



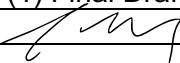
North Island Container Port Review

Long-Term Alternative Container Port Supplement

6th March 2020

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 **BLACK QUAY**
CONSULTING

Report Number	BQ-0935
Project Authors	A Zsembery / G Curry
Project Director	G Curry
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Prepared for:

Sapere Research Group Ltd

Level 8, 203 Queen Street
 PO Box 2475, Shortland Street,
 Auckland 1140

By:

Black Quay Maritime Consulting Pty Ltd

2 Codrington Street
 Cranbourne
 Victoria 3977

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1 Introduction

1.1 Reporting Requirements

Black Quay Consulting (Black Quay) has been engaged by Sapere Research Group Ltd in New Zealand (Sapere) to provide high-level independent desktop port planning advice as part of Sapere's commission to review all work undertaken to date in determining the best solution for Auckland's long-term container port needs.

It is understood that Sapere's review includes examining and testing the outcomes of the Port Future Study (PFS), the Northport Study and various claims and assumptions made by Port of Auckland (POAL) and Port of Tauranga (POT) in terms of their ability to accommodate the long-term trade task.

Specifically, Black Quay have been engaged to provide the following:

PART I: NZ Long-Term Maximum Container Vessel Review

- > Desktop Based opinion on the future long-term New Zealand fleet, restricted to high level assumptions around the maximum design vessel that can be expected to frequent North Island ports in the long-term (report no. BQ0934)

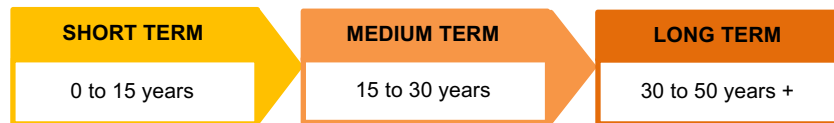
PART II: New Port Options Review

- > Critical desktop review of the two alternative port options presented in the PFS; namely the preferred options in the Firth of Thames and the Manukau Harbour with the intent of gaining improved confidence around the technical and operational viability of those options and review of the order of magnitude capital cost associated with each (this report)

PART III: Port of Auckland Expert Advice

- > Expert independent opinion and advice on POAL's claimed future capacity to deal with the long-term trade task (restricted to verbal advice only)
- > Other expert advice and opinion if required by Sapere, including potential input to proving claims made at other existing North Island ports (to be determined).

This report and other work prepared by Black Quay makes reference to timeframes, and therefore it is important to understand these in context. For clarity, timeframes referred to are as follows:



It is worth noting that this generally corresponds to the timeframe assumptions within the PFS.

1.2 Limitations of Use

This report and its contents form only part of Black Quay's wider remit to deliver the items listed in Section 1.1. Accordingly, all contents, assumptions and findings contained within this report must be considered alongside all other elements within Black Quay's remit.

The report may contain forward looking statements. These are based on Black Quay's initial views and assumptions of future scenarios or events as at the date of this report and are subject to change, including generally as a result of changing future economic conditions or other changes that might emerge.

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- > The actual performance results may differ from those projected, consequently, no guarantee is presented or implied as to the accuracy of specific forecasts, projections or predictive statements contained herein.
- > Inevitably, some assumptions will not materialize, and unanticipated events and circumstances may affect the ultimate results.

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2 Strategic Context

2.1 Background

The future of Auckland port has been questioned for some time. There is public pressure to relocate the port out of the city's waterfront, and this culminated with a court order for the port to cease land reclamation into the Waitemata Harbour. This effectively limited the port's ability to handle the future trade task that the port is there to facilitate.

Subsequent to the court order, Auckland Council (owner of the Port of Auckland) commissioned a comprehensive study into Port of Auckland's future and where best to locate the long-term port serving the city. The Port Future Study (PFS) generally concluded that Port of Auckland is constrained on a number of fronts, but that it could in theory continue to service at least some of the future trade task, depending on the level of trade growth over a limited timeframe.

However, this would require considerable reworking of its operations and did not provide ultimate surety around accommodating the long-term task. The PFS considered these technical and operational findings alongside other social and environmental factors; not least of all the public desire to see the port relocated out of the city centre. The Port has gained consent to extend Bledisloe wharf, but by suspending the extension rather than through reclamation.

However, the main finding of the PFS was that the construction of a new purpose-built, and state of the art port elsewhere scored higher than any other option investigated, including those to allow Port of Auckland to remain and expand in the longer term, or for Tauranga to take Auckland's future trade task alongside its own. The PFS also scored the notion of developing Northport to serve Auckland's future trade relatively low.

A primary reason for these findings was relative distance to markets. Whilst Port of Auckland's location means that freight must travel through the city centre to some degree (not ideal and generally contrary to modern port planning principles), the very nature of the port, being an historic hub within the city it serves means that its distance to market is relatively good.

Conversely, rather than simply being a port planning principle, the notion of relocating the port some distance from the primary markets in Auckland is questionable and would inevitably lead to higher freight costs.

This is of primary importance, not only to the study, but to Auckland's future as a trading hub. Should freight costs increase, then service providers along the supply chain will almost certainly pass these costs on to the consumer or customer. This in turn drives up export and import costs and competitiveness down.

As such, a primary factor in the scoring of options in the PFS was distance to markets. It is generally agreed that the South Auckland region will continue to be the central industrial hub for Auckland, and in being so, is at least in some ways equivalent to being the central industrial hub for New Zealand.

The PFS identified two (2) general areas where a new future port might be located; those being within the Firth of Thames and the Manukau Harbour. Whilst scores of the various options differed, the relatively short distance to markets for these areas (relative to South Auckland) scored highest. Indeed, an option constructed within the Manukau Harbour would mean that the port would be effectively integrated into South Auckland and the primary markets of the city.

Other principal advantages were claimed for these options, including the ability to stage and expand the capacity of the port almost indefinitely, thereby securing Auckland against a repeat of current long-term port related uncertainty. Whilst capital costs were inevitably high, all options investigated would require significant capital spending, and the ability to reduce operational costs was a contrary advantage.

Black Quay (who were involved in the PFS) will re-examine the theoretical viability of these options in this report, however this should be read in conjunction with the findings of Black Quay's separate fleet profile supplement (Report no. BQ0934 – 'North Island Long-Term Maximum Container Vessel'), given that the long-term shipping task is clearly of key importance in determining future port needs.

As part of the PFS, a fleet forecast was produced by Black Quay. This covered both container shipping, automotive shipping and other shipping types. Whilst high level in nature (Black Quay regularly undertake detailed global fleet forecasting), it was an important element of the PFS and proved to be a considerable

improvement over the then assumptions around the future New Zealand container design vessel.

