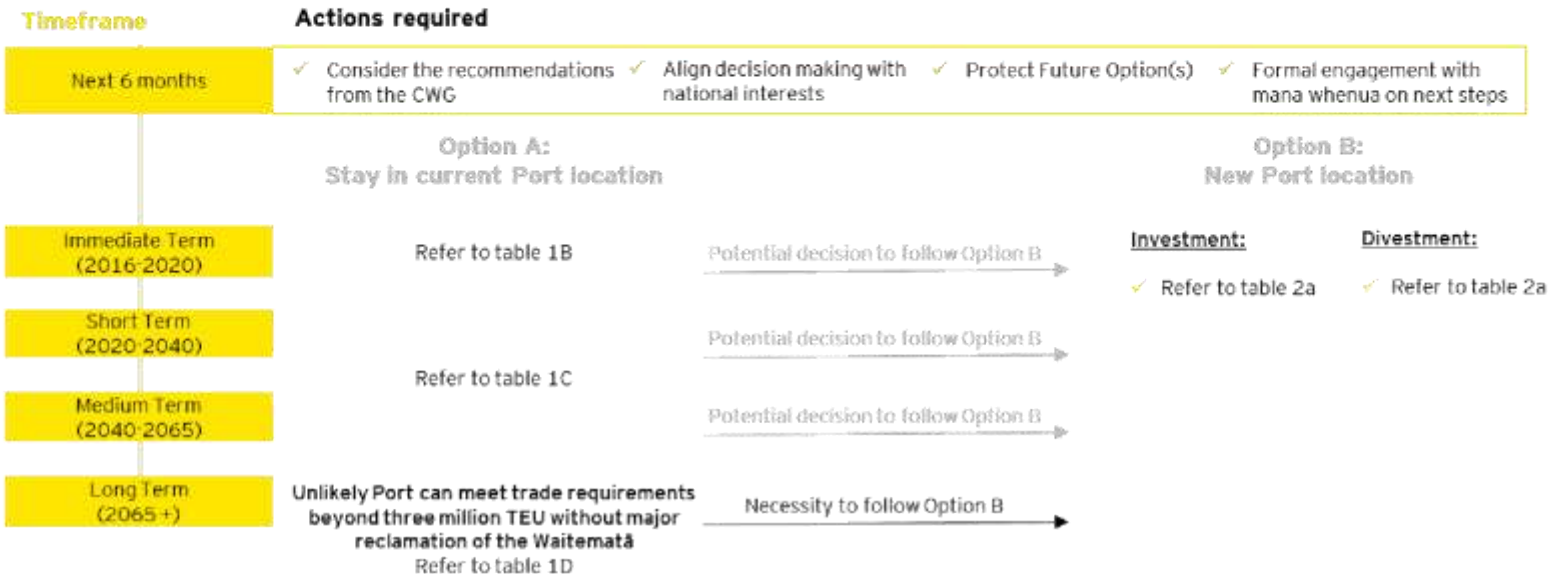
The Port Study has discussed the options available to accommodate the long-term trade forecast for Auckland. Determining the short and medium term path that will enable POAL to meet the long-term trade task is complicated. It will require detailed transitional strategy, high levels of co-ordination,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



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.

Item 16

Attachment C

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.

23. Coastal Processes and Biological Communities

Potential Port Sites

Manukau Sites

Thames Sites

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.

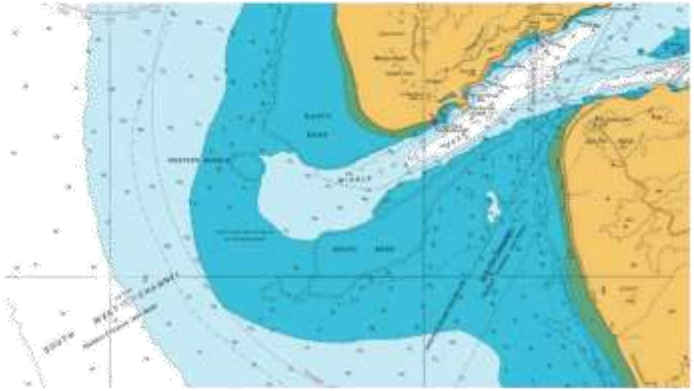
The wave climate driving the sediment transport on the west coast of the North Island is a high energy wave environment, open to the prevailing south westerly wind direction with long fetches across the Tasman Sea to the Southern Ocean. The consistent passage of weather systems across these water bodies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

