Analysis of the Upper North Island Supply Chain Strategy Working Group Options for moving freight from the Ports of Auckland

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Glossary of Abbreviations

Abbreviation	Stands for
AC	Auckland Council
AT	Auckland Transport
AUP	Auckland Unitary Plan
BOPRC	Bay of Plenty Regional Council
CBA	Cost Benefit Analysis
GDP	Gross Domestic Product
MACA	Marine and Coastal Area (Takutai Moana) Act
MBIE	Ministry of Business, Innovation and Employment
MMH	Marsden Maritime Holdings Limited
MoT	Ministry of Transport (New Zealand)
NRC	Northland Regional Council
NZTA	New Zealand Transport Agency
POAL	Ports of Auckland Limited
PoT	Port of Tauranga Limited
RMA	Resource Management Act 1991
TEU	Twenty-foot Equivalent Unit
UNISCS	Upper North Island Supply Chain Strategy
WTA	Willingness-to-accept
WTP	Willingness-to-pay

Glossary of Terms

Terms	Stands for
Berthage	The number, length and configuration of a port's container and bulk berth spaces.
Bulk cargo	Strictly speaking, bulk cargo is cargo that is transported unpackaged in large quantities. It refers to material in either liquid or granular form such as petroleum or grains typically dropped or poured directly into a bulk ship's hold. Smaller quantities can be boxed (or drummed) and palletised (break bulk). Bulk cargo is classified as liquid or dry. In this report, we use the term 'bulk cargo' loosely to describe any merchandise that is not moved by container. As we have used it, the term includes a range of cargoes, including bulk liquids (e.g. crude oil), unprocessed logs, and cars & scrap steel, coal, grain, flour & cement.
Container cargo	Any merchandise that is loaded into and shipped in an intermodal shipping container.
Distribution network	The land transport infrastructure, and associated inland ports and distribution facilities, that service a port. Includes both road and rail networks but not coastal shipping.
Exports	Cargo that leaves a New Zealand port bound for another country.
Imports	Cargo that enters a New Zealand port from another country.
Inland port	A cargo consolidation and distribution facility located inland of a port and generally linked to it via a rail line. Examples in New Zealand include Metroport and Wiri Inland Port in Auckland. (Note the Working Group referred to a Distribution Centre that is a similar but not completely synonymous concept.)
Intermodal container	An ISO standardised shipping container that can be moved between different freight modes (sea freight, road, rail) without having to unload and re-load its contents. See Twenty-foot Equivalent Unit (TEU)
Land transport infrastructure	The distribution networks, including road, rail and pipelines that move cargo between the port and its final origins or destinations inland of the port.
Outside-port cargo	Cargo moves into the port from sea and out by land, or vice versa. Includes imports, exports, and domestic coastal cargo.
Port access	The depth of a port's channels and berths.
Port exchanges	Cargo that both enters and exits the port by sea. Includes import and export transhipment and international transhipment cargo.

Terms	Stands for
Port infrastructure	The capital assets of a port, including the port access channels, berthage, handling (e.g. cranes) and storage facilities.
Storage	The container and bulk storage capacity of a port, including the total area of storage yards and the technology used to store and move cargo
TEU	A standard measure of intermodal container cargo volume that allows for conversion between containers of different sizes. Stands for 'Twenty-foot Equivalent Unit.'
Throughput	The total amount of cargo that is loaded or discharged at a port. Includes both outside-port cargo and port exchanges.
Upper North Island Ports	For the purposes of this study, the UNI ports are defined as: Ports of Auckland (POAL), Port of Tauranga (POT), Northport, and the docks near Whangārei at Refining NZ's refinery.

Executive summary

This report responds to Cabinet's request to officials for further advice on Upper North Island Supply Chain Strategy (UNISCS), following receipt of the Independent Working Group report in December 2019. Cabinet had appointed the Independent Working Group in September 2018 to review the Upper North Island freight and logistics sector and to advise on a potential future location or locations for Ports of Auckland Ltd (POAL), with serious consideration to be given to Northport.[1]

The Working Group's report concluded that the POAL's freight operation on the Waitematā Harbour "is no longer economically or environmentally viable" and that the freight operations should be progressively closed with future freight shipping handled by the development of Northport and the continuation of Tauranga's existing expansion plans.[2] The Working Group's report was accompanied by an economic analysis of scenarios over a 30-year timeframe, comprising different infrastructure configurations, including full and partial moves to Northport and/or the Port of Tauranga.

While noting that POAL is not viable as the Upper North Island's key import port in the long term, Cabinet sought further advice to inform future decisions on the UNISCS, including an assessment by officials of the Working Group's recommended scenario and the other scenarios it considered.[3]

This commissioned report by Sapere integrates analysis and findings from a consortium of consultants with expertise in port marine engineering, port planning, rail engineering, supply chain modelling, traffic modelling, coastal processes modelling, resource management planning and cost benefit analysis. These specialist inputs are incorporated into an economic assessment framework over a 60-year timeframe, which is appropriate when considering any investment in very long-lived infrastructure. The commissioned analysis has been required to: (a) assume the relocation of all freight operations from POAL; and (b) consider five options for relocation:

- Northport expansion
- Port of Tauranga expansion
- a shared increase in capacity at both Northport and Port of Tauranga
- a new port (greenfield site) on the Firth of Thames, and
- a new port (greenfield site) on the Manukau Harbour.

Much of the research and analysis has focused on addressing two key questions.

1. When do the freight activities of POAL need to move?
2. Where should the freight activities move to? (with regard to the five defined options)

[1] See https://www.transport.govt.nz/assets/Uploads/Our-Work/Documents/cc9d34704a/UNI-Cabinet-Paper-and-Terms-of-Reference_no-redactions.pdf

[2] See https://www.transport.govt.nz/assets/Import/Uploads/Research/Documents/Cabinet-Papers/1.-MOT10025-UNISCS-Final-Report_final_8-11-19.pdf

[3] See https://www.transport.govt.nz/assets/Import/Uploads/Research/Documents/Cabinet-Papers/CAB-19-MIN-0647-Minute-002-MarkUp-30012020-Redacted.pdf

Key findings

When does the freight port need to move?

1. The POAL freight operation is constrained on several fronts, including container terminal capacity and the berths and channel access to accommodate larger container vessels. Plans to address these constraints rely on resource consents being obtained in the near term.

2. Assuming the necessary consents can be obtained, the container terminal may have sufficient capacity for around 30 years under reasonable assumptions about freight growth. At that point, a substantial amount of further land reclamation in the Waitematā Harbour will be necessary.

3. Long lead times for planning, consenting and constructing port capacity elsewhere mean that there is shorter window of time for a decision about the long-term strategy to future proof port capacity. That window is approximately 10-15 years. Delays in a decision will make an eventual shift more difficult if existing options are diminished by other developments.

4. Port planners with international experience advise that it is important to identify the future freight volume at which the pre-determined long-term relocation plan would be triggered. This volumetric trigger approach acknowledges the uncertainty of long-run forecasts and allows for some flexibility to react to sustained upside or downside surprises in trend growth of freight.

5. Traffic congestion on Auckland roads is not a key factor in a decision to relocate the port freight operations. Modelling shows that average speeds in the city centre are likely to decrease over time, with port-related traffic being a minor contributor. Future congestion in the city centre is unlikely to improve in the event of a port relocation, allowing for the resulting redevelopment with a plausible mix of alternative residential, business and public uses on the waterfront land.

Where should the freight port move to?

A gateway test of sufficient long-term capacity

6. The gateway test is whether an option can future proof the Upper North Island supply chain by providing long-term capacity to accommodate the future freight task. Given the scale of investment and the long-lived nature of port assets, the test used here is a minimum of 60 years of capacity to handle current POAL freight volumes, allowing for a reasonable rate of growth.

7. Neither Northport nor the Port of Tauranga, on their own, can provide sufficient capacity to accommodate the long-term, 60-year freight task.

8. Northport could provide sufficient berth capacity until around 2060, which is not materially longer than the estimated 30-year capacity at POAL. To accommodate the freight task for the minimum test of 60 years, marine and coastal engineers conclude that Northport would need a 2km long quay, involving dredging and reclamation that expands beyond identified constraints to the west (residents, wetlands) and to the east (into Refining NZ's liquids berths and well beyond) with significant impacts on coastal processes affecting the nearby coastline and channel.

9. The Port of Tauranga would need significant expansion, into industrial areas on each side of the estuary channel, to accommodate its own long-term freight task and that of POAL. The necessary addition of berths and container facilities to the south and east would impact on flight paths and the airport runway, bridge marina and highway would need to be relocated. Marine and coastal engineers advise that tidal currents mean the increased shipping activity would be challenging, with a risk of congestion affecting vessel operations and limiting port capacity. Even if this long-term capacity can be realised, Tauranga would have few remaining options, other than expanding to the west of Sulphur Point, into the public reserve and marina.

10. A shared increase in capacity at Northport and Port of Tauranga could accommodate the freight task at 60 years, based on an assumed freight volume split, at which point these ports would likely be at, or near, full capacity with little or no room to expand. There is significant risk market forces would direct freight such that capacity at one or other port may be constrained by the limits described above at an earlier date. There would have been considerable investment into building a scaled-back container port at Northport that does not provide sufficient additional long-term capacity, relative to POAL on the Waitematā Harbour, while being further away.

11. The new port options, on the Firth of Thames or the Manukau Harbour, would have sufficient capacity for the long term beyond 60-years and well beyond. Following modern planning principles, the concept design is for a littoral island port (i.e. close to shore) that allows for capacity to be built in stages, expanding as needed in response to freight growth. Obtaining resource consents for these new ports, or indeed for any coastal change, will be challenging.

A cost benefit analysis to show the economic cost

12. The cost benefit analysis takes a long-term societal perspective for each option relative to the base case in which the port activities are assumed remain in place. There are detailed costings with respect to supply chain infrastructure (port, rail and road) and freight operations (freight movement costs, associated congestion, emissions and safety impacts). The benefits are more challenging to model and so are unavoidably imprecise, relating to the alternative uses of the Auckland waterfront land (i.e. amenity values, welfare gains, agglomeration benefits).

13. The cost benefit analysis shows that all options for moving the freight operations from the Waitematā Harbour are likely to involve a net economic cost. This result highlights how new port capacity, and associated landside infrastructure, inevitably involves large costs. A new port on the Manukau Harbour stands out as the highest-ranked option on the basis of being the least costly over the long-term, accounting for upfront capital expenditure and ongoing supply chain operating costs (-$1.982 billion, net present value basis). The proximity of Manukau Harbour to the freight destinations in South Auckland is the major reason for this result, with the relatively short distances being favourable for freight movement and, to some extent, the landside infrastructure costs.

14. The Port of Tauranga option is ranked second in terms of net economic cost (-$3.703 billion, net present value), followed by Northport (-$6.252 billion, net present value) and the option of a shared increase at Northport and the Port of Tauranga (-$6.847 billion, net present value). These options face higher freight movement costs with Northport, in particular, also requiring some large investments in rail and road infrastructure.

The other new port option, on the Firth of Thames, has a higher net economic cost (-$7.294 billion, net present value), than the Manukau Harbour option, due to the cost of constructing road and rail links over a longer distance that involves some complex terrain, and the greater distance from the freight destinations in South Auckland.

Results of the cost benefit analysis ($ million net present value**)**

	Northport expansion	Port of Tauranga expansion	Shared increase at Northport & Tauranga	Firth of Thames (new port)	Manukau Harbour (new port)
Total benefits	957	957	957	1,009	1,579
Total costs	7,209	4,661	7,804	8,303	3,561
Net benefits	-6,252	-3,703	-6,847	-7,294	-1,982
Benefit-cost ratio	0.133	0.205	0.123	0.121	0.443
Rank	3	2	4	5	1

Regional economic impact considerations

15. Assessment of regional economic development effects suggests that, on its own, a relocation of port activity is unlikely to substantially alter regional economies. This is consistent with relevant literature which shows that port investments have lower economic impacts relative to other transport-related investments such as airport, road and rail infrastructure.

16. The economic stimulus in Northland, under the Northport option, would likely be larger than that for the Bay of Plenty, under the Port of Tauranga option. This reflects the relative size of their economies when faced with a similar impulse from a port relocation. However, most of the gains would be felt in regions outside where the rise in activity takes place. Thus, an impulse felt in Northland would likely result in greater impacts in Auckland. If the freight operations were relocated to the Bay of Plenty, the impacts would be felt in Waikato and Auckland.

17. Ultimately, the potential for regional economic impacts is a subsidiary consideration, relative to the gateway test of an option providing sufficient long-term capacity and the consideration of the long-run economic cost implications from a national perspective.

Competition effect considerations

18. Competition effects are an important consideration. The three options involving existing ports (i.e. relocation to Northport and/or the Port of Tauranga) reduce or eliminate port competition unless there are changes in ownership. Increased port charges due to increased market power might range between 6 to 32 per cent relative to current Ports of Auckland port charges and 5 to 24 per cent relative to current Port of Tauranga port charges. Our view is that exporters and importers might face price increases at the higher end of the range.

19. A new port may increase or decrease competition, depending on ownership (e.g. independent or merged with existing ports) and regulatory settings (e.g. forced de-merger).

Supply chain participant perspectives

20. This study conducted targeted discussions with supply chain participants comprising shipping lines, freight forwarding companies, and critical industry and freight owners. It is clear that distance to market is critical to supply chain costs. These views necessarily reflect their own business perspectives.

21. Among those spoken with, Northport is generally considered too far from main markets to function as a primary import port, given the current predominance of industrial activities, warehousing and distribution hubs in South Auckland, Waikato and the Bay of Plenty. This is not a unanimous view, as some place less weight on additional costs with freight distance.

22. A clear message from participants who are importing or exporting break bulk or general cargo (i.e. cargo that is not containerised) is that they rely on current port proximity. Break bulk shipping comprises the importation or transhipment of cement, sand, grains and the export of scrap metal. Break bulk tends to be low margin freight and, in the absence of a nearby port, the additional landside transportation costs could make some of this trade prohibitive and would disproportionately increase costs.

23. Manukau Harbour was cited by supply chain participants as being right beside the industrial activities and the warehousing and distribution hubs of South Auckland, allowing for landside transportation costs to be similar or lower than current arrangements.

24. There is a perception that conditions and the bar at the Manukau Harbour entrance could make access uncertain. A port planner with extensive international experience has confirmed there is no credible basis for this view. It is necessary to differentiate between the current entrance and a future state with a dredged and maintained channel, which sediment flow modelling shows would be achievable and stable. The indication from a marine insurance underwriter is that, in this scenario, it is unlikely that insurance considerations would be a barrier for shipping access.

25. Shipping line representatives concluded that they would prefer a new port on the Firth of Thames, however a container port on the Manukau Harbour could work well for shipping routes from Australia and Asia. Ultimately, shipping lines will call where the main ports are located, while preferring to take the lower cost option, where available.

Conclusions and possible next steps

26. On the basis of the gateway test of long-term capacity and a cost benefit analysis to determine long-term economic cost, Manukau Harbour emerges as the option that can provide sufficient long-term port capacity at least cost.

    a) Manukau Harbour is one of only two options that meet the gateway test of ensuring sufficient long-term capacity – the other being a new port on the Firth of Thames.

    b) The cost benefit analysis shows that all options result in an economic cost, with Manukau Harbour being the lowest cost option.

    c) There is no sound basis for excluding Manukau Harbour as a viable option for a future container port, either due to its entrance or its location on the west coast.

27. Obtaining consents for any activity that involves coastal environments is highly challenging, given regulatory frameworks and environmental protections. Obtaining consent for a new port will be more challenging than for an existing port. Timeframes for the planning and consenting processes are estimated at 5-7 years for an existing port and 7-10 years for a new port. There is risk of consenting failure particularly for new ports but also for any coastal change.

28. With any decision taken, a detailed feasibility study will be needed to test and confirm a range details relating to port design, commerical arrangements, coastal engineering, landside infrastructure requirements, coastal planning and consenting details, as well as undertaking full engagement with stakeholders.

29. The large scale investment and the consenting challenges mean that it may be tempting to stay put on the Waitematā Harbour. This direction presents a risk of an economic bottleneck emerging sooner than expected, and suboptimal responses to supply chain resilience. Certainty is needed with respect to the long-term strategy for ensuring sufficient port capacity and appropriate investment decisions. A delay in taking a decision will make an eventual shift more difficult if existing options are diminished by other developments.The Auckland Council perspective warrants close consideration, given its port ownership stake. On the one hand, it could face the loss of the enterprise value of the freight operations and on the other hand, the proceeds from a land transaction (e.g. long-term lease arrangements) are unlikely to fund much more than a rectification of the land and establish infrastructure for a new waterfront precinct. Value uplift, to a large extent, may be captured by land developers, who would bear the construction and development risk.

Summary of iwi and Māori feedback

30. The key takeaways from iwi and Māori engagement were (Ministry of Transport, The Policy Shop, 2020):

- There will be a negative reaction from iwi and Māori groups if the Government takes any final decision on the relocation of Auckland's port without undertaking what they consider a process befitting the Treaty partnership – including the sharing of detailed information and analysis, and resourcing to facilitate informed decision making.
- Iwi dynamics and competing iwi claims will have a significant impact on Government decision-making on the future of POAL land.
- Port relocation is likely to increase the pressure for outstanding Treaty and Marine and Coastal Area (Takutai Moana) Act (MACA) claims over Auckland Port/Waitematā Harbour and whatever area is proposed for relocation.
- None of the options necessarily has a 'fatal flaw' from the perspective of Māori groups, and some would welcome a port being relocated to their rohe; but they will look to secure protection of customary interests, net environmental benefits and commercial investment opportunities.

Comparison with Working Group findings

31. This study reaches a different conclusion from the Working Group report and the main reasons for this difference are as follows.

    a) This study takes a position that a longer timeframe for analysis is necessary, with 60 years being the minimum, given the scale of investment and long-lived nature of port assets. The Working Group report used a timeframe of 30 years.

    b) This study has examined the new port options and concludes that there is no sound basis for excluding Manukau Harbour as a viable option for a future container port, either due to its entrance or its location on the west coast.

    c) This study has benefited from a detailed look at the current capacity and expansion plans of existing ports and at the long-term capacity requirements and associated costs for each option. In this respect, this study has had the advantage of being able to build on the work undertaken and commissioned by the Working Group.

    d) This study takes a different view on the treatment of avoided road costs (benefits); and treatment of financial streams from waterfront land differs; including amenity value;

Table 1 below provides further general comparison of the basis for the differences between the two studies. Table 24 in section 8 provides a specific comparison of the differences in the economic analysis of the Northport option (other options in Appendix A).

Table 1 Comparison with Working Group findings across five options in scope

Working Group findings	Key findings of this study	Basis for difference
Urgency is required, mainly due to landside pressures.	Certainty rather than urgency is the main issue. POAL has around 30 years before hitting capacity constraints.	Discussion with POAL and analysis of its port strategy by marine and coastal engineers and a port planner. Specialist traffic modelling used in current analysis.
Road congestion is a driver.	Freight is a small part of the congestion issue and alternative land use will likely generate even more traffic.	Specialist traffic modelling used in current analysis; not available to WG.
Northport is the only scenario that results in (significant) gains to society.	All options moving freight from Waitematā Harbour are a net economic loss to the nation, when a long-term societal perspective is taken into account.	Interpretation of costs and benefits relevant for economic CBA.
Auckland Council would benefit from relocation due to rates and lease income.	Auckland Council would deliver services for rates and lease rates cover council development costs, but not much more. An operating port is more valuable than a redeveloped site to Auckland Council.	Discussion with Auckland Council. Specialist valuation expertise used in current study.

Working Group findings	Key findings of this study	Basis for difference
Northport has capacity to grow to meet Auckland's freight task.	Northport cannot provide sufficient capacity to accommodate the long-term, 60-year freight task.	Specialist advice from marine and coastal engineers and a port planner, more in-depth than views put forward for WG. A longer time horizon.
Northport would result in cost savings to road users.	The Northport option results in higher road user costs.	Re-modelled underlying parameters around mode shares and trip characteristics; robust correction of Working Group data/assumptions.
Manukau did not warrant modelling on the basis of perceived barriers (e.g. risk and insurability).	Perceived barriers will not be insurmountable	Access to specialist advice.

Summary of findings with respect to policy objectives

The officials' briefing to UNISCS Ministers outlined a number of policy objectives for consideration to help guide decision making. The table below provides an overview of the research conducted in this work that is relevant to these objectives.

Findings mapped against policy objectives

Policy objective	Northport expansion	Port of Tauranga expansion	A shared increase at Northport & Tauranga	Firth of Thames (new port)	Manukau Harbour (new port)
Effect on supply chain efficiency (based on cost per TEU)	Materially reduces efficiency	Materially reduces efficiency	Materially reduces efficiency	Neutral or minor reduction	Neutral or minor increase
Effect on supply chain competition (based on port competition)	Materially reduces competition	Materially reduces competition	Materially reduces competition, with current ownership	May increase competition, or decrease competition if port merger	May increase competition, or decrease competition if port merger
Effect on supply chain resilience (Port number and capacity)	Reduces number of ports	Reduces number of ports	Reduces number of ports	Increases capacity and adaptability	Increases capacity and adaptability
Impact on Auckland congestion	Increases congestion through alternative POAL land use				
Regional and social economic development effects	High impact in Northland, with most effect in Auckland	High but diffuse benefit captured in Bay of Plenty and Waikato	Dispersed benefit in Northland, Waikato, Bay of Plenty and Auckland	A transfer within Auckland	A transfer within Auckland
Environmental effects – (based on land transport emissions)	Materially increase	Materially increase	Materially increase	Minor increase	Same or possible decrease
Recognising iwi interests and supporting their economic participation	Refer to Iwi engagement paper				
Transport safety costs	Materially increase	Materially increase	Materially increase	Minor increase	Same or possible decrease
Benefits to Auckland City of alternative use of the POAL land	Impact does not differ among the options				

1. Introduction

This integrative report summarises the findings of a collective of consultants led by Sapere Research Group (Sapere) containing eight workstreams (see Figure 1 below) in relation to the Upper North Island Supply Chain (equivalently Upper North Island Ports). The programme of work was to consider, from the specialist perspectives of each workstream, the options for movement of the Ports of Auckland Limited (POAL)'s freight traffic including bulk cars and container freight to other specified destinations in New Zealand.

The nature of the report is integrative, in that it combines insights from commissioned experts across a range of specialist areas in fifteen detailed subsidiary reports. The intention is for all pertinent knowledge to be contained in one place and that the material is:

- complete- includes as much data as is estimable
- transparent- outlines all assumptions, data sources and relationships
- accessible- easy to read and understand
- robust- defensible and able to withstand scrutiny
- relevant- of interest to decision-makers.

The main purpose of this report is to improve, rather than make perfect, the information base available to decision-makers. While the analysis contained in this report is as comprehensive as possible given the time and resources available, the report is a contribution to decision-making and on its own, cannot be the final word.

This section provides an introduction to the objective, context and scope of this programme of work, the project approach and the application of a standard cost-benefit analysis (problem definition and policy objectives, option identification, quantification and assessment) to structure the evidence of the workstream perspectives in the policy consideration in this integrated report. The intent is to develop an integrated summary of these perspectives on the assessment of each option within a coherent policy narrative, quantitatively assessed for each perspective where possible.

1.1 Ongoing consideration of North Island supply chain

Upper North Island Ports have been of interest to a range of parties for some time. One port company Chief Executive reflected that to his knowledge, there had been 22 previous studies into Upper North Island Ports within the last 15 years or so. He also observed that there been little action taken as a result of the past studies.

This report responds to Cabinet's request to officials to provide advice on Upper North Island Supply Chain Strategy, following receipt of most recent study from the Independent Working Group report in December 2019. Cabinet appointed the Independent Working Group in September 2018 to review the Upper North Island freight and logistics sector and advise on a potential future location or locations

for Ports of Auckland, with serious consideration to be given to Northport.[4] The Working Group review would set out the Independent Working Group's joint view of:

- Current and future drivers of freight and logistics demand, including the impact of technological change.
- A potential future location or locations for Ports of Auckland, with serious consideration to be given to Northport. As ports are long term assets, the work needs to take a view that is 30-50 years or longer.
- Supporting priorities for other transport infrastructure, across road, rail and other modes and corridors such as coastal shipping.
- Potential priorities for transport-related infrastructure investment from a national economic and regional development perspective.
- The optimal regulatory settings, and planning and investment frameworks across government to give effect to the review findings.
- Future challenges on which government and industry would need to work together.
- Key actions to be taken over the next five years.

The Working Group considered a range of scenarios to determine the most efficient arrangement of Upper North Island Ports.

The Working Group's final report to Cabinet strongly concluded the "Ports of Auckland's CBD freight operation is no longer economically or environmentally viable" and Auckland's freight operations should be progressively closed with future freight shipping handled by the development of Northport and the continuation of Tauranga's existing expansion plans.[5] The Working Group's report was supported by economic analysis over a 30-year timeframe of a range of scenarios that consider a number of different infrastructure configurations including sole port, partial move and split port options.

The Working Group's preferred approach was to encourage commercial supply chain organisation, including port landowners and operating companies, to make the investment required for the change. Total change costs were estimated by the Working Group to be around $10 billion, with the Crown's investment estimated to be $3-$4 billion over the next 10-15 years for rail and road infrastructure.

1.1.1 Further robust analysis was sought by Cabinet

While noting the Ports of Auckland Waitematā Harbour berths are not viable as the Upper North Island's key import port in the long term, in December 2019 Cabinet sought further robust advice to

[4] See https://www.transport.govt.nz/assets/Uploads/Our-Work/Documents/cc9d34704a/UNI-Cabinet-Paper-and-Terms-of-Reference_no-redactions.pdf

[5] See https://www.transport.govt.nz/assets/Import/Uploads/Research/Documents/Cabinet-Papers/1.-MOT10025-UNISCS-Final-Report_final_8-11-19.pdf

inform future decisions on the Upper North Island Supply Chain Strategy, with Ministers of Finance, Transport and Regional Economic Development reporting on a programme including:[6]

- logistics and supply chain analysis
- transport and environmental analysis
- land use planning and wider economic analysis
- legislative and regulatory considerations
- funding and financing
- governance and commercial considerations
- stakeholder engagement and communications.

1.2 This study was intended to be in partnership with officials

There was a particularly high rate of engagement between Sapere and officials in this programme of work, especially at the start, with the intent to develop the analysis in partnership with officials and engaging with a broad range of stakeholders. This included:

1. The Ministry of Transport (MoT) who was the lead agency responsible for this programme of work, and together with Treasury and the Provincial Development Unit (of the Ministry of Business, Innovation and Employment) formed the Oversight Group to govern the project and providing staff to co-lead the work-streams with consultants.

2. A collective of consultants led by Sapere providing expertise in:

   - port and marine engineering from Advisian and port strategy/planning from Black Quay
   - rail engineering from Rail Infrastructure Consultants NZ
   - transport and supply chain expertise and transport modelling from Murray King & Francis Small Consultancy Ltd and Richard Paling Consulting Ltd
   - traffic modelling from Flow Transportation Specialists
   - marine and coastal process modelling from eCoast
   - resource planning from Mitchell Daysh
   - business valuation from Sapere Valuation
   - social impact from Tika Impact Ltd

3. The MoT led stakeholder engagement with "cornerstone partners" including Auckland Council, Ports of Auckland, Bay of Plenty Regional Council, Port of Tauranga, Northland Regional Council, Northport Limited and Marsden Maritime Holdings Limited. The MoT together with iwi consultants from the Policy Shop engaged with iwi and Māori stakeholders.

4. Third party-related agencies including the Infrastructure Commission, Infrastructure Victoria, NZTA, KiwiRail and Auckland Transport were also contacted.