In essence, prior to the PFS, the New Zealand industry assumed a container vessel no larger than 8,000 TEU would frequent its ports. The PFS recommended that 8,000 TEU vessels would visit the country much sooner and that up to 9,600 TEU vessels would emerge on New Zealand loops. Since the study was completed, this has in fact occurred already.

The ability of New Zealand ports to accommodate the future fleet is of paramount importance. Therefore, understanding what it may be, should be a key part of this overall study (as it was within the PFS). Review of this was provided in the previous Black Quay report supplement.

This report provides a review of the top two alternative new port locations identified in the PFS study. As technical lead on the PFS, it was Black Quay who identified, analysed and developed these options as part of the study (not including land transport analysis).

It is important to note that Black Quay deliberately identified all theoretical locations for a new port around New Zealand's North Island Coast as part of the PFS. Whilst some of these options were known to be unrealistic, it was essential as part of a proven long-term strategy to identify all theoretical options so that they were not bought up at any stage in the future.

The detailed analysis included as part of the PFS (by Black Quay and other sub-consultants under EY, as well as EY themselves) identified several preferred alternative new port locations, namely those in the Manukau Harbour and Firth of Thames.

This report is intended to provide some renewed desktop review of the top two options, including revision (where deemed necessary) of the order of magnitude capital costs of building these ports.

3 New Port Drivers

The PFS study went into considerable detail around assessing the optimal port solution for Auckland and its hinterland. This included both container analysis as well as other non-container trade handling.

This report is not intended to go into every detail of the PFS, but rather to test some of the key assumptions around new port philosophy for the North Island, as identified within the PFS, and based on container handling only.

In particular, this includes review of the order of magnitude capital costs of the options. As noted previously, the distance to markets for any port servicing Auckland and surrounds is of primary importance and will have a crucial bearing on import and export costs. Indeed, Black Quay believe that this is more important than the capital costs of any construction, particularly over the longer term.

Black Quay have not been commissioned to review operational costs such as the critical cost per box per kilometre, which is understood to be undertaken by Sapere as part of this study. We do deliberately make the point here that this must be assessed truly and sensibly given the magnitude of the impact on Auckland and New Zealand more widely.

Black Quay's fleet summary provided some key theoretical findings for consideration in this review, namely:

- > There is potential for New Zealand's upper end container vessels to reach up to 14,000 TEU in size out to the long-term. The timing

of this could vary, and potentially come sooner, largely dependent on lifting/elimination of Australian port limitations.

- > If this were to occur, Port of Tauranga would in its current state, be better placed to accommodate them than Auckland (whilst recognising that significant upgrade/expansion works may be required at Tauranga).
- > Port of Auckland is highly dependent on various resource consents to meet even its medium term aspirations (noting that POAL have stated that they see their design life being medium term limited in any case as a result of the PFS recommendations).
- > Should Port of Auckland be granted consent to increase its channel, berth and terminal capacities, based on its current plans and stated ultimate limitations, it may still be relatively limited compared to Tauranga depending on the size of vessel at that time, but possibly even in the short to medium term (i.e. would require increased depth and berth length over and above its current resource consent applications).
- > Should vessels increase to 14,000 TEU in size and up to 380m long and 15.5m draft, Port of Auckland would not be able to accommodate these without sizeable increases in channel and berth depths and significant increases in berth length over and above anything in its current masterplan.
- > A new port location servicing Auckland and its hinterland would be inevitably designed to accommodate vessels of this size, as well as have contingency for any further increases. New options identified within the PFS could in theory achieve this.

The final point is reviewed herein, along with general considerations of the preferred new port options.

3.1 Critical Factors

Critical factors influencing new port options and rationale within the PFS is summarised below¹:

- > Depending on the future container trade forecast volumes and related CAGR (and therefore subsequent timing), the timing of a need to either expand Auckland Port or replace it becomes acute.
- > Depending on the future container trade forecast volumes and related CAGR, the ability of Auckland to handle the trade on its own becomes untenable.
- > Depending on the future container trade forecast volumes and related CAGR, the ability of Tauranga to handle both Auckland's long-term trade as well as its own would become untenable (circa 5million TEU +).
- > The distance of other existing ports, namely Northport, is prohibitive to it being able to service Auckland in a cost effective manner (in assessing transport costs based on distance, as well as capital development costs of all transport infrastructure, including landside).

- > Given that distance to market is critical, a new port's location as close as possible to Auckland's south and related primary freight transport network is imperative.

It must be made clear that the PFS called for more detailed study on the two preferred options so that their potential and feasibility can be fully understood.

This study does not constitute the level of detailed study required to do this. Accordingly, in order to fully understand the potential of the site/s, additional study will be required, likely based around some conceptual level planning, modelling and design.

