

Crude shipping project

Economic assessment of channel deepening at the
Marsden Point Refinery

NZIER report to Refining New Zealand

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Key points

This report sets out a framework for economic assessment of the proposal for deepening the channel for Marsden Point Refinery. It proposes a cost benefit approach that has been used in the Environment Court, supplemented by considerations of economic impact of the refinery's spending and employment in the region.

The cost benefit framework identifies the economic surplus from channel deepening, taking account of the externalities that may be created by it.

The cost of the channel deepening project is currently estimated at around \$37 million for dredging and a further \$20 million for additional tank storage to handle larger deliveries. This will have limited impact on the local economy if much of the inputs are imported, but will have greater economic consequence for the region and New Zealand in enabling the continuation of refinery operations.

The potential benefit from accessing larger loads in deeper draught ships is in cost savings in the order of \$12-17 million a year on current prices, depending on the size of heavier delivered cargoes enabled by channel deepening. These savings are largely captured by Refining NZ and its customers as developers of the project, which as New Zealand domiciled companies also provide a national benefit.

These potential cost savings also help to maintain the international competitiveness of the Marsden Point refinery and prolong its operation and contribution to the economy in Northland. This includes annual payments that are currently around \$68 million a year to its 500 employees and contractors, and additional payments are made on periodic maintenance shut-downs and investment projects additional to routine operations, which have flow on effects in stimulating other expenditure in the local economy.

RNZ faces increasing competition from larger refineries in Asia, which has been attributed with the closure of several Australian refineries of similar scale to Marsden Point. In the absence of channel deepening it will be more difficult to maintain competitiveness and continue to operate at its current level.

Marsden Point is New Zealand's only refinery, capable of refining oil products from both indigenous and imported crudes. The continuity of operation of the refinery has a particular significance for the Northland economy, given its low rating on a number of economic and social measures. Premature closure of the refinery, given its contribution to general business expenditures and wages paid in the region, would have a significant negative impact on regional economic activity and well-being.

By improving the competitive position of RNZ, channel deepening will confer years of extra refinery operation. It would also reduce the present value of these costs of refinery closure and site remediation, which are estimated at \$300 million, by deferring them indefinitely into the future when their present value cost will be lower.

There are also a number of external benefits for the wider community, such as fewer vessel movements around the refinery and reduced greenhouse gas emissions¹ from

¹ These reductions in greenhouse gas emissions contribute to but are not counted against greenhouse gas emission goals, because of the current exclusion of international shipping in international agreements

fewer crude deliveries. The proposed realignment of the channel also provides a benefit for other shipping in the approach to Whangarei Harbour.

Other external effects on the environment, such as on the seabed and reclamation areas, affect a small proportion of the marine and coastal area and do not appear to have significant scarcity or distinctiveness to warrant incurring high expenditure or opportunity cost to their protection.

If the refinery were to close it would probably convert to an oil terminal handling imported oil products for dispatch by pipeline to Auckland. That would reduce the overall number of shipping movements around Marsden Point, as crude carriers and coastal tankers were discontinued and replaced by tankers importing refined oil products. The environmental effects of such changes would need to be weighed against the loss of economic contribution from the refinery's probable contraction to an oil terminal, with much lower economic impact than the refinery in operation.

From the analysis in this report the channel deepening is likely to enable benefits that are larger than the costs incurred by the project, indicating it is an efficient use of resources, in line with the Resource Management Act's section 7(b). By assisting the refinery to continue its current operations and supply of economic surplus to the region and New Zealand at large, it also enables communities to provide for their economic well-being in line with the Act's section 5.

Summary of economic effects of channel deepening

Item	Unit	Value
Cost of channel deepening	\$ m	37
Cost of extra tank storage	\$ m	20
Combined cost of project	\$ m	57
Cost annualised over 15 years at 8%	\$m/year	6.7
Benefit in lower delivered costs	\$m/year	12 - 17
Present value (at 8%) of deferring refinery decommissioning/remediation		
From 10 years to 20 years	PV \$ m	75
From 10 years to 35 years	PV \$ m	119
Unquantified benefits		
Strategic advantage in widening the choice of available crudes and timeliness of shipping		
Benefit for all shipping from channel alignment reducing risk of navigational error		
Reduced greenhouse gas emissions per unit of delivered crude		

Source: NZIER

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1. Introduction

This report provides economic advice and evidence to support resource consent applications for changes in the sea approaches to Marsden Point wharf. The principal activity for which consent will be sought is dredging of the channel, primarily at the outer channel towards Fairway Shoal and at the Marsden Point Jetty. This will enable Suezmax ships with heavier loads than are currently possible to dock at the jetty which will improve the efficiency of deliveries of crude oil into the Marsden Point refinery.

1.1. Economics in the Resource Management Act

Economics in its broadest sense can be described as the study of how limited resources are used in satisfaction of potentially unlimited needs and wants. This is relevant to many of the operational and regulatory powers under the RMA, such as allocating land space and water to different activities, and allocating discharge capacity into different environmental media of air, soil and water. Economics can both indicate the likely consequences on economic activity of proposals and inform the choices made under the Act.

The purpose of the RMA is the sustainable management of natural and physical resources. Section 5 defines this as enabling people and communities to provide for their well-being while sustaining natural and physical resources to meet foreseeable needs, safeguarding life-supporting capacities of environmental media, and avoiding, remedying or mitigating adverse effects of activities on the environment. The Act defines environment broadly to include social, economic and cultural conditions.

Explicit economic considerations under the Act include section 5's references to enabling communities to provide for their economic well-being, and section 7(b)'s requirement to have regard to efficient use and development of natural and physical resources. Section 32 requires consideration of alternatives, benefits and costs before a proposed planning measure is put into effect, including after recent amendments how a proposal would affect opportunities for employment and economic growth. However, section 32 is not a specific requirement under the Act when considering resource consent applications, although it may influence how economics is considered. More relevantly, Schedule 4 to the Act requires an applicant for resource consent to include an assessment of:

- the actual or potential effect on the environment (which, as noted above, includes economic conditions) of the activity;² and
- any effect on those in the neighbourhood and, where relevant, the wider community, including any social, economic, or cultural effects.³

Further, section 104 of the Act requires a consent authority, when considering an application for resource consent to have regard to any effects (positive or adverse) on

² Clause 6 of Schedule 4.

³ Clause 7 of Schedule 4.

the environment of allowing the activity. As noted above, the definition of environment includes economic considerations.

Well-being can be regarded as equivalent to economic welfare, the conceptual measure of the amount of consumption that can be enjoyed by people in the economy, where consumption includes both that of market goods and non-market conditions such as the state of the environment. In practice non-market conditions are difficult to value in monetary terms so often decisions on their level are determined by political or judicial systems in which economic value is implicit (rather than explicit) in the decisions.⁴

A proxy for market-based consumption is income generated by the refinery's continued operation, as this enables consumption by people in Northland and New Zealand at large. The efficient use of resources can be inferred from the contribution of channel deepening to accessibility of ships with larger cargoes that lower crude delivery costs to the refinery below what they would be without the deeper channel.