[6] See https://www.transport.govt.nz/assets/Import/Uploads/Research/Documents/Cabinet-Papers/CAB-19-MIN-0647-Minute-002-MarkUp-30012020-Redacted.pdf

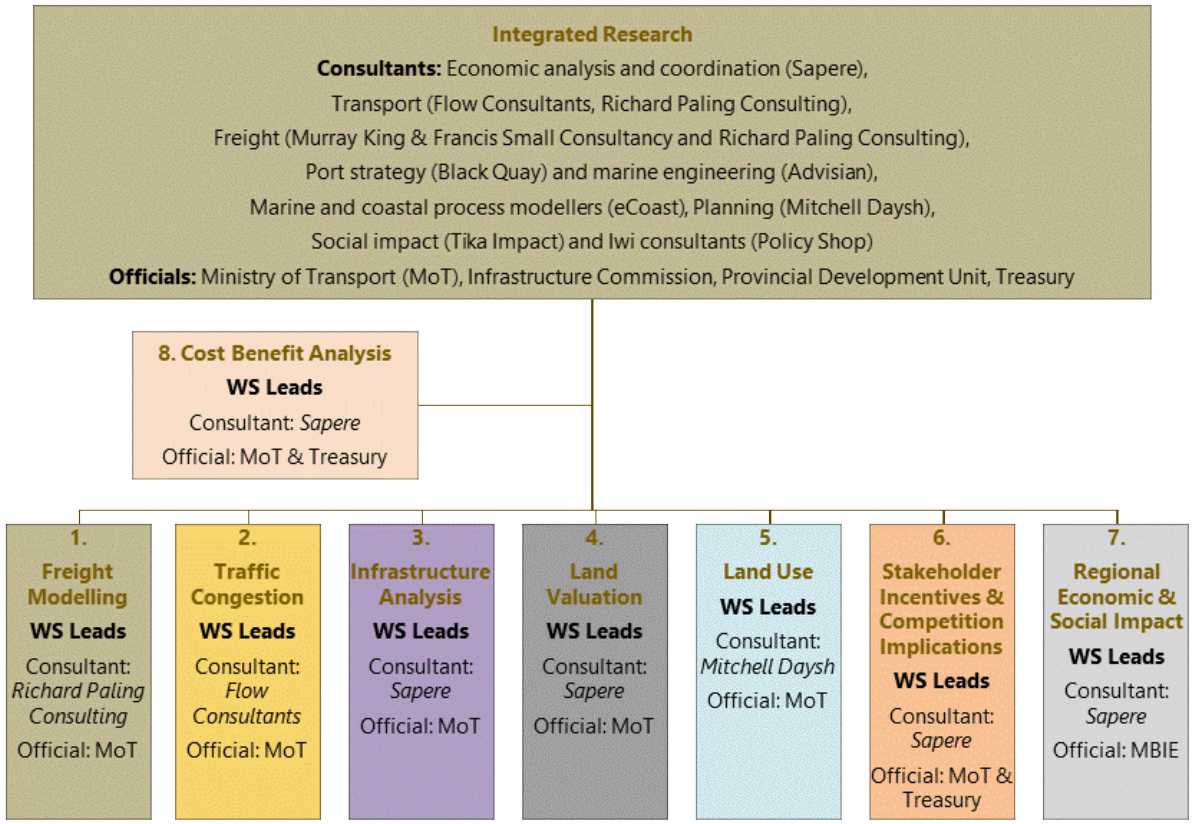
5. Sapere acknowledges the assistance of Ernst & Young with the economic analysis underpinning the 2019 Working Group report, and the contributions of supply chain stakeholders engaged to provide real world perspectives and insight into likely market reactions from proposed relocation of POAL.

1.2.1 COVID disrupted plans

The intention for close working relationships in each workstream between government officials and consultants was disrupted by the measures implemented for the control of the COVID pandemic. Consequently, while government officials worked closely with the consultant team in the early phases of the work, this engagement reduced from late March. Sapere led the team of consultants that produced the work in the workstreams of Figure 1 that are integrated in this report.

This commissioned study is a significant component but not the totality of the government programme led by the Ministry of Transport.

Figure 1 Project workstreams and specialist consultants



The instruction to us is that all freight is to be moved from POAL's Waitematā Harbour berths and only ferry traffic and cruise liner activity would remain. With this assumption we are to examine

- the drivers that influence when the port operations move and
- where they would be relocated.

Cabinet noted that the work programme would consider the Northport scenario and other scenarios looked at by the Working Group. There are five options in scope based on the options considered by the Working Group, all of which are covered to a similar degree in this report:

- Northport expansion
- Port of Tauranga expansion
- a shared increase in capacity at both Northport and Port of Tauranga
- a new port (greenfield site) on the Firth of Thames, and
- a new port (greenfield site) on the Manukau Harbour.

The scope excluded options for the partial move or split options (e.g. moving only cars from POAL) and any options not considered by the Working Group. Manukau Harbour was taken off the table early in the Working Group process and was not included in the Working Group's economic analysis.

The constrained project timeframe available meant that certain aspects were excluded, for example, willingness-to-pay surveys to underpin the economic value of the ports' social licence to operate, which limits this part of the economic analysis. Some stakeholders questioned the utility of findings within such a timeframe – however the breadth and depth of expertise participating in the workstreams in Figure 1 is greater than that available to the Working Group, and the significant body of work integrated in this report represents material progress understanding the specified options.

Progress was possible because the scope was designed to be as 'additive' as possible to existing understanding to consider the five options in terms of their suitability to assume all the freight task currently handled by POAL including containers, bulk and cars. That is we were informed by and built upon while specifically avoiding replication of previous work. This inherently includes a critical assessment of the economic analysis conducted for the Working Group to grasp where understanding can be advanced by the specialist analyses.

A key advance on previous work has been taking a longer view – specifically analysing and modelling key trends and economic value over a 60-year timeframe compared with 30-year timeframe in previous studies, suitable for a mega-project scale, multi-generational investment.

The programme of work also includes some perspectives on how POAL operations can be relocated including the potential next steps and factors influencing timing for decision making.

1.2.2 Our objective is a part but not whole of the government work programme

As consultants, our objective is to provide expertise that advances the evidence base for decision makers. This integrative report and the subsidiary reports are consultant branded reports that represent the expertise and opinions of their authors. Our objective, as consultants to government, is to apply our respective expertise to produce an evidence base that advances the understanding of current and future challenges and supports informed decision making. Within the constraints of the timetable and scope of work, we have made material progress was made on the issues particularly with respect to traffic modelling, infrastructure options and economic analysis.

We have attempted in this integrated report to present the lessons from the various workstreams in a way that supports the broader programme of work and the government task of developing policy, for example, by following the general structure for developing policy business cases.

We have attempted to align our collective reports with the advice sought by Cabinet, explain how the advanced knowledge developed can be employed in a decision process, and why that process leads to different conclusions on the path forwards than the Working Group.

The objective of the team of consultants to advance understanding of the Ports problem inherently involves a critique of the Working Group's report as the setting off point for our investigations. This critique is not the primary purpose of the body of work reported on here, however it is natural to reflect on how the current analyses raise challenges to the construction of a business case and cost-benefit analysis, from the definition of the problem, analytic methods and assumptions, and hence outcomes that vary from those of the Working Group. These differences are reflected upon in this report.

1.3 Structure of this report

The structure of this report includes:

- Section 2 describes our approach to combining the assembled expertise to support decision making for a mega-project.
- Section 3 describes [the freight forecasts and shipping trends over 60 years that underpin the expected effective capacity problem at POAL's Waitematā Harbour berths and establishes the gateway test for alternative options to future proof the Upper North Island's supply chain.
- Section 4 describes the implications of such forecasts if freight were to remain with POAL (the base case).
- Section 5 provides an overview of the options including infrastructure requirements and planning and construction lead times.
- Section 6 lays out the major analytical findings from the economic cost benefit analysis.
- Section 7 describes the impacts of alternative land use at POAL's Waitematā Harbour berths once the freight is removed.
- Section 8 provides an analysis of the differences in method and data that lead the current economic analysis to differ from that of the Working Group.
- Section 9 provides an estimate of resulting trends in supply chain costs based on the collated data.
- Section 10 describes the analysis of regional economic impacts conducted to complement the cost benefit analysis and the analysis social effects.
- Section 11 provides our commercial analysis of POAL and the financial implications for port owners.
- Section 12 describes the perspectives of supply-chain stakeholders that provided nuance to our understanding when developing the economic analysis.
- Section 13 describes the resource consenting issues for each option.

2. Advancing decision making for a mega-project

Our approach involves two complementary components: a quantitative component centred on a Cost Benefit Analysis (CBA) (with accompanying inputs and parameters from the relevant workstreams) and a qualitative component that establishes the fundamental narrative of the work.

The pivot for the CBA component is instructions provided by the (The Treasury, 2015). That guidance was augmented by parameter values and instruction contained in relevant NZTA materials (i.e. Economic Evaluation Manual, Benefits Framework and Transformative Transport Projects documents). Thus, we favour an orthodox or 'standard' approach to Cost Benefit Analysis.

2.1 Reflecting a prospective New Zealand mega-project

Large infrastructure projects such as the development of ports with associated road, rail, energy and water infrastructure have long been recognised as "mega-projects", about which a large body of management literature has emerged (Gellert, 2003). There is no single definition of megaproject in the literature and criteria vary, but generally characterised by a) a large investment commitment, b) a high level of innovation and complexity in the investment/construction phase, particularly organizational complexity with a vast array of stakeholders, c) very long-term operations and d) far reaching effects on their environment and society.

The broad approach intended to be taken in this work reflects the large and long-term public and private investment, and complex relationships between government divisions, infrastructure owners, operators and users, district and regional councils, iwi and Māori and general public stakeholders.[7]

For this work, that complexity includes the need for a deep understanding of the views of Treaty Partners. The key takeaways from iwi and Māori stakeholder engagement by MoT for this project are as follows (Ministry of Transport, The Policy Shop, 2020):

- There will be a negative reaction from iwi and Māori groups if the Government takes any final decision on the relocation of Auckland's port without undertaking what they consider a process befitting the Treaty partnership – including the sharing of detailed information and analysis, and resourcing to facilitate informed decision making.
- Iwi dynamics and competing iwi claims will have a significant impact on Government decision-making on the future of POAL land.
- Port relocation is likely to increase the pressure for outstanding Treaty and Marine and Coastal Area (Takutai Moana) Act (MACA) claims over Auckland Port/Waitematā Harbour and whatever area is proposed for relocation.

[7] For example, for the options apart from Tauranga there are outstanding Treaty claims over the relevant harbour water body. The Tauranga harbour claim is largely negotiated and involved a form of co-governance between iwi and councils. The prosecution and negotiation of these claims and associated settlements are likely to be a significant factor in implementing any relocation.

None of the options necessarily poses a 'fatal flaw' from the perspective of Māori groups, and some would welcome a port being relocated to their rohe; but they will look to secure protection of customary interests, net environmental benefits and commercial investment opportunities

2.2 How the workstreams advance our knowledge

Figure 1 outlines the structure of the eight analytic workstreams that have been undertaken to advance the evidence base that underpins understanding the challenges in the proposal to move the Ports of Auckland.

The first workstream is modelling of the future freight shipments that are currently handled by POA. These forecasts of freight volumes underpin understanding the freight handling capacity that both:

1. sets a future limit on the Ports of Auckland when current capacity for bulk, cars and/or container freight becomes insufficient, and

2. sets the minimum capacity requirement of any investment to replace or supplement the Ports of Auckland at (or before) that date, and well into the future to avoid further demand for further mega-project investment to boost capacity. This condition is the first test of any option.

The freight forecasts are also one key input of the CBA to assess the comparative economic value of the options (like any future forecast, freight projects are uncertain, and the range of forecasts employed to understand this uncertainty is discussed further below in Section 3).

- *Traffic Congestion* analysis both contributes to understanding the limits of the Ports of Auckland and the economic impact of options through the CBA (Flow Transportation Specialised, April 2020).
- *Infrastructure Analysis* both informs understanding of the capabilities and constraints on freight capacity at the sites in the options, and supplies inputs to the CBA (Sapere Research Group, 2020c; Advisian, 2020; Black Quay Consulting, 2020; Black Quay Consulting, 2020; Black Quay Consulting, 2020; Rail Infrastructure Consultants NZ, 2020; eCoast, 2020)
- *Land Valuation* supplies inputs to the CBA (Sapere Research Group, 2020d).
- *Land Use* provides perspectives on the alternative uses of land, consenting issues and supplies inputs to the CBA (Mitchell Daysh, 2020)
- *Stakeholder Incentives & Competition Implications* investigates the commercial viability of the options and the requirements for government funding, and supplies inputs to the CBA (Sapere Research Group, 2020b; Sapere Research Group, 2020a; Sapere Valuation, 2020).
- *Regional Economic & Social Impact* both provides some (constrained) view on regional impacts as well as supplies inputs to the CBA (Sapere Research Group, 2020e; Tika Impact, 2020).

2.3 How would we consider decision making for a mega-project?

The primary purpose of the other workstreams are to develop the evidential data that underpin the CBA inputs. We reiterate the emphasis that the objective of economic Cost Benefit Analysis is to

attempt to evaluate societal values, quantified in dollar terms for clear numerical comparison. Where understanding is not currently available to quantify the economic value of any societal benefit or cost, the analysis should qualitatively explain how the valued benefit or cost would influence the quantified outcome.

The capacity condition and the CBA results provide the primary selection criteria to assess whether the options are even technically feasible and then preferable from a societal viewpoint, summarised in a form like Table 2.

Table 2 Criteria for narrowing long list of options

	Option A	Option B	Option C	Option D	Option E
Gateway test*	Yes/No/Risk				
Total benefits	$m NPV				
Total costs	$m NPV				
Net benefits	$m NPV				
Rank	#				
Benefit-cost ratio	Benefit: Cost				

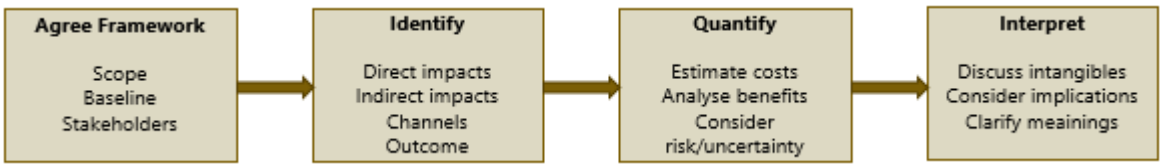
* Note: Long term capacity refers to the range of dimension of effective capacity, including but not limited to berths, channel depth and congestion, that limit the ability of an option to service freight demand beyond the modelling time horizon.

Cost Benefit Analysis is not perfect and such limitations may not adequately distinguish a single preferred option. Some societal benefits/costs cannot be easily monetised and are not directly included in the analysis. The economic analysis is then supported by a range of secondary analyses. These identify risks, constraints and other likely modifications of the economic analysis.

2.3.1 A 'standard' business case/economic CBA approach is uncontroversial and provides the basis for the analysis

The general structure of the 'standard' approach to CBA is shown in Figure 2. We worked systematically through the various steps sequentially to better highlight the basis, linkages and scale of effects being measured.

Figure 2 CBA structure



Source: Sapere

Traditionally, problems arise between steps two and three where the steps are often conflated, resulting in lack of transparency and inability to validate findings. We chose to separate these steps to aid understanding, remove ambiguity and highlight the thinking that underpins the various analytical

steps. This process is designed to allow easy reproduction and/or replication of results by other parties, as required.

The use of discounted cashflow techniques for monetised costs and benefits within a general modelling structure is also standard practice, resulting in common summary metrics (e.g. benefit-cost ratio, net present value).

This report is focused on the CBA outcomes with key themes from the CBA approach, assumptions and data. Detailed technical discussion on the CBA is included in (Sapere Research Group, 2020f)

2.3.2 Definition of the baseline and options

Economic Cost Benefit Analysis takes a 'with or without' measurement approach to policy proposals. The objective is to assess *the change* in economic effects of the policy options proposed to deliver the policy objectives by reference to what would have taken place in the absence of the proposal.

This 'without' element is the base case that is typically the "status quo" (i.e. "do nothing") scenario or, where doing nothing is unfeasible, the "do minimum" scenario. This comparison of the base case against proposed alternative options allows decision-makers to see the incremental effects of the policy options available.

In the base case, POAL is assumed to remain and expand on the Waitematā Harbour for 60 years for the purpose of estimating a counterfactual infrastructure cost. In the real world, POAL may face constraints on some aspects and not on others, and any scenario attempting to estimate such will be contestable. The simple modelling choices are that all or none of the required consents are obtained. Section 4 describes the reasons we have chosen an unconstrained base case, including consistency with prior analysis.

2.3.3 Basic CBA attribution rules

The following set of basic rules for attributing impacts was utilised.

- Use marginal or incremental costs and benefits relative to the base case where available. Only use average or other costs where no alternative is available.
- Use economic (resource) costs and benefits as much as possible. Financial costs and benefits are distributional impacts that do not have an impact on overall net economic impact and are hence excluded.
- The relevant span is national- displacement and offsetting effects are included as much as possible.
- Only include those impacts (or a share of those impacts) that occur in the relevant time period for analysis.
- Assign impacts to their appropriate place (i.e. disbenefits as costs and avoided costs as benefits).

2.4 Important caveats

While the current work builds upon and extends understanding of the options to move freight from POAL's Waitematā Harbour berths, inevitably there have been constraints. The total project duration has been rapid, and resources have been prioritised towards those areas and issues in which advances were feasible in the available time. Hence, we stress that none of these caveats is sufficiently major to render findings invalid, but rather we raise these limitations for context and transparency.

In particular, in extending the analysis and economic modelling horizon to 60-years, in many cases existing data and/or forecasting tools do not look ahead for such a long period. In these cases, "work arounds" were needed, or educated guesses drawing on the consortium team expertise were used.

Data issues arose in relation to:

- estimating the economic life of some assets
- determining costs for asset maintenance and whether given estimates included such costs
- port charges
- calculating infrastructure costs outside the scope of expertise or past the model time period,
- detail on origins and destinations of freight in Auckland (and elsewhere).

We outline elements that are absent from, or remain unresolved in, our analysis. We also set out the reason why and the implications of such absence or lack of finality for our reported results in Table 3.

Table 3 Outstanding data issues

Element	Impact and reason	Implication
Port charges	Supply chain costs likely to be underestimated, due to lack of data	Common across base case and options, rankings unlikely to be affected
Rail safety externality impacts	Rail freight movement safety costs incomplete due to inability to isolate freight component	Total impact likely to be minimal given current very low level of e.g. national deaths per rail km
Balancing container flow impacts*	Unresolved due to lack of data	Differential cost impacts of full versus empty containers are coarsely estimated
Transhipment costs at alternative ports*	Absent due to insufficient understanding of incidence	Could underestimate costs of alternative ports, particularly Manukau, if transhipments significant
Ship size impacts	Unresolved as available information and understanding insufficient and time/resource constraints	Potential inaccuracy in impact estimates
Destination of freight in Auckland	Estimated due to lack of precise data	Aligned with Working Group assumptions for comparability
Congestion costs other than value of travel time	Traffic costs potentially understated due to time/resource constraints	Underestimation consistent with EEM standard practice
Impact on consumers	Unresolved as extremely complex to analyse	We don't fully understand the full implications on end user costs

* =further, more detailed work is recommended

3. Outlook for freight growth and vessel size

The outlook for the growth in freight volumes informs conclusions about the capacity of POAL and the infrastructure capacity needed for other port options to accommodate the future freight task.

3.1 Forecasting growth in container freight

Forecasts for freight growth at POAL use the Ministry of Transport freight model, as updated for the 2019 National Freight Demand Study. The forecasts relate to the base case, in which POAL is assumed to be able to expand on the Waitematā Harbour to handle growth for 60 years. Containerised freight, comprising imports and exports, is of primary focus given volumes involved, the land area needed, and the growth outlook. Three forecasts were prepared for the period to 2079, with 2018 as the base.

- Medium growth – a compounding annual rate of growth of 2.26 per cent. This is referred to as the calibrated forecast.
- Higher growth – a compounding annual rate of growth of 2.51 per cent. This is referred to as the calibrated (higher growth) forecast. It uses higher population and GDP growth rates.
- Low growth – a compounding annual rate of growth of 0.75 per cent. This is referred to as the officials' agreed forecast.

To put these rates in context, annual growth in container freight in the Upper North Island ports has averaged over 4 per cent across 2012 to 2019. This study focuses on the calibrated forecast (medium growth) as being the most plausible rate of growth for container volumes over the long-term. The decision to focus on the calibrated forecast takes into account port planning assumptions used in Australia and advice from a port planner with extensive international experience. Detailed analysis has been included for the low growth forecast at the request of officials.

Summary of freight forecast differences

The low growth forecast is based on officials' agreed assumptions for population and GDP growth and supply and demand drivers within the model. This results in a forecast of freight growth that is materially lower than in prior studies and lower than trend growth in the Upper North Island. The lower growth rate arises because the model assumes that domestic supply of goods grows in line with domestic demand and this results in low growth in import volumes.

The calibrated (medium growth) forecast adjusts the model's demand and supply drivers to better reflect trend import flows through the ports. The model treats the demand for, and supply of, manufactured and retail goods as being dependent on a weighted relationship to regional population and GDP growth. The adjustment is that the demand for manufactured and retail goods continues to grow strongly as the economy develops but the capacity to supply these goods domestically grows more modestly. The resulting imbalance is met by imports, as has been the case in New Zealand for some time. This outcome is consistent with the economy continuing to focus more on services with a reduced focus on manufacturing.

The high growth calibrated forecast is designed to test the impact of population and GDP growth being higher than in the calibrated forecast. It uses slightly higher, but still plausible, assumptions about long-run population and GDP growth.

Table 4 summarises the average annual growth rates of the forecasts over the 60-year timeframe. The average annual growth rates over 30 years are also shown, to enable a comparison with figures used in the 2019 consultants' report commissioned by the Working Group, which used a 30-year timeframe. This comparison shows that the calibrated forecast for this study has a similar annual rate of growth to the lower figures used in the consultant report commissioned by the Working Group.

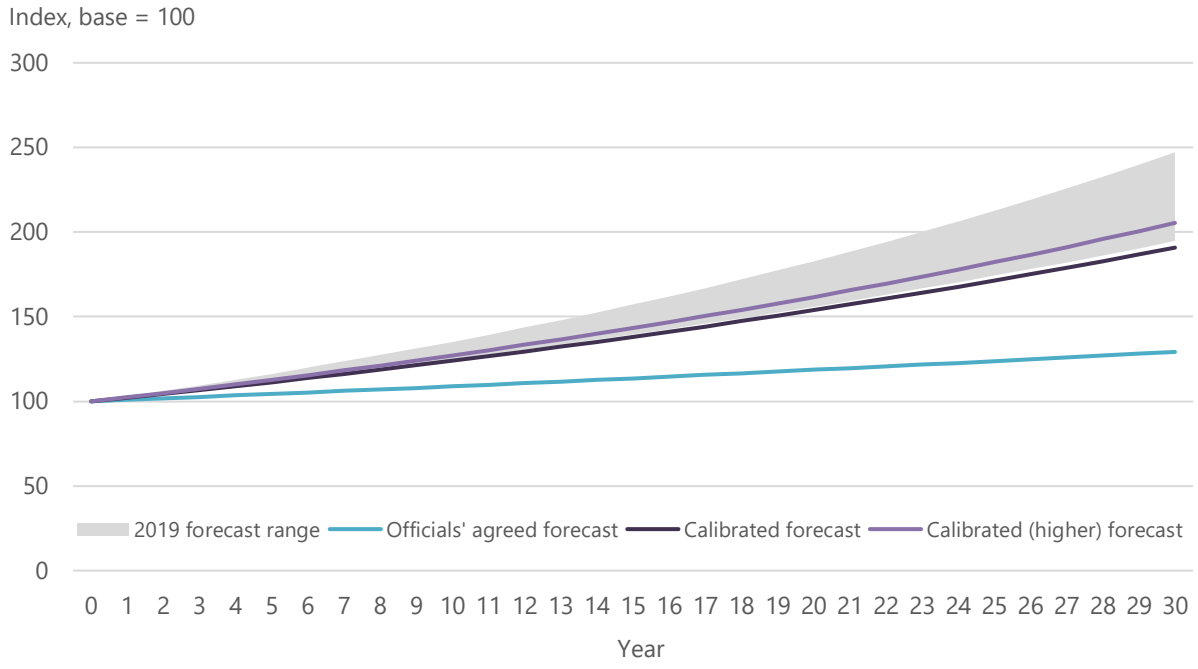
Table 4 Container freight forecast scenarios for Ports of Auckland – compounding annual growth rates

Scenario	Over 30 years	Over 60 years
Officials' agreed forecast (low growth)	0.86%	0.75%
Calibrated forecast (medium growth)	2.18%	2.26%
Calibrated forecast (higher growth)	2.43%	2.51%
Working Group Consultants' report (2019) – low	2.24%	n/a
Working Group Consultants' report (2019) – high	3.06%	n/a

Sources: Freight modelling workstream outputs; EY (2019) consultants' report to the UNISCS working group – rates derived from the range of TEU volumes reported for 2018 and 2049.

Figure 3 compares the trend growth rate for each forecast, over 30 years, with a range derived from the figures in the 2019 consultant's report to the Working Group. Of note, the calibrated forecasts sit either side of the lower end of the forecast range for container freight used in the 2019 report.

Figure 3 Container freight forecast scenarios for Ports of Auckland – comparison of trend growth



Sources: Freight modelling workstream; EY (2019) with additional analysis by Sapere

3.2 Sizing the future freight task

The future freight task represents the volume that would need to be accommodated over 60 years, either at POAL or one of the port options. As well as the import and export of containers, the freight task also comprises bulk freight (i.e. importation or transhipment of cement, sand, grains and the export of scrap metal) and vehicle imports (all motorised vehicles). Results are shown for the medium and officials' agreed forecast and include transhipments.

Container freight is measured by twenty-foot equivalent units (TEU). Container freight grows to 3.84 million TEU in 2079 in the calibrated forecast, or 3.8 times the volume in 2020. Under the officials' agreed forecast, container freight reaches 1.53 million TEU in 2079, or 1.6 times the volume in 2020.

Table 5 Container freight forecasts for Ports of Auckland – size of future freight task

Forecast	**2020** million TEU	**2079** million TEU	**Ratio of 2020 to 2079**
Calibrated	1.01	3.84	3.8 times
Officials' agreed	0.99	1.53	1.5 times

Source: Sapere

Bulk freight, under the calibrated forecast, grows to 4.63 million tonnes in 2079, or 2.7 times the volume in 2020. Under the officials' agreed forecast, bulk freight reaches 2.67 million tonnes in 2079, or 1.6 times the volume in 2020.

Table 6 Bulk freight forecasts for Ports of Auckland – size of future freight task

Forecast	**2020** million tonnes	**2079** million tonnes	**Ratio of 2020 to 2079**
Calibrated	1.71	4.63	2.7 times
Officials' agreed	1.68	2.67	1.6 times

Source: Sapere

Vehicle imports are assumed to grow at the rate used for container imports in each forecast. Under the calibrated forecast, vehicle imports, reach 1.68 million in 2079, or 5.3 times that of 2020. Under the officials' agreed forecast, vehicle imports reach 0.48 million in 2079, or 1.6 times that of 2020.

Table 7 Vehicle import forecasts for Ports of Auckland – size of future freight task

Forecast	**2020** million vehicles	**2079** million vehicles	**Ratio of 2020 to 2079**
Calibrated	0.31	1.68	5.3 times
Officials' agreed	0.30	0.48	1.6 times

Source: Sapere

3.3 The container forecast is the most critical

Of these forecasts, the container forecast is the most critical, given POAL constraints and the outlook for growth. The container trade also requires considerable investment in berthage, automation and other infrastructure. In contrast, vehicles require a wharf to pull alongside, and yardage for temporary parking, but can be driven off and out of the way, promptly. To this end, we sought an external expert view on the long-term outlook for global and regional container trade. This view, in effect, points to use of the calibrated forecast (medium growth) over the officials' forecast (low growth) for this study.

Black Quay perspective on the outlook for container trade

Black Quay are specialist consultants, providing advanced port planning and specialist advisory services to clients around the world. The company has presence in Australia, the United States and the United Kingdom and planning studies delivered over the last five years include assignments in Australia, North America and the Middle East.

Black Quay regularly prepares global and regional forecasts of container trade, based on research into consumption, manufacturing and industrial trends. Outlooks for containerised trade for western nations over the last five years have generally followed an annual average growth rate of between 2.6 per cent and 3.4 per cent. Black Quay has not prepared forecasts for this study but offers the following high-level opinion.

Black Quay advises that global growth rates for container trade will likely reduce over time, as a result of the container market maturing and less potential for further products to be containerised. Balancing this, container consumption per capita in western countries is still growing and healthy growth is expected in the medium term. There is no reason to expect that New Zealand would be different.

Black Quay expects a generalised reduction for Australia from 2.6 per cent per year in the short to medium term, to between 2.0 per cent and 2.26 per cent per year in the long term. This view factors in near-term Covid19 impacts and reflects the growing reality of Australasia being connected to Asia from an economic perspective. Black Quay's view is that Asia will represent more than 90 per cent of Australasian trade in the medium term.

Black Quay considers that an annual growth rate of 1 per cent or less into the long term would be implausible and out of step with their port planning work elsewhere. In Black Quay's view, basing a regional port strategy for the long term on an annual container growth rate of 1 per cent or below would be high risk and would not appear to fully consider long-term population trends, consumerism trends, ageing and disruptive manufacturing techniques and the development of emerging industries.

Black Quay advises that it is important to identify the future freight volume at which a pre-determined long-term relocation plan would be triggered. This volumetric trigger approach acknowledges the uncertainty of long-run forecasts and allows for some flexibility to react to sustained upside or downside surprises in trend growth of freight.

Source: Black Quay memo, May 2020.

3.4 Outlook for larger container vessels

Container vessels continue to grow in size, driven by economies of scale and competitive pressures. Larger vessels mean larger loads, fewer visits and longer time to unload in port. The ability to accommodate these larger vessels is one dimension of port capacity, with the implications being:

- entrance channels need sufficient width and depth to enable access
- more depth necessary at vessel berths and in turning bays
- longer vessel berths needed alongside the wharves.

Cascading effects across the global container vessel fleet are likely to increase the upper end of the fleet visiting New Zealand, as well as the average vessel size. An outlook prepared by Black Quay concludes that vessels of 7,500 to 8,000 TEU added on New Zealand routes (after 2019), will gradually be replaced in the medium term (15-30 years) by vessels of 8,500 TEU and above, with a maximum size of 11,000 TEU. Longer term (30-50 years), a small number of dimension-specific 13,000 to 14,000 TEU vessels will be operated on the primary Australasian services and would represent a significant component of overall service capacity.

3.5 Important implications for POAL

POAL is, currently, constrained to vessels under 6,000 TEU and this has likely contributed to low growth in container volumes and an increasing loss of market share to the Port of Tauranga, which can accommodate these larger vessels. As examples, Maersk first sent a 9,500 TEU ship to Tauranga in 2016 and has been making regular calls since, with a successful trial of an 11,300 TEU ship in 2017.