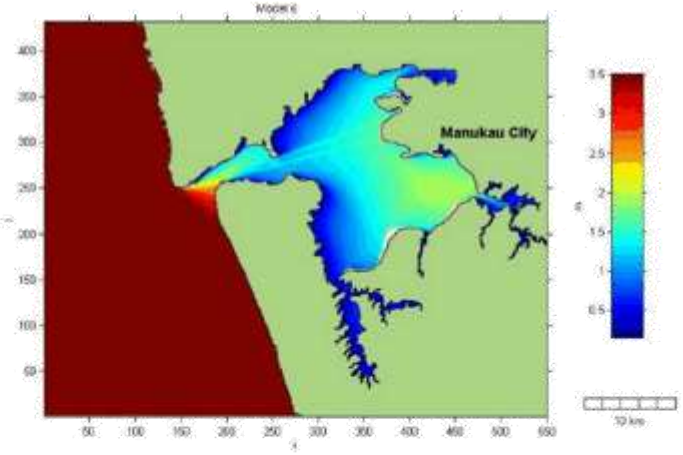
Site 15a Waimango Point is semi-sheltered. Open to northerly wind and infrequent but energetic cyclone swell from the north. Low sediment transport rates. Would require extensive infrastructure, although short dredged entrance channel.

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°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.

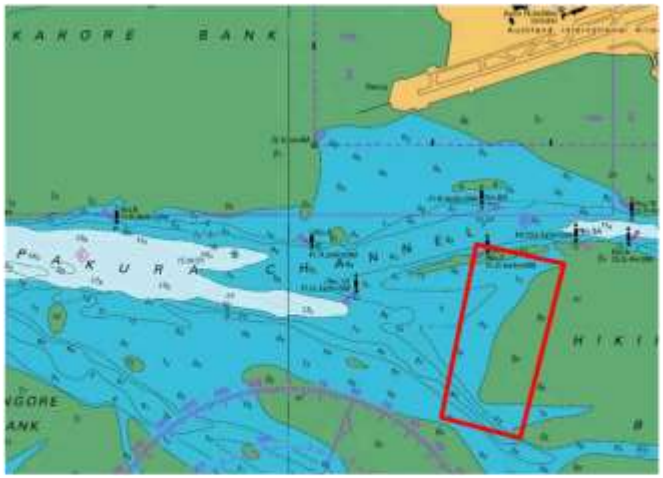
23.2.3 Hikihiki (7C)

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
Ophiurus 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.

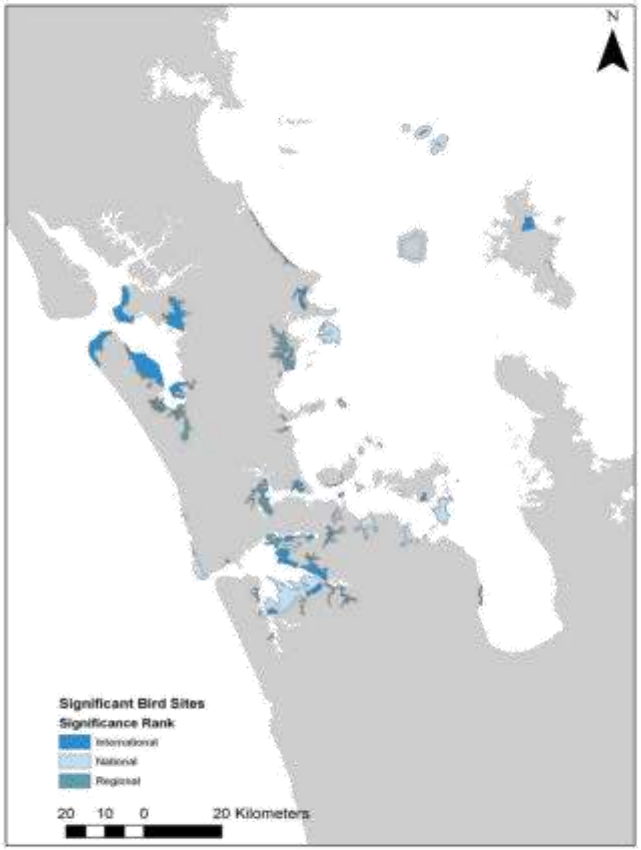
The Manukau's intertidal flats cover approximately 18,000ha when exposed at low tide, and are very important as foraging areas for shorebird species. There are a number of important high tide roosts around the harbour, including foreshore and shell banks at Karaka, the old Mangere sewage ponds, Puhinui, 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]