Applications for resource consent are usually taken as evidence that a proposal benefits the applicant, so the RMA focus is on external "spillover effects" that might arise. That includes external effects on natural and physical resources and also on the economic conditions within the environment.

1.2. Methods of economic analysis

Although the RMA does not specify a method for economic assessment when considering consents, a useful approach is **cost benefit analysis (CBA)**, the standard economic method for determining whether a project or proposal is worthwhile. It compares the economic value of the project against the costs of implementing it, not just for the company but for the wider economy. NZIER have adopted the CBA approach in undertaking this assessment.

Such analyses are used in consent applications. For instance, in seeking consent for extending its runway, Wellington International Airport Limited has submitted a CBA following the approach set out by the Environment Court (*Port Gore Marine Farms v Marlborough District Council*) for assessing economic effects (the sum of net addition to producer surplus, consumer surplus, and positive externalities less negative externalities). Cost benefit analysis directly addresses the issue of efficiency of resource use, and even if not fully quantified applies a logical framework for comparing outcomes with and without a proposed change.

Another common approach is **economic impact analysis (EIA)**, which shows how a project impacts on aggregate measures of the economy such as spending, contribution to GDP, incomes and employment. EIA often uses economic multipliers which show how the direct spending and job creation by the project stimulates indirect spending and job creation in other local sectors which either supply inputs to, or use the outputs from the project. But multipliers are confined to impacts on "the economy" and cannot account for external effects on the environment. They can exaggerate impacts of changes in the economy, as being derived from a static model of inter-industry transactions they do not allow for new demands changing prices and re-allocating

⁴ For instance, if a planning rule upheld by legal process determines that a given area should be set aside for conservation, it implies the area is worth to the public at least as much as the highest value alternative use for the area. Such considerations are not often explicit in such decisions, raising the risk that value can be very variable across different decisions.

resources across the economy.⁵ Multipliers do exist, but their quantification is difficult and prone to misplaced precisions and overstated by multiplier analysis. Because of these limitations such analysis is not used here.⁶

1.3. Economic outline of Marsden Point channel deepening

Economic value from channel deepening at Marsden Point could arise from:

- Producer surplus from efficiencies in cargo handling that improve profitability for the oil supply industry, both RNZ and its customers
- Consumer surplus would arise if New Zealand consumers obtained lower prices, new products or improved security of products; but in practice the landed cost of imported refined product sets the price across the market so such consumer benefits are extremely limited for refined oil products
- Externalities include positive environmental effects e.g. a safer channel due to realignment with reduced environmental spill risk, or fewer ship movements enabled by deeper draught vessels and larger loads, with less disruption for other activity around the shipping channels; or negative effects, such as any residual unmitigated adverse environmental effects.

Beyond RNZ's private interest in improving its operational efficiencies by accessing the services of larger ships and cargoes, there is wider economic case to be made around effects external to RNZ:

- Direct economic benefit of more heavily loaded ships – cost savings for the refinery and its NZ customers relevant to s7b efficiency and s5 wellbeing – a private benefit except to the extent it keeps the refinery in operation
- Strategic interest in increased competitiveness and longevity of the refinery – relevant to s5 wellbeing and to efficiency through improved security of supply, avoidance of business disruption from RNZ losing competitiveness, lowering New Zealanders' disposable income
- Additional work done, employment and spending associated with the dredging operation – fits with s5 wellbeing to the extent it provides a share of income to people and businesses in the region, but such impacts of shipping channel deepening may be quite small if much of the dredging equipment or labour is specialised and imported
- Continued refinery operation – fits with wellbeing to the extent that it provides spending and jobs in a region with limited alternatives for work.

Making the case for channel deepening in a CBA framework requires:

- Identifying the counter-factual or base case that would prevail in the absence of channel deepening

⁵ A better tool is General Equilibrium (CGE) Analysis, which does account for resource constraints and price effects, but is rather more complex than the commonly encountered multiplier analysis.

⁶ Multipliers' methodological weaknesses are recognised in the government sector and rarely taken seriously by decision-makers. For an overview of these weaknesses, see publications by the [Australian Productivity Commission](#), the [New Zealand Treasury](#) and [MBIE](#). All three clearly state that multipliers over-state economic impacts and thus lack credibility for policy analysis.

- This involves outlining the refinery’s role in the current supply of refined oil products in New Zealand and how that might evolve given influences on the wider economy and on future oil demand and supply
- It identifies the value at risk should the absence of channel deepening constrain the company’s ability to adapt to new conditions and remain competitive with other suppliers to fulfil that role
- Identifying, quantifying and valuing to the extent possible the incremental changes in continued operation of the refinery with channel deepening
- Estimating effects over a long time period, to compare costs and benefits and see which is the larger over the period in present value terms
- Testing robustness of results to changes in inputs and assumptions.

In this report estimates of annualised capital costs are presented for two timeframes: the maximum consenting period of 35 years, and a shorter timeframe of 15 years to reflect more commercial considerations of quicker expected payback where the investment is likely not to last as long because of risk or the need for future upgrade. The results are intended to illustrate return in the long term over the full consenting period and against more stringent short term criteria.

2. Prospects without channel deepening

2.1. The issue facing Refining NZ

RNZ operates in a highly competitive market for refined oil products, where addition of new capacity, new technology, greater refinery scale and access to very large crude carriers has lowered the supply cost curve for crude oil in the Asia-Pacific region. New ways of improving operating margins at Marsden Point are needed to remain competitive with much larger refineries in Singapore, Korea, India and the Middle East. Reducing costs of delivery is one such option for protecting margins at Marsden Point to support long term sustainability of the refinery.

Suezmax tankers (120-180,000 deadweight tonnes (dwt) with cargo capacity up to around 1.05 million bbl) offer operational cost advantages over more common Aframax tankers (80-120,000 dwt, 700 kbbl). The increase in US fracking production has reduced demand for Suezmax on the Trans-Atlantic trade, freeing Suezmax vessels to ply for business on other long haul routes.

Increasing accessibility of Suezmax to Marsden Point would enable greater access to West African crudes, which tend to be sold in large parcel sizes. That could also enable Refining NZ's customers to adjust their slate of crudes from different source regions and take advantage of crude sourcing and trading benefits that may accrue from access to more commonly traded larger parcel sizes.

The channel approach to Marsden Point Wharf currently has a draught limit of 14.7m, which limits the use of Suezmax vessels to around 900 kbbl laden capacity. Relieving these constraints would increase the availability of vessels carrying heavier loads of 1.05 mbbbls to service the refinery and reduce the likelihood of costs being incurred from periodic unavailability of the most economic vessels.

Currently Marsden Point receives 4 deliveries a year in not-fully-laden Suezmax vessels and 55 deliveries in Aframax vessels, with an average load across all vessels of around 700kbbl. With channel deepening that could shift to 25 Suezmax and 23 Aframax deliveries a year with average load of 850 kbbl, with continued Aframax deliveries comprising shipments from Asian ports that have constraints on larger vessels.