Black Quay concludes that POAL is currently at a critical disadvantage, relative to the Port of Tauranga, in accommodating larger container vessels. The POAL 30-year plan provides for the construction of a third berth for container vessels and for the entrance channel to be dredged in two phases. Those plans are contingent on obtaining resource consents. If both stages of POAL's planned dredging are consented, then visits of some 11,000 TEU vessels would become possible, however, it is Black Quay's view that access would be significantly limited in terms of specific vessel dimensions and operating parameters (i.e. weight limits and a limited tidal window).

POAL would still be at a disadvantage relative to the Port of Tauranga in future, in terms of channel depth. The extent of this disadvantage depends on the future size of vessels, but the disadvantage could become more apparent in the short to medium term. Should container vessels increase to 13,000 to 14,000 TEU in size, and up to 380m long and a 15.5m draft, access to POAL would not be possible without sizeable increases in channel depth and berth length beyond that allowed for in the 30-year plan and the current resource consent applications.

4. Ports of Auckland – the base case

This section considers the capacity of POAL to accommodate the long-term freight task. The purpose is to assess when the freight operations of the port might need to move and determine a base case to inform the cost benefit analysis of the port options.

4.1 Plans to address constraints and increase capacity

The freight forecasts assume that POAL can remain and expand on the Waitematā Harbour to accommodate the increasing volume of freight over 60 years. However, the POAL freight operation is currently constrained on several fronts, including container terminal capacity and the berths and channel access to accommodate larger container vessels.

The POAL 30-year plan provides for an increase in capacity at the Fergusson Container Terminal. The first stage involves constructing a third berth, automating the container yard and finishing some reclamation. A second stage involves relocating the administration block to extend the reefer space, constructing rail-mounted gantry and automating the rail yard. The 30-year plan also provides for the Freyberg Wharf to be converted to container terminal operations and for the channel to be dredged in two stages. Some of these steps require resource consents to be obtained (e.g. dredging work). Figure 4 shows the planned expansion of container operations. Freyberg is the triangular wharf.

Figure 4 Ports of Auckland plan for expanded container terminal operations

Source: Advisian

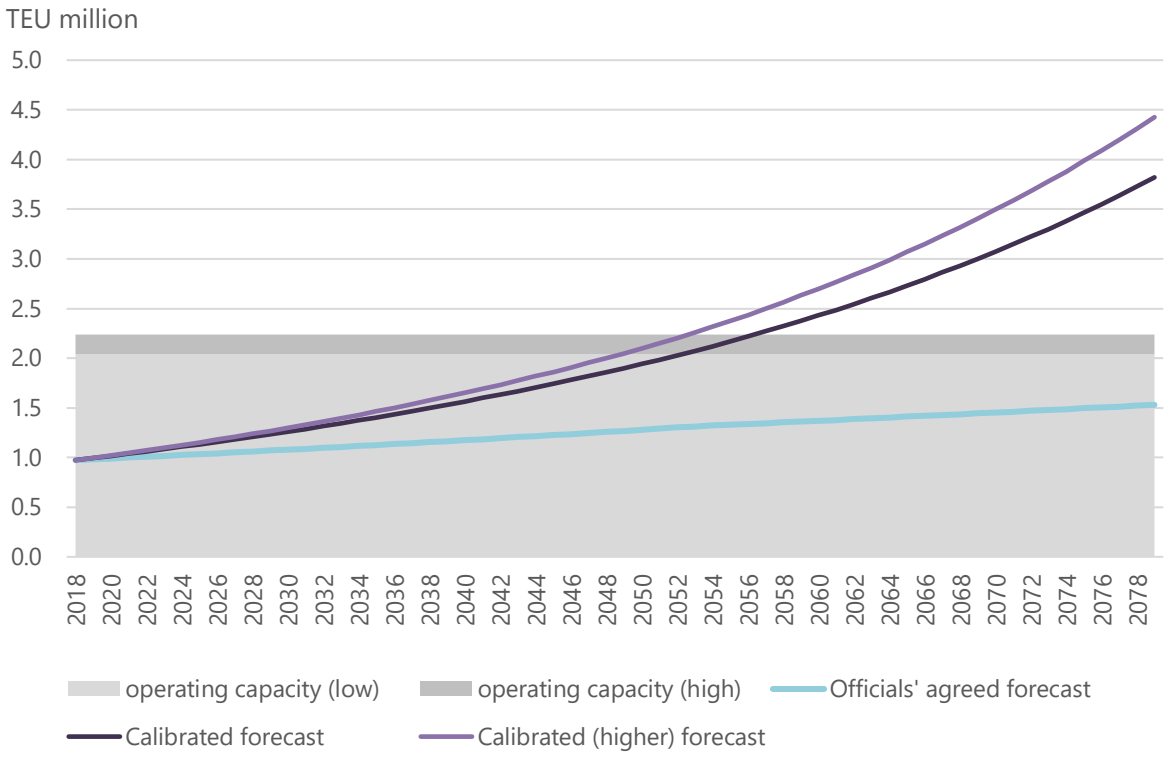
4.2 Thirty years of port capacity plausibly remains

Two sets of port consultants, Advisian (marine and coastal engineers) and Black Quay (port planners), were asked to independently assess the POAL 30-year plan and to offer a view on future capacity to accommodate the container trade. The port consultants differentiate between peak capacity (i.e. the maximum), at which a port can operate for short periods, and an effective or sustainable operating capacity. The latter is the level at which a port can operate reliably and economically, beyond which there are increasing risks from congestion for productivity, safety and profitability.

The port consultants recommend the concept of operating capacity be adopted for port planning purposes. That is, it would be prudent to avoid using peak or best-case maximum capacities in planning for the long term. The views offered by the port consultants suggest a planning assumption of 2.04 to 2.24 million TEU per year for the future combined operating capacity of the Fergusson Container Terminal and the Freyberg Wharf.

The estimates of annual operating capacity can be compared with the freight forecasts to determine how long growth may be accommodated. Figure 5 plots the forecasts of TEU volumes per year against the low and high estimates of future annual operating capacity.

Figure 5 Freight forecasts with estimates of Ports of Auckland operating capacity



Note: Operating capacity shown represents future capacity under current plans; capacity in 2020 is approximately 1m TEU

Sources: Sapere; Port consultant estimates

The conclusion is that the POAL plan will enable sufficient operating capacity for approximately 30 years from 2020, with the range being 31 to 35 years of capacity, under the calibrated freight forecast (medium growth), depending on the estimate of effective operating capacity. The range is 28 to 32 years of capacity under the higher growth calibrated forecast.

This conclusion assumes that constraints, such as channel dredging to enable larger vessels to access the harbour entrance, will be addressed (i.e. that the necessary consents will be obtained). Under the officials' agreed forecast, using officials' agreed assumptions, there is sufficient long-run capacity, although, as noted above, this is less plausible.

4.3 The POAL base case as a baseline to test other options

At the heart of a robust cost benefit analysis is a base case against which to compare the proposed alternative options. This base case is sometimes referred to as the "counterfactual", "status quo", or "do minimum" scenario. The base case allows decision-makers to see the incremental effects of doing something by accounting for the likely effects of not doing anything. As well as being essential for estimating the incremental costs and benefits of a decision, the base case for this study gives useful insights on the extent to which freight operations at the POAL site:

- contribute to traffic congestion in Auckland's central city and elsewhere
- provide for efficient delivery of freight to final consumers
- maintain a competitive tension between the Upper North Island ports
- provide resilience to the supply chain in the Upper North Island.

Establishing the base case is not straightforward. The Treasury's guidance on cost benefit analysis notes that this is particularly difficult when the "do nothing" scenario is likely to evolve over the period of analysis. This study considered two base cases: constrained and unconstrained.

A constrained base case would involve limiting expansion, possibly in line with the POAL 30-year plan. The assumption would be that any necessary resource consents sought by POAL for major expansion would not be granted, for example, due to environmental and/or societal considerations. In contrast, an unconstrained base case assumes that POAL would receive necessary consents to expand as needed over the long term.

In practical terms, having two base cases would be analytically unwieldy and create confusion rather than clarity. In addition, the need for comparability with previous work, particularly the Working Group study, suggests a single base case.

4.4 A simplifying assumption of further port expansion to meet 60-year needs

This study uses an unconstrained base case, where POAL is assumed to be able to remain and expand on the Waitematā Harbour for the 60-year period of analysis. In effect, the constraints that have been previously identified around the ability of POAL to accommodate the future freight task have been put to one side, to assess the incremental impacts of the relocation of freight operations.

Accommodating the growth in container volumes out to 2079, as determined in the calibrated forecast, would require an expansion to the port precinct, beyond that envisaged for in the POAL 30-year masterplan. Marine and coastal engineers Advisian have concluded that this would involve substantial reclamation into the Waitematā Harbour.

This future reclamation may not necessarily extend beyond the north face of the Fergusson Wharf. Such an expansion could, potentially, involve extending the container terminal an estimated 800 metres east of the existing Fergusson North Wharf with an associated 24 hectares of reclamation to obtain enough berth capacity to service vessels until 2079. In effect, this would see the Fergusson Container Terminal approximately doubling in size. Figure 6 shows what this scale of expansion could look like, for illustrative purposes. This does not represent a concept plan or a worked up plan or a proposal from POAL but, rather, highlights the extent of development that might be needed.

Reclamation is a controversial issue. This level of reclamation may prove very difficult to consent, particularly as expansion eastward will have coastal impacts on the sediment flow through the Waitematā Harbour, potentially causing siltation to occur around Mechanics Bay and Judges Bay. Such an expansion of the port precinct would also likely require the relocation of existing facilities at Mechanics Bay and Judges Bay.

Figure 6 POAL – A concept for required container terminal area, assuming unconstrained expansion to 2079

Source: Advisian

Note: This is not a plan or proposal from POAL

5. Overview of options and infrastructure

This section provides an overview of the specified relocation options, including the infrastructure needed to accommodate the future freight task and the timeframes involved.

5.1 Option set

This study has been directed to consider five options for the relocation of the POAL freight task:

- Northport expansion
- Port of Tauranga expansion
- a shared increase in capacity at both Northport and Port of Tauranga
- a new port on the Firth of Thames, and
- a new port on the Manukau Harbour.

Each option involves a managed closure of the POAL freight operations. Port capacity is constructed, either at existing ports or at a new port to handle the future freight task. Alongside this, the necessary landside infrastructure, in the form of road and rail capacity to accommodate the future freight task would also be constructed.

The timeframe assumption used across these options, for simplicity, is that construction would commence in 2030 with the additional capacity, either at an existing port or a new port, being in use from 2035. The timeframe assumption allows time for a planning and consenting phase. This is based on the results of a planning evaluation, which concluded that obtaining the necessary consents would be challenging. Allowing for a design phase, technical reports, and the consenting process, the conclusion is the timeframe would be 5-7 years at an existing port and 7-10 years for a new port.

These five options are compared against the base case, where POAL remains in place and expands on the Waitematā Harbour and the Upper North Island continues to be serviced by the Port of Tauranga and Northport in their current roles.

Under the assumption of a relocation to an existing or new port from 2035 onwards, the estimates of infrastructure costs that would otherwise be incurred in retaining and expanding POAL on the Waitematā Harbour after that point, are treated as being avoided costs.

5.2 Port capacity assessments

A port capacity assessment was prepared for each option, with regard to the future freight task of approximately 3.8 million TEU in 2079. The estimates of capacity, concept layouts and costings were prepared by port consultants, taking into account existing infrastructure, scope for expansion, and potential environmental constraints. The cost estimates were subsequently scaled to reflect the relatively lower freight growth path under the officials' agreed forecast.

5.2.1 Northport expansion

Northport is located at Marsden Point, on the southern side of the entrance to Whāngārei Harbour. While Northport has some room to expand in a physical sense, identified environmental constraints to both the west and the east mean that the scope to expand the port is limited.

Northport could provide sufficient berth capacity until around 2060, under the calibrated freight forecast, which is not materially longer than the estimated 30-year capacity remaining at POAL. Northport could comfortably accommodate container trade of 2.6 million TEU per year, if required to handle the POAL future freight task, whereas that task would reach 3.8 million TEU in 2079.

To accommodate the future freight task, marine and coastal engineers conclude that Northport would need a 2km long quay, involving dredging and reclamation that expands beyond identified constraints. To the west, those constraints include residential areas and wetlands associated with an estuary. To the east, expansion would need to be into the area occupied by Refining NZ's liquids berths and well beyond, with significant impacts on coastal processes that would affect the surrounding coastline and entrance channel. Figure 7 shows what that scale of expansion would entail.

The landside infrastructure requirements include a four-lane road, including sections from Warkworth to Te Hana and a western bypass of the Brynderwyn Hills. These projects are likely to happen in the medium-to-long term and so are treated as being brought forward by port expansion. As most freight is destined for industry and distribution centres in South Auckland, the conclusion from transport planners and consultants is that a freight-focused rail route through Auckland would be required to separate freight from the metro passenger service. This would comprise an additional track on the line from Swanson to Avondale with a new line deviating from Avondale to Southdown. A freight hub in north west Auckland would not be a substitute for this, as freight from Northport arriving by rail would be transferred by road to South Auckland, increasing handling costs and adding to congestion.

Figure 7 Northport expansion – concept layout for forecast freight task, 2079

Source: Advisian

5.2.2 Port of Tauranga expansion

The Port of Tauranga is located on the south east side of Tauranga Harbour. The port has the largest container terminal operation at Sulphur Point, on the eastern side of the channel, with bulk freight, such as log exports, on the eastern Mount Maunganui side of the channel.

The Port of Tauranga is able to accommodate its own long-term freight task, with capacity of up to approximately 5.0 million TEU. This would involve expansion within the existing port precinct, with the identified areas, beyond current expansion plans, being a northern berth on Sulphur Point and between the liquids berth and Mount Maunganui Wharves with associated terminal backing. It also assumes conversion to automated stacking cranes.

To accommodate the freight task for the minimum test of 60 years, an additional 3.8 million TEU on top of its own long-term freight task, the Port of Tauranga would need significant expansion, into industrial areas on each side of the estuary channel. The necessary addition of berths and container facilities to the south and east of the port precinct would likely impact on flight paths from the nearby airport. The implication of this expansion is that the airport runway, bridge marina and highway would need to be relocated to accommodate the growth, triggering further infrastructure costs.

Marine and coastal engineers advise that the associated increase in shipping activity would be challenging, given tidal currents, with a risk of congestion affecting vessel operations and limiting port capacity. Even if this long-term capacity can be realised, Tauranga would have few remaining options, other than expanding to the west of Sulphur Point, into the reserve and marina.

The landside infrastructure requirements include improvement works on SH1/ SH29 from south of Cambridge to Tauriko. These works may occur in the medium-to-long term without the additional expansion of the Port of Tauranga and so are treated as needing to be brought forward, rather than wholly new costs. Additional works at the SH2/Dive Crescent interchange, adjacent to the Port operations at Sulphur Point, would also be needed. Identified improvements to rail infrastructure include capacity additions (passing loops) on the East Coast Main Trunk and the North Island Main Trunk (Whangamarino), as well as the construction of a fourth main line from Westfield to Pukekohe. The additional passing loops mean that the Kamai Tunnel would not be a constraint to increased freight traffic.

Figure 8 Port of Tauranga expansion – concept layout for forecast freight task, 2079

Source: Advisian

5.2.3 An increase in capacity at Northport and Port of Tauranga

This option involves the POAL future freight task being split between Northport and the Port of Tauranga, with expansion occurring at both ports. It builds on the work undertaken for the options where either Northport or the Port of Tauranga accommodate that future freight task. The split is based on the principle of Northport being developed to have some critical mass across freight types.

The container freight was split according to the estimate of operational capacity at Northport. The geometry of Marsden Point and the risk of impacting on coastal processes mean that Northport has limited growth opportunity to the east. For this reason, the future berth capacity is capped at approximately 3.5 million TEU, which is larger than under the Northport option, due to half of the POAL bulk freight and vehicle trade tasks being assumed to be handled at the Port of Tauranga. The remainder of the container trade task is allocated to the Port of Tauranga.

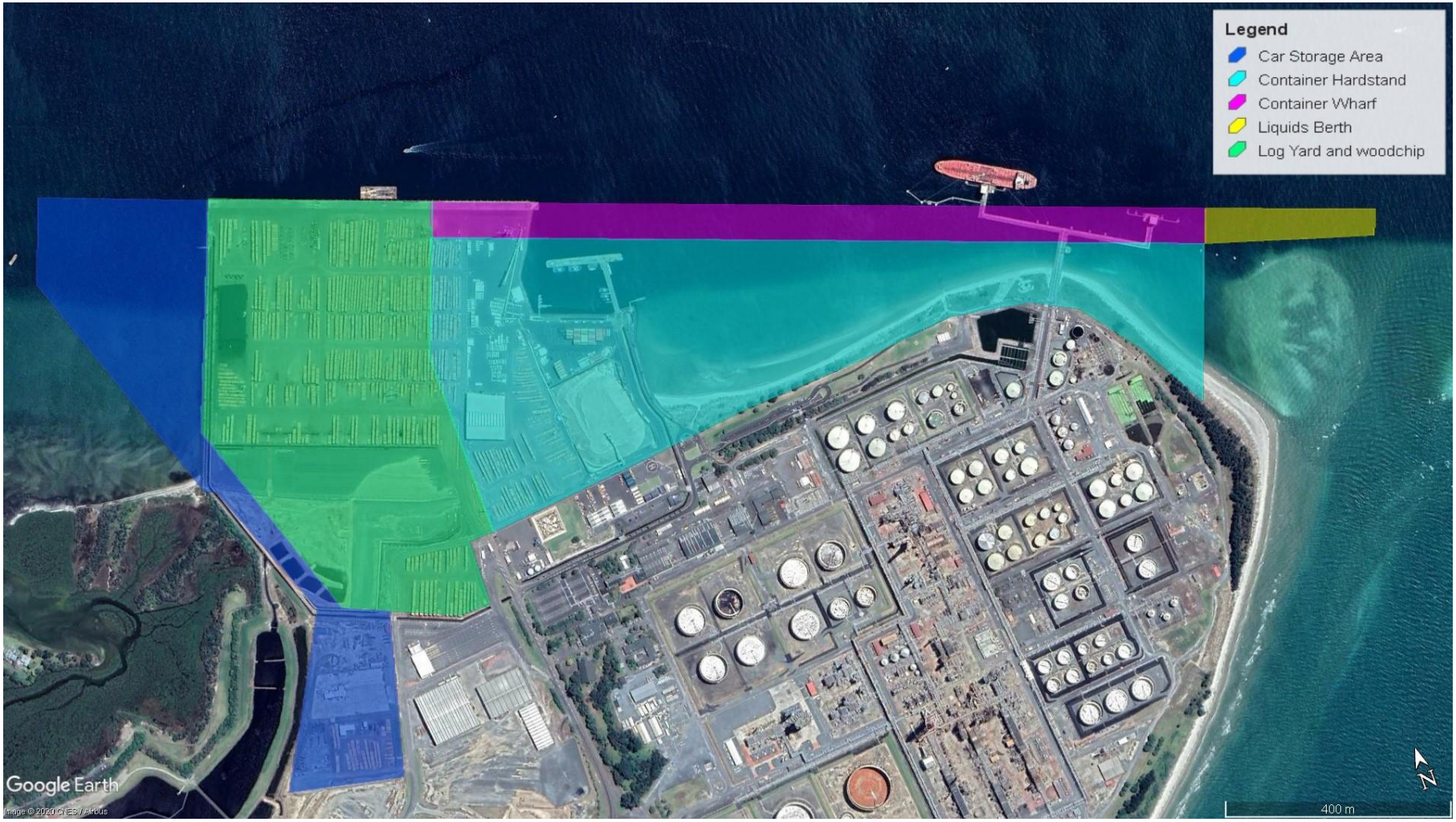
It is possible that a different split may be more practical, or commercially viable, given the relative proximity of existing industry and distribution centres to the two ports.

At the Port of Tauranga, the addition of part of the POAL future freight task, the long-term container throughput increases beyond the approximate capacity of 5 million TEU per year. Further growth would necessitate the addition of berths and container facilities to the south and east of the port precinct, as outlined above, and this would likely impact on flight paths from the nearby airport.

Under this shared increase in capacity, Northport and Port of Tauranga could accommodate the freight task at 60 years, at which point these ports would likely be at, or near, full capacity with little or no room to expand. It is possible that fewer containers could be handled at Northport, thereby creating some room for growth, but those containers would instead need to be handled at the Port of Tauranga, which would also be approaching its practical limit.

Marine and coastal engineers also advise that the relocation of part of the POAL future freight task to Northport and the Port of Tauranga will mean substantial shipping activity, which would be challenging given the tidal currents. Both Northport and the Port of Tauranga are estuary ports with natural navigation channels subject to strong currents. Such conditions make vessel navigation and turning difficult and can impact port capacity due to limitations on vessel sailing times. The risk of port capacity limitations due to navigation issues could be reduced through the use of larger tugs and possible channel modifications, although this would be subject to navigation and coastal process studies.

Figure 9 Northport expansion under split option – concept layout for forecast freight task, 2079



Source: Advisian

Figure 10 Port of Tauranga expansion under split option – concept layout for forecast freight task, 2079

Source: Advisian

5.2.4 A new port on the Firth of Thames

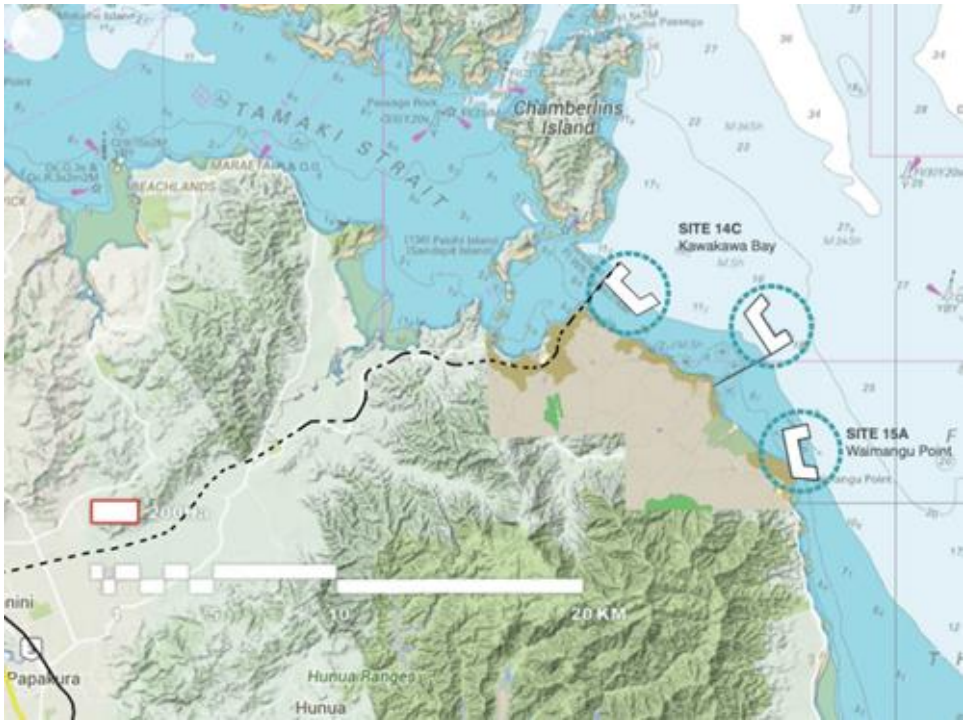
This option involves building a new port on the Firth of Thames to accommodate the POAL future freight task. The location is based on the 2016 Port Future Study, which identified sites with potential for an offshore island port connected by a short marine bridge, as Figure 11 shows. The focus here is on Kawakawa Bay, as being representative of the costs involved. The other sites are not ruled out.

A new port on the Firth of Thames has some perceived advantages in that its east coast location would be close to current shipping routes and close to landside supply chains around South Auckland and the Bay of Plenty. There is sufficient natural depth and although the route has complexities, navigating large vessels into the Firth of Thames is likely to be straightforward. The port's C-shape design and breakwaters would provide protection from waves in a relatively unprotected environment. While this raises the construction cost, this is balanced by the lack of need for dredging.

Port planners Black Quay reviewed their basic theoretical footprint and construction rationale for this option, as prepared for the 2016 Port Future Study to capture the main cost implications. The concept is for an offshore island port that can be expanded over time to 10 million TEU per year, if required. Capacity and costs have been scaled back to 5 million TEU, more than needed for the forecast freight task of 3.8 million TEU in 2079. The theoretical footprint is based on productivity assumptions at the berth and the yard, aligning with the high productivity of modern container terminals.

A new road connection would be needed, likely a four-lane road from the Mill Road area with a bypass of Clevedon, with an improved connection from Mill Road to the Southern Motorway. A new rail line, connecting from the North Island Main Trunk, would traverse some complex topography near Kawakawa Bay that would require some high-cost tunnelling.

Figure 11 A new port on the Firth of Thames – potential sites (concept only)



Source: Black Quay

5.2.5 A new port on the Manukau Harbour

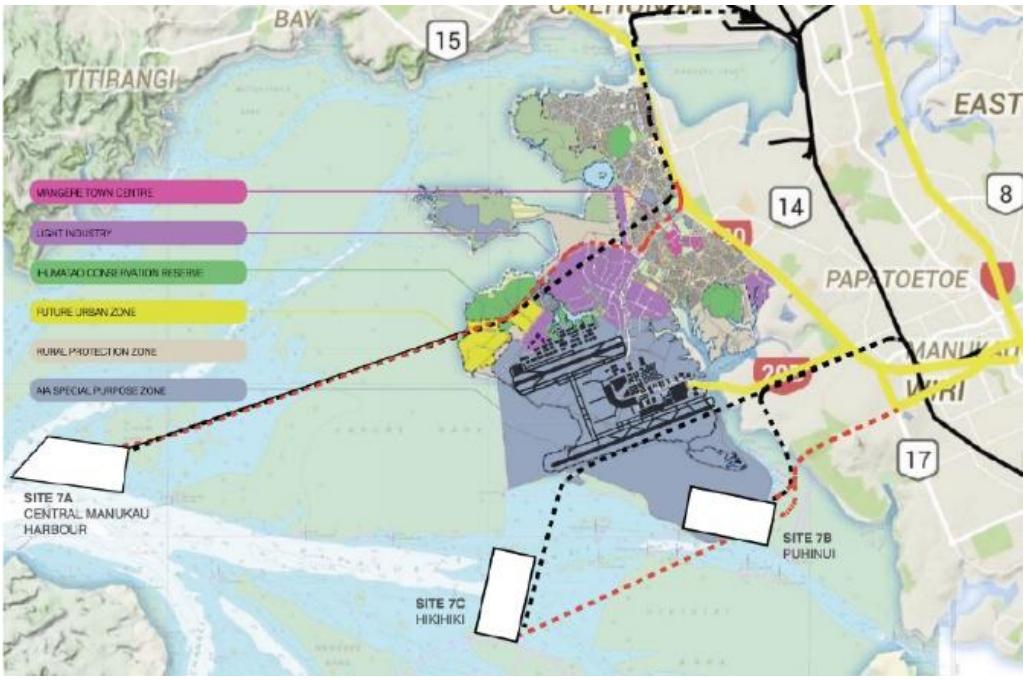
This option involves building a new port on the Manukau Harbour to accommodate the POAL future freight task. The location is based on the 2016 Port Future Study, which identified three sites with potential for an offshore island port connected by a marine bridge, as

Figure 12 shows. The focus here is on the Puhinui site, as being reasonably representative of the costs involved. It is likely that the sites located further offshore would incur a higher construction cost, for example, for longer marine bridges. However this would be offset by being closer to the natural channel inside the harbour, compared with Puhinui, which is closer to the east shore, and so requiring a large amount of upfront dredging in the inner harbour. Dredging channel through the entrance bar would be necessary.

Port planners Black Quay revisited the Manukau Harbour concept, as prepared for the 2016 Port Future Study, and reconfirmed that, in their view, it is feasible in principle as a new port, and potentially offers the best location. The close proximity of Manukau Harbour to the existing industrial area and distribution centres of South Auckland and to road and rail networks means that freight costs would likely be lower than other options. The expansion potential and ability to phase development would secure future port capacity needs for the Upper North Island. The concept is for an offshore island port that can be expanded over time to 10 million TEU per year, if required. Capacity and costs have been scaled to 5 million TEU, more than needed for the future freight task.

There is a perception that weather events and the bar at the Manukau Harbour entrance could make access uncertain. In Black Quay's view, shipping access to the harbour is a sound concept, taking into account that modern vessels likely to use a new port in the Manukau Harbour are significantly more advanced and manoeuvrable than those in the past. Tugboats could be stationed to escort ships through the entrance as a safety measure, if needed, and this is not uncommon at ports worldwide.

Figure 12 A new port on Manukau Harbour – potential sites (concept only)



Source: Black Quay

A further factor that has been raised is the sedimentation of the dredged channel. While maintenance dredging would be required, sediment flow modelling prepared for this study suggests that a dredged entrance channel would be achievable and stable, with annual dredge volumes being comparable with other ports around New Zealand. With respect to this future state, an indication from a marine insurance underwriter is that, in this future scenario, it is unlikely that insurance considerations would be a barrier for shipping access.

Shipping line representatives concluded that they would prefer a new port on the Firth of Thames, however a container port on the Manukau Harbour could work well for shipping routes from Australia and Asia. Ultimately, shipping lines will call where the main ports are located, while preferring to take the lower cost option, where available.