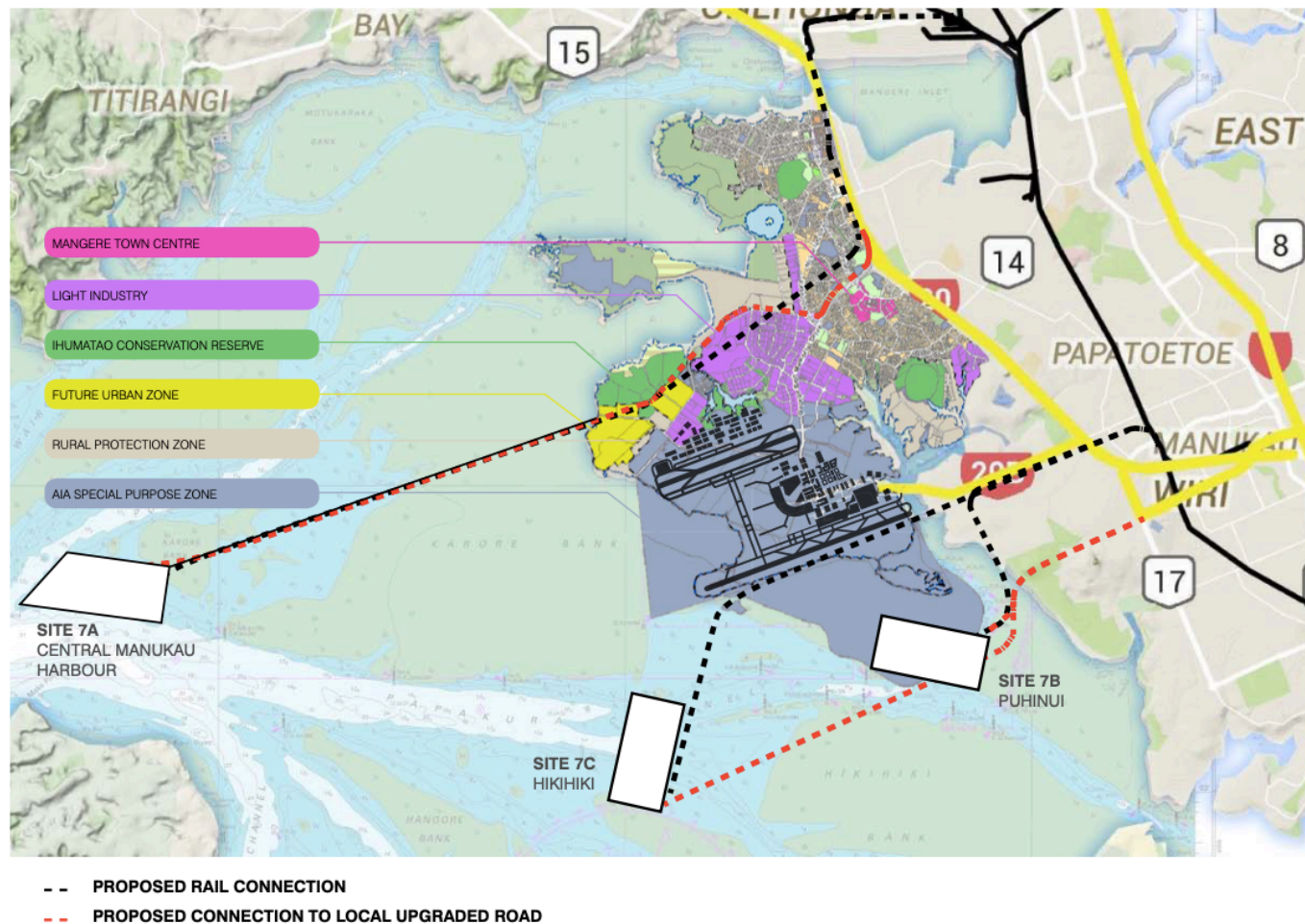
¹ The PFS went into considerable detail and on multiple considerations. It is important to understand these entirely.

4 Manukau Harbour Options

4.1 Identified Locations

The theoretical locations for a new port in Manukau, as identified in the PFS study are illustrated below. It should be noted that the 'Puhinui' option (Site 7B) was preferred (above all other options, including existing ports).

Figure 1 Port Future Study, Manukau Harbour Options (Black Quay, 2016)²



² This was prepared for EY under the PFS. Accordingly, it must not be shared as part of any other report.

4.2 Rationale Review

The Manukau Harbour was chosen as a potential location for a new port to serve Auckland for a number of reasons:

- > Its close proximity to South Auckland and the future trading hubs of the city, meaning near direct sea access to this area and reduced freight costs.
- > Its close proximity to the Waikato Region, meaning close sea access to this area.
- > Its close proximity to the primary landside transport regimes.
- > The fact that the harbour was used for port operations up until recently.
- > The ability to phase development and to secure future port capacity needs of Auckland and surrounds (near unlimited expansion potential).
- > The prospect of building an offshore island to reduce noise and light pollution associated with modern port operations (whilst recognising that these would also be reduced as part of world's best practice).
- > The ability to make use of relatively deep water access and thereby reduce dredging costs in theory.
- > The bathymetry in the area, meaning that construction costs would be minimised (in comparison to other options examined).

- > Moving the port out of Auckland to match the public mood to do so, and free up Auckland waterfront for other purposes.

Due to what appeared to be various political agendas during the preparation of the PFS, various attempts were made to discredit the Manukau harbour options. These were all substantially addressed during the study and the option was generally accepted as worthy of more detailed study. It is important to understand the nature of this, which has been summarised below:

4.2.1 Relative Development Cost Exposure

The notion of building a new port in the Manukau harbour would no doubt be an expensive exercise. What is important here is that building any new port will always be costly. The question then comes down to whether or not Manukau would cost substantially more than any other viable option versus the benefits that it could provide over those.

The estimated capital costs at this early stage are reviewed in the following section, however as a general point, Black Quay do not believe that this option would present significantly higher development costs than if any of the existing ports were expanded (recognising that both would be expensive).

This might raise some eyebrows on first read. After all, expanding operations at an existing port, with road, rail and channel access already in place, as well as substantial existing area would seem like a less expensive exercise intuitively. Whilst it is true that expansion of existing ports are often less expensive than building a

new port from scratch, the context of this needs to be better understood.

The PFS was based on agreed trade forecasts. These forecasts presented future trade volumes for Auckland that would mean that none of the existing ports could accommodate it alongside their own. So, if one considers the expansion of Tauranga to meet its own long-term task as well as that of Auckland, it would not be merely an exercise of typical expansion. Rather, it would be a large-scale transformational project, likely over many years.

Furthermore, the disruption of existing operations at the port would be sizeable and likely to lead to significant inefficiencies over the construction period.

Tauranga have claimed that they would handle all the long-term task but have never demonstrated (at least to our knowledge) how they would achieve this. Black Quay concluded that to do so would require major expansion, and a likely loss of other trade type areas for containers. This could include logs which are an important element of local industry. Either way, the capital cost of developing the port would be high.

The same applies to Auckland. Black Quay concluded in the PFS that Auckland could be made to handle the future task, but this would require major reclamation into the harbour, and potentially doubling its footprint. Even if this is argued by the port, the argument is irrelevant in long-term thinking, as trade would inevitably mean further and further expansion in a matter of time. Again, the capital cost of this development would be high in New Zealand terms.

Whilst Northport scored badly in the PFS for a number of reasons, and none more so than its unsuitable location and resultant impacts on trade costs, the cost of development at the port is not well understood.

There may be a case that developing Northport would cost less capital up front, but this would be based on absorbing only some of Auckland's trade task. If the port were to take all of Auckland's trade, not in today's volumes, but considering long-term future volumes, this would require massive expansion across all aspects of the port. And this is before the capital costs of rail and road are considered, which are more than likely prohibitive.

In other words, the long-term rationale of Northport is flawed. It would cost a large amount of capital to develop it to a point where it could absorb the long-term task, and worse still, there may be limited options to expand it beyond a certain point.

So then, the capital cost of building a new littoral port in the Manukau Harbour is perhaps more comparable to expansion of the existing ports than one might first think. However, it is the ability to expand the Manukau options that has an even greater influence on capital costs (as the cost to expand would likely be less).