There are various options for channel deepening and disposal of spoil, with capital costs that currently are indicatively estimated to be NZ\$37 million [Royal Haskoning DHV]. If undertaken by a national dredge operator, this will represent a significant investment within the national economy. However, it appears likely that – due to availability of the specialised equipment required – much of this may accrue to overseas firms if the services are imported. In that situation, the direct impact on the regional or local economies in Whangarei and Northland is likely to be reduced.

2.2. Current supply of oil products in New Zealand

2.2.1. Refining NZ in national oil supply

Since the building of the Marsden Point refinery in the 1960s, New Zealand's oil supply has relied upon a mixed system, in which the bulk of oil is imported as crude feedstocks and refined into products at the refinery, with a smaller proportion of refined oil products imported from sources in Australia and Asia. The refinery's products are distributed across New Zealand via the Refinery-Auckland Pipeline (RAP), by road tanker around Northland, and by coastal tankers to oil depots at other ports around New Zealand.

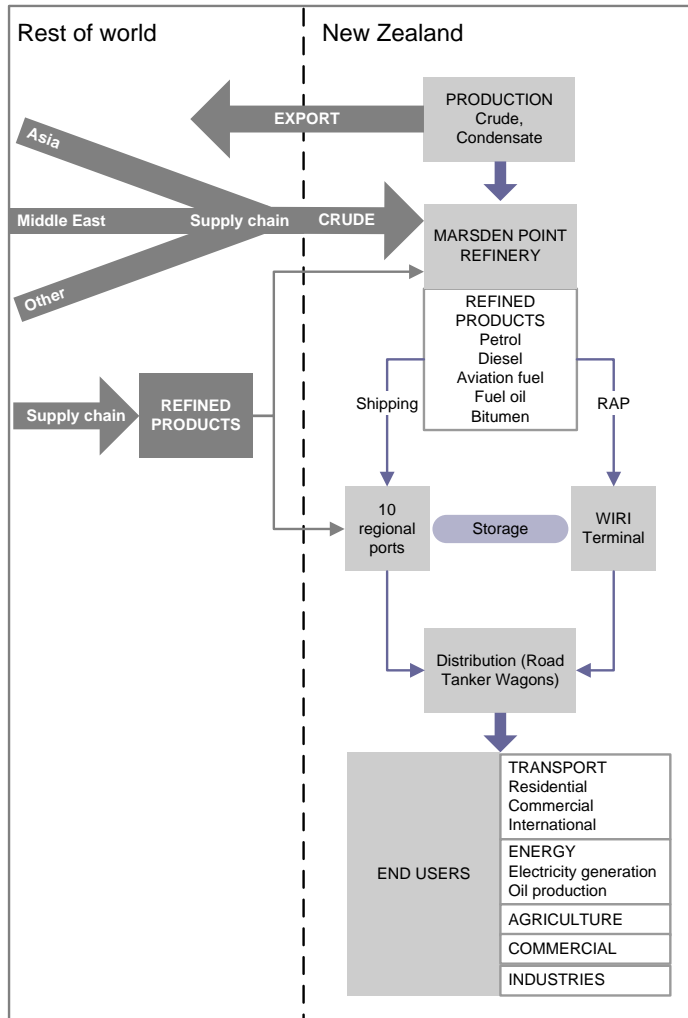
Refining NZ currently supplies:

- all of New Zealand's fuel oil for ships
- around 86% of the country's jet fuel
- 67% of its diesel
- 63% of its petrol
- between 60% and 75% of all bitumen for roading.

It also produces sulphur that is used in fertiliser manufacture, and carbon dioxide that is used in the food and beverage industries.

Refining NZ's refinery processes crude oil for its customers, and it charges a tolling fee for its refinery services. Refining NZ's customers, the major oil product wholesalers in New Zealand, bear the costs and associated risks of crude purchasing, shipping and maintaining crude, feedstock and product inventories. But the tolling fee charged by the refinery for processing is calculated as if the refinery bears these costs (using international market assessments and freight rate benchmarks) to calculate a notional margin, of which 70% is ascribed to the refinery fee (subject to a fee floor and margin cap) and 30% to the oil companies.

Figure 1 RNZ in New Zealand's Oil Supply



Source: NZIER

Reducing shipping cost and improving efficiency will be reflected in an improved notional margin shared between RNZ and its customers. Regardless of this margin split, the whole reduction in transport cost enabled by larger shipping can be regarded as a benefit to New Zealand as it accrues to New Zealand domiciled companies.

2.2.2. Current oil demand and supply security

According to the Ministry of Business Innovation and Employment's *Energy in New Zealand*, in 2015, oil was the source of 31% of the primary energy used in New Zealand. From a high of 50% in 1975 that share dropped to 27% in 1993 then recovered to the mid 30%-40% range in the 2000's where it has fluctuated since then. Despite that apparent decline oil still accounted for 44% of total consumer energy in 2015, and 99% of all energy used in transport. Transport accounts for about 81% of all oil and oil product consumption in New Zealand, and other major users are the primary

industries of agriculture (5.8%), forestry (1.1%) and fishing (1.6%), other industry (7.4%), commercial (2.3) and residential users (1.2%).

Oil and oil products remain of critical importance to New Zealand, and for many of their uses (particularly transport) there currently are no large scale practical or cost effective substitutes available in the short to medium term, making security of supply of oil products an international issue. In 1974 the International Energy Agency (IEA) was set up by the OECD in response to major oil market disruptions, requiring that member countries like New Zealand hold supply in hand for at least 90 days of their previous year's consumption.

2.3. Influences on future oil demand

The latest Energy Supply and Demand Forecasts from the Ministry of Business Innovation and Employment were prepared in 2011 and provide forecasts for the period 2011-2040. These show New Zealand's primary energy growing at 1% per annum on average over that period, with oil growing at 0.6% per annum so that its share of primary energy slips from 33% to 29%. Most energy sources show a similar decline in share of primary energy, with the principal exception of geothermal energy which forecasts suggest will have a share rising from 21% to 35% over the period.

Oil is forecast to hold up better as a share of total, consumer energy, remaining at 44% over most of the forecast period. Its annual average growth rate is 0.8% over the period. Most oil products also record positive growth throughout the forecasts, with the exception of gasoline that declines by 0.2% per annum on average.

There are many influences on oil demand and fuel efficiency. Change in car ownership patterns, climate change policy and the emergence of alternative fuels and electric cars have all been suggested as factors that moderate future demand for oil. Their influence may be observed in forecast oil demand growing slower than general economic growth, but not markedly so in the next few decades.

Internationally oil production has run ahead of demand in recent years reducing oil prices. We assume oil's predominant share of transport fuels market will continue into the foreseeable future with only marginal shifts into new technologies, as while oil remains cheap there is less incentive to bring alternative energy into use.