5.2.6 Conclusions about port capacity

Whether an option can future proof the Upper North Island supply chain, by providing long-term capacity to accommodate the future freight task, can be seen as a gateway test. Given the scale of investment and the long-lived nature of port assets, the test used here is a minimum of 60 years of capacity to handle the current and forecast POAL container freight volumes. Ideally, a port option would still have clear capacity to expand thereafter. To put this timeframe in perspective, the Ports of Auckland has been in its present location for approximately 180 years.

The primary benchmark used here is the capacity to accommodate approximately 3.8 million TEU per year in 2079, based on the medium growth freight forecast, referred to as the calibrated forecast.

Neither Northport nor the Port of Tauranga, on their own, can provide sufficient capacity to accommodate the long-term, 60-year freight task. A shared increase in capacity at Northport and Port of Tauranga could accommodate the freight task at 60 years, at which point these ports would likely be at, or near, full capacity with little or no room to expand. There would have been considerable investment into building a scaled-back container port at Northport that does not provide sufficient additional long-term capacity, relative to POAL on the Waitematā Harbour, while being further away

The new port options, on the Firth of Thames or the Manukau Harbour, would have sufficient capacity for the long term. Following modern planning principles, the design would be a littoral island port (i.e. close to shore) that allows capacity to be built in stages, expanding as needed.

There will always be some uncertainty with forecasts of freight volumes into the long term. The conclusions here attempt to balance evidence of capacity with risk, with the focus on avoiding being caught out with insufficient port capacity after making a decision that involves considerable long-term investment and is likely to be irreversible in nature.

5.3 Schedule of landside infrastructure

The road infrastructure requirements were identified by using regional traffic models to determine the impacts of the port-related traffic on the road network. Each port option is assumed to require a four-lane road (two lanes each way) to separate truck traffic and other vehicles. Road projects for existing ports are treated as being brought forward, rather than wholly new costs, with the estimates derived from business cases. Road connections for the new ports are treated as new costs that would not otherwise occur and were estimated by benchmarking against comparable projects elsewhere.

The rail infrastructure requirements for the existing port options were based on rail capacity model, with high-level cost estimates being prepared with specialist input. The rail alignments and network connections needed for the new port options were developed and costed by rail engineers.

Table 8 Summary of landside infrastructure projects

Option	Road infrastructure	Rail infrastructure
Northport	• Additional works along SH1 between SH15 and Te Hana are likely to be required, with safety improvements. • Corridor widening and rerouting at the Brynderwyn Hills would be needed and is treated as being brought forward. • SH1 Warkworth to Wellsford project is assumed to be brought forward.	• Capacity additions on the North Auckland Line (rail loops). • Construction of: – the Marsden Point spur – a third main line from Swanson to Avondale, – a new line from Avondale to Southdown.
Port of Tauranga	• Additional works on SH1/ SH29 from south of Cambridge to Tauriko are likely to be necessary and are treated as being brought forward. • Additional works at the SH2/Dive Crescent interchange, adjacent to the Port operations at Sulphur Point.	• Capacity additions (rail loops) on: – the East Coast Main Trunk – the North Island Main Trunk (Whangamarino). • Construction of a fourth main line from Westfield to Pukekohe.
Northport and Port of Tauranga	• Additional works assumed to still be brought forward for traffic increases.	• Capacity additions scaled back to match each port's share of freight task.
Firth of Thames	• A new roading link from Mill Road to the Firth of Thames site will be required, with a bypass of Clevedon. • An improved connection from Mill Road to the Southern Motorway is also likely to be necessary.	• Construction of a new line to a new port on the Firth of Thames, connecting from the North Island Main Trunk.
Manukau Harbour	• A new arterial standard roading link from Roscommon Road/Wiri Station Road is assumed to be required. • An improved connection to SH20, in the form of an upgraded interchange at Lambie Drive.	• Construction of a new line to a new port on the Manukau Harbour, connecting from the North Island Main Trunk.

5.4 Summary of infrastructure costs

Cost schedules for port, rail and road infrastructure for each option were prepared as an input into the cost benefit analysis. Figure 13 and Table 9 summarise the estimate of infrastructure costs (in real terms) for each option, split out by port, rail and road infrastructure. The road costs for existing ports are treated as being brought forward, under the assumption they would otherwise occur later. The figures on the left are for the calibrated freight forecast and those on the right are for the officials' agreed forecast.

Figure 13 Summary of infrastructure costs by option

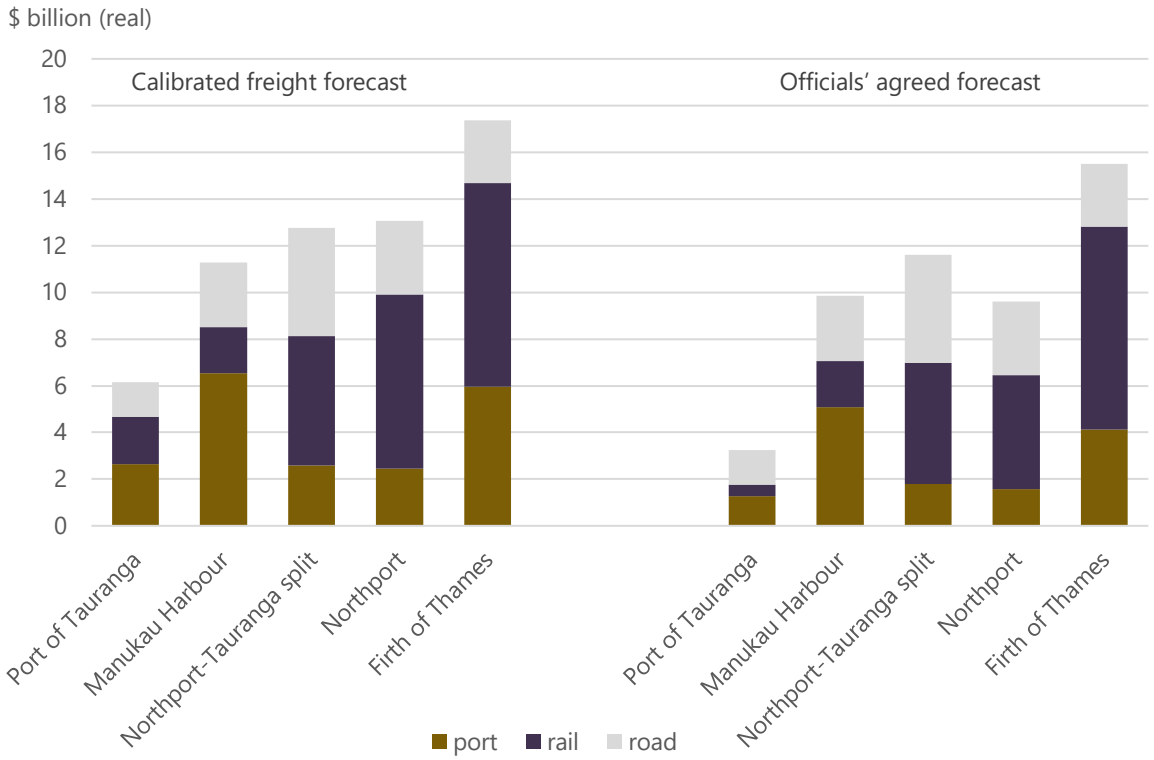


Table 9 Summary of infrastructure costs by option (real, 2019, $b)

Option	Calibrated freight forecast				Officials' agreed forecast			
	Port	Rail	Road	Total	Port	Rail	Road	Total
Port of Tauranga	2.6	2.0	1.5	6.2	1.3	0.5	1.5	3.3
Manukau Harbour	6.5	2.0	2.8	11.3	5.1	2.0	2.8	9.8
Northport and Tauranga	2.6	5.5	4.6	12.8	1.8	5.2	4.6	11.6
Northport	2.5	7.5	3.1	13.1	1.6	4.9	3.1	9.6
Firth of Thames	6.0	8.7	2.7	17.4	4.1	8.7	2.7	15.5

Source: Sapere

5.5 Implications for phasing of costs

The following considerations have been used to inform the phasing of costs over time for the schedules of infrastructure costs. This approach has also informed the cost benefit analysis.

- It appears that the earliest that major new port capacity could be planned and built would be over a 10-year period from 2020. The assumption would be that a decision about the location of future port capacity is made immediately, with the time taken for the approvals process being 5 years (i.e. the lower end of the estimated range), and construction costs being incurred over the next 5 years.
- The latest that a decision could be taken about major new port capacity would be 15 years from when POAL operating capacity is reached. The above analysis suggests that this decision could be taken as late as 2033 or 2040, with the assumptions being that planning costs would be incurred over 10 years, followed by construction costs over the next 5 years. A delayed decision is not without risks, for example, in that the trigger point may not be obvious at the time, or that the timeframes for the approvals process and construction phase turn out to be materially longer than expected.

The following timeframes have been used for the phasing of costs in the infrastructure schedules, following the principle of avoiding using best-case assumptions when planning for the long term.

- Upfront costs for planning and approvals allocated to the 2020s. These are spread evenly over the decade.
- Construction costs allocated to the 2030s, spread evenly over the decade, with the assumption being that new port capacity (or a new port) would be ready to be commissioned by 2040.
- Given the above timings, the avoided base case costs (i.e. in the counterfactual) are those that are scheduled to occur after the 2030s.

These assumptions are be applied to all options, for modelling simplicity and to enable comparability. There may be a case for assuming that existing ports could happen slightly earlier, given the estimation of a shorter timeframe for the approvals process, and this is explored as a sensitivity test in the cost benefit analysis.

6. Major analytical findings from the cost benefit analysis

This chapter summarises the key results of our analysis, which is designed to build upon previous analysis undertaken for the Working Group by EY in 2019. The focus of the chapter is the CBA findings, which we cast here in summary form.[8] Before outlining results, we briefly describe the relevant costs and benefits contained in the analysis. Results are structured as follows:

- top level or global findings (i.e. comparison across all options)
- sensitivity and scenario testing at global level
- comparison with Working Group results
- discussion on what results mean.

6.1 Taxonomy of costs and benefits aligns with previous work

The underlying model used to perform the economic analysis for the Working Group was made available to us. The model provided a high-level taxonomy of costs and benefits which we considered met the needs for this work. Given this, and the desire to compare results of this analysis with the Working Group's findings, we chose to use the same base cost and benefit categories.

Table 10 outlines the cost and benefit categories used. We reiterate that costs and benefits are economic in nature. That is, they reflect (as much as is possible) the monetary value of resources used in the respective activities, and include costs and benefits incurred/received by parties outside of those directly involved in activities. In other words, externalities are included in the analysis. In addition, we are interested in the incremental costs and benefits only (i.e. those costs and benefits that would not otherwise have occurred in the base case or status quo).

Further detail on the content components is provided in supporting papers including technical notes on the cost benefit analysis (Sapere Research Group, 2020f) and the reports of the seven analytic workstreams that support the economic analysis (see Figure 1 and references). While the ultimate responsibility for the analysis results rests with us, the reliance on expert input and collaborative nature of the data-gathering process is highlighted by the list of sources and contributors shown in the table.

[8] A supplementary technical paper (Sapere Research Group, 2020f)is provided outlining in more detail the approach, inputs, process and assumptions underpinning the summary results.

Table 10 Cost and benefit categories

Category	Impact	Content	Sources/contributors
Freight operations (Opex)	Road use, direct	Freight moving cost	Richard Paling Consulting
	Rail use, direct	Freight moving cost	Murray King & Francis Small Consultancy, KiwiRail
	Road use, indirect	Congestion, emissions, safety	Flow Consultants, Richard Paling Consulting
	Rail use, indirect	Emissions	Murray King & Francis Small Consultancy Ltd
Supply chain investment (Capex)	Port development	Planning, capital works and equipment costs	Advisian, Black Quay, Mitchell Daysh, ECoast
	Road investment	Planning, construction costs, distortionary costs to the economy from using the tax system to fund investments	NZTA, AT, AC
	Rail investment	Planning, construction costs, distortionary costs to the economy from using the tax system to fund investments	Rail Infrastructure Consultants, NAL business case, Kiwirail, Murray King & Francis Small Consultancy Ltd, AC
Land redevelopment	Net economic value of alternative use of Auckland site	Value from improved visual amenity and environmental protection (including the harbour) to ratepayers, non-market gains to consumers and producers of buildings on site, agglomeration benefits to businesses, improved recreational experience for users of park	AC, Panuku

6.2 All options result in net costs to society relative to the status quo; Manukau favoured

Table 11 shows that all the options to relocate freight operations from Auckland result in net costs to society. The Manukau (Puhinui) option results in the least cost to society: a net cost of around $2 billion in present value terms, while the Firth of Thames option would result in the greatest cost to society, of just over $7 billion.

The highest benefit-cost ratio (BCR) for the Manukau (Puhinui) option is 0.443, which means that the costs are roughly two and a quarter times the benefits. The worst performing option (Firth of Thames) has costs that are just over eight times greater than the benefits.

6.3 Low operating costs main reason why Manukau stands out

Clearly, there is more of a story to tell around the apparent lack of benefits or the preponderance of costs. Table 12 breaks down the costs and benefits across all options for the calibrated projection (i.e. the projection that results in the highest BCR).

The table shows that a major reason that Manukau stands out is the relatively low operating costs of that option. Due to its proximity to the current site for freight operations in Auckland, we observe that all relevant operating costs are lower than the status quo.

We also see that freight movement costs are highest for the Tauranga option, which is marginally above that for the split Tauranga/Northport option.

Predictably, the difference in port development costs between the 'new' port options and those for existing ports is very clear. Similarly, there is a noticeable difference in costs for options with existing rail accessibility (i.e. Tauranga has existing rail access and Manukau is close to rail services) and the other options where either new investment or upgrades to existing infrastructure, or both, is required.

Overall, the Tauranga option has the lowest capital costs due to the positive state of the existing port and rail facilities. We note however, that some of the additional costs for capital works relating to the airfield, marina and highway around the current Tauranga site were not subjected to as rigorous an estimation process as the other capital costs.

6.4 Land redevelopment benefits uniform across options; Manukau and Firth of Thames have additional benefits

There is uniformity of land redevelopment benefits across all the options. The same assumptions around the economic value of alternative land use apply to all options (e.g. direct use benefits from parkland, non-market gains to consumers and producers of the apartment and business buildings, wider amenity gains from visual improvements and resource protection and agglomeration effects of better effective density due to the CBD location). While the absolute value of the land redevelopment benefits is equal across options, the impact on the BCRs differs due to the divergence in costs for each

option. Further detail on the composition of land redevelopment benefits is contained in section 7 below and a supporting paper on alternative land use.

In addition, the aforementioned beneficial impacts on road and rail use, transport safety, emissions and traffic congestion for Manukau and the benefits associated with reduced traffic congestion for the Firth of Thames option means these two options have greater total benefits than the other options.

Table 11 CBA results (PV, $m)

	Northport		Tauranga		Firth of Thames		Northport and Tauranga		Manukau	
	Officials	Calibrated	Officials	Calibrated	Officials	Calibrated	Officials	Calibrated	Officials	Calibrated
Total benefits	$957	$957	$957	$957	$1,009	$1,009	$957	$957	$1,384	$1,579
Total costs	$5,878	$7,209	$3,168	$4,661	$7,930	$8,303	$6,645	$7,804	$3,581	$3,561
Net benefits	-$4,921	-$6,252	-$2,210	-$3,703	-$6,921	-$7,294	-$5,688	-$6,847	-$2,197	-$1,982
Rank		3		2		5		4		1
BCR	**0.163**	**0.133**	**0.302**	**0.205**	**0.127**	**0.121**	**0.144**	**0.123**	**0.386**	**0.443**

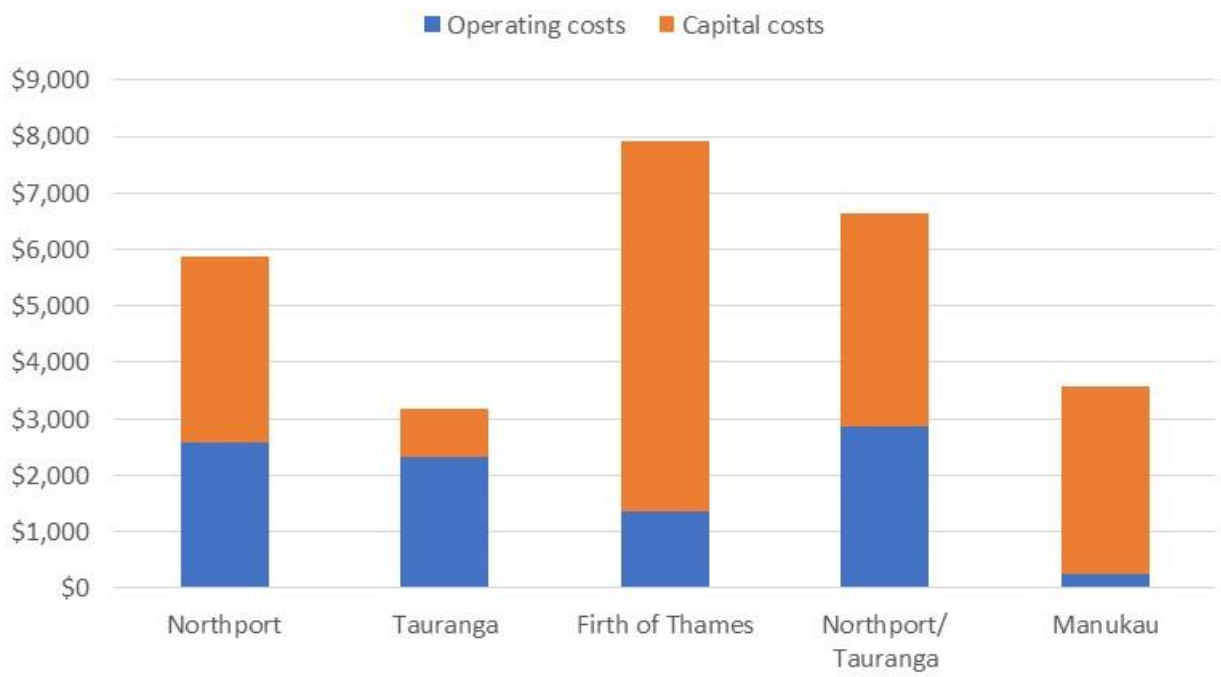
Table 12 CBA components, calibrated projection (PV, $m)

	Northport	Tauranga	Firth of Thames	Northport and Tauranga	Manukau
User costs: Rail	$881	$1,285	$459	$1,123	-$159
User costs: Road	$2,023	$2,010	$77	$2,124	-$314
Congestion costs	$104	$16	-$51	$60	-$127
Emissions costs	$188	$198	$31	$202	-$16
Safety costs	$105	$109	$16	$113	-$5
Deadweight costs	$565	$105	$941	$607	$802
Total operating costs	*$3,866*	*$3,723*	*$1,525*	*$4,229*	*$178*
Port Capacity Investment	$619	$430	$2,242	$599	$2,515
Rail transport investment	$2,099	$123	$3,403	$1,965	$2,741
Road transport investment	$626	$386	$1,132	$1,012	$325
Total capital costs	*$3,344*	*$938*	*$6,778*	*$3,575*	*$5,580*
Agglomeration benefits	$27	$27	$27	$27	$27
Amenity benefits	$919	$919	$919	$919	$919
Consumer welfare benefits	$9	$9	$9	$9	$9
Producer welfare benefits	$3	$3	$3	$3	$3
Total benefits	*$957*	*$957*	*$1,009*	*$957*	*$1,579*
Total costs	*$7,209*	*$4,661*	*$8,303*	*$7,804*	*$3,561*

6.5 Operating costs dominate for existing port options

The composition of total costs for all options is shown in Figure 14. The figure confirms the preponderance of capital costs for the 'new' port options, especially Manukau where capital costs are responsible for approximately 95 per cent of total costs. For the 'existing' port options operating costs account for a maximum of 80 per cent of total costs for Tauranga to a low of 18 per cent for the Firth of Thames.

Figure 14 Cost breakdown by option, Calibrated forecast (PV, $m)



Source: Sapere

6.6 Amenity gains to households dominate land redevelopment benefits; 'new port' options have additional operational benefits

The composition of total benefits is shown in Table 13 below. Clearly, the overwhelming majority of benefits arise due to amenity-based impacts from relocation of freight operations. These amenity benefits, described further below in the section on alternative land use, account for 96 per cent of total estimated benefits for the Northport, Tauranga and combined Northport/Tauranga options. The equivalent share for the Firth of Thames is 91 per cent, while amenity benefits account for 58 per cent of benefits for the Manukau option.

Table 13 Composition of benefits, Calibrated forecast (PV, $m)

	Northport	Tauranga	Firth of Thames	Northport and Tauranga	Manukau
Agglomeration benefits	$27	$27	$27	$27	$27
Amenity benefits	$919	$919	$919	$919	$919
Consumer welfare benefits	$9	$9	$9	$9	$9
Producer welfare benefits	$3	$3	$3	$3	$3
Rail freight movement benefits					$159
Road freight movement benefits					$314
Traffic congestion benefits			$51		$127
Emissions benefits					$16
Safety benefits					$5
Total	$957	$957	$1,009	$957	$1,579

Source: Sapere

Direct amenity benefits arise from the public being able to enjoy recreational activities (or the possibility of such) from development of parkland on the current site following relocation of freight operations. Indirect amenity benefits accrue to Auckland households who are in favour of the freight operations moving from the current site. In essence, this is the willingness-to-pay of these households for the freight operations to move.

We were unable to undertake detailed survey work to elicit estimates of these benefits, but applied analogous benefits estimates from studies overseas to the current situation:

- The $27 million in agglomeration benefits is essentially the productivity gain to businesses who locate on the former freight operations site, due to greater effective density and co-location possibilities.
- Consumer welfare benefits accruing to residents who live in the apartments assumed to form part of the redevelopment represent what is known as a 'consumer surplus.' This benefit was calculated by estimating the demand curve for the apartments and their likely sales prices and measuring the extent to which the willingness to pay for the apartments exceeds the price paid for them.
- A similar equation is estimated on the supply side to estimate the willingness of producers in this case developers and builders to supply apartments for less than the amount paid for the apartments.

The Firth of Thames and Manukau 'new port' options both give rise to traffic congestion benefits, while the Manukau option also sees benefits, relative to the status quo of avoided operating costs including externalities (i.e. safety, emissions, traffic congestion). In total the reduced operating costs account for 39 per cent of total estimated benefits for Manukau.

6.7 Environmental and transport safety externalities

The public are reasonably concerned with the environmental and transport safety impacts of major developments. The current economic analysis includes externalities including road and rail greenhouse gases and air pollution and road safety for truck road use based on truck vehicle kilometres travelled (Sapere Research Group, 2020f). These analyses focus on operational externalities – "capitalised" externalities such as embedded GHG emissions in port construction cannot be estimated on the high-level concept plans for each option and would be part of detailed feasibility analysis of preferred options.

For comparison of the relative impacts between the current options under consideration, the following tables show the total addition emissions and road deaths and injuries over the analysis period (2020-2079). These volumes are monetised in the CBA as shown in Table 12.

- **Results for environmental emissions**: Table 14 shows the volume of environmental emissions in tonnes relative to baseline. Annualised the Northport and Tauranga options result in an additional 200-230 thousand tonnes CO2 per annum compared with a reduction of 13 thousand tonnes CO2 per annum for Manukau.

Table 14 60-year additional environmental emission relative to baseline (tonnes)[9]

	Northport	Tauranga	Firth of Thames	Northport and Tauranga	Manukau
Rail CO2	2,291,035	3,399,309	496,579	2,955,999	-74,487
Estimate Rail Last Leg CO2	401,670	708,736	406,127	585,910	-219,587
Truck CO2	9,388,863	9,765,522	1,417,589	10,103,669	-492,103
Truck NOX	27,806	26,968	4,157	28,507	-2,772
Truck PM10	1,106	1,086	158	1,144	-114
Truck CO	7,199	7,056	1,093	7,434	-710
Truck HC	874	846	140	897	-124

Source: Sapere

- **Road safety implications:** Table 15 shows the road safety impacts over the same period. Annualised the Northport and Tauranga options result in an additional 3 to 3.3 deaths per annum compared with a slight reduction for Manukau.

Table 15 60-year additional road safety incidence relative to baseline

	Northport	Tauranga	Firth of Thames	Northport and Tauranga	Manukau
Additional Deaths	181	189	27	195	-9
Additional Serious Injuries	496	517	75	535	-26

[9] The environmental analysis follows the NZTA Economic Evaluation Manual

Additional Minor Injuries	1,826	1906	276	1971	-96

Source: Sapere

Rail safety externalities have not been calculated because the current incidence is very low nationally and the incremental change due to the different port options will be insignificant.

6.8 Sensitivity and scenario testing show discount rate and timing most influential

We subjected the core results above to a range of tests, starting with the discount rate used. Recall that the recommendation of Treasury is to apply a discount rate of 6 per cent to analysis of the types of investment involved in relocation decisions of this kind. We test the effect of lower (i.e. 4 per cent) and higher (i.e. 8 per cent) discount rates.

We also test the effect of adding a 15 per cent contingency to capital costs. Finally, we test the sensitivity of results to timing changes. In particular, we: shorten the transition period for the relocation by reducing the construction time from 10 years to 5 and the time for full relocation of freight from 5 years to 2 (effectively bringing forward the move by 7 years).

Appendix B contains the details of results of sensitivity analysis for discount rate changes and the timing change as the remaining sensitivity tests were largely inconsequential.

6.9 Hastening the relocation of freight operations improves BCRs but worsens net benefits for all but the Manukau option

Table 16 presents the effects, using the calibrated freight forecast, of reducing the construction time for the port relocation from 10 years to five and the time for full relocation of freight from five years to two (effectively bringing forward the move by seven years).

The effect is to improve the BCRs but worsen the net benefits (rise net costs) across all options except Manukau, which sees net benefits improve slightly. Qualitatively, this is much the same effect as lowering the discount rate. The explanation for such effects is similar: benefits rise proportionally more than costs (lifting the ratio of benefits to costs). However, the size of costs means that, in absolute terms the effect of the lower proportional change in costs essentially swamps the rise in benefits, leading to a worsening of net benefits to society for all but the Manukau option.

Focussing again on the Manukau option we see that benefits rose by around 39 per cent while costs rose by around 17 per cent. Net benefits rise by around 2 per cent, while the BCR improves by about 20 per cent.

Table 16 CBA sensitivity results for shortened construction and transition, Calibrated forecast (PV, $m)

	Northport		Tauranga		Firth of Thames		Northport and Tauranga		Manukau	
	Core	Quicker	Core	Quicker	Core	Quicker	Core	Quicker	Core	Quicker
Total benefits	$957	$1,375	$957	$1,375	$1,009	$1,441	$957	$1,375	$1,579	$2,191
Total costs	$7,209	$8,970	$4,661	$6,001	$8,303	$9,682	$7,804	$9,785	$3,561	$4,134
Net benefits	-$6,252	-$7,595	-$3,703	-$4,626	-$7,294	-$8,241	-$6,847	-$8,410	-$1,982	-$1,943
BCR	**0.133**	**0.153**	**0.205**	**0.229**	**0.121**	**0.149**	**0.123**	**0.141**	**0.443**	**0.530**

Table 17 CBA sensitivity results for shortened construction and transition, Officials' agreed forecast (PV, $m)

	Northport		Tauranga		Firth of Thames		Northport and Tauranga		Manukau	
	Core	Quicker	Core	Quicker	Core	Quicker	Core	Quicker	Core	Quicker
Total benefits	$957	$1,375	$957	$1,375	$1,009	$1,441	$957	$1,375	$1,384	$1,961
Total costs	$5,878	$7,400	$3,168	$4,242	$7,930	$9,190	$6,645	$8,360	$3,581	$4,103
Net benefits	-$4,921	-$6,025	-$2,210	-$2,867	-$6,921	-$7,749	-$5,688	-$6,985	-$2,197	-$2,142
BCR	**0.163**	**0.186**	**0.302**	**0.324**	**0.127**	**0.157**	**0.144**	**0.164**	**0.386**	**0.478**

6.10 Real options approach has potential to alter results but quantitative modelling not possible in timeframe

Port capacity decisions contain considerable uncertainty.[10] It is very difficult to attach probabilities to the possibility of particular events happening, such as COVID-19; changes in market or consumer sentiment and relevant technology (e.g. the effect of containerisation has been monumental but was not predicted). This feature distinguishes uncertainty from risk.

Port capacity and/or location decisions are generally expensive and irreversible. Analytical methods drawing on Discounted Cashflow (DCF) techniques and associated present value calculation are a key component in investment decision-making, often through the use of cost benefit analysis.

The effect of using such techniques is that decisions are made at a particular point in time, in a yes/no manner based on information available at the time. While that information can be risk-adjusted, it is still a guess as to what the state of information is likely to be in the future.

If new information emerges after the project has begun, that information could be useful to inform the investment decision, but only if there is an opportunity to use the new information (e.g. if investments are staged and later investment decisions can be confirmed some time after the project has commenced). This is the so-called "real option" which is a derivative of a financial option that involves "the right but not the obligation" to buy/sell an instrument at a specified price and time.

For various reasons, this staged decision-making process is not necessarily the norm, so it is not possible to beneficially exploit new information in investment terms once that information is known (i.e. the real option is lost).