Where a new port option does score badly however is the upfront capital. This is because despite the ability to stage the development, the first stage would inevitably be more expensive, as all the transport access and upfront works are required. Nevertheless, the new port option would likely cost less over time and certainly present less landside freight handling costs than other options.

4.2.2 Operational Costs

As stated, a primary driver for Manukau harbour scoring highly is its distance to markets.

The strategic strength of the harbour in this regard have been downplayed by various parties. Concentration in the media for instance has been more on how fantastical the notion of a new port there is. In fact, if a new port were built there, it could not be in a better operational position.

Assuming that Auckland's industrial future sits in the south of the city (and the Waikato region), the port would literally be integrated directly into the supply chain. From a port planning perspective, it is near perfect in this regard, and would connect relatively easily to the road and rail networks.

This would then reduce inner city traffic, now associated with the Port of Auckland. This is in stark contrast to building a port on the wrong side of the city and over 150km away.

Shipping access is discussed in the following sub-section.

4.2.3 Sea-Based Access

One of the larger blockers during the PFS study, was the claim that the harbour would not be accessible by ships and is dangerous.

Largely this was based around the notion that because it isn't currently a shipping harbour, it can't be in the future, and that it is dangerous having seen lost ships in the past.

This claim was never given any credibility. In fact, Black Quay met with the harbourmaster and representatives to discuss the Manukau harbour concepts and no credible argument was provided against it.

The discussions around lost shipping was also highly questionable, given the ship in question sank in 1863 (HMS Orpheus). Modern shipping has almost no relation to shipping at that time, with vessels now more powerful, more situationally aware, more reliable and more manoeuvrable.

However, other significant episodes did occur in more modern times. In 2003, a 4,500 tonne ship (Spirit of Enterprise) hit the sandbar at the mouth of the harbour when leaving it, after losing its rudder due to an unexpected wave. It is understood that the same ship also ran into similar trouble a few years before. This meant that restrictions were put in place based on tidal state.

The PFS did not make any claim to the contrary that waters along the west coast are rougher than those experienced on the east coast, and called for more detailed study (which has not been undertaken to Black Quay's knowledge).

The point made in the PFS was that shipping likely to use a new port in the Manukau harbour is significantly more advanced and

manoeuvrable. In addition, the report suggested that tugs might be stationed to escort ships through the harbour entrance as a safety measure. This is not uncommon in the ports and maritime industry. In Black Quay's opinion, shipping access to the harbour is a sound concept unless proven otherwise.

Even the shipping industry, whilst stating publicly that they might prefer an east coast option, gave no firm statements that they would not be able to access the harbour. In other words, no proof whatsoever has ever been provided to discount the Manukau Harbour being used for shipping. Indeed, it already was until recently (recognising that the frequency and size of vessels being discussed as part of a new container port would be notably larger).

The second factor raised was that shippers would not access the west coast from an operational perspective because it didn't follow current shipping routes. Again, this was largely aimed at discrediting the option without any formal investigations or detailed study to corroborate the claim.

It is true that the creation of a new west coast port would require an adjustment to New Zealand shipping routes. However, to claim that this change would be untenable or threaten New Zealand from a shipping access perspective is baseless. In some ways, it would fit better with the Australian routes, but in any case, shipping would simply adjust routes to suit. Some minor increases in distance on some routes would be matched by reductions on others.

In any case, the notion of cost increases is also baseless. The cost of shipping is rarely associated with relatively minor route length changes, but rather on ports' proximities to the major shipping

routes. Changing routes to include a west coast call would do little if anything to change Auckland's position relative to the Asian and west coast north American routes for instance, and as stated, provide some reduction in steaming time to and from Australia.

Shipping operations aside, the final factor that was raised was the sedimentation of the channel and harbour mouth; the argument being that it would require near constant dredging. The PFS included involvement by a prominent New Zealand coastal engineering consultancy. They investigated the issue and concluded that the issue of sedimentation was exaggerated and that whilst maintenance dredging would be required, the frequency and volumes of this would be no more than would be expected as part of any major port maintenance. Again, it is important to note that the PFS called for more detailed study on the options, including on this matter.

4.3 Capital Cost Review

The capital cost estimations of the Manukau preferred option have been grossly misstated in the New Zealand media and by certain public figures.

The overall capital and operational costs considered in the PFS were prepared by numerous expert consultants, all reporting to EY. As such, Black Quay cannot provide comment on some of these costs, including road and rail costs as they were calculated by other parties.

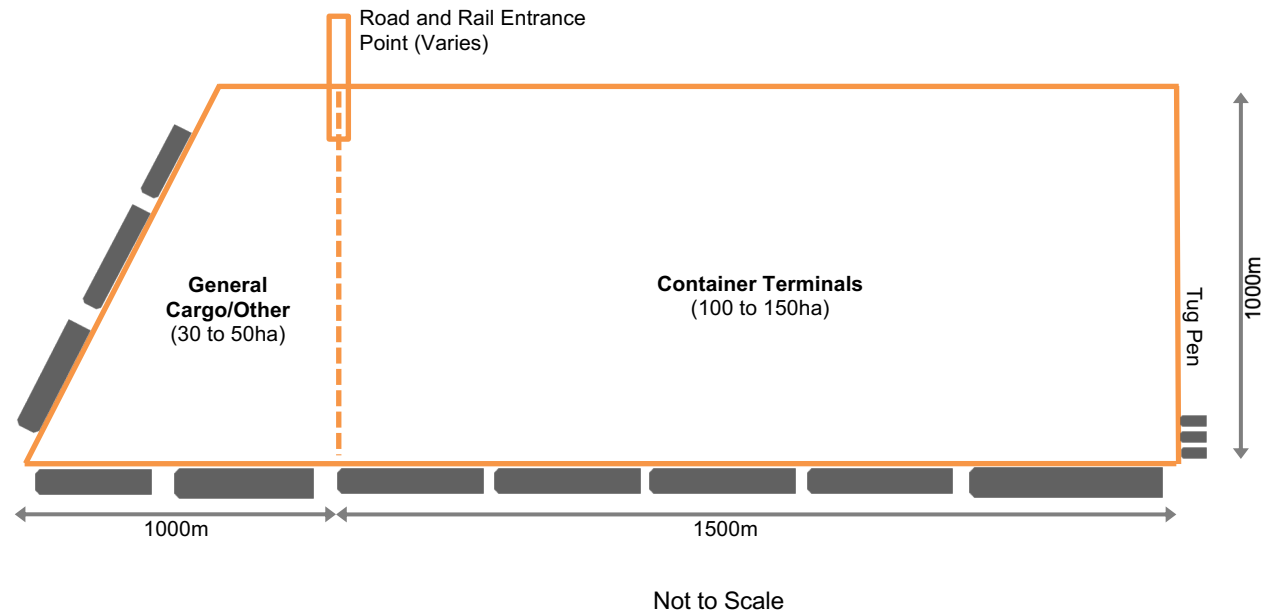
The cost of development of the port itself was calculated by Black Quay. This was a high-level order of magnitude estimate only as no concept designs were prepared.