2.4. Regional implications of RNZ operation

Northland is a region that has been struggling in comparison to its resource base and other regions for several decades.⁷ It has a higher share of employment in the primary sector, a sector in which employment has been falling. It also has the highest age dependence ratio (proportion of people under 15 and over 65) of any New Zealand region, and this is forecast to significantly increase as the able bodied move to other regions in search of jobs. It has the second-lowest labour force participation and second-lowest-employment rate of all New Zealand regions. Median household income in the region is approximately 20 percent lower than median household income in New Zealand.

⁷ MBIE Regional Economic Activity Report 2015

As a substantial employer in the Whangarei District, offering relatively highly-skilled and highly paid job opportunities⁸ the continued operation of the refinery is a significant driver of economic activity for the region. Our estimate of the size of the contribution over the past five years based on economic data for the region⁹ and Refining NZ annual reports is included in the following table (Table 1).

Table 1 Economic contribution of Refining NZ

Contribution to economic activity and employment

Contribution	2011	2012	2013	2014	2015
Gross Domestic Product¹ (\$million)					
Petroleum Manufacturing ²	432	400	463	519	542
Northland Region Total	5,336	5,410	5,524	5,681	5,940
Refining NZ share of Northland GDP	8.1%	7.4%	8.4%	9.1%	9.1%
Employment (number of people)					
Refining NZ employees	310	320	341	355	355
Refining NZ contractors ³	130	125	116	118	149
Refining NZ jobs	440	445	457	473	504
Whangarei ⁴ jobs (estimated)	34,700	34,800	35,600	35,800	36,900
Northland Region jobs	77,854	77,642	77,739	78,339	80,199
Notes:					
1. GDP is stated in 2010 prices.					
2. Refining NZ is assumed to be the only enterprise recorded in the category					
3. NZIER estimate from Refining NZ payments to contractors, assuming similar payments per worker as for company employees					
4. Whangarei District (Territorial Local Authority)					

Source: NZIER analysis of regional reports prepared by Infometrics

⁸ Based on data from Refining NZ annual report and Infometrics we estimate that average annual earnings per employee/contractor working at Refining NZ in 2015 was in excess of \$120,000 compared with an average of \$50,000 across the region.

⁹ These statistics are taken from the Infometrics database of regional economic activity available at <http://ecoprofile.infometrics.co.nz/Northland%2bRegion/Gdp/Structure>. The estimates prepared by Infometrics are based on regional GDP and income and employment data by Statistics New Zealand

Refining NZ's contribution to economic activity has increased more quickly than the growth in the Northland economy over the past five years. Employment growth at Refining NZ has kept pace with growth in employment in Northland.

Refining NZ currently pays about \$68 million per year to people working for the refinery. The Refining NZ annual report for the year ended 31 December 2015 reported wage and salary payments to employees of \$48 million and payments to contractors of \$20 million. We understand from Refining NZ that almost all of these payments (94 percent) are made to employees and/or contractors' businesses residing in the region. Refining NZ jobs are more highly paid than the average for the region and we estimate that wage, salary and contractor payments account for over 2 percent of the payments for the region and just over 3.5 percent of the payments made in the Whangarei territorial local authority.

In addition to the 'steady' annual employment described above, Refining NZ also employs additional staff for annual shutdowns. These vary in size and duration each year but can offer work for around 500 people for a period of 3 to 4 weeks.¹⁰

Refining is a capital intensive business with a long history of periodic investment in capital renewal and upgrading projects which inject substantial funds into the regional economy. Over the past 11 years RNZ has invested around \$735 million to produce low sulphur diesel, remove benzene from petrol and improve energy intensity and reduce carbon emissions profile.¹¹ The refinery's substantial links to other industries and contractors in the region were illustrated in the economic assessment of the CCR project (NorthTec 2012). That project involved total expenditure of \$365m, of which \$147m was spent in Northland, \$27m in the rest of New Zealand and \$191m overseas, with estimated employment up to 350 in construction and a further 657 jobs stimulated in industries supplying the project, as summarised in Table 2.

Table 2 Summary impacts from the CCR project

NorthTec Impact Report CCR project	Direct \$m	Indirect \$m	Total \$m	Multiplier
Total spending \$m	365			
Imported \$m	191			
Northland source \$m	147	100.0	247.0	1.7
Rest of New Zealand \$m	27	40.5	67.5	2.5
Employees (number)	350	657	1007	2.8

Source: NorthTec

¹⁰ The expenditure on shutdowns is capitalized in the Balance Sheet of the Refining NZ Annual Report rather than being recorded as an expense in the Income Statement (in the year in which it was incurred). Employment created by such shutdowns is unlikely to be attributed to the 'Petroleum Manufacturing' industry in the economic data we have summarised in Table 1, which hence understates the full impact of RNZ in the region.²

¹¹ These investments included the \$180 million Future Fuels Project in 2005, the \$190 million Point Forward Project in 2009 and the \$365 million Continuous Catalyst Regeneration Platformer (CCR) project completed in 2015.

The incomes earned by Refining NZ staff and contractors directly help retain nearly 500 households in the region and their consumption of goods and services generates income and employment for local businesses in Whangarei. Periodic shutdowns and investments provide additional incomes in the region, and expenditure by the company and its employees has flow on effects in stimulating other business in the economy. As these investments are capitalised into the company's balance sheet they are additional to the income and expenditure due to the company's routine operation.

2.5. Potential savings from heavier loaded vessels

There are realisable economies of scale in receiving deliveries in larger cargoes. Compared to Aframax tankers with 700 kbbl load, transport cost would be lowered by about US\$0.15 per bbl (NZ\$0.21/bbl) in a Suezmax with 950kbbl, a further US\$0.15 per bbl with a 1Mbbbl load and further US\$0.14 per bbl with 1.05Mbbbl load. At July 2016 exchange rates (0.70), in New Zealand dollars these savings would translate to \$0.21, \$0.42 and \$0.61 per bbl respectively on successively larger loads; with a longer term exchange rate (0.65) the corresponding New Zealand dollar savings per bbl would be 0.23, 0.46 and 0.67 respectively.

Currently the refinery receives about 40.7 mbbbl per year, in cargoes on average just under 700 kbbl per delivery. Deliveries from Asia tend to be in slightly smaller loads (650 kbbl) than those from the Middle East and West Africa (723 kbbl) or from the Russian terminal at Kozmino (740 kbbl).

Assuming that the 37% of shipments from Asia that arrive in smaller loads are less likely to change (in the short term) because of constraints on the ports in Asia, the saving in delivery cost for the remaining 63% would on current prices be about \$11.8 million per year if delivered in 1 Mbbbl loads or about NZ\$17.3 million per year if delivered in 1.05 Mbbbl loads.¹² That is a saving to the refinery and its customers, and also to New Zealand.