In general terms, relying solely on the information that is available at a point in time to make investments that are complex and expensive (e.g. infrastructure), could be sub-optimal. For this reason, decision-makers behind a new port or large port would likely combine DCF analysis with some level of discussion around the project's "real options".[11] Real options can take several forms:

- The option to expand or downsize a project in response to changing demand – a staged or modular approach creates options to expand or contract in the light of information emerging after commencement.

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[10] Uncertainty refers to a situation where an event is imaginable, but its probability is unknown—a 'known unknown' in the words of Donald Rumsfeld. In contrast, risk refers to a set of possible outcomes with known probabilities attached. The critical difference between risk and uncertainty is that risk can be insured against; whereas insurance is more difficult, if not impossible, with uncertainty. The inability to insure against uncertainty makes it more damaging from the point of view of the firm. More specifically, for valuation purposes we refer to Knightian risk and uncertainty, being that 'risk' is randomness with known probability distributions and 'uncertainty' is randomness with unknown probability distributions. (LeRoy, Stephen F., and Larry D. Singell. "Knight on Risk and Uncertainty." *Journal of Political Economy* 95, no. 2 (1987): 394-406)

[11] The Real Options approach is recognised in the Ministry of Transport's analytical framework for decision-making. The framework acknowleges the usefulness of a real options approach for decisions with high uncertainty but where better information may become available, for irreversible investment opportunities with longer horizons, for projects that can be structured into multiple stages with opportunities after each stage to continue, alter or delay. < https://www.transport.govt.nz/multi-modal/keystrategiesandplans/strategic-policy-programme/real-options/>

- The option to defer investment – If demand is uncertain the decision maker can exercise the option to defer the project until the uncertainty is resolved, to avoid committing to potentially redundant investment if demand turns out to be low.
- The option to abandon or temporarily shut down staged investment – If new information indicates lower demand than first thought, the decision maker can exercise the option to abandon or mothball future stages of the project.
- The option to switch the way demand is met – It is worth trying to keep open the option of changing a project to take advantage of new technology or information that may become available.

Each of these options – expansion, downsizing, deferral, abandonment and modification – adds value to a project by allowing decision makers to exploit upside opportunities (e.g. project expansion) while limiting downside losses (e.g. abandon or downsize). Indeed, some projects that would fail an up-front DCF analysis (equivalently have a BCR less than one) may go ahead when real options are considered, where there is flexibility to manage the downside.

Formal modelling of the value of options has shown that these options can be more significant than the NPV of the project itself. It is not always necessary to explicitly model real options, but it can be useful to reflect on how they can change the economics behind whether to invest in a project or how to stage it.

In the time available to complete this work, quantitative modelling was not feasible. We can, however, apply the lessons from available literature to the decision at hand.

6.10.1 Qualitative, high-level assessment of real options suggests 'new port' options favoured

There are four broad lessons from the options literature that we think are useful for this analysis:

- doing nothing may not always be harmful – if delaying resolves uncertainty, then the value of waiting may exceed the costs
- multi-stage projects increase the possibility that new and valuable information comes to light
- policy or regulatory uncertainty can destroy value
- partial or full public ownership often results in earlier and larger investments in port capacity.

On the face of it, viewing the alternative candidates for relocation of Auckland's freight operations through a real options lens would tend to favour 'new port' options, as:

- they appear amenable to staging (i.e. it is not necessarily a one-shot game) as the opportunity cost of delay may not be as material as it would be for the existing ports who have stakeholder demands and existing clients to satisfy
- any ownership issues can be determined on a 'clean sheet' basis and policy certainty enhanced in a more manageable way
- they already contain an inherent delay, due to planning, consenting and design requirements.

7. Alternative land use at POAL

If the POAL site is vacated, it is highly likely that the site will be redeveloped. Work by Warren and Mahoney, undertaken to inform the 2019 study, suggested that the site could be used for a mixed-use development, including residential, hotel, commercial and retail uses, as well as significant area set aside for public space.

Our approach builds on that work by Warren and Mahoney, which is considered sound and reasonable. We apply the following assumptions for this study. These assumptions have informed several elements of this work, including the traffic modelling and land value estimates.

Table 18 POAL redevelopment land-use assumptions

Category	Gross floor area or apartments	Employees or residents
Residential	5,800 apartments	11,600 residents
Commercial	227,500[2]	11,380 employees
Hotel	600 rooms	included above
Retail	20,200m^2	2,525 employees

Source: Warren and Mahoney (2019); adapted by Flow and Sapere

This section starts with a description of the derivation of amenity values from more general alternative land use in Auckland (i.e. not having freight operations on the existing site). We have used these values as a proxy for social licence effects. We then examine the traffic impacts of the proposed alternative land use more specifically.

7.1 Relating social licence to amenity from alternative land use

Social licence to operate is a broad concept, only relatively recently appearing in New Zealand.

The concept of social licence to operate (SLO) appears to be at the heart of the desire to relocate freight operations from their current site on the Waitematā Harbour. Sometimes called 'licence to operate' or just 'social licence', it emerged out of the need for the mining industry to recover its reputation after a series of highly publicised environmental disasters and the community conflict that followed, in the mid-1990's. SLO first appeared in New Zealand literature and media in 2012 (Edwards & Trafford, 2016).

There is currently a lack of clarity around what exactly SLO means and what its characteristics might be.

Edwards and Trafford (2016) state that a common theme around what it means to have a SLO in relevant industries (e.g. mining, forestry, agriculture, aquaculture, gas and oil) is broad – ongoing local community and stakeholder approval or social acceptance of the activities of a corporation. Notwithstanding the difficulty describing in exact terms what having a SLO means, the emerging

importance of the concept demonstrates the concern that society has for how our resources are developed and used.

Some components of SLO include the following (Boutlier, 2014):

- perceptions of legitimacy, credibility and fairness
- trustworthiness
- general acceptance of a project or activities
- quality and quantity of contact with organisation undertaking relevant activities
- impacts on environmental and social infrastructure

SLO can be both tangible and intangible. In relation to the former, approval or opposition expressed by a community can be felt in significant ways, while the intangible element arises because SLO is not like a legal permit or authority to undertake activities (Edwards & Lacey, 2014).

In a New Zealand context, a review of SLO found that most New Zealanders want economic growth but at the same time they want to protect the environment as this underpins their quality of life. This result holds even if it comes at the cost of slower economic growth and jobs (Sustainable Business Council , 2013). The authors state that:

> New Zealand consumers want business to focus on social and environmental performance, as well as profit, and say they will switch products and services if they found that a product or service was having a negative effect on the environment, people, society or otherwise behaving unethically.

Finally, the paper highlights that New Zealanders' think that the environmental issues most in need of addressing to live up to our overseas marketing messages (i.e. where they see potential SLO issues arising internationally) are associated with:

- water quality of lakes, rivers and coastal areas
- farm run-off
- waste disposal
- mining impacts on national parks and forests.

7.1.1 Relevance of SLO to current study is through amenity values…

On the face of it, there may be questions around the relevance of SLO to freight operations of POAL on the Waitematā Harbour. There has not been an environmental disaster in recent memory, nor any strong sense that POAL has acted in a manner that is inconsistent with the requirements to maintain SLO.

However, there is some, perhaps additional dimension that means social licence is relevant to the freight operations where they currently are in Auckland. A survey conducted in June 2019 for the Working Group showed that up to 72 per cent of Aucklanders surveyed would prefer Auckland's cargo

port to move to a new location.[12] By implication, 28 per cent of Aucklanders surveyed would prefer that Auckland's cargo port remain where it is (Colmar Brunton , 2019).

Clearly there is some support across Aucklanders for the relocation possibility. The contention here is that this support is grounded in notions of SLO. More particularly, this characterisation of SLO can be represented in terms of costs and benefits.

The dimension that most fits for the current analysis is that of amenity value, which could be described as the characteristics that influence people's appreciation of a particular area. In blunt terms, the port could currently be seen as an eye-sore whose activities consume the harbour and act as a barrier between the city and waterfront.

Removing freight operations would effectively switch the amenity value from being negative currently to positive in future. Thus, it is possible to include SLO considerations in the current analysis by reference to possible amenity values.

7.1.2 ...but directly applicable values not available; inference used based on analogous figures in literature

Unfortunately, there are no 'off the shelf' amenity value figures relevant to freight operations at a New Zealand seaport that we can draw on. In the absence of directly applicable values, we looked to the literature for examples where analogous values had been calculated.

Table 19 contains a summary of the most relevant articles we were able to source.

Table 19 Summary of relevant studies valuing externalities

Source	Topic area	Finding
(Sal Salazar & Garcia-Menendez, Port expansion and negative externalities: a willingness to accept approach, 2016)	Negative externalities borne by local residents from port expansion (Valencia, Spain)	Median willingness-to-accept the consequences of port expansion of €121.66 per annum per household
(Sal Salazar & Garcia-Menendez, 2005)	Non-market benefits of an urban park (Valencia, Spain)	Residents closer to the park derive benefits that are 44 per cent greater than those residents with lower proximity
(Fleming & Ambrey, 2011)	Valuing scenic amenity using life satisfaction data (Australia)	Willingness-to-pay of AUD$12,000 per household per annum to obtain a one unit improvement in scenic amenity

[12] The survey showed that 55 per cent expressed a preference for the cargo port to be moved, while 17 per cent were not sure whether they would prefer the cargo port to be relocated. We have combined those two totals to derive the 72 per cent figure.

Source	Topic area	Finding
(Fransico, 2010)	Valuing aesthetic (i.e. visual) improvements (Philippines)	Households are willing to pay US$29-US$32 on a one-off basis to remove billboards
(Sal Salazar & Garcia-Menendez, 2003)	Valuing the environmental improvements of redeveloping port areas for recreation purposes (Castellon, Spain)	Mean individual willingness-to-pay of 7,475 pesetas
(Giacarria, Frontuto, & Dalmazzone, 2016)	Valuing externalities associated with energy infrastructures (Piedmont Region, Italy)	Mean willingness-to-pay per individual of €1,148

The port expansion study by Saz-Salazar and Garcia-Menendez (2016) identified the following problems perceived by residents as a result port expansion or operations:

- visual impact
- land reclamation
- land reclaimed from the sea
- nuisances affecting nearby residents (e.g. noise, pollution, congestion).

Of particular interest to this study is the finding that the most important concern for survey respondents in that study is the 'reclamation of land from the sea' problem. Unfortunately, their empirical estimates of willingness-to-accept negative externalities from port expansion is not disaggregated by the type of problem.

Other notable findings from the studies are that:

- the main approach used is contingent valuation, to elicit willingness-to-pay (WTP) or willingness-to-accept (WTA) measures
- results are highly sensitive to survey methods and models used, raising concerns around generalisability
- the ability to control for well-known potential biases is mixed
- the results of the studies are a contribution to a growing area of research, rather than the final word
- relevant values (either WTP or WTA) are non-linear with respect to incomes and proximity to the activities or proposal under study.

While acknowledging these caveats, we see merit in attempting to translate findings to the current enquiry.

7.1.3 Port-related studies most relevant, supplemented by scenic amenity insights

Of the studies in the table above, two are port related. Both studies are by the same authors, for port expansion in Valencia and redevelopment of dockland areas for recreation purposes in Castellon. The

former study uses a WTA approach while the other uses a WTP approach. These studies provide a range for the monetisation of greater amenity.

We start with initial values of 7,475 Spanish pesetas (in 2003) for the WTP of individuals over 18 for redeveloping dock land for recreation purposes and €121.66 per annum per household WTA (in 2016) for port expansion. Using available income growth figures and purchasing power parity exchange rates we were able to convert these amounts to New Zealand dollar equivalents in 2019.[13]

We then aggregated these household estimates by applying the values to Auckland on a relevant household basis, by using the total estimated number of households in Auckland multiplied by the share of Aucklanders who preferred the freight operations to move. Based on census data, for 2001-13 we assume a constant annual growth rate for household numbers in Auckland and project that out 60 years. We then calculate the present value of the stream of calculated benefits to arrive at figures for the possible benefits felt by Aucklanders as a result of relocation of freight operations. These figures sum the values from 2045, as that is the year after no further freight operations will take place as modelled in the analysis.

7.1.3.1 Non-use amenity benefits could be $820m-$1 billion in present value terms; we use mid-point in CBA

Table 20 shows that the present value of potential amenity benefits that could accrue to Auckland households would lie in the range $820 million-$1,007 million.

Table 20 Key parameters for estimating amenity value range

	Low	High
2019 NZD values (Household WTA or WTP)	$310.13	$380.81
Total number of households in Auckland	540,000	540,000
Proportion of Aucklanders who want freight port to move	72%	72%
Relevant households who will derive benefit (2019)	388,800	388,800
Average annual growth rate of HH's 2001-2013 (Census data)	1.7%	1.7%
Undiscounted total amenity value from 2045	$12,601m	$15,473m
Present value total amenity value from 2045 (6% discount rate)	**$820.2**	**$1007.1m**

Given the nature of the method used and the subject matter of the proposal, it is possible that such amenity benefits could arise prior to the modelled date when operations cease. That is, just knowing that operations are going to cease may result in benefits to households once the announcement is made. If we assume an announcement is made in 2020, then the present value of amenity benefits

[13] https://databank.worldbank.org/indicator/NY.GDP.MKTP.CD/1ff4a498/Popular-Indicators#

https://coinmill.com/ESP_EUR.html#ESP=13472

would fall in the range of $2.8 billion-$3.4 billion. If benefits accrued in this manner, the BCR for Manukau would be above one in value.

We note that these figures treat Auckland households as homogeneous (i.e. proximity to the harbour site is not factored into the analysis). We also assume, for consistency purposes, that individuals under the age of 18 are not relevant to the valuation as was the case in the other studies.[14]

While an approximation only, we are comfortable that the values estimated give a broad sense of the potential amenity benefits relevant to freight operations removal from the current site.

For the purposes of the CBA, we have used a mid-point value of around $914 million in present value terms for the social licence/indirect amenity value benefit. This figure is added to the $5 million in direct amenity values to derive the total amenity value benefit of $919 million presented earlier in the report. To this value we add the agglomeration benefits to business productivity and the non-market gains to consumers and producers to estimate total economic benefits from alternative land use.

7.1.3.2 Using Australian figures on scenic amenity value raises potential benefit to over $2 billion; viewed as implausible

For the sake of comparison, we used the same basic calculation method for the Australian WTP value in 2011 of $12,000 per household for a one-unit improvement in scenic amenity (e.g. from very low to low, or from low to medium). After inflating that value to 2019 terms and applying across estimated relevant households in Auckland in 2045 we generated a figure of **$2.046 billion** in present value terms for potential amenity value benefits. If this value was used, the Manukau option would have a BCR above one in value.

This is essentially a one-off, single year estimate as the one-unit improvement is not expected to accrue each year. Assuming that households would benefit as soon as the announcement was made, this present value figure is estimated to be $5.769 billion, which would mean both Manukau and Tauranga options had BCRs over one in value.

In our view these estimates are highly questionable. The approach requires Auckland households to be willing to pay what is in effect over 10 per cent of average household income for the year-ended 30 June 2019 (i.e. average household income was $120,381) in a single year. Such an amount seems to us implausible, given the availability of scenic amenity in the immediate vicinity of the current site and the harbour more generally. Such figures are more illustrative rather than instructive.

[14] Thus, the individual amenity value estimated was multiplied by two to get a household value, based on the average size of an Auckland household being three and the share of the Auckland population aged 18 and under being around a third. https://www.stats.govt.nz/tools/2018-census-place-summaries/auckland-region

7.1.4 Offsetting effects at other ports not factored into analysis due to unique features of Auckland site

Given the estimates used in this part of the work draw on studies estimating the WTA port expansion and/or WTP for redevelopment of dock land areas, it is natural to question whether the communities in the regions where relocation might happen have offsetting impacts.

That is, while Auckland households might gain from having the harbour site used for purposes other than a port, in regions such as Northland and the Bay of Plenty, households might not be as willing to accept port expansion. In other words, there is no net benefit to society as a whole because relocation merely transfers costs to other regions.

We make two related points that support a view that there are real benefits from a move and not a transfer as such. The first is that we are using port expansion or dock land redevelopment as a form of proxy for amenity, which is itself a proxy measure for social licence.

Expansion is an incremental concept whereas cessation of freight operations completely is a binary concept. In our view, there is likely to be a significant difference between the two concepts that makes precision difficult, especially in the time available for this work. Further, in the case of redevelopment of former dock land, that is either not feasible or desirable in the alternative port locations.

The second, perhaps more important point is that the current site is in the heart of Auckland's CBD with significant foot traffic with the Waitematā Harbour often referred to as 'the jewel in Auckland's Crown.' The current port sites in Northland and Bay of Plenty do not share the same characteristics as the existing Auckland site; it is unlikely that there would be the same sentiment towards the current port sites in those regions. Similarly, the proposed Manukau and Firth of Thames sites would not seem to be held in as high regard.

On balance, we consider that while the prospect of offsetting costs to other locations is a theoretical possibility, in reality we are probably on safe grounds in not including such potential costs in the analysis.

7.2 Modelling congestion impacts

Two redevelopment scenarios were tested to determine the traffic generating potential, relative to the base case where the POAL freight activities remain at the current location.

- The first scenario is one in Table 18 above (i.e. with 5,800 apartments, and hotel, commercial, retail businesses for a total of almost 14,000 employees), sourced from the Warren and Mahoney 2019 study.
- The second scenario represents 50 per cent of this level of development without hotel development (i.e. 2,900 apartments, commercial/retail for a total of almost 7,000 employees).

These scenarios were tested using standard traffic models under two freight forecast scenarios, where, in the base case, port traffic activity increases in line with the calibrated freight forecast and the

Officials' agreed forecasts. The output takes the form of the number of vehicle movements and average speeds.

7.2.1 Congestion is unlikely to improve in the event of a move and may be worse

The results of the traffic modelling are shown in Table 21 below. The effect on the operation of the road network of a car or light goods vehicle is less than a large truck. Therefore, all vehicles have been converted to passenger car units (PCUs) using a standard factor of 2 or 3 for large trucks (with cars being 1 PCU). The model horizon extends to 2048 and results are show for that year.

The modelling indicates:

1. The total PCUs under the lower intensity redevelopment scenario *would be similar to* what would otherwise occur under the base case with the calibrated freight forecast scenario for POAL.

2. However, under the plausible higher intensity redevelopment scenario, the total PCUs *would be significantly greater* in number than what would occur under the calibrated freight forecast scenario for POAL. It should be noted that the higher intensity redevelopment scenario does not represent an upper bound for the level of redevelopment intensity that could plausibly occur.

These modelling results arise even with the assumption that significant proportions of residents and employees would be likely to travel by modes of transport other than the private car to and from this central Auckland site.

We acknowledge that traffic associated with the POAL operations are relatively consistent throughout the day, whereas traffic associated with the redevelopment scenarios will be more heavily concentrated toward the weekday morning and evening peaks.

7.3 POAL congestion effects may be unacceptable without shifting more freight to rail

Table 21 shows the growth in the number of trips (measured in PCUs) from the POAL site by 2048 compared to existing trips. The doubling in the number of trips from the POAL site over this time should be emphasised. While it may be possible for a greater proportion of freight to be carried by rail, if the POAL operations remain in central Auckland, freight trips by road will be considered as essential, and congestion for these essential trips may be considered to be unacceptable.

Table 21 also shows the further increase in traffic due to site redevelopment, including percentage changes relative to the base case in 2048. Again, this approximately doubles the total volume of traffic with, for example, a seven-fold increase in evening peak car traffic. The lower intensity development option slightly decreases the total traffic in this year, with increased car trips offset by decreases in truck trips.

Table 21 Movements from POAL site in passenger car units, in 2048 (PCUs per hour, two way)

Scenarios	Inter-peak PCUs			Evening peak PCUs		
	Cars	Trucks	Total	Cars	Trucks	Total
Existing (2020)	160	470	630	170	500	660
Base case (2048) (calibrated forecast)	320 (100%)	950 (102%)	1250 (98%)	340 (100%)	1030 (106%)	1370 (108%)
Redevelopment (higher intensity)	2170 (578%)	130 (-86%)	2300 (84%)	2450 (621%)	150 (-85%)	2600 (90%)
Redevelopment (lower intensity)	1090 (241%)	70 (-93%)	1150 (-8%)	1220 (259%)	80 (-92%)	1300 (-5%)

Source: Flow Transportation Specialists

7.3.1 Average traffic speeds would be lower

The results of these forecast flows associated with the POAL site have been assessed in the Auckland City Centre SATURN model. This model has a furthest horizon year of 2036, so this year has been used for the assessment. The ATAP assumption, that the grade separation of intersections along Grafton Gully (at The Strand and Alten Road) would occur has been included in the model.

Table 22 below summarises the average travel speeds in the Auckland City Centre under two redevelopment scenarios for the year 2036. By this year the general increase in CBD traffic will reduce average travel speeds between 18 to 27 per cent. In the event the site is redeveloped, increased congestion will further reduce CBD travel speeds. The key finding is that average travel speeds in the Auckland City Centre are likely to be lower under the higher intensity redevelopment scenario by 7 to 12 per cent than what would otherwise occur in 2036 under the base case.

The above speeds relate to the averages within the entire model, so the results may under-represent the extent of congestion in particular areas. However, the model outputs indicate the extent to which the higher intensity redevelopment scenario will lead to lower vehicle speeds in the city centre.

Table 22 Average Travel Speeds in the Auckland CBD, 2036 (km per hour)

Scenarios	Morning peak	Inter-peak	Evening peak
Existing (2020)	22.4	34.1	18.9
Base case (2036 calibrated forecast)	16.9 (-25%)	27.8 (-18%)	13.8 (-27%)
Redevelopment (higher intensity)	16.3 (-7%)	25.8 (-9%)	12.7 (-12%)
Redevelopment (lower intensity)	17.2 (-2%)	27.5 (-2%)	14.2 (-2%)

Source: Flow Transportation Specialists

8. Comparison with Working Group findings

In this chapter we investigate the divergence between the findings of this analysis and those of the Working Group. The purpose for this comparison is to allow decision-makers to understand the basis for the Working group report as well as where and why the current analysis departs from that work.

We acknowledge that the current analysis was at something of an advantage relative to that completed for the Working Group in terms of time and resource availability. In particular, the current analysis has access to:

- specialist independent capabilities in the traffic modelling, freight movement and supply chains, shipping logistics, port planning and engineering, resource consenting and environmental assessment
- agency inputs from AC, AT, NZTA, Kiwirail, on top of the Oversight Group members
- representatives of the Cornerstone Partners and other associated organisations (e.g. local government) both remotely and through site visits
- other relevant stakeholders such as shippers, freight forwarders and manufacturers of freight products.

8.1 The Working Group identified Northport as the preferred location; Tauranga the worst, Manukau not modelled

The Working Group considered scenarios presented in a CBA by EY (EY, 2019). Table 23 indicates that Northport is the only scenario where society is made better off, relative to the base case of freight operations in Auckland remaining at their current site. Specifically, benefits are twice the costs and society is better off by around $1.7 billion, in present value terms, over the 30-year analysis period.

The Tauranga scenario performs worst and would result in society being worse off by almost $3.2 billion in present value terms over the 30-year analysis period.

Of note is that no Manukau option was modelled, despite the results of the 2016 Port Futures Study highlighting that Manukau was the preferred location.

Table 23 Summary results of EY analysis, 2020 to 2050 (PV, $m)

	Scenario 2.1 - Full move to Northport	Scenario 2.2 - Full move to Tauranga	Scenario 2.3 - Full move to Firth of Thames	Scenario 2.4 - Full move to Northport and Tauranga
Total benefits	$3,464	$362	$553	$1,913
Total costs	$1,776	$3,526	$3,417	$3,370
Net benefits	$1,688	-$3,164	-$2,864	-$1,457
BCR	**2.0**	**0.1**	**0.2**	**0.6**

8.2 Comparisons at analytical level reveal key differences in characterisation of benefits and calculation of costs

For explanatory purposes we used detailed cost and benefit figures from the underlying model utilised by the Working Group (and ourselves) to compare respective estimates for the Northport option.[15] As indicated earlier, the Working Group did not model a Manukau option, so there is nothing to compare to. The remaining options perform relatively poorly in both analyses, so there is little to be gained from any comparison.

The key areas of comparison are as follows:

- road investment costs
- road user costs
- rail investment costs
- rates and leasehold income benefits
- economic costs of using the tax system
- alternative land use benefits.

In addition, there are other less material differences in the estimated values for traffic congestion, emissions and safety, all of which are closely related to differences in distances travelled.

8.2.1 The current study covers 60 years, while the Working Group report was for 30 years, so big differences to be expected

Table 24 contains the most basic comparison with the EY results. The table shows a difference of over $5 billion in present value terms between the estimated costs of the Northport option produced in this study versus the Working Group estimates.[16]

With estimated benefits diverging by over $2 billion, it is not surprising that the BCRs are substantially different. We examine the major reasons for this difference below.

Table 24 Comparison with Working Group findings for economic analysis of Northport (PV, $m)

Benefit/cost category	Sapere	Working Group/EY	Difference
User costs: Rail	$881	$262	$619
User costs: Road	$2,023	-$1,166	$3,189
Congestion	$104	-$99	$203
Emissions	$188	-$23	$210

[15] We note that the figures in the spreadsheet model do not coincide with those in the published report. We rely on the spreadsheet model as it is more detailed than the published report and is, to the best of our knowledge the most up-to-date source of cost and benefit data.

[16] Appendix A provides similar comparisons between the current and Working Group economic analyses for Tauranga, Firth of Thames and split Northport and Tauranga. The Working Group did not include the Manukau in its economic analysis.

Benefit/cost category	Sapere	Working Group/EY	Difference
Safety	$105	-$22	$127
Deadweight costs	$565	NA	-$565
Total operating costs	*$3,865*	*$262*	*$3,603*
Port Capacity Investment	$619	$644	-$24
Rail transport investment	$2,099	$933	$1,166
Road transport investment	$626	-$1,355	$1,981
Total capital costs	*$3,344*	*$1,577*	*$1,767*
Rates income benefit	NA	$313	-$313
Leasehold income benefit	NA	$412	-$412
POAL Dividend benefit	NA	-$147	$147
Agglomeration benefits	-$27	NA	$27
Amenity benefits	-$919	NA	$919
Consumer welfare benefits	-$9	NA	$9
Producer welfare benefits	-$3	NA	$3
Total benefits	-$957	-$3,390	$2,433
Total costs	*$7,209*	*$1,986*	*$5,223*
BCR	*0.13*	*1.71*	

8.3 Several other material differences:

We see other differences as follows:

- **Re-sequencing road infrastructure projects are counted by the Working Group as economic benefits, when they shouldn't be, eliminating $1.4 billion of claimed benefits**

  Avoided costs are a valid inclusion as a benefit in a CBA (Treasury , 2015). By avoiding costs, the resources that would have been consumed by undertaking a particular activity are available for use elsewhere. A common example is avoided illness costs of a health intervention: the where a preventive action reduces illness, that costs of that illness to the health system and/or individuals or society more generally that would otherwise have been borne are counted as benefits from the intervention.

  The EY analysis for the Working Group ascribed benefits to the ability to avoid costs of road infrastructure projects by delaying the projects due to the relocation of freight operations. It is not that the projects would not be needed at all as a result of the relocation, but that they would not be needed until later in time, resulting in cost savings. The time period used for the Working group analysis effectively meant that the entire costs of some roading investments was avoided (as the 're-entry' of costs subsequently fell outside the study period).

In our view, the best characterisation is of delayed costs rather than avoided costs. Normally, there may be some beneficial impacts in terms of the time value of money. That is, by avoiding expenditure in one time period, interest payments are avoided, or the money is able to be invested and earn a return until it is needed to be spent.

Similar arguments hold, but in the opposite direction, for projects that are brought forward as a result of the relocation. Neither bringing forward or pushing back projects should be counted in a CBA as effectively avoiding the costs entirely and hence the benefits counted by the Working Group (amounting to almost $1.4 billion over the 30-year period of their analysis) should not be.

In the context of the respective analyses, the current work departs from the EY work in that we do not find support for the notion of including benefits for road investment project deferral in our calculations. They are not avoided costs in an economic sense. We do, however, account for timing changes in the provision of infrastructure in our analysis, but only as it affects costs through the discounting process, though this is not separately specified (i.e. it is netted off from the relevant cost line item).

- **Mode share and composition of trip assumptions drive road user costs substantially apart; correcting inconsistent treatment removes $1.2 billion in benefits from Working Group findings relocation**

  The Working Group estimated that there would be road user cost savings from moving Auckland freight operations to Northport. The key to this finding is that the total distance travelled (i.e. vkt) would be lower for Northport than it is at Auckland presently. This distance is affected by mode share differences between the current situation and the Northport option, as well as the current length of trips from the Auckland site (i.e. the status quo) and from Northport.

  The Working Group used a weighted average truck trip distance for the Auckland status quo of around 81 kilometres. They also assumed a rail share of 6.5 per cent for the Auckland status quo. The combined effect of these two factors makes Northport more attractive as far more freight is transported using rail (70%), which reduces the effective total distance travelled by road per unit of freight relative to the status quo, leading to cost savings.

  Examination of the composition of the trips used to derive the 81-kilometre estimate indicated that a key driver of this figure was a 9 per cent proportion of road trips in the base case that were destined for Wellington. The basis for this destination was not able to be established.

  Furthermore, trip numbers in the Northport scenario were assumed by the Working Group analysis to be split evenly between Massey and Wiri. That is, the share of trips destined for Wellington (and indeed other locations around Auckland) effectively disappear and are re-routed to Massey or Wiri. The effect of this is to reduce the average trip distance as a result of relocation to Northport, relative to the status quo. Hence, benefits to road users arise.