However, in order to provide some basis for the high-level estimates, Black Quay did prepare a basic theoretical footprint and construction rationale for all options. Where possible, these were assessed on a like for like basis. In other words, the footprints were considered the same, however certain spatial and geographical considerations at each potential site meant that some tailoring was required. For example, the orientation and shape of the site changed based on prominent wave and current directions where known, or depth of water meant increased fill volumes for some over others.

The generic theoretical footprint is provided below. This is not to be published or shared but is given to provide Sapere with a reference point for the capital cost estimations. It is also important to note that these are not designs as such but were developed in an attempt to capture primary capital cost implications based on broad potential infrastructure requirements. It may well be that more detailed study would point towards a hybrid of these being more cost effective or beneficial, however the principle of an expandable island port remains.

Finally, the theory is based on certain productivity assumptions at the berth and the yard over time. These generally align with high productivity modern container terminals, including those that are at least partially automated.

Figure 2 PFS Theoretical Island Concept 1 - Manukau Inner Harbour Example (Black Quay, 2016)³



³ Whilst vessels shown are approximate, they include up to 320m container vessels and 265m PCTCs and can easily take larger vessels if required.

Whilst the above theoretical concept was designed around the assumption of relatively naturally protected water within the Manukau Harbour, it was recognised that more detailed study might determine a need for some degree of wave protection.

If this did turn out to be the case, the theoretical concept designed for the Firth of Thames (see Figure 6) might be more appropriate. This is a matter for more detailed planning.

The capital costs of an island port in the Manukau Harbour have generally been quoted in the media as being in the region of NZD \$4billion and then discredited. This is incorrect.

In fact, the cost quoted, whilst not entirely accurate, seems to relate to Black Quay's order of magnitude cost to build the port itself, and not the adjoining infrastructure. This is an example of why it is not helpful to involve parties without a full understanding of port planning in a process as important as this one is to Auckland. The landside transport capital costs were calculated by others as part of the PFS.

Black Quay's order of magnitude cost estimates for a Manukau option in the PFS are provided below. Two (2) of these are provided given that the options varied considerably:

Figure 3 High-Level Capital Estimate for Theoretical Central Manukau Harbour Concept (Black Quay, 2016)

Item	Unit	Quantity	Cost	Notes
Consulting & Design	Cost	Cost	\$100million	Allowance
Approvals (including EIA)	Cost	Cost	\$50million	Allowance
Reclamation	\$50/m3	21million m3	\$1.05billion	Possibly lower but rate kept high on likelihood that relatively expensive material will need to be brought in. Based on +10.5m freeboard
Caisson Perimeter (reclamation fill)	\$200,000/lin m	6,000m	\$1.2billion	Caisson perimeter built and then inner area reclaimed. Cost includes seabed preparation. Assumes caissons built nearby and floated into place.
Access Bridge x 2	\$50,000/lin m	6,500m x 2	\$650million	Simple suspended concrete structures. Two bridges side by side
Pavement & Drainage	\$250/m2	2 million m2	\$500million	Based on concrete pavement (typical HD)
Dredging (mobilisation)	Cost	Cost	\$20million	Allowance
Dredging (works)	\$60/m3	4 million m3	\$240million	Assumes moderate materials only
Terminal Works	OOM	OOM	Say \$1billion	Developed by others most likely (i.e. lease to operator/s).
Berth	\$150,000/lin m	2,200m	330million	2.2km of berthline assumed
Tug Berths & Slips			\$50million	Allowance
TOTAL			\$5.19billion	Does not include road, rail and services costs

Figure 4 High-Level Capital Estimate for Theoretical Puhinui Manukau Harbour Concept (Black Quay, 2016)

Item	Unit	Quantity	Cost	Notes
Consulting & Design	Cost	Cost	\$100million	Allowance
Approvals (including EIA)	Cost	Cost	\$50million	Allowance
Reclamation	\$50/m3	21million m3	\$1.05billion	Possibly lower but rate kept high on likelihood that relatively expensive material will need to be brought in. Based on +10.5m freeboard
Caisson Perimeter (reclamation infill)	\$200,000/lin m	6,000m	\$1.2billion	Caisson perimeter built and then inner area reclaimed. Cost includes seabed preparation
Access Bridge x 2	\$50,000/lin m	700m x 2	\$70million	Simple suspended concrete structures. Two bridges side by side
Pavement & Drainage	\$250/m2	2 million m2	\$500million	Based on concrete pavement (typical HD)
Dredging (mobilisation)	Cost	Cost	\$20million	Allowance
Dredging (works)	\$60/m3	35 million m3	\$2.1billion	Assumes moderate materials only
Terminal Works	OOM	OOM	Say \$1billion	Developed by others most likely (i.e. lease to operator/s)
Berth	\$150,000/lin m	2,200m	330million	2.2km of berthline assumed
Tug Berths & Slips			\$50million	Allowance
TOTAL			\$6.47billion	Does not include road, rail and services costs

The cost differential between the two Manukau options is due largely to increased dredging costs at Puhinui. This is because the site is closer to land than the central harbour option, meaning that the natural depth of water realised in the access channel does not extend as far as the Puhinui site.

Whilst the access bridge costs are less, this does not balance the cost of the additional dredging.

When considering the operational costs over the long-term, the additional distance required to access the central site becomes material. This had a bearing on the Puhinui option being preferred over the central harbour option, despite the near NZD \$1.5billion of additional capital costs for the port. It is Black Quay's opinion that this requires more detailed study (as eluded to in the PFS) and that it may be the case that one of the sites within the harbour proves to be a better option overall. However, the principal of the site being located within Manukau Harbour, and the general location of the options relative to natural depth water and landside access remains sound.

As stated, Black Quay did not prepare landside infrastructure costs estimates and this needs to be investigated further. However, given that these are order of magnitude initial estimates with a 50% variance anyway, we feel that an estimate of around NZD \$10billion total (in the absence of more detailed study) may be appropriate (i.e. total cost to bring the port online).