If increasing dredging depth also enabled *all* deliveries to move to 1 Mbbbl cargoes at some point in the future where Far East port draught constraints were alleviated, there would be a saving in delivery cost of about NZ\$16.8 million per year. This would increase to \$24.7 million if all deliveries were of 1.05 Mbbbl cargoes. Delivery cost savings, would be only about \$9 million if all shipments were of 950 kbbl, but these are unlikely to be common as the refinery's customers would aim to get the greatest economic gains, which come from the largest possible shipments. These estimates are illustrative of the incremental costs of different load sizes, but we expect savings are most likely in the middle of the range, around \$17 million.

In summary, the projected cost savings in transport of crude associated with the Crude Shipping Project are around NZ\$17 million per year at current prices and sourcing patterns, but could be about NZ\$25 million per year in future if Asian ports are able to despatch heavier laden vessels.

¹² This assumes NZ\$/US\$ exchange rate of 0.65, the long term average exchange rate over the past 22 years. In recent years the NZ\$ has risen to over 0.70 against the US\$ which would lower the savings, other things held constant. At 0.70 the potential savings would be \$11M/year from 1Mbbbl cargoes and \$16M/year from 1.05Mbbbl cargoes.

2.6. The future without channel deepening

Without channel deepening, RNZ would be unable to access the heavier loaded ships in which the cost of transport per barrel is lower than in the smaller Aframax or underloaded Suezmax ships. We have estimated potential savings for RNZ of NZ\$17 million for delivery of the current slate of annual crude requirements in loads up to 1.05 Mbbbl, compared to delivery as at present in loads averaging around 700 kbbbl.

Without access to larger cargoes RNZ's margins will be squeezed by competition from more scale efficient refineries in Asia. A number of refineries in Australia have recently closed or been converted to refined product import terminals (with a workforce of about a tenth of that of the refinery operation), including Shell Clyde (Sydney 2015), Caltex Kurnell (Sydney 2012) and BP Bulwar Island (Brisbane 2015). All closures have been attributed to competition from more modern, larger and efficient refineries in the Asian region driving structural change on the supply chain.¹³

Tighter competition from larger refineries offshore exerts continuous pressure on refinery margins which at some point could cause production to no longer be worthwhile. In that case the refinery could shut down and New Zealand would move to importing all its refined oil products. RNZ's expenditures and employment in Northland would cease except to the extent it retained some oil terminal operations to receive imported products and feed them into the Refinery-Auckland Pipeline.

This implies the choice between channel deepening and not deepening can be summarised as three potential outcomes:

- With channel deepening, there would be a saving in the cost of deliveries of crude oil, some operational efficiencies for RNZ and its customers in availability of ships and consignments, and improvement in the refinery's competitiveness sustaining spending and employment to the Northland regional economy
- Without channel deepening,
 - in the short term the refinery would continue to operate but without the savings and operational efficiencies provided by larger cargoes, losing competitiveness against larger refineries overseas
 - In the long term, the refinery could not compete with imported refined product and would close its refining operations and likely convert to an import terminal and distribution point, with reduction in spending and employment in the region and in New Zealand at large.

The consequences of these different outcomes with and without channel deepening are summarised in Table 3 below. We use an extreme scenario of the refinery closing and converting to an oil terminal at some indeterminate point in the future as an illustrative example, not as a prediction.

Expectations behind this table include:

¹³ See <http://www.smh.com.au/business/shell-shelves-refining-at-clyde-20110412-1dbxn.html>
http://www.bp.com/en_au/australia/media/media-releases/bulwer-island-refinery-processing-halt.html
<http://uk.reuters.com/article/uk-australia-bp-refinery-idUKKBN00J0PX20150603>

- Closure of the refinery would also lead to discontinuation of coastal tanker distribution, as Marsden Point becomes a terminal serving only Auckland, via the RAP, and Northland via road tanker wagons
- Refined product imports would arrive in vessels that are of 55 kilo-tonnes capacity (requiring 47 shipments per year into Marsden Point and 36 to other New Zealand ports) or in 80 kilo-tonne vessels (requiring 32 shipments to Marsden Point and 24 to other ports); and in addition, imports of black products (bitumen and heavy fuel oil) in 20 kilo-tonne vessels (requiring 9 shipments into Marsden Point and 19 to other ports)

Table 3 Summary of channel deepening and alternatives

Item	With channel deepening	Without channel deepening (short term)	Without channel deepening (long term)
Refinery operation	Continued operation	Continued operation	Closed
Oil terminal & tank farm	Continued operation	Continued operation	Continued operation
Refinery-Auckland pipeline	Continued operation	Continued operation	Continued operation
Crude delivery savings \$m/yr	17	0	
Crude tanker deliveries	48	59	Discontinued
Coastal tankers (50kt)	Ca 46 voyages a year	Ca 46 voyages a year	Discontinued
Number of Product import vessels @55-80 kt (additional to current shipments)			32-47 into Marsden Point + 9 for bitumen & fuel oil; +24-36 to other New Zealand ports + 19 for bitumen & fuel oil
Channel dredging \$m	37 + periodic maintenance		
Additional storage tank \$m	20		
Site remediation \$m			300
Employment #	355	355	35
Employment wages \$m/yr	48	48	5
Contractors #	148	148	15
Contractors \$m/yr	20	20	2
Local employment \$m/yr	45	45	4
Local contractors \$m/yr	18	18	2

Source: NZIER

- Employment at the terminal is approximately 10% of that at the refinery, and there would be a similar proportionate drop in contractor use
- Local impact of employment and contracting (i.e. that accruing to Whangarei and Northland) is 94% of total spending on these categories.

The timing of refinery closure is indeterminate but Table 4 illustrates how the remediation costs avoided (or deferred) by pushing back the date of refinery closure, reduce in present value terms when discounted at Treasury’s public sector discount rate of 8%. A higher discount rate reduces the present value of cost and increases the saving still further. Similarly, the further into the future the cost is avoided, the smaller its present value and bigger the saving compared to earlier closure. This table is illustrative only and not a prediction of expected continuation of the refinery.

Table 4 Value in extending refinery operation

New Zealand millions dollars converted to present values at 8% discount rate

Years hence	10	15	20	35
Remediation cost	139	95	64	20
Saving in cost	-161	-205	-236	-280

Source: NZIER

If the refinery were to close imminently, RNZ may be liable for site remediation costs.¹⁴ This report does not make substantive comment on contamination at the site, recognises the historical land use as a refinery and is likely to require remediation of the site. The site remediation cost could be in the order of \$300 million, but the present value of that cost declines the further into the future it is deferred. Assuming the remediation cost remains the same in real terms (i.e. not adjusted for general inflation) if closure were deferred 10 years the present value would be \$139 million, after 20 years it would be \$64 million and after 35 years, \$20 million. If, for example, closure would occur in 10 years without channel deepening but is deferred a further 10 years by channel deepening, the benefit (avoided cost) gained would be \$75 million (\$236 million - \$161 million). If the technology of site remediation improves in the future, the cost of remediation may even decrease over time, adding another benefit to deferring the risk of refinery closure through the channel deepening project.

¹⁴ This is not intended as a substantive comment on contamination at the site, or the dredging project but simply recognises the historical land use as a refinery and the likelihood of remediation cost associated with the site.