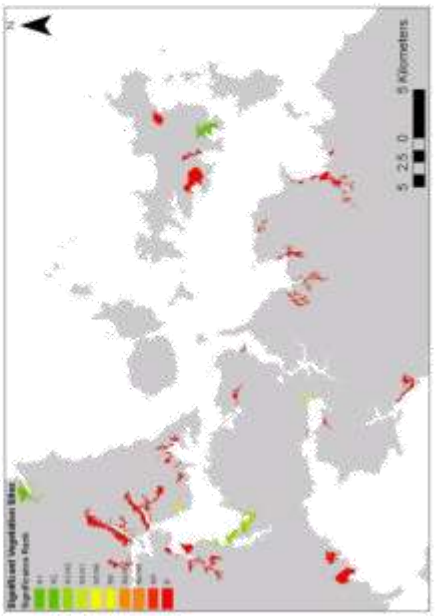


[20] The delineated areas depict the broader areas that are described in the results (namely, Kaipara Harbour, Manukau Harbour, the outer Hauraki Gulf and the inner Hauraki Gulf).

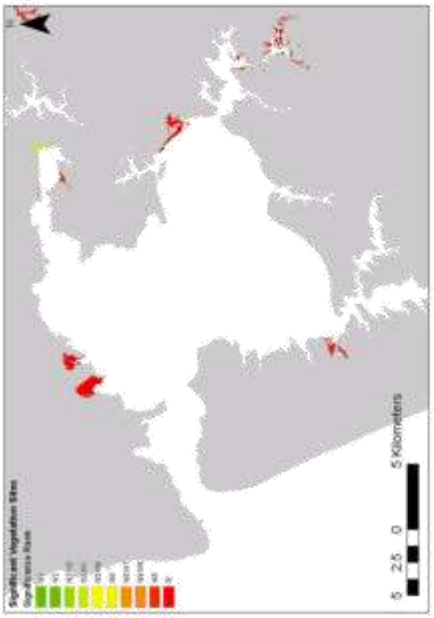
Item 16

Attachment C

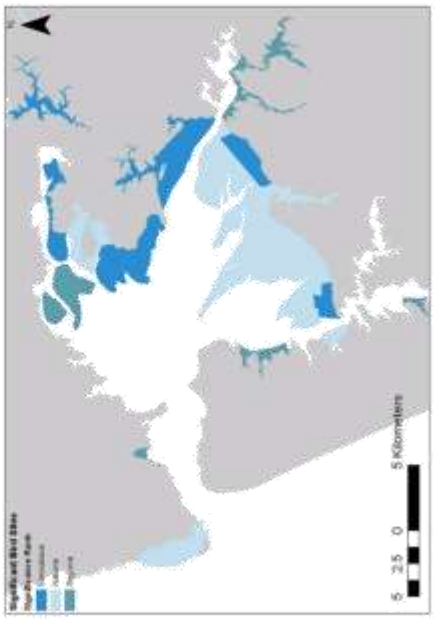
Areas of coastal vegetation with significance in the inner Hauraki Gulf



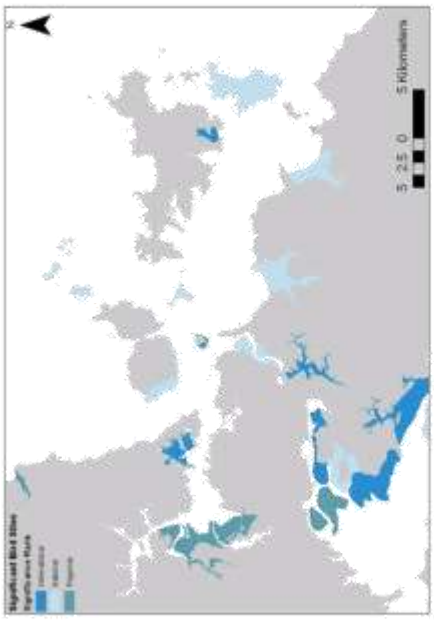
Areas of coastal vegetation with significance in the Manukau Harbour