As for review of the port figures themselves, Black Quay believe that they are still sound for theoretical order of magnitude costs, but that inflation should be taken into account given the time that has

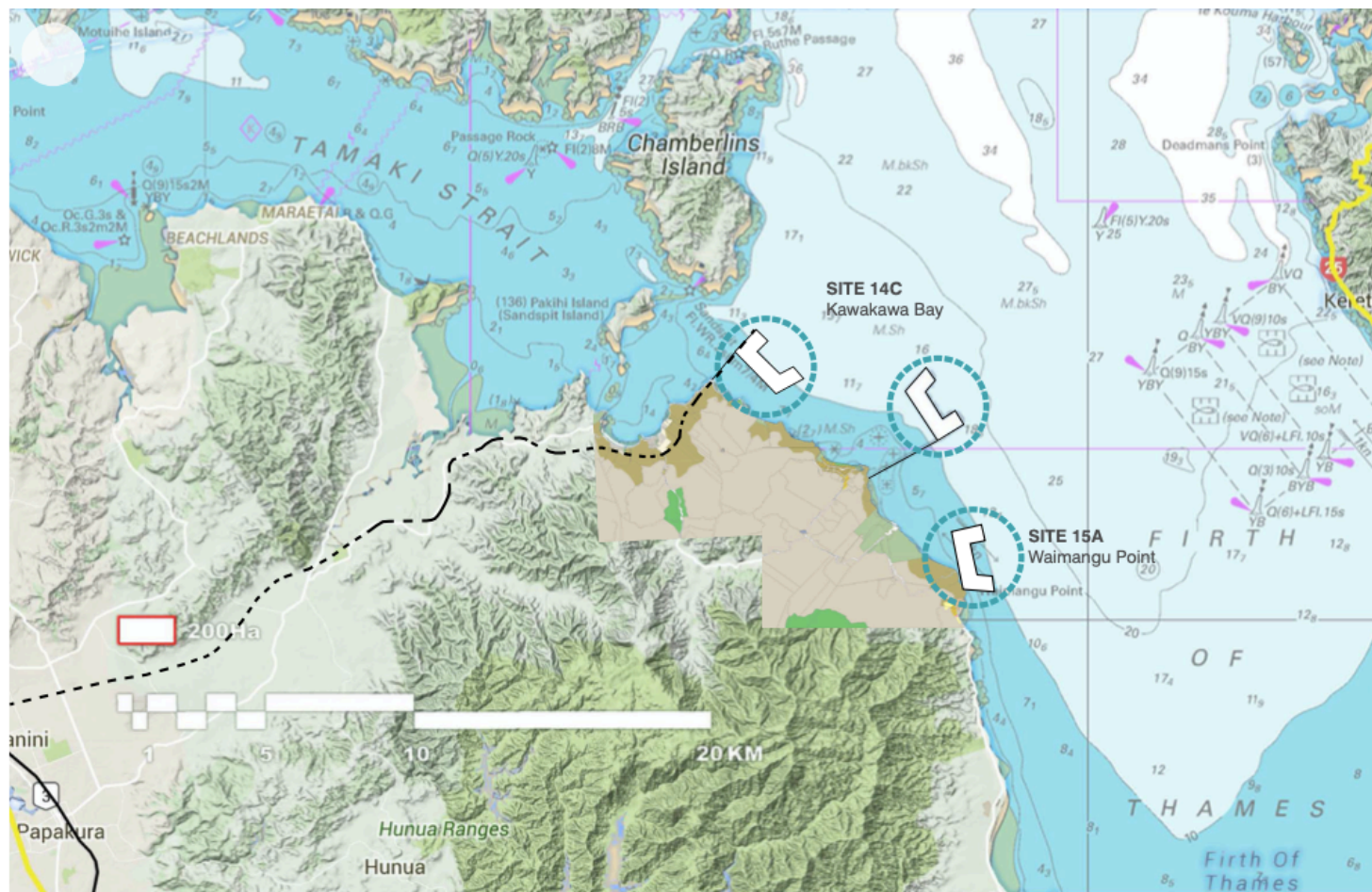
passed. This should also account for increasing costs of construction over time.

5 Firth of Thames Options

5.1 Identified Locations

The theoretical locations for a new port in the Firth of Thames, as identified in the PFS study, are illustrated below. It should be noted that the 'Kawakawa Bay' option (Site 14C) scored top 2 (above all other options, including existing ports).

Figure 5 Port Future Study, Firth of Thames Options (Black Quay, 2016)⁴



⁴ This was prepared for EY under the PFS. Accordingly, it must not be shared as part of any other report.

5.2 Rationale Review

The Firth of Thames preferred option was chosen as a potential location for a new port to serve Auckland for a number of reasons:

- > Its close proximity to South Auckland and the future trading hubs of the city, meaning very good sea access to this area and reduced freight costs.
- > Its very close proximity to the Waikato Region, meaning close sea access to this area.
- > Its location on the East Coast meaning that shipping transfer would be relatively straightforward.
- > Its reasonable proximity to the primary landside transport regimes.
- > The ability to phase development and to secure future port capacity needs of Auckland and surrounds (near unlimited expansion potential).
- > The prospect of building an offshore island to reduce noise and light pollution associated with modern port operations (whilst recognising that these would also be reduced as part of world's best practice).
- > The ability to make use of deep water access and thereby nearly eliminate dredging costs in theory.
- > The bathymetry in the area, meaning that construction costs would be minimised (in comparison to other options examined).

- > Moving the port out of Auckland to match the public mood to do so, and free up Auckland waterfront for other purposes.

Due to what appeared to be various political agendas during the preparation of the PFS, various attempts were made to discredit the Firth of Thames options. These were all substantially addressed during the study and the option was generally accepted as worthy of more detailed study. It is important to understand the nature of this, which has been summarised below:

5.2.1 Relative Development Cost Exposure

As with Manukau Harbour, the notion of building a new port in the Firth of Thames would no doubt be expensive. The same rationale applies to that discussed under the Manukau options and should be referred to.

The estimated capital costs at this early stage are reviewed in the following section, however as a general point, Black Quay do not believe that this option would present significantly higher development costs than if any of the existing ports were expanded.

The capital cost of building a new littoral port in the Firth of Thames is perhaps more comparable to expansion of the existing ports than one might first think. However, it is the ability to expand the Firth of Thames options that has an even greater influence on capital costs (as the cost to expand would likely be less).

Where a new port option does score badly however is the upfront capital. This is because despite the ability to stage the development, the first stage would inevitably be more expensive, as

all the transport access and upfront works are required. Nevertheless, the new port option would likely cost less over time and certainly present less landside freight handling costs than other options.