  The current study modifies the calculations in two ways. Firstly, the proportion of trips destined for Wellington are removed and reallocated to other Auckland locations in both the base case and alternative. Secondly, trips in the Northport option are allocated to the same destinations as in the base case (i.e. rather than assume trips re-route to Massey or Wiri, trips are assumed to be destined for the same locations as in the base case).

The effect of removing the proportion of trips destined for Wellington is to reduce the base case trip distance to almost 21 kilometres. This 21-kilometre distance is above that estimated by specialist transport modelling, but is internally consistent, based on a conservative stance.[17]

The effect of reallocating trips in the Northport option on the same basis as the status quo locations for trips had a modest impact on the estimated trip distance form Northport, raising it by almost four kilometres per trip (i.e. from 150.5 kilometres in the Working Group analysis to 154.25 kilometres in the current study).

The adjustments were designed to be as close to the Working Group as possible, with the exception of the unsupported Wellington trip share, as well as being consistent and realistic. The combined effect is to add a total of around 64 kilometres to trips from Northport, relative to the base case.

As a result of these adjustments and an estimated rail mode share of 50 per cent estimated by freight experts, the cost savings estimated by the Working Group of $1.2 billion are reversed and additional costs of around $2 billion are estimated.

Ultimately, experts can disagree on what the best data and inputs are, and both the current and Working Group analyses rely on simplifying assumptions around the ultimate destination for freight in Auckland (regardless of where the freight enters New Zealand). The approach taken in the current work focusses on consistency, validity and a conservative bias.

- **Rail investment is underestimated in the Working Group analysis, including these costs add around $1 billion to costs**

  The rail line from Auckland to Northport would need significant upgrading, as well as a new spur line from Whangarei to Northport and the Working Group largely allowed for this. Relevant specialist opinion is that the allowance for the Avondale to Southdown line was too low and that an allowance for a third track alongside the section from Swanson to Avondale should be added, as well as the addition of passing loops on the line north of Auckland. On that basis, additional costs should be included in the analysis.

- **The current study included costs of using the tax system to fund investment ($565 million) which the Working Group did not, and the Working Group counted $725 million in benefits that are not economic in nature**

  Rates and leasehold income are not economic benefits amenable to inclusion in a CBA

  As mentioned above, economic CBA is primarily concerned with changes in real resources, in terms of their availability and/or use. Economic CBA specifically excludes transfers among parties where real resources remain unaffected, unless incentives are altered as a result of the transfer, which might result in resource changes in future (Treasury , 2015, pp. 10,11). This is one of the areas where CBA differs from financial analysis.

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The payment of rates and income received from leases are cash transfers between parties and do not result in creation or destruction of resources, per se. Therefore, they should not be included in an economic CBA. That is not to say that these payments are unimportant, only that they are financial in nature rather than economic. Removing these transfers strips $725 million of estimated benefits from the Working Group analysis. There is no effect on the findings of the current study as such transfers are already excluded.

- **Accounting for possible distortionary effects from using the tax system to fund infrastructure investment increases costs by $565 million; the Working Group analysis did not include such costs**

  The current study includes so-called deadweight costs, which in this case are the costs of taxation which is required to pay for the road and rail upgrades necessary under the Northport option. As well as efficiency costs associated with the process of taking money off one party and using it on another party, there are also distortionary effects as people look to change behaviour as a result of the tax/transfer system, resulting in economic (output) costs.

  The recommended cost associated with using the tax system in this way is 20 per cent (Treasury , 2015, p. 15). On the assumption that central government would fund the road and rail infrastructure upgrades, additional costs of $565 million are incurred.

  The Working Group did not allow for such costs in their analysis. To the extent that deadweight costs are removed (i.e. that private parties fund the necessary investments), costs would reduce by $565 million (from $7,209 million to $6,664 million) and the BCR for a relocation to Northport would increase marginally from 0.133 to 0.143.

- **The current study includes benefits from alternative land use of $957 million that are not included in the Working Group analysis**

  As highlighted above, the relocation of freight operations from the current Auckland site would give rise to benefits in the form of enhanced amenity, and gains to residential apartment owners and businesses.

  The amenity benefits are direct in nature (i.e. enjoyment of actual users of park land developed once the relocation takes place) and indirect in nature (i.e. visual, environmental and other psychic gains to people who would prefer that the freight operations activities took place elsewhere). The latter is by far the largest contributor to benefits ($919 million, 96 per cent of total amenity benefits). Such benefits are essentially a proxy for social licence in the current study.

  The Working Group analysis does not include such benefits.

8.4 Some gaps could get bigger after trying to equalise the respective study periods

We highlighted above that the Working Group analysis covers 30 years, while the current analysis covers 60 years.

The effect of the different analysis period for the respective studies is not uniform for the main areas of divergence identified above. For instance, where the calculated impact is differentially signed (i.e. one study estimates benefits while the other study estimates costs) then the possibility exists of stronger divergence.

- For instance, if the beneficial impact on road user costs from relocation to Northport found by the Working Group was to be extended out another 30 years to a 60 year time period, benefits (shown as negative costs) would rise and the gap between the estimates in the two studies would also grow.
- The same is not necessarily true for road investment costs even though the estimates in the respective studies are oppositely signed (the Working Group sees benefits; the current analysis sees costs). Infrastructure investments of the type needed for this analysis do not involve ongoing costs, unlike road user costs.

As result, extending the time period for the Working Group analysis out to 60 years would not automatically give rise to an increase in the gap between estimated values, due to the lumpy nature of such investments.

For those situations where costs and/or benefits were included in one study but not the other (i.e. deadweight costs and income streams from land redevelopment), the period for analysis is immaterial.

9. Estimating supply chain costs

CBA results can give us one view of supply chain costs and another view is an estimate of how supply chain estimates might change. One of the oft-heard claims in discussions around port relocation and the movement of freight is that "any lengthening of the supply chain costs, and usually a lot". Taken at face value, this would suggest that the option that minimises total distance (however measured) would be preferred.

A precise answer requires knowledge of the (unit) cost of the supply chain. However, the supply chain cost per kilometre has not been estimated in New Zealand – and such an exercise to determine the (unit) cost of the supply chain directly would be the equivalent of the whole UNISCS project.

We have developed an estimate employing a proxy measure derived by summing estimated freight movement costs by road and rail to freight destination and dividing by the total freight volume expressed in either TEU or tonnes. [18]

$$Supply\ chain\ costs = \frac{Total\ costs}{Total\ freight\ volume}$$

We caution that the measure of supply chain cost is for the Auckland freight volumes only across the current and proposed Upper North Island Ports. To the extent that it is referred to at all, the best description would be the Upper North Island supply chain costs for the Auckland freight volumes, excluding congestion costs.

9.1 A wide range for cost per TEU

This section seeks to employ the information available from the data collected for the CBA to address the question *"what are the supply chain costs that individuals/society will face tomorrow as a result of our decision to move the port?"*. All the values in this section are in real 2019 dollars for direct comparison to today's supply chain costs.

The estimated supply chain cost per TEU in Table 25 is based on the cost (including social cost) to move a TEU from the port to that TEU's final destination.[19] In this analysis, the Manukau option has an advantage over the POAL Waitematā Harbour berths as well as more distant options. The tables below highlight the advantage that the Manukau option has over not only the other alternatives but also the current Auckland site, achieving an estimated net saving in costs per TEU. By 2043 there is a partial transition of freight to the new port, and the estimated cost saving is around $5 per TEU. By 2073 the transition is complete, and the estimated cost saving is around $7 per TEU or ~7 per cent of the base case cost per TEU.

[18] For clarity, we avoid "freight task" typically understood as including distance and measured in tonne km.
[19] This includes multiple destination sites across Auckland. The operating costs of congestion cost externalities were not able to be included. The congestion modelling is not able to distinguish the additional congestion in the Auckland CBD from total congestion impacts including the part that relates to trip generation from redevelopment of the current site. Hence, including total congestion costs would overstate supply chain costs.

Table 25: Cost $ per TEU (Calibrated) with externalities but excluding infrastructure, (real, 2019)

Year	2033	2043	2053	2063	2073
Ports of Auckland (base case)	94.63	95.42	96.23	97.03	97.82
Northport	NA	370.85	443.76	447.68	451.45
Tauranga	NA	387.53	465.09	469.39	473.43
Firth of Thames	NA	187.79	212.76	214.60	216.38
Northport-Tauranga split	NA	388.69	466.76	471.31	475.62
Manukau Harbour (Puhinui)	NA	90.03	89.44	90.19	90.93

Source: Sapere

To get a sense of what might be termed the "total supply chain cost" (excluding congestion), we include a provision for infrastructure. In particular, we spread capital costs (net of terminal values) shown in Table 26 evenly over the 60-year analysis period as a simple estimate of the amortisation of the capital costs.

Table 26: Supply chain infrastructure costs $ millions p.a., 60-year analysis period, (real, 2019)

Scenario	Calibrated forecast (net of terminal values)	Officials' agreed forecast (net of terminal values)
Ports of Auckland (base case)	1,164	116
Northport	5,169	3,002
Tauranga	3,176	1,554
Firth of Thames	8,724	7,557
Northport-Tauranga split	5,111	3,783
Manukau Harbour (Puhinui)	6,082	5,085

Source: Sapere

Importantly there is no provision for a return on capital or port charges and is subject to simplifying assumptions about the origin and destination of freight. This reiterates the point that these figures are an approximation of the true supply chain cost. Table 25 and Table 27 are now consistent with the core CBA results presented earlier. The current Auckland site is the least expensive option now and into the future, by 2073 being around $18 per TEU or ~18 per cent of the base case cost per TEU.

The cost per TEU is decreasing with time when infrastructure is included as the even spread of capital is divided by a larger freight task towards the end of analysis period.

Table 27: Cost $ per TEU (calibrated) with externalities and infrastructure costs, (real, 2019)

Cost per TEU	2033	2043	2053	2063	2073
Ports of Auckland (base case)	108.98	107.02	105.54	104.46	103.72
Northport	NA	422.32	485.09	480.68	477.64
Tauranga	NA	419.15	490.48	489.66	489.52

Firth of Thames	NA	274.66	282.53	270.30	260.59
Northport-Tauranga split	NA	439.58	507.64	503.95	501.52
Manukau Harbour (Puhinui)	NA	150.60	138.08	129.02	121.76

Source: Sapere

9.2 Reconciling results of cost per TEU with the CBA

One apparent inconsistency with the core CBA results is that the Firth of Thames option remains the third cheapest, even after adding capital costs, even though the Firth of Thames is the most expensive of all the options in our core results.

The reason for this is because the values we have presented here are real, whereas the values in the core CBA analysis are adjusted for net present value:

- Capital costs of the base case (POAL) are lower and deferred, the first major capital expenditure under $1.5 billion in 2040.
- Firth of Thames option is unique in that its capital costs are overwhelmingly front loaded compared to other options, as shown in the table below. This makes the capital costs appear larger for the Firth of Thames (relative to other options) when adjusted for NPV.
- Additionally, a lot of these capital costs in the Firth of Thames option are offset by high terminal values. However, these terminal values are incurred in the year 2079 and are discounted by over 96% in the CBA, rendering them almost insignificant.

In the cost per TEU analysis above the terminal values are not discounted at all and have a significant impact on the net cost

Table 28: Total Capital Costs in the 2020 and 2030 Decades (real 2019 dollars)

	Capital costs (not including terminal values) incurred in the decades 2020 or 2030
Ports of Auckland (base case)	21,361,830
Northport	9,709,500,000
Tauranga	3,182,900,000
Firth of Thames	17,141,875,180
Northport and Tauranga	9,620,700,000
Manukau	8,724,007,954

Source: Sapere

9.3 Cost per TEU change over time

The costs per TEU change over time as investment occurs:

- Table 28 shows that the capital costs are still significantly higher under the Firth of Thames option compared to other options. If the real capital costs are higher than the other

options for the Firth of Thames, why is the cost per TEU the 3rd lowest? Well, initially we do see the cost per TEU for the Firth of Thames option as the highest.

- But after the port transition has begun, in 2043, we see in Table 25 that that the cost per TEU dramatically increases for the options with Northport or Tauranga.

The core CBA results also showed total transport costs being higher in the options with Northport or Tauranga relative to the Firth of Thames option, but not to the extent we see in the cost per TEU. The reason for this is values are discounted by 68% by the time the port transitions in 2040.

The implications are important. NPV adjustments inflate the Firth of Thames capital costs (as they are more front loaded than other options) relative to other ports and reduce the impact of the Firth of Thames option's lower transport costs relative to the options with Tauranga and Northport. These two effects are not present in our cost per TEU analysis above, hence, we see the Firth of Thames option performing significantly better in this cost per TEU analysis.

10. Regional economic and social effects

The relocation of Auckland's freight operations is a significant undertaking, which would represent a considerable injection of activity to a new location. The EY report for the Working Group did not examine social impacts in any degree, but did estimate that a shift of freight operations from Auckland to Northport would result in:

- a $200 million boost to the Northland economy (over 30 years, in present value terms)
- around 2,000 sustained jobs (i.e. not related to the construction of the required supporting infrastructure).

The EY report for the Working Group indicated that the direct employment impacts from the relocation are likely to be relatively modest, due mainly to advances in automation. Thus, the estimated employment figures above relate mostly to supporting industries (i.e. indirect employment).

The Regional Economic Development and Social Assessment workstream was commissioned for two reasons. The first reason was to extend the work undertaken for the Working Group by EY on regional impacts to:

- include another relocation possibility for freight operations other than Northport (i.e. Port of Tauranga)
- apply 'non-standard' approaches to the analysis in addition to the more 'standard' multiplier-based impact completed previously.

The second reason for commissioning the workstream was to assess the potential social effects of the relocation of freight operations from their current site on the Waitematā Harbour.

Data availability dictates that the analysis in this working paper proceeds on a regional basis. That is, no sub-regional data is available and therefore we primarily compare Northland and Bay of Plenty regions (as the locations of Northport and Port of Tauranga respectively). The Waikato region is assessed implicitly, rather than as a standalone location as such.

As the Firth of Thames and Manukau options are in the same region as the current site, there is essentially no impact at the regional level that could reasonably be estimated.

With the regional economic modelling tools available we have identified modest impacts of port expansion or creation on regional economic development.

On the one hand, the economic stimulus in Northland is much larger than that for Bay of Plenty, reflecting the relative size of their existing economies. However, the major share of gains is felt in regions outside where the rise in activity takes place (e.g. in neighbouring locations). Thus, any impulse felt in Northland would most likely result in greater impacts in Auckland.

10.1 Regional impacts cannot be equated to CBA results

We wish to highlight that the figures estimated in the workstream analysis are distinct from those produced as part of the CBA. There is a clear distinction between analysis using input-output (I-O) approaches and CBA. Methods such as I-O analysis produce different 'raw' outputs to CBA (i.e. they report macroeconomic impacts), do not provide clear social decision rules (unlike CBA), do not

measure the economic efficiency of an investment and do not include some of the non-market commodities allowed for by CBA, such as some non-work travel time savings (Wallis, 2009).

In saying this, I-O analysis could be used as a complement to CBA at the regional level if there is a need to assess economic impacts (e.g. on GDP or employment) as opposed to benefits (Wallis, 2009). However, fundamentally CBA and I-O (multiplier) analysis speak different languages. It is not possible to derive a direct linkage between the outputs of CBA and changes in macroeconomic indicators, such as GDP. CBA provides no direct information on such indicators.

Thus, projects which record a negative NPV (BCR below 1.0) may still produce increases in GDP. Notwithstanding this incompatibility, we present the findings of our somewhat exploratory analysis as an addition to the CBA.

10.2 We estimated a modest package of regional economic impacts

We estimated the following three elements for the Northland, Port of Tauranga and split options:

- capital costs- effectively the construction component associated with infrastructure and other physical structures
- employment- the jobs associated with the proposal (relocation)
- catalytic benefits- the relocation as a driver of productivity and attractor of firms and associated labour.

Analysis of sub-regional distribution impacts within Auckland are not possible as neither the data nor models have sub-regional resolution.

10.2.1 Short-term (construction) stimulus material, reflecting initial expenditure; split option most impactful

The input-output/multiplier analysis done by EY for the Working Group was reproduced using updated capital expenditure figures and extending the scope to the Bay of Plenty region.

Table 29 shows that the short-term expected impulse from construction (capital) expenditure ranges from a low of almost $6 billion in Bay of Plenty to a high of $19 billion in the split Northport/Tauranga option. Predictably, the value-added (essentially GDP) values are more modest. The employment impacts (FTE job numbers) are significant. Most of the impact will occur in the ten-year period between 2030 and 2039.

Table 29 Results from input-output model for period 2020-2079 (nominal $m)

	Initial spend ($m)		Output ($m)		Value Added ($m)		Jobs (FTE #'s)	
	Officials	Calibrated	Officials	Calibrated	Officials	Calibrated	Officials	Calibrated
Northland	*$8,105*	*$11,452*	$11,903	$16,712	$4,148	$5,842	44,467	61,903
Bay of Plenty	*$3,947*	*$6,901*	$5,953	$10,336	$2,347	$4,142	23,244	41,293
Split option	*$10,137*	*$12,731*	$15,205	$19,033	$5,544	$6,968	56,564	70,904

Across the entire 60-year period where capital expenditure takes place, the total boost in economic activity (direct, indirect and induced effects) ranges from a low of almost $6 billion in Bay of Plenty to a high of $19 billion in the split Northport/Tauranga option. Predictably, the value-added (essentially GDP) figures are more modest. The employment impacts (FTE job numbers) are significant.

We point out that most of the impacts contained in the table will occur over a 10-year period, between 2030 and 2039 (i.e. they are not enduring). These results as presented assume that all of the impact is felt within the region, which is clearly not realistic but in the absence of any data on which to allocate impacts across other regions, is the default setting. Ongoing effects shows impact greater in Northland, but most of the impact would occur outside the region of port development

10.2.2 Ongoing effects shows impact greater in Northland, but most of the impact would occur outside the region of port development

Readily available evidence specific to port development is restricted to European studies, but does point to positive impacts, though probably modest (Bottasso, Conti, Ferrari, & Tei, 2014; Rodrigue, 2020).

Growth in traffic volumes is not associated with significant employment with elasticity levels between throughput and employment that are typically less than 0.05 jobs per 100 tons (Rodrigue, 2020). Using an elasticity of 0.03 (i.e. for every 100 tons of additional throughput 0.03 jobs arise) and the estimated tonnage once the transition is completed (11.3million – 15.7 million tonnes), we estimated that between 3,075 and 4,273 jobs would be supported from the transfer of freight operations. These jobs could be considered on-going in nature and would continue to rise in line with freight volume.

Using elasticities relating the change in tonnage at a port to GDP (Bottasso, Conti, Ferrari, & Tei, 2014), Table 30 shows the estimate an annual change in GDP once the freight has fully moved. Table 30 shows that the effects of the impulse are greater outside the actual region where port development takes place.

While the impact in Northland is larger than that for the Bay of Plenty in both relative and absolute terms, that is to be expected given the incremental effect of Auckland's previous freight operations on the respective location. The incremental impulse on Northport's tonnage is over four times that for the Port of Tauranga, whereas Bay of Plenty's GDP is only around twice that for Northland.

Table 30 Annual GDP impact (nominal $m)

	Local (GDP share)	Wider (GDP share)	Total (GDP share)
Bay of Plenty	$9-$26 (0.03%-0.09%)	$43-$154 (0.15%-0.53%)	$52-$180 (0.18%-0.62%)
Northland	$18-$53 (0.14%-0.42%)	$89-$319 (0.70%-2.53%)	$107-$372 (0.84%-2.95%)

One potential take-away from this work is that while relocation to Northport results in greater GDP impacts, most of those could be felt in Auckland while the impulse from relocation to Port of Tauranga could affect Waikato as well as Auckland, though more modestly.

10.2.3 More novel approach has potential, but hard to be definitive

In recent times, a movement away from more 'mechanical' approaches to estimation has started. The approach highlights the role quality plays in regional attractiveness using two dimensions. The first is quality of life (QL), which pertains the attractiveness of a region to live in, while the second is the quality of doing business (QB), which mainly relates to the state of the regional labour market. The intuition is that workers and firms choose to locate in places that differ in their rent, wages and amenities.

Workers derive utility from the consumption of (tradable) goods and (non-tradable) housing and from local amenities, and their consumption expenditure depends on local wages and rents. Firms earn profits equal to the price of the goods they produce less the cost of labour and land inputs (local wages and rents). Local amenities may raise or lower production costs (either through affecting productivity or by directly shifting input costs, given a certain level of productivity).

As alluded to above, an important factor in this approach is labour supply, both in quality and quantity terms. A worker's optimal location choice is the city in which their utility is maximised given the local wages, rents, and amenities. For firms, the optimal location is the city in which their profit is maximised given those same factors (Motu Economic and Public Policy Research, 2018). As Motu (2018) put it:

> A place with high rents but low wages must have amenities that make it a nice place to live otherwise people would move elsewhere & newcomers would not arrive ("sunshine wages")
>
> A place with high rents and high wages must have amenities that make it a good place to do business otherwise firms would move elsewhere & new firms would not be established ("productive")

Table 31 contains measures of QB and QL for the settlements relevant to this analysis. Tauranga is relatively rare in that it has positive values for both QB and QL, which suggests it would be attractive to people and businesses. Whangārei on the other has negative measures for both. Auckland is a mixed picture, performing strongly on quality of business but much less so on quality of life.

The key question is the extent to which relocation of freight activities would improve the quality of the labour supply (and hence spur development). Unfortunately, this remains largely unknown and was not able to be explored. We do see though, that Tauranga appears primed to exploit any opportunities that come its way in terms of attracting people and businesses.

While there appears to be a degree of stickiness in quality measures (i.e. places with low (high) quality in one or other dimension tended to continue to have low (high) quality measures in future) though it is possible to change over time. The question is still open in respect of the effect of a relocation of port activities.

Table 31 Measures of QB and QL

	Quality of life	Quality of business
Tauranga	0.28	0.66
Whangārei	-0.36	-0.53
Auckland	-0.81	2.28

Source: Motu 2018

10.3 Social analysis not 'full-blown' impact analysis, but identifies gaps, areas for further work

The focus of the social analysis was on gaps and areas where future work would be helpful, once a site has been chosen. Use of social analysis to choose a site was not feasible within the constraints of time available.

The key points made were:

- maintaining social license is increasingly important for ports worldwide and environmental issues are at the forefront of concerns
- social considerations are pertinent throughout the entire port lifecycle from proposal, commissioning, construction, operation, decommissioning
- social changes relevant to relocation of port activities include community participation, labour force impacts and opportunities, communications, interactions with landscapes, environmental factors and land values
- issues requiring further investigation include poor planning, displacement, poor construction and delays.

Overall, the initial work provided some food for thought around how important it is for ports to create and maintain social license. While a range of site-specific features and characteristics of the local populations was identified, it was too difficult to be definitive about relative rankings in this analysis.

11. Financial implications for port owners

This section explores whether there is enough financial incentive for ports to take up options without Government intervention. This summarizes a detailed valuation report and financial model prepared in March 2020 by Sapere Valuation. Close examination of that report and model is recommended if the reader requires a full understanding of findings.

In undertaking this analysis, we have considered whether an investment in a new or expanded port is a worthwhile financial investment. We do this by comparing the present value (PV) of the costs associated with future port expansion to the marginal enterprise values (EV) achieved when a port captures Auckland's freight.

This section examines the commercial motivations of the shareholders of the Upper North Island ports; not their social motivations. The land values associated with alternative uses for the Ports of Auckland are complex, and Auckland Council is likely also to be motivated by the prospect of a different waterfront layout more than they are a dividend cheque. These non-market motivations (associated with changes in leisure amenity, for example) are not included here.

To calculate EV and PV of costs we have applied an appropriate nominal, post-tax discount rate with reference to POAL's weighted average cost of capital (WACC) of 5.2 per cent to 6.1 per cent (mid-point of 5.8 per cent).

11.1 POAL is worth almost $1 billion to Auckland Council

It is in the commercial best interests of POAL (and by extension its shareholder, Auckland Council) for the Ports of Auckland to remain in place. Left alone, POAL will continue to invest in automation and future three-berth capacity. This will allow it to expand operational capacity and avoid congestion in the short or medium term.

To calculate EV and PV of costs we have applied an appropriate nominal, post-tax discount rate with reference to POAL's weighted average cost of capital (WACC) of 5.2% to 6.1% (mid-point of 5.8%).

Our enterprise value modelling has shown that displacing the Ports of Auckland's freight creates a $938 million financial disadvantage for Auckland Council relative to remaining in place. This financial disadvantage is established by comparing enterprise valuations for POAL under two scenarios: cease or stay. This difference assumes that Auckland Council can release the market value of POAL land, at full sales valuation.

Our estimate of the current market value for the entire business enterprises of POAL in Table 32 below is based on the alternating assumptions that a) the status quo is retained or b) that POAL's exit is announced and implemented within eight years.

We assess the enterprise value of POAL's port operations is approximately $2.1 billion. If these operations are expected to cease in eight years' time, the current market value of the enterprise would be reduced to approximately $353 million. (This latter figure assumes a total cease of the port, including marine service and cruise ship operations, and is the amount associated with the remaining

eight years of life of the port). This implies a foregone enterprise value of approximately $1.765 billion (being $2.1 billion less $353 million).

Table 32 Conclusions on market value for POAL (PV, $m)

	Status quo	Freight ceases at Waitematā Harbour
Enterprise Value as a seaport	2,118	353
Plus market value of the land if POAL continues as landowner after 8 years		827
Sub-total for POAL	2,118	1,180

Source: Sapere

POAL and thereby Auckland Council would, however, retain the land (with an indicative market value of approximately $827 million) which would partly offset the foregone enterprise value. The result is such that Auckland Council would be worse off by approximately $938 million (being $1.180 million less $2.118 million). We test this assumption later in this section.

11.2 POAL profit and dividend to Auckland Council

POAL profit is established using publicly disclosed financial information. Dividend information is more difficult as Auckland Council does not disclose the detail surrounding its investment in POAL but instead groups its investment in POAL with several other subsidiaries. POAL's comprehensive income is detailed below. Table 33 sets out POAL's comprehensive income which belongs to Auckland Council. [20]

[20] The financial analysis highlights that:
(a) AC is the beneficial owner of POAL's annual 'comprehensive income'. Comprehensive income consists of (a) NPAT and (b) other income such as revaluation changes in POAL's assets or financial instruments that it is a party to.
(b) During FY16 to FY19, POAL's NPAT averaged $68.8 million per year and other income averaged $42.6 million per year resulting in an average comprehensive income of approximately $111.4 million per year.
(c) From this comprehensive income, a portion is paid out as dividends and a portion is retained in POAL (but nevertheless remains AC's equity).
(d) During the last four financial years, AC received dividends from POAL of approximately $48 million per year (or approximately 70% of NPAT and 42% of Comprehensive Income). This dividend payout is expected to reduce for the next two financial years as a larger portion of profit is expected to be retained within POAL for capital expansions.
(e) POAL retains the rest of the comprehensive income as AC's un-distributed equity (approximately $63 million per year during FY16 to FY19). As at the end of FY19, the book-value of AC's equity (the amounts not distributed) was approximately $800 million.
(f) The conclusions in the valuations commissioned for this report implies that the market value of Auckland Council's equity in POAL exceeds its book-value and instead ranges from $1.656 billion to $2.091 billion ($1.854 billion at the mid-point).

Table 33 POAL's comprehensive income which belongs to Auckland Council (nominal $m)

	FY16	FY17	FY18	FY19	Average
Net profit after tax	84	60	77	54	69
Other comprehensive income	68	30	43	30	43
Comprehensive income	**152**	**90**	**120**	**84**	**111**
Distributed as dividends	42	54	50	46	48
Retained in POAL	109	36	70	38	63

Source: Sapere, March 2020, using publicly disclosed financial information

If POAL's port operations cease, the effect on Auckland Council's financial statements would include a cessation of the dividend stream after POAL has vacated the land, a cessation of some of the other comprehensive income as it relates to port operations and port assets (excluding land), a continuation of some of the other comprehensive income as it relates to land assets and recognising an impairment write-down of Auckland Council's investment in POAL.

The magnitude of this write-down is still to be ascertained more precisely, but the valuation analysis approximates $195 million, set out fully in Sapere Valuation's report (Sapere Valuation, 2020).

11.3 The present value of Auckland's freight is $1.765 billion to another port company

We assess the present value of freight that would be moved from Auckland as $1.765 billion. If the alternative ports are of reasonably similar efficiency and profitability, then the foregone enterprise value of $1.765 billion could be expected to manifest as an increased enterprise value for the alternative ports, to the degree they share in the increased revenues and they acquire the capital assets necessary to facilitate their respective increases.

So, for example, if Port of Tauranga captures the entirety of Auckland's freight, its enterprise value will increase by $1.765 billion from its current assessed value of $5.1 billion. If, for example, Northport captures the entirety of Auckland's freight, its enterprise value will increase by $1.765 billion from its current assessed enterprise value of $314 million.

11.4 Capitalised value of the infrastructure investment varies up to over $4 billion

The $1.765 billion value uplift associated with moving Auckland's freight is then compared with the present value (PV) of the costs associated with future port expansion.