Areas of significance to coastal birds in the Manukau Harbour



Areas of significance to coastal birds in the inner Hauraki Gulf



134

24. Manukau Harbour Dredge Volumes

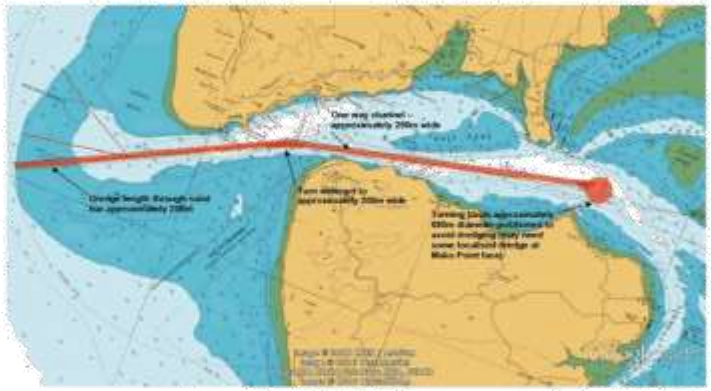
The digital bathymetry for Manukau Harbour (developed by Mead et al., 2007), was used to estimate the volumes of material that will require dredging for the navigation channels for the 3 Manukau Harbour options.

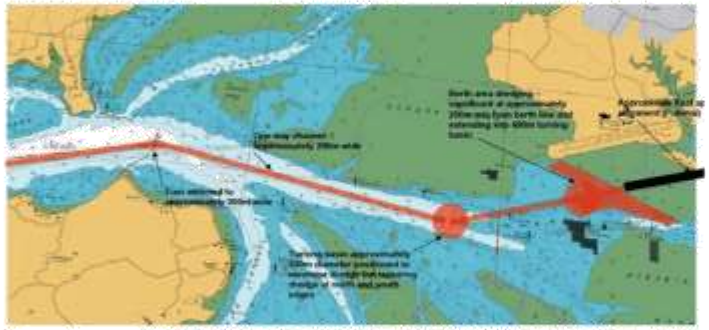
Assumptions:

- 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.

References

Bell, R. G., S. V. Dumnov , B. L. Williams & M. J. N. Greig, 1998. Hydrodynamics of Manukau Harbour, New Zealand, New Zealand Journal of Marine and Freshwater Research, 32:1, 81-100,

Grange K.R. 1977 Littoral-benthos sediment relationships in Manukau Harbour. *New Zealand Journal of Marine and Freshwater Research* 11:111-123

Grange K.R. 1977 Soft-bottom macrobenthic communities of Manukau Harbour, New Zealand. *New Zealand Journal of Marine and Freshwater Research* 13:315-329

Kendrick, T.H., Francis, M.P. 2002Fish assemblages in the Hauraki Gulf, New Zealand, *New Zealand Journal of Marine and Freshwater Research*, 36: 699-717

Kelly, S. 2008. Environmental condition and values of Manukau Harbour. Prepared by Coast and Catchment Ltd. for Auckland Regional Council. Auckland Regional Council Technical Report 2009/112

Mead, S., Haggitt, T. Phillips, D. 2007: Identification of regional significant marine receiving environments in the Auckland region. ASR Report to Auckland Council - 332 pp plus GIS module.

Mead, S. T., A. Bou and J. Frazerhurst, 2008. *Coastal Process Assessment at Keith Park to Greers Road.* Prepared for Harrison and Greirson, June 2008.

Morrison, M. Dury, J., Shankar, U., Middleton, C. Smith, M. 2003: A broad scale, soft sediment habitat assessment of the Hauraki Gulf. NIWA report to the Department of Conservation. 56pp

Niwa (2005) Mud, glorious mud. Water & Atmosphere 13: 20-21

Smith, A., Duffy, C., Leathwick, J. 2013: Predicting the distribution and relative abundance of fishes on shallow subtidal reefs around New Zealand. *Science for Conservation 323*: 1-25, Supplements 1-2.

Wong, C., O'Shea, S. 2009: Benthic Communities of eastern Waiheke Island, Hauraki Gulf. Earth and Oceanic Sciences Research Institute & School of Applied Sciences, Auckland University of Technology (AUT), New Zealand. 2pp.

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 Mäori. 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