3. Economic consequences of channel deepening

The consequences of channel deepening depend on establishing the counterfactual that would prevail if the deepening project did not proceed. We assume this is continuing supply by Aframax and partially loaded Suezmax vessels, which would involve more frequent sailings and higher cost deliveries than is possible with more fully laden Suezmax vessels. The refinery needs to invest to maintain its competitiveness as the supply-cost curve continues to be squeezed.

3.1. Components of an economic assessment for consenting purposes

Components of economic assessment for a consenting assessment are summarised in Table 5 below.

Table 5 Components of an economic assessment

Item	Comment	Without channel deepening	With channel deepening
Price of refined oil products	Determined by the landed price of refined product imports	Market determined	Market determined
Refined oil product consumers	Facing the price of refined product delivered to retail outlets or other sources (bulk deliveries)	Small consignment size in limited New Zealand market may affect some product availability	No change in price or consumer surplus; small improvement in availability
Refinery margin	Notional difference between product value and (delivered) feedstock value	A producer surplus declining as squeezed by competitive imports; declining activity to future non-viability	Producer surplus maintained by lower costs of delivery - \$17m a year deferment of non-viability
Owners' margin	Share of the notional margin on refining	A producer surplus in decline	Producer surplus maintained
Wider economy	Macro-economic effects on balance of payments and exchange rates - significance and direction of impact indeterminate	Risk of stranded assets if rising imports change distribution routes for refined products	Producer surplus maintained from distributional assets (RAP, coastal tankers) utilisation

Environmental effects	Risk of vessel grounding	Unchanged	Lowered by deeper straighter channel
	Risk of vessel collisions	Unchanged	Lowered, but if it happens, spill impact could be greater
	Risk of channel congestion	Unchanged	Lowered, but not currently an issue
	Seabed disturbance	Unchanged	Raised along the channel, but a small proportion of harbour area
	Spoil deposition	Unchanged	Raised, but the two offshore deposition areas occupy a small proportion of Whangarei Harbour/Bream Bay (being 5.75 km ² and 2.5km ² respectively, including buffer zone)
	Greenhouse gas emissions	Smaller ships have higher cost and emissions per tonne	Larger ships have lower cost and emissions per tonne, but may cover longer distances
Local market stimulation	Regional impact of channel deepening works	Unchanged	Dredging works of \$37m plus \$20m share of installing new tanks
	Regional impact of continued operation	Depends on rate of decline due to loss of competitiveness	Arrested decline due to loss of competitiveness

Source: NZIER

3.1.1. Effects on oil product consumers

The price of refined oil product is driven by the cost of importing into the country, so there is little price advantage to the consumer in local production. This is explicit in MBIE's Review of Oil Security in New Zealand (2012) which found the principal advantage of security was the avoidance of disruption costs (such as extra costs and

time in finding alternative transport methods). When international prices for oil and oil products move, domestic prices move with them.

This means there is little likelihood of channel deepening conferring any price advantage giving rise to consumers' surplus in New Zealand.¹⁵ There is a possibility of consumer gain if channel deepening improves the availability of vessels and regularity of refinery operation and supply, but the value of this is probably very small.

3.1.2. Effects on oil product suppliers

The suppliers of oil products in this case are RNZ and its customers (oil product wholesalers), both of whom stand to protect producer surplus should the dredging project proceed relative to the counterfactual under which competitive pressure from non-New Zealand suppliers will squeeze margins and surpluses.

As indicated above, the potential savings in delivering feedstock to Marsden Refinery can be regarded as producer surplus from the channel deepening. We estimate that for 1.05 Mbbbl loads the saving could be around NZ\$17 million per year. RNZ will bear the costs of channel deepening, which in broad indicative terms have been estimated at \$37 million, depending on the disposal method for sediment. It will also incur costs for additional tank capacity to handle the larger volumes being landed, the cost of which has been estimated at \$20s million. Combined with the dredging the total project initial cost would be \$57 million.

In broad terms the Net Present Value of costs is compared against a stream of annual surpluses over a period of years to give the net present value of producer surpluses from the project. For this estimate environmental costs are not included because of practical difficulties in establishing the value of such environmental attributes as ecological integrity and cultural preference. Annualising \$57 million at 8% discount rate over the 35 year maximum consenting period amounts to \$4.9 million cost per year. With a shorter payback period of 15 years the annualised cost would be \$6.2 million. Both these estimates are well below the potential savings from larger loads in shipments of either 1 Mbbbl (\$12 million) or 1.05 Mbbbl (\$17 million).¹⁶

So the net benefit of each larger load configuration appears to be positive on an annualised basis assuming constant prices over time. But the net present value over the full consenting period would vary according to future movements in the delivery cost per barrel.

3.1.3. Effects on the local economy

The direct impact of the channel deepening project involves a capital expenditure of \$37 million on dredging operations and \$20 million on installing further tank capacity at the refinery. Of this \$57 million, much of it will not be spent in the local economy if dredging contractors, materials for tank expansion are obtained from suppliers outside the region, but a proportion of labour on tank installation is likely to be sourced locally and support incomes in the region. There may also be periodic maintenance spending

¹⁵ In other products and markets, it is possible for transport costs to create a wedge between the international price and price in the domestic market, creating a domestic glut which keeps prices low, but this is unlikely for oil products.

¹⁶ This result also holds with shorter payback periods: e.g. at 7 years the annualised cost would be about 10 million, still net beneficial if maintenance dredging has annual cost of less than \$1 million.

but these are unlikely to exceed \$1 million a year. The direct impact, and any indirect impact from flow on expenditure, are likely to be small.

The main effect on the local economy is derived from the improvement in the refinery's competitiveness and its effect of increasing the probability of continuation of current operations. This will prolong the period over which the refinery can deliver the economic contribution outlined in section 2.4 above.

3.1.4. Effects on the wider economy

A principal difference between the outcome with and without the channel deepening is that an increase in imports of refined products can be avoided or deferred by retaining the viability of the refinery. In principle, increasing imports can have impacts on balance of payments and pressure on the exchange rate. In practice this is unlikely to be significant, as the refinery's customers import crude to which the refinery adds value through refining, rather than importing refined product. As the difference between imported crude and imported refined product is a small proportion of the cost of supplying oil products to New Zealand, macro-economic effects such as pressure on balance of payments or exchange rates can be ignored in this case.¹⁷

The counter-factual also includes risk of stranded assets if rising refined imports change the distribution network within New Zealand. The principal asset potentially at risk is the Refinery to Auckland Pipeline (RAP), which handles direct transport into Auckland, and the RNZ refinery terminal infrastructure. As the RAP would continue to be the least costly way of transporting product into Auckland if RNZ converts to importing refined product, the risk of asset stranding is not significant.

Refined products would most likely be imported directly into other coastal terminals in New Zealand to avoid the double handling of imported products, so the distribution of refined product through coastal shipping would cease.