Furthermore, the cost of connecting the port to the road and rail networks would be substantially more complex and costly than that at Manukau Harbour. This should be investigated and confirmed beyond this study.

5.2.2 Operational Costs

As with Manukau Harbour, a primary driver for the Firth of Thames option scoring highly is its distance to markets.

Whilst not as good as the Manukau options, the site is still excellently placed to serve Auckland. Of further interest is that it is positioned more centrally between Tauranga and Auckland, meaning that in theory, it could be built to combine both Auckland and Tauranga's task in time; further adding to its cost/benefit viability (although it is understood that this was not included in the PFS study figures).

Again, the strategic strength of the port in this regard have been downplayed.

Assuming that Auckland's industrial future sits in the south of the city (and the Waikato region), the port would be very close to the supply chain. From a port planning perspective, it is strong in this regard, and would still connect relatively easily to the road and rail networks.

This would then reduce inner city traffic, now associated with the Port of Auckland. This is in stark contrast to building a port on the wrong side of the city and over 150km away.

Shipping access is discussed in the following sub-section.

5.2.3 Sea-Based Access

It is fair to say that the notion of a new port at Firth of Thames has been easier to digest than one at Manukau.

This is largely because the port would be on the east coast as opposed to the west coast and then sit more easily with current shipping routes.

Natural depth is no issue and although the route has some complexities, it is likely reasonably straightforward to navigate large vessels into the Firth.

5.3 Capital Cost Review

As with the Manukau Harbour option, capital cost estimations of the Firth of Thames option have been grossly misstated in the New Zealand media and by certain public figures.

The overall capital and operational costs considered in the PFS were prepared by numerous expert consultants, all reporting to EY. As such, Black Quay cannot provide comment on some of these costs, including road and rail costs as they were calculated by other parties.

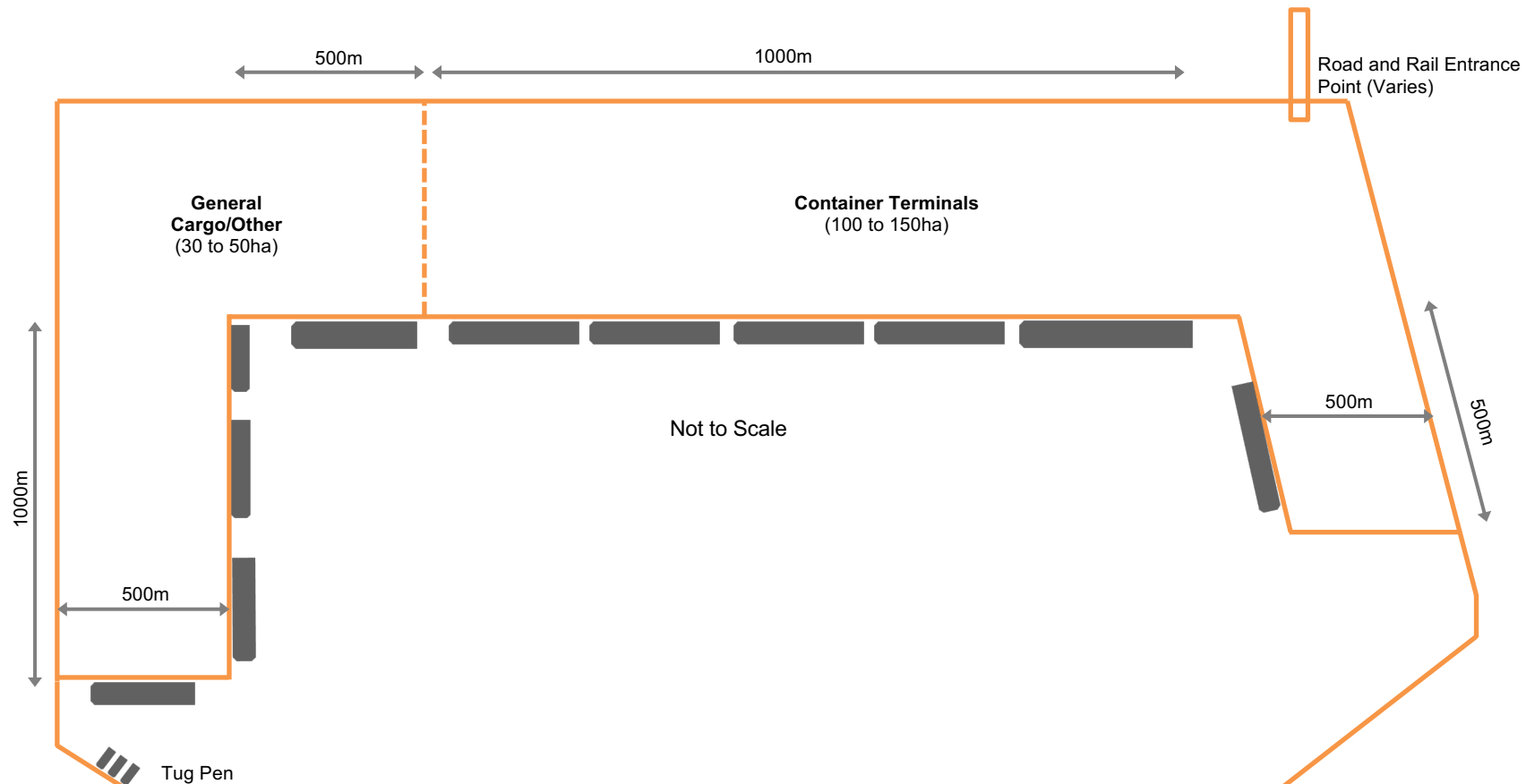
The cost of development of the port itself was calculated by Black Quay. This was high level order of magnitude estimate only as no concept designs were prepared.

As with Manukau harbour, Black Quay did prepare a basic theoretical footprint and construction rationale for all options.

The generic theoretical footprint is provided below. This is not to be published or shared, but is given to provide Sapere with a reference point for the capital cost estimations. It is also important to note that these are not designs as such but were developed in an attempt to capture primary capital cost implications based on broad potential infrastructure requirements. It may well be that more detailed study would point towards a hybrid of these being more cost effective or beneficial, however the principle of an expandable island port remains.

Finally, the theory is based on certain productivity assumptions at the berth and the yard over time. These generally align with high productivity modern container terminals, including those that are at least partially automated.

Figure 6 PFS Theoretical Island Concept 2 (Exposed Example) (Black Quay, 2016)⁵



⁵ Whilst vessels shown are approximate, they include up to 320m container vessels and 265m PCTC and could accommodate vessels larger than this

The PFS capital cost estimate for the Firth of Thames options were all largely similar. This is provided in the table below.