The costs associated with building or expanding a port to take Auckland's freight were a key output of the infrastructure workstream. The infrastructure costs include the cost of dredging, landside port development and on-port moveable equipment. They do not include the cost of rail, bridge, tunnel or road infrastructure required to support the port. In the case of existing ports like Tauranga, the costs are adjusted so that they only reflect the additional investment required on top of what would likely have been spent anyway. The infrastructure costs provided were in real (today's dollar) terms.

We make a set of assumptions about when capital spend will happen and other assumptions to allow comparison across the port options. The result is set out in the table below and shows that the status quo, unsurprisingly, has the lowest PV of port infrastructure investment.

Table 34 Present Value of port infrastructure investment required to handle Ports of Auckland freight ($m)

	Status quo	Tauranga	Northport	Northport -Tauranga split	Manukau Harbour (Central)	Manukau Harbour (Puhinui)	Firth of Thames
Total real cost of option	1,270	2,633	2,451	2,596	5,213	6,601	6,349
PV cost of option 2020s - 2050s at 5.8% WACC	608	1,031	1,176	1,253	2,930	4,435	4,092

Source: Sapere

11.5 New port options are not commercially viable

The cost of the new port options is substantially higher than the value uplift associated with taking Auckland's freight. That is, the expected PV cost is greater than PV benefit in the case of the Manukau Harbour options and the Firth of Thames. For example, the Puhinui site in Manukau Harbour would cost PV$4.4 billion while the value associated with the freight it would process is $1.765 billion.

To justify an investment of approximately $4.4 billion, a port at Manukau would need to handle approximately 1.9 million TEU annually (versus Ports of Auckland's current load of 940,000 TEU) and would still need to grow annually at 2.3 per cent.[21]

The implication of this is a large proportion of Port of Tauranga's existing freight volumes of 1.2 million TEU would be required to run through the new port options – scaling back Port of Tauranga and making a regional monopoly.

Beyond that, decision makers face additional uncertainty including uncertainty associated with the future freight flows, in relation to the realisable value of POAL's land in Auckland and in relation to land availability and social licence at each of the alternative locations. The implication is therefore that fully private port investment in the new port options is unlikely.

[21] Crudely calculated as 940,000 TEU ÷$2.1 billion x $4.4 billion. While there are some time-value considerations which would spread the investment-cost over three years, the benefits would also be delayed for three years before accruing to the project. As such, this estimate appears to be crude but conservative. We point out that this is based on the growth forecast and profitability performance observed at POAL. If another port had higher growth forecasts or better profitability performance, then the required freight volumes could be lower. This calculation also disregards any other freight revenues such as freighting vehicles and marine services.

11.6 The two-port model may be mutually advantageous but at the cost of complimentary investment

The Working Group recommended the two-port model, splitting the freight load between Tauranga and Northport. Practically speaking, this would require development to accommodate Auckland's load at Northport and letting Tauranga develop organically, as it would have done in any case. That would include Metroport continuing, but only at the rate it would otherwise have done. From this valuation perspective the two-port model is NPV-positive, meaning the cost of expanding both ports is less than the benefit to be gained. [22]

- The infrastructure workstream found that operating capacity extension at the Northport and Tauranga port sites to support the two-port model will require investors to finance (in real terms) $2.6 billion over the 60 years.
- In present value terms, the investment is $1.3 billion, with the Northport expansion requiring the lion's share of investment: just under three quarters of the $1.3 billion.
- By this investment, the Northland and Tauranga ports will be able to handle similar freight volumes as Auckland would have, well beyond the 60-year term of analysis.[23]
- The first phases of port development at Northport will require a total (real) investment of $1.1 billion with approximately $450 million required up-front for super-structures (Quay cranes, automated stacking crane and straddles).

We note, however, that this scenario involves considerable other complimentary investment in landside infrastructure and, also, leads to an inefficient national supply chain solution. Also, this scenario assumes that freight traffic will flow to Northport

11.7 It is unlikely the three ports can work to find a solution

Whether a cooperative solution between POAL, POT and Northport is possible is a valid question to ask. The answer is, however, that it is unlikely.

- POAL would need to be paid at least $938 million to entice it to cease operations (a "pay-off"). If POAL was a strong negotiator, and there were other potential buyers for the port operations, it is possible that it could negotiate for a higher price to cease because it would know that the buyer of the port freight gains a benefit of $1.765 billion for the value of the freight.

[22] From a market perspective, investment in Northport may be considered high risk for investors as market sounding suggested that the distance to Northport from markets make it a relatively more expensive option than Tauranga and growth in markets was expected to occur more quickly in Waikato than North of Auckland.

[23] If Northport was successful at capturing all of Auckland's freight volumes (and PoT took none) then operational capacity at Northport will be reached by the 2050s (Advisian, 2020); a more realistic scenario is that Auckland's freight load will be shared with PoT, and operational capacity will remain available at Northport until well beyond the 60 year forecast term.

- Based on the PV of cost of $1.3 billion, there is no configuration under which POAL, POT, Northport working together or separately would invest in a project to expand capacity at both or either of Northport or Tauranga. This is because the cost of expansion plus the amount needing to be paid to POAL is less than the value of the additional freight traffic that the parties would capture ($1.765 billion).
- Similarly, POT and Northport would not autonomously make an investment decision (i.e. without the involvement of the other parties): they would not invest in capacity and pay POAL to cease operations in Auckland.
- In the case of POT making the investment decision independently, the required expansion investment to house Auckland's freight is $1.13 billion. Due to the size of this investment, a deal with POAL to cease Auckland freight will be infeasible even if POT captures the entire Auckland freight load.

11.8 The land value released to Auckland Council may be lower than expected

The working group estimated undeveloped POAL land to have a value of approximately $1 billion (as set out in the Port Future Study of 2016). The value assessment in the analysis above is based on a conclusion from a valuation expert of a range of between $701 million to $911 million (midpoint $827 million). This valuation is a present-day market valuation of 43 hectares of cleared, developable port land made available in eight years.[24]

The concluded mid-point of $827 million land value does not provide an indication of the non-market values that Auckland Council or others might attach to the port land. It does not assume the identity of the buyer - only that there is a willing buyer and seller - although we are aware that there are entities that have expressed an interest in the land should it be made available for sale. The figure does not assume there is in fact a sale, only that the land has a residual value to POAL as an asset.

The mid-point value $827 million is approximately $447 million more than the value assessed by management and CBRE in their latest assessment of the market value of POAL's freehold land. The concluded mid-point is approximately $173 million less than the $1 billion assessment set out in the Port Future Study and referred to by the working group.

Planning analysis has also indicated that considerable uncertainty exists around the ability for Ports of Auckland to quickly sell the ~43 hectares of available land under Ports of Auckland to a development company. There is potential, for example, for legal challenge regarding the land's status which may mean a land sale is blocked while respective rights and interests are resolved.

Further, there are substantial development costs needing to be incurred before value in alternative use can be released. From Auckland Council's perspective:

[24] No reference is made in the working group's report of 9 August 2019 as to the net developable land expected to be available from the POAL site. JLL's report of 2016 assumed this would be approximately 34.1Ha, while CBRE assumed 43.0Ha. The valuation above adopts the 43.0Ha proposed by CBRE. The rest of the land (34.0Ha) is assumed to be converted to public spaces, roading and other assets owned by Auckland Council (AC).

- It will likely, as for Wynyard Quarter, pursue a sale by leasehold. Punuku's experience of this development is the cost of land remediation and preparation is substantial and equal to the value of the lease.
- Any costs involving a direct private benefit will, as much as possible, be funded by the developer not the Council.
- Any additional rating value will be offset in costs of delivery of services of a public good nature including three waters, establishing a new train station and other service delivery suited to an intensive, inner city suburb.

In short, the land valuation will be seen by Auckland Council as spent already. Thus, with lower values attached to the land the difference between the cease and stay scenario is larger, and the "pay-off" required to compensate Auckland Council for a move might be $1.8 billion.

11.9 All scenarios reduce competition but one

We have considered the potential impact on competition of alternative options for handling sea freight currently shipped via the POAL. A reduction in competition would reduce the discipline that drives firms to adopt the most cost-efficient means of supply, redirect resources to profitable use, provide cheaper and better products, and curb excess returns.

Our analysis follows broadly the approach the Commerce Commission might take in assessing the competitive effects of any application to approve a merger or acquisition. We take this approach because most of the scenarios would entail some form of arrangement or understanding between entities that might otherwise be in competition with each other. At its core, the Commerce Commission will compare the expected change in competition under a proposed arrangement with the level of competition that would occur if the arrangements did not proceed, and this is the approach we follow.

The Ports of Auckland and Port of Tauranga currently compete for ocean freight in the Upper North Island. As the Port of Tauranga has influence over the governance of Northport, these ports are 'one head in the market' from a competition approach the Commerce Commission might take. The existing market therefore has characteristics of a duopoly—a situation in which two suppliers dominate the market for a service.[25]

Each port intensifies its competitive offering via inland freight hubs:

- the Port of Tauranga has a hub in Auckland (Metroport), and is in partnership with Tainui to develop a hub in Hamilton
- the Ports of Auckland has hubs in Waikato, Wiri, Bay of Plenty and Manawatu.

[25] The Port of Tauranga owns 50% of the shares in Northport and of the four Board members one is the CEO of the Port of Tauranga and another the Chair of Port of Tauranga's Board. These relationships mean that the Port of Tauranga is likely to be considered to be associated with Northport (in terms of s.47(3) of the Commerce Act) and therefore, for the purposes of competition analysis, are in effect a single entity. The Ports of Auckland holds a 20% share in the company that owns the other 50% of Northport. It is unlikely that this ownership interest would enable Ports of Auckland to exert a substantial degree of influence over Northport.

Consistent with economic theories of capacity competition between duopolies, market shares of imports and exports are inversely related to the total costs to importers and exporters from utilising supply chains via Auckland or Tauranga. In simple terms, shippers use a port less if a supply chain costs them more. As a result, we currently see a higher proportion of:

- containers are exported via Tauranga, due to the proximity of exporting producers
- containers of manufacturing goods imported via Auckland, close to distributors
- cars are imported via Auckland, as the majority of car dealers are in South Auckland.

Relative to existing arrangements, all but one option would reduce competition between ports in the Upper North Island, to the detriment of New Zealand exporters and importers.[26] Our analysis is summarised in Table 35 below.

Table 35 Impact of options on port competition

Scenario -POAL freight moves to:	Effect on competition	Economic impact
Northport	Substantial lessening of competition, Upper North Island	higher prices, reduced service and innovation
Tauranga	Substantial lessening of competition, Upper North Island	higher prices, reduced service and innovation
New port, fully owned by Tauranga	Substantial lessening of competition, Upper North Island	higher prices, reduced service and innovation
New port, fully owned by Auckland	Increase in capacity competition	lower prices, improved service and innovation
New port jointly owned, competing operators	Substantial lessening of competition in ports, competition retained for terminal operation	On balance, higher prices, reduced service and innovation

We consider whether greater cooperation between New Zealand ports, increasing their market power in negotiations with shipping companies, would be a benefit to New Zealand. Shipping firms are on the 'buy' side of the market—the shipping companies purchase port services on behalf of New Zealand exporters and importers. To the extent shipping lines have market power, it is 'countervailing market power' to that of the port companies; this countervailing market power means that the shipping companies would be able to negotiate better terms with the ports than otherwise and some of that benefit would flow to exporters and importers.[27]

If port companies in the Upper North Island were to gain additional market power, that market power would allow them to raise prices above those that would occur in the base case. These price increases

[26] Our analysis was based on competition impacts with no change in regulatory structure. So absent regulation, even if there were efficiencies there would be a lower level of competition (and therefore higher prices and reduced service and innovation) than in a market with two strongly competing ports. This is explained in more detail in the competition report.
[27] Our comments are consistent with the Productivity Commission's findings – see detail in the competition report.

can be expected to largely be passed through to New Zealand exporters and importers. The standard Cournot model of competition, would predict increases in port charges of 6 to 32 per cent, relative to existing charges at the Ports of Auckland, and 5 to 24 per cent relative to existing charges at the Port of Tauranga. A consistency of assumptions logic might suggest that exporters and importers may face price increases toward the higher end of this range under the scenarios that give rise to increased market power.

11.9.1 Indicative price effects

We apply a Cournot model of competition to provide indicative estimates of the price impacts of reduced competition for port services in the Upper North Island. The estimate is developed by making several simplifying assumptions. As with the competition assessment above, the estimates presented in this appendix are also 'broad brush'.

The model takes in the existing market shares between the Ports of Auckland and the Port of Tauranga and assumes a coordinated arrangement between the ports in the future (that is, an effective port monopoly for shipping containers in the Upper North Island). We assume a price sensitivity of demand for imports and exports of -2.5 to -3.5). Table 36 shows predicted percentage increase in prices, as a result of reduced competition, relative to existing charges at the Ports of Auckland Port of Tauranga:

Table 36 Price changes implied by reduced competition

Price elasticity of demand	**-2.5**	**-3.5**
Percentage price increase—Auckland	38%	29%
Percentage price increase—Tauranga	29%	17%

11.10 Government funding and financing

The brief did not extend to considering detailed financing options. We were, however, asked to provide an indicative scoping of the likely investment required from central government under each of the options. The working assumption is that local government and/or private investors finance the port infrastructure and consenting costs, and central government finances complementary rail and road infrastructure, and any other costs required to facilitate the investment. Central government would also shoulder any costs associated with preparing enabling legislation, if needed.

The figures below provide a broad, summative indication only. The analysis did not extend into evaluating how the government might share the cost of road or rail with private entities, in public private partnerships or through tolling or levies for example. Detailed feasibility analysis is a proposed next step.

11.10.1 Complementary investments in rail and road likely paid for by the Crown

The infrastructure workstream concluded that substantial government investment in road and rail will be required to support the expansion in both Northland and Tauranga.[28] Road and rail are complementary investments to a port, and as such, port companies and their shareholders rely on signals from the government about when and where road and rail investments will occur. Planning for complementary road and rail would need to run concurrently with the port planning, risking delays to opening. If road and rail cannot be provided to support the expanded port at Northport, no mutual arrangement will be able to be reached between Cornerstone Partners.

More detail on the configuration of road and rail options associated with moving freight by rail between the locations is provided in the infrastructure findings.

11.10.2 Motivating Auckland Council to release the port

It is clear to us that Auckland Council has the most to lose from any of the options posed, if only financial implications from its shareholding in the Port are taken into account. Also, it is clear that the capital required does not justify moving the port on commercial grounds alone. This provides an indication that some sort of incentive to move might be required.

Estimating the amount that might be required is challenging and speculative:

- A move of freight operations leads to a loss for POAL of $938 million (the financial difference between cease and stay, with staying meaning a port restricted to 2.1 million TEUs a year but operating in perpetuity).
- The land under the port is not easily sold and the loss to Auckland Council might be as high as $1.8 billion. In the other direction, Auckland Council might value the social benefits of moving the port so highly that it considers it has made no 'loss' at all from moving the port.
- The required payout could therefore be anything in the range of $0 to $1.8 billion. It might take the form of shares in the new port company, be paid in cash or in the form of other transfers.

11.10.3 Crown funding of port development

If a new port were the chosen direction, it is likely the Crown would need to seek an innovative funding solution. The Crown would likely need to carry the risk of the port being constructed particularly given the consenting issues but, once constructed, there are an array of options for

[28] The working assumption behind this analysis is that local government and/or private investors finance the port infrastructure and consenting costs, and central government finances complementary rail and road infrastructure, and any other costs required to facilitate the investment. Central government would also shoulder any costs associated with preparing enabling legislation, if needed.

financing. Long-term assets such as a port are much sought after by pension funds and other perpetual investors.

12. Supply-chain stakeholder perspectives

This section provides key stakeholder perspectives on the scope of this report. Two senior transport specialists and Sapere undertook targeted consultation with key stakeholders across the supply-chain including: shipping companies, ports, freight forwarders, a marine insurer and critical industry and bulk importers.[29] There is clearly a mix of views amongst these stakeholders and we caution about taking these as representative of a full market sounding.

These discussions were undertaken to inform the analysis and economic modelling of this study with real world perspectives and insight into likely market reactions from proposed relocation of POAL. Discussions considered the current need for relocation, the benefits and constraints of alternative port options and likely outcomes.

The **key themes** identified from engagement with key supply-chain stakeholders are noted below.

12.1 Northport does not make intuitive sense

Distance from and to market is critical as is avoidance of double handling where possible. Increasing the length of the supply chain invariably increases costs. While many cities have relocated their port, most moves have been within 50km. Northport is considered too far from main markets, especially the growing markets and distribution hubs of South Auckland, Waikato and the Bay of Plenty, but also from sizeable export markets. Stakeholders see that there will be additional cost and risk (e.g. of product spoilage) from routing freight through Northport. Based on current freight flows, it is in the wrong location where very little freight business is either generated or destined.

The extent to which this distance matters depends on the stakeholder. From a logistics perspective, one interviewee indicated this transport cost was a small part of his overall cost. Others felt differently.

12.1.1 Rail transport may be suboptimal

The main rail line connecting Northland to Auckland is not straight and therefore slow. The distance (approx. 200km) is just on the limit for what is generally considered optimal for rail freight. Stakeholders believed international studies indicate road is more cost effective than rail for distances less than 200km, while rail is preferred for the 200-500km range and coastal shipping (that requires a Waitematā Harbour berth) for longer distances.

[29] The supply chain stakeholders are not identified for confidentiality. This engagement was separate from engagement undertaken by officials with iwi and Māori stakeholders (reported in (Ministry of Transport, The Policy Shop, 2020) and cornerstone partners.

12.2 Manukau's proximity to land-side supply chain is an advantage

While the harbour present challenges to operational capability that may be addressed, the shortening of the supply chain is highly desirable.

12.2.1 This advantage may not be permanent

Land-side supply chain infrastructure is dynamic, shifting to follow cost efficiencies. The current volumes of import cargo going to South Auckland, may be a result of historical practices and influences rather than a sustained and/or distinct advantage. As an example, we note that the recently established inland port and logistics hub in Ruakura is port neutral.

12.2.2 Perceptions of risk at Manukau

There are perceptions that Manukau has elements of risk attached to it, including distance from shipping routes, poor weather and that the harbour entrance would make access uncertain and raise insurance issues. Technical solutions include a tug station and dredged entrance channel, with annual maintenance dredge volumes being comparable with those at Taranaki and Otago. It was acknowledged that those issues could be tested empirically and are not resolvable until a full feasibility study is completed. Discussions with shipping company representatives and a marine insurer elicited the following points.

- The port consultant's view, factoring in harbour master views on a Manukau container port with a dredged channel and a tug station, is that shipping access to the harbour is a sound concept unless proven otherwise by a full feasibility study.
- New Zealand insurance companies only insure the cargo, and there is no additional premium for west coast ports. Container ships are international vessels insured by large international insurers such as Lloyds. These insurers would be reactive to and go along with a national decision if it is determined to be a feasible project.
- A shipping route from Australia and south east Asia to a container port on the Manukau Harbour would work. A first stop would be to deliver imports to Auckland at Manukau, then a vessel would head through Cook Strait to pick up exports from the South Island, and then back up to the Port of Tauranga as the last stop to pick up exports before departing New Zealand, as is currently the case, with Tauranga usually being the last port of call.
- The uptake for a new port on the Manukau Harbour could play out like Sulphur Point at the Port of Tauranga. Initial uptake may be slow, but shipping lines would assess the new port to determine if it offers advantages e.g. avoiding other port calls. After one shipping line becomes the first mover, other shipping lines will gradually follow, and it could become accepted. The uptake by shipping lines would be strengthened if there is certainty that POAL is going to close to freight activity.

12.3 Firth of Thames is favoured by shipping companies

Shipping company representatives affirmed a preference for a new port at the Firth of Thames as an alternative to POAL. It is thought the Firth of Thames option can viably co-exist with the Port of Tauranga, from a shipping logistics perspective. The rationale is that a new port on the Firth of Thames would be positioned to feed into South Auckland, Hamilton/Waikato and Tauranga/Bay of Plenty and further south, handling imports and exports.

12.3.1 Positive container balancing and competition implications

There is a massive need for empty containers in Waikato making it logical to investigate a distribution hub somewhere around Hamilton. Firth of Thames would also maintain competition for cargoes into and out of the Waikato region.

12.4 Tauranga may provide port scale efficiencies

The small-scale, long-distance nature of the supply chain means that shipping is relatively expensive into New Zealand and the business is finely balanced from a commercial perspective. To maintain future cost competitiveness, shipping lines are moving towards use of larger vessels, where possible. The move to a 9,000 TEU vessel is needed to consolidate freight, to be efficient in this small market.

Some supply chain stakeholders believe further development would give sufficient scale to Tauranga to pursue operational efficiencies and savings. The countervailing challenge for Tauranga is the inland movement of full containers north to Auckland and then empty boxes down south from Auckland with capacity approaching limitations of the current train programme.

12.5 Reducing the number of ports raises concerns

The closure of POAL with business shifting to Tauranga and/or Northport results in what is essentially a single owner. A potential outcome that several stakeholders expressed concern over.

If the competitive tension between POAL and POT disappeared, most stakeholders expect some cost would be added to the total cost charged to the importer/exporter and ultimately the consumer. (See also competition analysis in section 11.9.)

12.6 Shipping routes could adjust to any port option

Ultimately shipping lines are likely to call where the main ports are located, always preferring to take the lower cost option.

12.7 General cargo and bulk will need to stay in Auckland somewhere

General cargo typically arrives on ships like the “handisize” 30,000 tonne ships and sometimes the up to 60,000 tonne “handimax” ships. The load is not enclosed in a container and the customer organises

a fleet of trucks to run in a circuit to ensure the ship unload time is minimised. This general cargo is carried by road.

After discussions with industry stakeholders, many companies exporting and importing bulk freight in Auckland expressed significant concerns over the disruption to their supply chain and business if the port was to be moved from POAL. The effect will be different for different products:

- Scrap steel bulk is a low margin product. There was a significant risk that the scrap steel trade could cease altogether if the conditions following the port relocation were unfavourable. Some companies involved in the trade indicated that subsidies could be required for their business to continue to be viable.
- The effect on sand, ash and similar products is highly uncertain. It is already a burden on New Zealand production to have to import them and extra transport costs from a remote port would simply exacerbate the problem. One company implied that in such circumstances it may cease to locally manufacture and instead opt to import the finished product.
- Cement supply to Auckland by sea would cease. The industry states there would be a considerable effect on price if cement is moved by road (as would likely be the case). Such a scenario could result in up to 14,000 extra truck movements, and given cement is a key element in the cost of concrete, overall construction costs could rise as a result.
- Finally, some edible goods companies raised concerns around their ability to stay compliant with regulation and maintain the quality of their product if the port was moved. Should conditions turn unfavourably following the port move, Aucklanders could see lower quality products and, higher prices.

Overall, market discussions with industry found that around 65 per cent of all bulk (in terms of tonnes) currently going through POAL could be significantly negatively impacted if the port is moved.

We recommend investigating the ability to keep berthage and yard space to allow general cargo to be unloaded in Auckland.

Taking advice from an industry expert, in our modelling, we chose to only reduce bulk traffic of sand and cement by between 50 per cent and 70 per cent and eliminate road metals/aggregates.

13. Resource consenting issues

We commissioned a high-level/ desk-top evaluation of the consenting constraints at each proposed port site, examining the interplay of the relevant national, regional and district planning documents. The environmental values under the New Zealand Coastal Planning Statement ("NZCPS" see Appendix B).

The resulting evaluation explained how environmental values would bear on the ability to obtain the necessary approvals required under the Resource Management Act 1991 ("RMA" or "the Act"). The advice received also identifies the key risks and challenges associated with securing these approvals and sets out high level consenting strategies for each site.

The planning evaluation included:

- A review of the relevant national policy documents prepared under the RMA, particularly as they relate to development within the coastal environment.
- A review of other relevant documentation (including recent approvals under the RMA) in order to assist in identifying the environmental values that might exist at each site.
- A review of the policy framework set out in regional policy statements, regional coastal plans and district plans where relevant.
- A review of the consenting requirements set out in regional coastal plans and district plans.

The five sites were evaluated based on the infrastructure requirements summarised in section 5.2.

The evaluation found that establishing 'greenfield' port infrastructure will present considerable consenting challenges – primarily considering the (unbalanced) expectations for the management of environmental effects stemming from the NZCPS. A new port may need to be implemented through legislation.

A detailed analysis of all the relevant objectives and policies has been carried out for each site and can be found in the supporting papers provided to officials.

13.1 Assumptions

For the purpose of this high-level review, it has been assumed that some or all the following activities, will be required for all the sites:

- Within the coastal marine area: land reclamation (scale dependent on location); occupation of the coastal marine area; structures in the coastal marine area; construction discharges; capital and/or maintenance dredging; disturbance of the foreshore and/or seabed; and shipping activities.
- Land based activities: coastal port activities: in general, includes activities normally associated with the operation of vessels and other water related activities; cargo, handling and storage; embarking, disembarking and transit of passengers; launching, retrieval and storage of vessels; berthage and mooring activities; associated marshalling, parking, and manoeuvring of vehicles and trains, maintenance activities associated with port structures and development; and ancillary activities to the above.

It is acknowledged that extensive road and rail connections to the sites will be required for some of the options. For the new port sites in the Firth of Thames, considerable infrastructure upgrades are likely to be required as there are currently no rail or state highway connections in proximity to these sites. Any roading and rail connections to the established road and rail network has been considered at a high level, reflecting the level of uncertainty about where these connections could be located.

It is noted that, given the linear nature of new road and rail infrastructure, it is plausible for this infrastructure to be designed to avoid areas of higher environmental, cultural or social value. As such, the location of required road and/or rail connections is not expected to be the determinative factor to the evaluation of alternative sites – at least from a consenting perspective. Furthermore, it is noted that road and rail infrastructure may be able to be authorised via designation (providing some additional permitting flexibility).

Some matters have not been evaluated as being either less critical or subject to evaluations in other reports: water servicing requirements (i.e. waste water, stormwater or drinking water supply), including associated water takes and discharges; any air quality or air discharges; other activities, such as storage and use of hazardous substances, contaminated land matters, natural hazards matters, and transportation matters (such as access design, parking requirements); the economic viability or otherwise of port development at each site; and the operational and functional suitability of the sites for shipping purposes

13.2 Consenting expansion of Ports of Auckland

Existing ports including the Ports of Auckland are considered to present viable options for expansion / enhancements of port facilities over 30-year time frame, subject to the appropriate management of potential effects on the environment and Mana Whenua values. Being an existing port, the Auckland Unitary Plan ("AUP") already recognises the importance of the port through bespoke zoning and rules which continue to provide for its ongoing operation and use. For works within the Port Precinct, it is considered that seeking resource consents for the expansion works and associated activities fits comfortably within the planning framework, albeit subject to a detailed assessment of the potential effects of such activities on water quality, ecological values, amenity, noise and cultural values.

Recent developments by Panuku in the Waitematā Harbour have involved significant engagement with Mana Whenua, and the resolution of issues relating to historical associations with the Waitematā Harbour and the reclamation of the coastal marine area that is subject to applications under the Marine and Coastal Area (Takutai) Act 2011.

The assumption that the port can expand according to its 30-year plans for additional yard capacity at Fergusson Container Terminal and the conversion of Freyberg Wharf to container operations is sustainable but there is much less certainty about the ability to expand further after 30 years. While the amenity (and other) environmental effects arising from any future expansion proposal would appear to be manageable when considered in isolation, it should be anticipated any proposed expansion or enhancement of the port will draw considerable public interest and strong opposition from a range of stakeholder groups (e.g. Urban Auckland, Stop Stealing Our Harbour and some Iwi). It may be that perceived social effects, as opposed to biophysical effects, are unable to be avoided or mitigated by any future expansion or enhancement of the port.

In summary, future expansion would not achieve 'social license' and would attract extensive delays in the consenting process from appeals etc.

13.3 Northport expansion

The Northport site is located within the Marsden Point Port Zone in both the Whangārei District Plan and the Proposed Northland Regional Coastal Plan. At present, there is port zoned land that is not currently used by Northport. Port expansion activities to the south and south west will occupy this port zoned land and may also occur in the Business 2 and Business 4 zones. The Northland Regional Policy Statement is enabling of regionally significant infrastructure, which includes Northport. The site is not located in any identified outstanding or high landscape and natural character areas. However, the site forms part of the wider coastal natural character environment, and in particular Mair Bank, which extends east of the oil refinery is identified as a High Natural Character Area.

While the port (and port zoned area that is not currently developed for port use) is within the Significant Marine Mammal and Seabirds Ecological Area, the significance of the ecological values in this area were assessed as part of Refinery New Zealand's resource consent application for dredging within the Whangārei Harbour and surrounds in 2017. The outcome of this application demonstrated that potential effects on threatened or endangered marine mammals could be appropriately managed, and consent was granted. This previous application would suggest that any such potential effects can be adequately managed / overcome (for example through the use of marine mammal observers during construction).

For works within the Port Zone, it is considered that seeking resource consents for the expansion works and associated activities fits comfortably within the planning framework, albeit subject to a detailed assessment of the potential effects on such activities on marine mammals and sea birds, and cultural values.

If dredging that affects Mair Bank is required (i.e. beyond the entrance to the harbour), this activity could present significant consenting challenges, or barriers to consenting, due to the directive provisions of the Proposed Northland Regional Plan (which give effect to the requirements set out in Policies 11 and 13 of the NZCPS) relating to the management of ecological, cultural and high natural character values in this area.