3.2. Effects on the natural environment

Effects on the natural environment fall into three broad categories: effects on other vessels and activities sharing the harbour entrance, effects of seabed disturbance and effects of emissions into the environment. Economic valuations of environmental protection are rarely explicitly used in RMA settings because of practical difficulties in estimation, but economic principles still apply to the consideration of environmental effects. We note that separate assessments relating to effects on a range of environmental disciplines have been commissioned from other consultants as part of the Crude Shipping Project.

¹⁷ Section 2.4 above describes the regional implications of Refining NZ's operations (Table 1) and its proportionate share of national economic activity will be small (around 0.2%). Any reduction in refinery activity is likely to be met by increases in refined product imports. The refinery adds value through its refining margin on processing imported crude, whereas importers add rather less value through their procurement processes, the difference between New Zealand refined and imported oil products that switch at the margin will be smaller still and have little effect on the total economy.

Vessel movements

Relative to the counterfactual, larger cargoes reduce the number of vessel trips required to deliver the refinery's feedstock. RNZ advise this could reduce the number of deliveries for current yearly volumes from 59 to 48, a reduction of about 19%.

While the current harbour channel may not be congested at present, reduction in vessel movements will have a positive effect in reducing the likelihood of vessel encounters and the already low possibilities of collision or running aground. The proposed channel realignment will improve navigational safety for all shipping, not just crude tankers.

If the refinery were to close, vessel movements would reduce as crude carriers and coastal tanker trips are discontinued and replaced by fewer deliveries of refined oil products. There might be implications for vessel movements around other ports in New Zealand, but as shipments for refined product into other ports are driven by demand, and the average size of refined product tankers could be higher than that of the current coastal tankers, it is unlikely that there would be an increase in shipping movements in aggregate.

Seabed disturbance

Seabed disturbance may be viewed as an adverse effect on the environment and will certainly be increased, at least temporarily, along the channel. While other experts will assess the extent and severity of disturbance, the very low proportion of sea bed within the harbour entrance directly affected, and the frequency of shipping using the channel, suggests that in economic terms protecting it in its current state would not warrant incurring high expenditure or opportunity cost. Doing so would be inefficient as the marginal cost would be high while the marginal benefit would be low. In the environment, as in other resources, scarcity and authenticity confer economic value and neither of those is significant in this case.

Emissions

Another consequence of channel deepening is that with larger loads and fewer ships the volume of greenhouse gas emissions from crude deliveries should decline relative to the counterfactual.¹⁸ With or without the channel deepening project, change in the sources of crude due to regional pricing dynamics could lead to switching sources to longer routes with higher emissions (eg. substituting supplies from West Africa or Middle East for those from Asia), but other things held constant, larger loads reduce the emissions per barrel transported.

The RMA's s104E appears to preclude consideration of climate change except for energy efficiency and renewable generation, but wider government policy on climate change still allows councils to consider emission-related measures that are not covered by existing policy instruments. As international shipping is outside the coverage of Kyoto Protocol and subsequent international agreements, it is an external effect on

¹⁸ Currently the crudes imported at Marsden Point come from Middle East (48%), Far East/Asia 38%, Siberia 13% and West Africa (2%). If those proportions remain the same, larger cargoes and fewer trips should lower the fuel use and greenhouse gas emissions on supply relative to the current situation, but some significant shifts in sourcing – e.g. less from Asia, more from West Africa – could increase the distance shipped and counteract that reduction in emissions.

environment whose benefit can be considered, although difficult to quantify to the extent it depends on future changes in shipping patterns.

There may be other environmental effects which are less amenable to quantification. But beyond the obvious impacts on dredging and deposition, the reduction in vessel movements and opportunities for reclamation are potentially positive for the environment and reduce costs for people in it, even if they cannot all be quantified.

3.3. Sensitivity of estimates

All numerical estimates depend on the assumptions and inputs on which they are based. This report refers in various places to the effect of variations in inputs used in the calculations, including the New Zealand and US dollar exchange rates, variations in load size and use of different discount rates (see section 2.5 above). The size of the cargo has the most significant impact on the results of the comparison of costs and benefits from the proposed project.

3.4. Summary of quantified estimates

Table 6 shows the annual avoided costs of larger shipments enabled by channel deepening. The left centre column shows the effect if 63% of refinery feedstock is delivered in loads larger than 700 kbbbl (principally those from Middle East and West Africa); the right-centre column shows all deliveries (including those from Asia) moving to larger cargoes if current load constraints at Asian ports were to be remedied at some point in the future.¹⁹ The outcome may be higher or lower than \$17 million per year, depending on the size of the delivered cargoes.

Table 6 Benefit (avoided costs) of larger loads delivered

Average nominal cargo size	25.6mbbl in larger loads	40.7mbbl in larger loads
	<i>\$m/year</i>	<i>\$m/year</i>
950 kbbbl	5.8	8.1
1000 kbbbl	11.8	16.8
1050 kbbbl	17.2	24.7

Source: NZIER²⁰

With the costs of deepening and associated tank capacity expansion estimated at \$57 million, the annualised cost over 15 years at a risk adjusted discount rate of 8% would be \$6.2 million.²¹ With operating costs assumed to be less than \$1 million, all the

¹⁹ There is no immediate prospect of all Asian ports removing their depth constraints, but they may do in the future

²⁰ Red cells indicate annualised cost exceeding benefit, amber cells indicate low net benefit and green cells indicate strong net benefits

²¹ We use the short 15-year timeframe as it is more stringent than the costs annualised over the full 35-year consent period.

estimates above except for the current import slate in 950 kbbl loads would produce net benefit over deepening costs, indicating an efficient use of resources.

Unquantified benefits come from a reduction in shipping movements around the harbour mouth and reduction in greenhouse gas emissions on shipping. Adverse effects on an already modified environment are unlikely to have high dollar cost.

There is strategic benefit in prolonging the refinery’s operation against foreign competition. This defers the date at which refinery closure would incur site remediation costs of \$300 million, the present value of which would be in the 10s to 100s of millions of dollars depending on how long channel deepening extends operation. Closure would also lead to 85% reduction in employees, contractors and above-average wages paid in Northland, as summarised in Table 7. The reduction in employees would have a negative impact on community well-being, so its deferment is beneficial.

Table 7 Impact of prolonging refinery operation

	Employees	Contractors	Combined
Staff numbers	-270	-79	-349
Wages \$m/year	-57	-17	-74
Northland \$m/year	-54	-15	-69

Source: NZIER

4. Conclusions

This report has set out a framework for economic assessment of the proposal for deepening the channel for Marsden Point Refinery. It proposes a cost benefit approach that has been used in the Environment Court, supplemented by considerations of economic impact of the refinery's spending and employment in the region.

The cost benefit framework identifies the economic surplus from channel deepening, taking account of the externalities that may be created by it.

The potential cost savings from accessing larger loads in deeper draught ships are a clear example of enhanced producer surplus from the proposal. These are largely captured by Refining NZ and its customers as developers of the project, but are also a benefit to the nation as they accrue to New Zealand domiciled companies.