Figure 7 High-Level Capital Estimate for Theoretical Firth of Thames Concept (Black Quay, 2016)

Item	Unit	Quantity	Cost	Notes
Consulting & Design	Cost	Cost	\$100million	Assumption
Approvals (including EIA)	Cost	Cost	\$50million	Assumption
Reclamation	\$50/m3	37million m3	\$1.85billion	Possibly lower but rate kept high on likelihood that relatively expensive material will need to be brought in. Based on +10.5m freeboard
Caisson Perimeter (Reclamation & Breakwater)	\$200,000/lin m	12,500m	\$2.5billion	Caisson perimeter built and then inner area reclaimed. Cost includes seabed preparation. Also includes cost of protective breakwaters
Access Bridge x 2	\$50,000/lin m	3,500m x 2	\$350million	Simple suspended concrete structures. Two bridges side by side
Pavement & Drainage	\$250/m2	2.65 million m2	\$662.5million	Based on concrete pavement (typical HD)
Dredging (mobilisation)	Cost	Cost	\$0million	No dredging required due to deep water (requires verification)
Dredging (works)	\$60/m3	0 m3	\$0million	No dredging required due to deep water (requires verification)
Terminal Works	OOM	OOM	Say \$1billion	Developed by others most likely (i.e. lease to operator/s)
Berth	\$150,000/lin m	2,200m	330million	2.2km
Tug Berths & Slips			\$50million	Assumption
TOTAL			\$6.89billion	Note items still missing and point made above

The cost differential between the lowest cost Manukau option and the Firth of Thames options is largely due to shape and orientation of the site.

The theoretical concept was based on providing protection from waves in that it is self-contained and protected by its own shape and associated breakwaters and revetments.

This was by no means tested and is another aspect that needs to be checked and refined through more detailed study, as called for in the PFS. However, the principle is thought to be sound.

Its shape means that the cost of reclamation, land development and breakwater construction is approximately twice the cost of land provision in the more protected Manukau Harbour environment.

However, the cost of development at the Firth of Thames is balanced somewhat due to the lack of need for dredging.

As stated, Black Quay did not prepare landside infrastructure costs estimates and this needs to be investigated further. However, given that these are order of magnitude initial estimates with a 50% variance anyway, we feel that an estimate of around NZD \$10 to \$12billion total (in the absence of more detailed study) may be appropriate. However, what is required for the Firth of Thames

option is more detailed testing of the landside transport link capital costs.

As for review of the port figures themselves, Black Quay believe that they are still sound for theoretical order of magnitude costs, but that inflation should be taken into account given the time that has passed. This should also account for increasing costs of construction over time.

5.4 Further Landside Capex & Opex Considerations

Whilst Black Quay did not prepare these as part of the PFS and cannot disclose any findings by others, we make the following points for Sapere to consider:

- > As a basic principle, you may consider landside freight costs in New Zealand to be between \$3.50 and \$5 per kilometre per container. This varies across road and rail as well as location, but this is complex work.
- > In terms of landside infrastructure capex, you might consider in the region of \$400million for road and rail to Puhinui and \$600m for Kawakawa Bay. These are thumb in the air estimates and need to be confirmed in detail. The PFS called for all costs to be considered in detail.

5.5 Conclusions

- > The PFS called for more detailed study of the two preferred new port options. Nearly 5 years later, this still hasn't occurred. Instead, various discredited options have been revisited without any credible evidence that they address the major issues with them.
- > If the last 5 years had seen more in-depth study, it appears likely that a sensible approach for Auckland future port needs would have been agreed upon by now.
- > Since the completion of the PFS, no credible evidence has been presented to discount the new port options put forward in the PFS as representing the best outcomes for the city.
- > A revisit of the Manukau Harbour preferred option has only confirmed that it is feasible in principle and potentially offers the best location relative to trade.
- > The same is true of the Firth of Thames option which in theory, still provides an excellent option to serve Auckland and its hinterland (albeit with higher landside costs than Manukau).
- > Given Black Quay's conclusion that New Zealand container ship demand could reach between 13,000 TEU and 14,000 TEU ships, both these options would intrinsically accommodate them, and do so in a tailored manner. They would also allow larger vessels to visit should this ever eventuate.
- > The capital cost estimates provided as part of the PFS are deemed to still be reasonable plus allowance for inflation. What

must be clear though is that these are port development costs and do not include the cost of road and rail connections.

- > The costs of a new port in the Firth of Thames versus one in the Manukau Harbour appear largely similar (around NZD \$6billion to \$7billion). However, the makeup of these costs is markedly different;
 - The preferred Manukau Harbour option requires considerably more dredging (whilst noting that the lesser preferred central harbour option would require less dredging)
 - The preferred Firth of Thames option would require nearly no dredging, however the reclamation and land development costs would be higher because the site is in an unprotected natural environment
- > The Firth of Thames option presents an easier shipping option given it would sit well within the existing shipping routes. However, the option of switching shipping to the west coast has not been disproved to any extent (noting that shippers have been vocal about their preference for the east coast).
- > Whilst it may well be that the Firth of Thames option would be preferred on some aspects, it should not be discounted that the operational cost of freight handling over the long-term was shown to be considerably less through the Manukau Harbour preferred option. This could have a sizeable impact on New Zealand's cost of imports and exports.
- > As an approximation (given the lack of additional study called for in the PFS), Black Quay suggest a new port development cost of

between NZD \$7billion and NZD \$10billion. This should be tested through more detailed study.

- > Although a backlash is expected from the views of some regarding the capital cost of developing a new port, Black Quay make the point that this should be better understood in context. A new port would:
 - Offer sizeable operational cost reductions, which will drive down the costs of imports and exports
 - Would ensure that the capacity issue for the North Island would not happen again (as the port could be expanded as demand dictates)
 - Centralise port options and jobs
 - Would allow potential amalgamation of the port authorities and contracts for competing operators to be issued, thereby increasing competition and reducing costs for the NZ consumer and exporter.
- > The capital cost could be met by various strategies. One that Black Quay suggests requires further study which would be to lease the Port of Auckland under a long-term agreement which would include a requirement for the private owner to build the new port (and operate it). It may also be the case that the proceeds from selling off current Port of Auckland land could contribute towards the cost of a new port, although it is expected that this would not cover the development costs.

Contact:

Black Quay Consulting

E: info@blackquayconsulting.com

P: Australia +61 (0) 406 954663
United Kingdom +44 (0) 7852 557750

W: www.blackquaymaritime.com