13.4 Port of Tauranga expansion

The Port of Tauranga, and more specifically, Sulphur Point, is part of existing and clearly defined Port Zones in the Bay of Plenty Regional Coastal Environment Plan and the Tauranga City Plan, which generally allow for a range of port type activities, within defined limits and locations.

Further to the above, the site is located within the Port Industry Zone (Figure 8) in the Tauranga City Plan and the Tauranga Harbour Port Zone (Figure 9) in the Bay of Plenty Regional Coastal Environment Plan. Proposed port expansion activities to the south and south west would likely occur in the Active Open Space, Commercial and Industrial Zones. As such, expansion of port facilities at Tauranga has been found to be a relatively straightforward proposition.

There is much less certainty about the ability to expand capacity to hold the entirety of the ports of Auckland's freight task than there is for expansion plans to hold a share of that capacity. This is because if expansion is required toward the Southern end of the existing port there are potential imitations to development (at height) arising from Tauranga Airport aircraft slope surfaces and viewshafts to Mauao.[30]

Relocating the airport runway eastwards to potentially gain additional height capacity at Sulphur Point has not been considered as part of this evaluation. Notwithstanding this, it is expected that such a project would also have significant consenting challenges itself - particularly given that it would reduce the buffer between the end of the runway and adjacent residential and commercial areas.

The consenting issues associated with improvements and additional capacity to the bridge and highway adjacent to Sulphur Point were not considered in the workstream and are not included in the port consenting cost estimates. Improvements to bridge and road infrastructure would be consented concurrently.

13.5 The Firth of Thames sites

There are two potential sites in the Firth of Thames: Kawakawa Bay and Waimaongō Point.

Both sites are located within the jurisdiction of Auckland Council. As a unitary authority, Auckland Council undertakes the functions of both a regional and district council. All the relevant regional and district planning requirements under the RMA, including the Regional Policy Statement for Auckland, are contained within a single document – the AUP. The AUP was prepared subsequent to the NZCPS being gazetted and is considered to give effect to the directive provisions of the NZCPS (specifically, Policies 11, 13, and 15).

These policies direct Auckland Council to avoid all effects on outstanding natural landscapes and features, and to avoid significant adverse effects on high natural character areas and indigenous biodiversity and other seascapes. In addition, the requirements of the Hauraki Gulf Marine Park Act 2000 require consideration, as the AUP directs that the management of the Hauraki Gulf gives effect to sections 7 and 8 of the Hauraki Gulf Marine Park Act 2000. Section 7 of this Act recognises the Gulf's national significance and its life supporting capacity that provides for the relationship with Mana Whenua and social, economic, recreational and cultural wellbeing of people and communities. **Thus, it is considered likely that designing a consentable port development in either location will be very difficult.**

[30] The Specified Airport Slope Surfaces are a requirement of the Civil Aviation Authority.
These slopes must be kept free from objects or structures to ensure aircraft safety is maintained when operating at low altitudes in the vicinity of an airport. Due to the proximity of Tauranga Airport, these surfaces impose height constraints on activities and structures on Sulphur Point, particularly at the southern end where it is located beneath the arrival and departure flight path. As these surfaces are fixed, there are generally few options available for securing additional height allowance above these surfaces. This has an overall limiting function on the extent to which future port activities can expand or be undertaken vertically, particularly at its southern extent.

- **Kawakawa Bay:** It is considered that obtaining the necessary resource consents to establish and operate a new port at the Kawakawa Bay site is unlikely to be viable. The development includes a new reclaimed island of around 250 hectares, Construction of two approximately 6km long new bridges to provide access to and from the port and two breakwaters up to 1km in length. Limited dredging activities would be required, as would the construction of transportation links. Parts of the coastline of the Kawakawa Bay site are identified as having both outstanding natural landscape values and high natural character values.
- **Waimaongō Point:** this site may be able to be designed and sited so as to avoid areas of particular significance in the AUP, but the effects that emanate from construction and subsequent modification to the coastal marine area are likely to be sufficiently adverse to independently challenge parts of the objectives / policies of the plan. More detailed work on construction methodology and specific mitigation strategies to address such issues may assist to ameliorate some of these policy concerns.

13.6 Manukau Harbour sites

There are three sites on the Manukau Harbour that were examined: central Manukau Harbour, Hikihiki and Puhinui. Of the three, and when compared to the Firth of Thames greenfield sites, the Puhinui site has relatively fewer identified significant ecological and outstanding landscape and natural character values to contend with. Notwithstanding this, the site is surrounded by areas of broadly defined significant marine and terrestrial ecology, areas of outstanding natural character and areas of significant value to Mana Whenua. Thus, **obtaining the necessary resource consents to establish and operate a new port anywhere in Manukau Harbour will present considerable challenges.**

- **Central Manukau Island Port site**: this option consists of a new reclaimed island in the central harbour, up to 250 hectares in area; dredging of the Papakura Channel; Construction of a 9km long causeway to provide access between the port and the wider Auckland Area; and the development of new transportation links between the causeway and the existing transportation network.

Given the clear direction within the AUP provisions to avoid significant adverse effects on indigenous biodiversity and other seascapes, it is considered that it will be difficult to design an option at this site that will not generate such effects. For example, The Central Manukau Harbour holds values relating to both indigenous species and migratory birds. Consenting is not expected to be viable without a plan change. If pursued, this would involve rezoning land and coastal marine area to a port zone and obtaining resource consents.

Undertaking a plan change to provide a port zone over the land and coastal marine area where the port and associated infrastructure will be located will also not be without significant challenges. Any plan change must give effect to the NZCPS and give effect to the relevant higher order provisions of the AUP. Based on the evaluation of the environmental values present at this site, it is considered that successfully promoting a plan change to rezone the site for port purposes is also likely to be difficult.

- **Puhinui Island Port site:** This option consists of the establishment of a new reclaimed island, on the edges of Papakura Channel, Waokauri Creek and Puhinui Creek. The

proposed island port would occupy a footprint of approximately 250 hectares, and would require dredging, construction of two bridges, and the extension of existing transportation links.

This is the most consentable of the greenfield sites. Situated off the coast of the Puhinui Reserve and Auckland International Airport, the site is located within the General Coastal Marine Zone. A small area of Coastal - Minor Port Zone is located immediately adjacent to / within the site and provides for activities associated with the existing LPG terminal. On land, the closest surrounding zones include a mixture of highly modified and highly natural land uses, including Special Purpose (Airport and Quarry) and Business Zones to the north, and Open Space type zones to the east.

The proposed site is surrounded by areas of broadly defined significant marine and terrestrial ecology, areas of outstanding natural character and areas of significant value to Mana Whenua. For example, the wider Puhinui site is located within six Significant Terrestrial Ecology Areas and six Significant Marine Ecology Areas. These ecological areas occupy almost all the seaward area of the proposed Puhinui site as well as the adjacent coastline. The intertidal banks and shellbanks near Puhinui Creek are valued for their gently graded sand flats, which support dense populations of intertidal sand flat organisms and provide an extensive feeding ground for thousands of international migratory and New Zealand endemic wading birds, including a number of threatened species. Nearby are significant areas of mangroves, including some of the oldest mangroves in the harbour. The saltmarsh impounded behind the Puhinui shellbanks is one of the largest and least disturbed areas of saltmarsh remaining in the Manukau Harbour. The saltmarshes support a variety of indigenous flora and fauna.
A plan change is considered necessary.[31]

Legislative change, allowing for alternative planning routes other than a plan change, could also be pursued should this site be the preferred location for a new port. A description of the possible alternative planning routes is provided below under the heading, "Alternative planning routes require legislative change".

- **Hikihiki Island Port sites:** This option involves establishment of a new reclaimed island on the Hikihiki Bank, adjacent to the Papakura Channel. The proposed island port would occupy a footprint of approximately 250 hectares, and would require dredging, construction of two bridges, and the extension of existing transportation links. It is not yet known where the bridges will connect with the surrounding land. Due to the proximity of Auckland International Airport, the wider landward area of the site is generally well serviced by established infrastructural networks and industrial precincts.

The site is considered to be more consentable than Central Manukau harbour as the ecological values are already affected due to the proximity of nearby highly modified environments, such as Auckland International Airport. The site itself is a natural seascape and forms part of the wider coastal natural character environment.

[31] If it proves viable to site and design the Puhinui port to avoid identified significant natural character and landscape areas, the prospect of consents being obtainable is improved. If this site is chosen, finer grained analysis of the numerous ecological and landscape values identified by our planning advisors will be required.

The proposed Hikihiki site is however located within two identified Significant Ecological Areas – Marine 2. These ecological areas occupy a large portion of the Hikihiki Bank and relate to the intertidal banks and wading bird habitats. The intertidal banks at the Hikihiki site are of ecological significance and support some of the most diverse and abundant intertidal sand flat organisms in the Manukau Harbour. The area is also an extensive feeding ground for migratory and endemic wading birds. These areas cover the vast majority of the site. It is clear that the Hikihiki site is surrounded by areas of broadly defined significant marine and terrestrial ecology, areas of outstanding natural character and areas of significant value to Mana Whenua. Thus, the proposal will be confronted with significant consenting challenges particularly given the clear direction within the provisions of the AUP to avoid significant adverse effects on indigenous biodiversity and other seascapes.

13.7 Consenting costs and timeframes

Expert input has been obtained about the time required to consent the Port development at each of the sites, and a guide to the costs associated with this process. Their estimates are based on the RMA approvals processes for similar large-scale infrastructure projects. The timeframes are high level, and assume that the plan change and resource consent applications will be prepared and processed concurrently.

The experts have highlighted that timeframes for any High Court, Court of Appeal and Supreme Court process are difficult to estimate and will depend on the circumstances of the case. A relatively streamlined pathway through the High Court could take approximately one year, whereas if the case is referred back to a lower order Court to revisit an earlier decision, this process could take two to three years. The estimation of the costs (also in Table 2) for the RMA approval process includes:

- input into the design process by planners and technical experts who will be preparing assessments of effects
- preparation of assessments of effects by technical experts, such as benthic, marine biologists and terrestrial ecologists, coastal processes experts, acoustic engineers, transportation engineers, landscape architects, cultural advisers, archaeologists, geologists, economists
- preparation of the resource consent and plan change applications; Council/EPA processing, including notification, hearing and decision
- applicant's costs for the hearing
- applicant's costs associated with an Environment Court appeal
- applicant's costs associated with a High Court (or other Court) appeal.

The costs for each project will generally be greater in the first three – five years, as expenditure associated with detailed design, consultation, option evaluation, the preparation of technical assessments and hearings will likely occur within this period. The expenditure in later years, whilst still significant, will be more likely linked to legal / appeal costs.

The costs, although significant, are minor in the scale of investment in ports that is likely to be required under any scenario. Table 37 summarises consenting costs and timeframes by scenario.

Table 37 Consenting costs and timeframes

	Base Case	Northport	Port of Tauranga	A shared increase in capacity at both Northport and Port of Tauranga	A new port on the Firth of Thames	A new port on the Manukau Harbour
Consenting cost	$3 – 5 million	$3 – 6 million	$3 – 6 million	$3 – 6 million	$7 - $8 million	$7 - $ 8 million
Consenting timeframes	5 - 8 years	5 - 8 years	5 - 8 years	5 - 8 years	8 – 10 years if possible	7– 9 years
CBA input	$4.5 million incurred in decade 2020 – 2030	$3 million incurred in decade 2020 – 2030	$3 million incurred in decade 2020 – 2030	$3 million incurred in decade 2020 – 2030	$7 million incurred in decade 2020 – 2030	$7 million incurred in decade 2020 – 2030

13.8 Directive policies in the NZCPS almost prevent new ports in the identified locations

These findings from the land use planning evaluation highlight that there are some significant, **if not insurmountable, challenges in obtaining the necessary RMA approvals for new port developments in the coastal environment under the current legislative scheme.** For the most part, these issues are the result of:

- The policy statement sitting at the top of the order, being the NZCPS, includes language that directs that adverse effects on certain environmental values are avoided
- **The Supreme Court's decision that the use of terms such as "avoid" have an ordinary meaning of "not allow" or "prevent the occurrence of"**[32] and do not allow for a broad overall judgement of both the positive and adverse effects when assessing the merits of an activity.[33]

The NZCPS does not replicate that directive policy language when it turns toward recognising and providing for the development of infrastructure such as port facilities. This means that the directive policies of protecting indigenous biodiversity (NZCPS Policy 11), preserving natural character (NZCPS Policy 13) and protecting natural features and landscapes (NZCPS Policy 15) effectively trump the more generally expressed enabling policies that apply to such things as infrastructure and port development.

[32] Note that decision makes exceptions for minor or transitory effects, however the nature of effects likely to be generated by a new greenfield port development are assumed to extend beyond minor or transitory.
[33] *Environmental Defence Society Inc v The New Zealand King Salmon Co Ltd* [2014] 1 NZLR 593.

In recent years, the interpretation of the NZCPS provisions, particularly Policies 13 and 15, has been extensively litigated in the Courts. The most significant of these being the Supreme Court decision *Environmental Defence Society Inc v The New Zealand King Salmon Co Ltd* [2014] 1 NZLR 593. In this decision, the Supreme Court found that the use of terms such as 'avoid' has an ordinary meaning of "not allow" or "prevent the occurrence of". As a result of this interpretation, the language used within Policies 11, 13 and 15 (being as directive as it is) therefore effectively establishes 'bottom lines' as the policies all seek to avoid (i.e. not allow or prevent the occurrence of) certain effects in the interests of protecting indigenous biodiversity (Policy 11), preserving natural character (Policy 13) and protecting natural features and landscapes (Policy 15).

Against the backdrop of this jurisprudence, subsequent experience has shown that the NZCPS (and plans prepared post the gazettal of the NZCPS) can present some significant consenting challenges for any new development in the coastal marine area – regardless of its merits or community benefits. In places of outstanding or high natural character or landscape value, or where ecological values are significant, the 'avoid' language in Policies 11, 13 and 15 (and the policies in corresponding lower-order plans) can effectively act as a bar to consents being able to be obtained.

When applied to the current context, most greenfield sites in the coastal marine area are likely to exude significant natural, ecological and / or landscape values, meaning that their level of policy protection is elevated within the NZCPS. This effectively amounts to a policy underpinning of considerable disadvantage for the proponent of any new port infrastructure of scale within the coastal marine area.

In addition, port authorities are not able to designate land to enable the development and operation of port activities in district plans. This is somewhat at odds with the situation available for other operators of significant infrastructure, such as airports, network utilities, water utilities and state highways. This means that the proponents of new port infrastructure must rely on resource consents, which can be multifaceted and complex, and which rely on a high level of certainty at the outset as to what is to be built, in order to authorise the land use activities associated with ports.

The current proposition that freight activities might be relocated away from the Ports of Auckland and replicated at another location is somewhat unprecedented in the RMA era. This analysis has revealed some of the challenges confronting a future applicant, if it is decided to pursue an alternative site to provide for port infrastructure, particularly where the preferred site falls within the coastal marine area.

13.9 Alternative planning routes require legislative change

A few mechanisms have been considered to assist in bridging the current lacunae. These mechanisms include:

- Allowing the new port sites to be designated in District Plans.
- Amending the NZCPS to be more enabling of new regionally or nationally significant port development and qualifying how the "avoid" policies relate to such infrastructure (i.e. by providing for some exceptions to the requirement to avoid adverse effects and / or significant adverse effects for nationally significant infrastructure).
- Enacting special legislation that establishes a bespoke planning approval process for new port development in an identified location. The special legislation could establish a

bespoke, one-off planning approval process for the new port development in an identified location. The special legislation would ideally override all other legislation that affects the planning authorisation process and provide a fast track process for obtaining the necessary authorisations for the development and its ongoing use. Once the necessary approvals are in place, the special legislation would terminate, then future works at the site would revert to being governed by the relevant local authority and the district and regional / unitary plans.

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Appendix A: Economic analysis comparisons

Table 24 in section 8 provided a comparison of costs and benefits between the current economic analysis with that produced for the Working Group. The tables in this appendix provide the same comparisons for Tauranga, Firth of Thames and split Northport and Tauranga. The Working Group did not include the Manukau in its economic analysis.

Table 38 Comparison with Working Group findings for economic analysis of Tauranga (PV, $m)

$m	Sapere	Working Group/EY	Difference
User costs: Rail	$1,285	$160	$1,125
User costs: Road	$2,010	$1,583	$426
Congestion	$16	$135	-$119
Emissions	$198	$31	$167
Safety	$109	$30	$79
Deadweight costs	$105	NA	-$105
Total operating costs	*$3,723*	*$1,939*	*$1,784*
Port Capacity Investment	$430	$330	$100
Rail transport investment	$123	$3,090	-$2,967
Road transport investment	$386	-$1,448	$1,834
Total capital costs	*$938*	*$3,420*	*-$2,482*
Rates income benefit	NA	$313	-$313
Leasehold income benefit	NA	$412	-$412
POAL Dividend benefit	NA	-$147	$147
Agglomeration benefits	-$27	NA	$27
Amenity benefits	-$919	NA	$919
Consumer welfare benefits	-$9	NA	$9
Producer welfare benefits	-$3	NA	$3
Total benefits	-$957	-$2,172	$1,215
Total costs	*$4,661*	*$5,506*	*-$845*
BCR	*0.21*	*0.39*	

Table 39 Comparison with Working Group findings for economic analysis of Firth of Thames (PV, $m)

$m	Sapere	Working Group/EY	Difference
User costs: Rail	$459	$139	$321
User costs: Road	$77	-$1,130	$1,207
Congestion	-$51	-$96	$45
Emissions	$31	-$22	$53
Safety	$16	-$21	$37
Deadweight costs	$941	NA	-$941
Total operating costs	*$1,525*	*$139*	*$1,386*
Port Capacity Investment	$2,242	$3,256	-$1,014
Rail transport investment	$3,403	$890	$2,514
Road transport investment	$1,132	-$2,282	$3,414
Total capital costs	*$6,778*	*$4,146*	*$2,632*
Rates income benefit	NA	$313	-$313
Leasehold income benefit	NA	$412	-$412
POAL Dividend benefit	NA	-$147	$147
Agglomeration benefits	-$27	NA	$27
Amenity benefits	-$919	NA	$919
Consumer welfare benefits	-$9	NA	$9
Producer welfare benefits	-$3	NA	$3
Total benefits	-$1,009	-$4,276	$3,268
Total costs	*$8,303*	*$4,431*	*$3,871*
BCR	*0.12*	*0.97*	

Table 40 Comparison with Working Group findings for economic analysis of split Northport & Tauranga (PV, $m)

$m	Sapere	Working Group/EY	Difference
User costs: Rail	$1,123	$211	$912
User costs: Road	$2,124	$208	$1,915
Congestion	$60	$18	$42
Emissions	$202	$4	$198
Safety	$113	$4	$109
Deadweight costs	$607	NA	-$607
Total operating costs	*$4,229*	*$445*	*$3,783*
Port Capacity Investment	$599	$514	$85
Rail transport investment	$1,965	$1,329	$637
Road transport investment	$1,012	-$27	$1,038
Total capital costs	*$3,575*	*$1,843*	*$1,733*
Rates income benefit	NA	$313	-$313
Leasehold income benefit	NA	$412	-$412
POAL Dividend benefit	NA	-$147	$147
Agglomeration benefits	-$27	NA	$27
Amenity benefits	-$919	NA	$919
Consumer welfare benefits	-$9	NA	$9
Producer welfare benefits	-$3	NA	$3
Total benefits	-$957	-$751	-$206
Total costs	*$7,804*	*$2,435*	*$5,369*
BCR	*0.12*	*0.31*	

Appendix B: CBA sensitivity analyses

Lower discount rate improves BCRs but worsens net benefits

Table 41 compares the core results for all options with the results from lowering the discount rate to 4 per cent for the Calibrated freight forecast. BCRs across all options rise, but the net costs to society also rise for all options except Manukau. The lower discount rate sees both costs and benefits rise, but the proportional change in benefits is greater than the proportional change in costs.

As the majority of benefits do not arise until much later in the analysis period (i.e. once freight operations cease), the effect of discounting is felt more acutely on the benefits side. For the Manukau option, the nearer-term capital costs rise but the ongoing operational costs, which are lower than those of the status quo across the board effectively outweigh the rise in costs over time and hence net costs reduce considerably, to just over a billion dollars.

The best performing option (Manukau) now has a BCR of 0.752, which while still beneath 'break even', has risen by around 70 per cent, from 0.443 with a 6 per cent discount rate. Benefits for this option almost doubled, while costs grew by just under a quarter.

Table 42 shows the same pattern emerges for results using the Officials' agreed freight forecast.

We do not report the results for a higher discount rate assumption (i.e. eight per cent), but qualitatively the same results are found.

Table 41 CBA lower discount rate sensitivity results, Calibrated forecast, PV, $m

	Northport		Tauranga		Firth of Thames		Northport and Tauranga		Manukau	
	6%	4%	6%	4%	6%	4%	6%	4%	6%	4%
Total benefits	$957	$2,019	$957	$2,019	$1,009	$2,125	$957	$2,019	$1,579	$3,290
Total costs	$7,209	$11,524	$4,661	$8,716	$8,303	$10,655	$7,804	$12,325	$3,561	$4,376
Net benefits	-$6,252	-$9,505	-$3,703	-$6,697	-$7,294	-$8,530	-$6,847	-$10,305	-$1,982	-$1,087
BCR	**0.133**	**0.175**	**0.205**	**0.232**	**0.121**	**0.199**	**0.123**	**0.164**	**0.443**	**0.752**

Table 42 CBA lower discount rate sensitivity results, Officials' agreed forecast, PV, $m

	Northport		Tauranga		Firth of Thames		Northport and Tauranga		Manukau	
	6%	4%	6%	4%	6%	4%	6%	4%	6%	4%
Total benefits	$957	$2,019	$957	$2,019	$1,009	$2,125	$957	$2,019	$1,384	$2,872
Total costs	$5,878	$8,621	$3,168	$5,525	$7,930	$10,082	$6,645	$9,653	$3,581	$4,489
Net benefits	-$4,921	-$6,602	-$2,210	-$3,506	-$6,921	-$7,957	-$5,688	-$7,634	-$2,197	-$1,617
BCR	**0.163**	**0.234**	**0.302**	**0.365**	**0.127**	**0.211**	**0.144**	**0.209**	**0.386**	**0.640**

Higher discount rate worsens BCRs but improves net benefits

Table 43 shows that increasing the discount rate from the core value of 6 per cent to 8 per cent has the opposite effect of lowering the discount rate on BCRs, which drop across all options.

In essence, raising the discount rate increases the 'punishing' effects of discounting on impacts further out in time. This means that benefits reduce proportionally more than costs do, bringing the BCR down as a result. Again however, the relativity between costs and benefits means that the effect on net benefits (costs to society in this case) is more subdued.

Manukau remains the best performing option, but the BCR for the option is now 0.279 as opposed to 0.443 with a discount rate of 6 per cent (a fall of some 68%). Benefits fell by around a half, while costs fell by around 24 per cent, leading to a fall in net costs to society of around 4 per cent.

Similar results are found using the Officials' agreed freight forecast (see Table 44).

Table 43 CBA higher discount rate sensitivity results, Calibrated forecast, PV, $m

	Northport		Tauranga		Firth of Thames		Northport and Tauranga		Manukau	
	6%	8%	6%	8%	6%	8%	6%	8%	6%	8%
Total benefits	$957	$475	$957	$475	$1,009	$501	$957	$475	$1,579	$796
Total costs	$7,209	$4,853	$4,661	$2,688	$8,303	$6,462	$7,804	$5,331	$3,561	$2,855
Net benefits	-$6,252	-$4,377	-$3,703	-$2,213	-$7,294	-$5,960	-$6,847	-$4,856	-$1,982	-$2,060
BCR	**0.133**	**0.098**	**0.205**	**0.177**	**0.121**	**0.078**	**0.123**	**0.089**	**0.443**	**0.279**

Table 44 CBA higher discount rate sensitivity results, Officials' agreed forecast, PV, $m

	Northport		Tauranga		Firth of Thames		Northport and Tauranga		Manukau	
	6%	8%	6%	8%	6%	8%	6%	8%	6%	8%
Total benefits	$957	$475	$957	$475	$1,009	$501	$957	$475	$1,384	$700
Total costs	$5,878	$4,216	$3,168	$1,951	$7,930	$6,185	$6,645	$4,802	$3,581	$2,824
Net benefits	-$4,921	-$3,740	-$2,210	-$1,476	-$6,921	-$5,683	-$5,688	-$4,327	-$2,197	-$2,124
BCR	**0.163**	**0.113**	**0.302**	**0.244**	**0.127**	**0.081**	**0.144**	**0.099**	**0.386**	**0.248**

Hastening the relocation of freight operations improves BCRs but worsens net benefits for all but the Manukau option

Table 45 presents the effects, using the calibrated freight forecast, of reducing the construction time for the port relocation from 10 years to five and the time for full relocation of freight from five years to two (effectively bringing forward the move by seven years).

The effect is to improve the BCRs but worsen the net benefits (rise net costs) across all options except Manukau, which sees net benefits improve slightly. Qualitatively, this is much the same effect as lowering the discount rate. The explanation for such effects is similar: benefits rise proportionally more than costs (lifting the ratio of benefits to costs). However, the size of costs means that, in absolute terms the effect of the lower proportional change in costs essentially swamps the rise in benefits, leading to a worsening of net benefits to society for all but the Manukau option.

Focussing again on the Manukau option we see that benefits rose by around 39% while costs rose by around 17%. Net benefits rise by around 2%, while the BCR improves by about 20%.

Table 45 CBA sensitivity results for shortened construction and transition, Calibrated forecast, PV, $m

	Northport		Tauranga		Firth of Thames		NPort and Tga		Manukau	
	Core	Quicker	Core	Quicker	Core	Quicker	Core	Quicker	Core	Quicker
Total benefits	$957	$1,375	$957	$1,375	$1,009	$1,441	$957	$1,375	$1,579	$2,191
Total costs	$7,209	$8,970	$4,661	$6,001	$8,303	$9,682	$7,804	$9,785	$3,561	$4,134
Net benefits	-$6,252	-$7,595	-$3,703	-$4,626	-$7,294	-$8,241	-$6,847	-$8,410	-$1,982	-$1,943
BCR	**0.133**	**0.153**	**0.205**	**0.229**	**0.121**	**0.149**	**0.123**	**0.141**	**0.443**	**0.530**

Table 46 CBA sensitivity results for shortened construction and transition, Officials' agreed forecast, PV, $m

	Northport		Tauranga		Firth of Thames		NPort and Tga		Manukau	
	Core	Quicker	Core	Quicker	Core	Quicker	Core	Quicker	Core	Quicker
Total benefits	$957	$1,375	$957	$1,375	$1,009	$1,441	$957	$1,375	$1,384	$1,961
Total costs	$5,878	$7,400	$3,168	$4,242	$7,930	$9,190	$6,645	$8,360	$3,581	$4,103
Net benefits	-$4,921	-$6,025	-$2,210	-$2,867	-$6,921	-$7,749	-$5,688	-$6,985	-$2,197	-$2,142
BCR	**0.163**	**0.186**	**0.302**	**0.324**	**0.127**	**0.157**	**0.144**	**0.164**	**0.386**	**0.478**

Appendix C: NZ Coastal Policy Statement

The purpose of the NZCPS is to state objectives and policies in order to achieve the overarching purpose of the Resource Management Act 1991 (RMA) in relation to the coastal environment.

The NZCPS contains a number of enabling policies that would assist the RMA approval process for any of the coastal port options identified. However, the NZCPS also includes a range of policies which are specifically directed at the protection, or avoidance, of adverse effects on, significant coastal values.

Policy 9 of the NZCPS specifically relates to ports. The policy recognises that a sustainable and effective national transport system requires an efficient network of safe ports, servicing national and international shipping, with efficient connections with other transport modes.

Reclamation activities within the coastal marine area are specifically addressed in Policy 10 of the NZCPS. Policy 10(1) seeks to avoid reclamation unless (i) land outside of the coastal marine area is not available for the proposed activity, (ii) the activity can only occur in or adjacent to the coastal marine area, (iii) there are no practicable alternative methods (to reclamation) of providing the activity, and (iv) the reclamation will provide significant regional or national benefit. It would be reasonable to assume that all of the coastal port sites could demonstrate that the matters set out in this policy can be met and that reclamation avoidance is not a practicable option.

Policy 11 addresses indigenous biodiversity. Policy 11(a) seeks to protect indigenous biodiversity within the coastal environment by avoiding adverse effects on more sensitive areas of indigenous biodiversity. By contrast, sub-paragraph 11(b) seeks to avoid significant adverse effects and avoid, remedy or mitigate other adverse effects in less sensitive indigenous biodiversity. similar cascading management approach is set out within Policy 13 with respect to natural character. Specifically, Policy 13(a) seeks to preserve natural character and protect it from 'inappropriate use and development' by avoiding adverse effects of activities in areas of outstanding natural character. Policy 13(b) requires a lesser level of protection for natural character areas that are not 'outstanding' and states that significant adverse effects on natural character are to be avoided, and all other effects on natural character are to be avoided, remedied or mitigated.

Policy 15 addresses natural features and natural landscapes. In line with Policies 11 and 13, the cascading approach requires under sub-paragraph (a) that natural features and landscapes (including seascapes) be protected from 'inappropriate use and development' by avoiding adverse effects on areas identified as outstanding natural features and outstanding natural landscapes. Sub-paragraph (b) requires that significant adverse effects on other natural features and landscapes (including seascapes) be avoided, and all other effects on those features and landscapes be avoided, remedied or mitigated.

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