Another element of surplus comes from the deferment of costs of closure of the refinery should it be unable to access the larger cargoes to remain competitive with overseas refineries. One such cost is the remediation of the refinery site after closure, which could be worth more than annual savings in delivery costs, depending on how many years of extra competitive operation would be conferred by channel deepening.

We estimate these annual savings in delivery costs to be around \$12-17 million a year, depending on the average size of landed cargoes enabled by the deeper channel. This range is well above the annualised cost of deepening of around \$6 million a year. This would improve the competitive position of the refinery against foreign supplies and sustain the operation of the refinery into the future.

A number of external effects can also be considered beneficial for the wider community. Larger cargoes would mean fewer vessel movements around the refinery of benefit to all users of the harbour entrance, compared to current operations without channel deepening. Fewer vessels would also reduce greenhouse gas emissions from crude deliveries, which would be a measurable benefit should international shipping come under an emissions pricing scheme.

Other external effects on the environment, such as the seabed and reclamation areas, do not appear to be affecting elements of scarcity or high value for natural character. Such effects would not warrant incurring high economic cost to avert them and retain the environment in its current condition.

Aside from these cost benefit considerations, the continuity of operation of the refinery has a particular significance for the Northland economy, given its low rating on a number of economic and social measures, such as high unemployment, low household income, higher dependency ratio than the corresponding New Zealand averages.

Closure of the refinery, with its well-paid workforce and its contribution to business expenditures in the region, would have a significant negative impact on regional economic activity which may take some time to recovery.

If the refinery were to close, then the overall number of shipping movements would reduce as crude carriers and coastal tankers were discontinued and replaced by imports of refined product. While some might consider that beneficial, it would not be

economically significant given the low incidence and risk of adverse effects of vessel movements in the harbour entrance.

That effect would need to be weighed against the loss of economic contribution from closure of the refinery and its probable contraction to an oil terminal, providing only a tenth of the employment and reduction of the economic impact of the refinery in operation.

Appendix A Response to Cultural Effects Assessment

In June 2017, the Tangata Whenua o Whangarei Te Rerenga Paraeroa Draft Cultural Effects Assessment (CEA) of the Refining NZ Crude Freight Proposal was circulated for comment. It concluded that the economic benefits of the proposal would not outweigh the potentially adverse ecological and cultural effects. In particular, it concluded:

- Positive social and economic effects on Tangata whenua as a result of the Crude Freight Project were likely to be negligible as more jobs for locals are unlikely to arise
- They had concerns about the potential future constraints to their economic aspirations, in the areas of aquaculture, commercial fishing and ecotourism
- The health and welfare of Tangata whenua would be affected by their inability to gather kai and feed their whanau or manuhiri at the marae.

We respond to these to the extent that they relate to the NZIER *Economic assessment of channel deepening at the Marsden Point Refinery*.

A.1 Positive social and economic effects

The CEA sees little employment benefit for local tangata whenua from current refinery operations. Compared to around 350 employees and 150 contractors identified in the NZIER report, it identifies 32 employees who identify as Māori or part Māori, and it is unknown how many of the employees are local tangata whenua.

The NZIER report agrees (page 5) with the CEA that if the dredging activity involves specialised equipment provided by overseas firms, the direct impact on the regional or local economies is likely to be limited. The dredging and consenting process is only short term and forms a small part of the economic impact of the Crude Freight Project. More significant are the long term improvements in competitiveness that prolong the refinery's operation and its role as a source of incomes and spending in the region.

While the refinery may employ few Māori directly or via consultants' services, the positive social and economic effects of the refinery are not confined to the direct effects on Māori employment. The refinery also supports indirectly other businesses that employ Māori through its purchases of services and through the spending of its employees on their consumption goods.

The NZIER report was not tasked with identifying the effects on Māori specifically and there are practical challenges in accurately doing so. While that impact is unknown, if the channel deepening improves the competitiveness, market share and longevity of the refinery operation it will benefit all those who receive income directly and indirectly from that continued operation in the region, Māori and non-Māori alike.

The CEA also notes that the NZIER report does not elaborate on when the refinery would close or how much longer it could stay open with channel deepening. That is a forecasting issue depending on many factors of technological and market development which was beyond the scope of the NZIER report. The CEA considers the oil industry to have a limited lifespan in the future anyway, which may be true in view

of development of new technologies like electric vehicles and concerns over continued use of fossil fuels. However, there is a lead time in new technologies becoming commercially competitive and also in transforming the stock of equipment (especially in transport) from oil-based to other technologies, so it is not unreasonable to seek consent for further refining operations over the full 35 year consenting period.

A.2 Potential constraints on future economic aspirations

Noting that a draft AEE report (Boyd 2017) concludes that dredging and spoil disposal would have negligible effects on commercial fishing in the area the CEA expresses concern about losing future potential economic opportunities. It cites commercial cockle and pipi fisheries on the Snake and Mair Bank, that were closed in 2012 due to low biomass but could recover and enable future commercial fishing to resume. Māori own 50% of New Zealand's fishing quota and are involved in aquaculture, with entitlement to 20% of any new aquaculture space allocated in future.

Fishing, aquaculture and seafood processing may provide scope for expansion into sustainable long term business in Northland. Typically, most of the jobs are in seafood processing which is lower paid than fishing or aquaculture which use more specialised qualified labour. At present, neither fishing and aquaculture nor seafood processing make significant contribution to Northland's GDP, each accounting for about 0.2% of total regional GDP in 2015 (compared to the refinery's 9%). The significance of a recovered Snake and Mair Bank to the potential for growth is not evident from the CEA but is unlikely to be large relative to the benefit of continued refinery operation.

CEA notes that impact on Māori customary and recreational fishing has the potential to affect local tangata whenua who collect kaimoana to supplement low incomes. Changes in recreational opportunity can affect economic well-being if it changes the cost of exercising that opportunity or, in this case, the cost of obtaining the gathered food to supplement other income. That economic effect depends on the scale of area affected, the number of people affected and the availability of substitutes (e.g. access to other fishing areas) and there is nothing to suggest this effect would be significant.

A.3 Other matters

The CEA queries the NZIER report about how channel deepening allows the cost of site remediation at refinery closure to be deferred to an unspecified date in future. It notes that tangata whenua are uncomfortable with the idea of passing on the costs and burden of site remediation to future generations to deal with.

The NZIER report's discussion on this is about the economic cost of site remediation, not about who pays or bears the cost of remediation. The cost today of deferring remediation is lower the further in the future it falls because of the effect of discounting the future costs. One way to think of this is that if a sinking fund were set up putting an amount aside each year to pay for the future remediation, the amount set aside each year would be smaller the longer the period before remediation is required, because of the cumulative effect of set asides and compound interest.

There are numerous financial mechanisms that could be used to ensure remediation of the site is paid for by those who enjoy the use of the site in its lifetime rather than people in the future, including RMA financial contributions, bonds and depreciation allowances used by the company. These were outside the scope of the NZIER report.