hale & twomey

RAP Contingency Options

Prepared for Ministry of Economic Development
October 2011

Hale & Twomey Limited is an energy consultancy specialising in strategic issues affecting the energy sector. With a comprehensive knowledge of local and international energy markets, we provide strategic advice, comprehensive analysis and services across the entire sector.

Hale & Twomey prides itself on being able to analyse and interpret the detail, then translate the implications into strategic directions for our clients. We provide expertise to a broad range of companies and government departments. Hale & Twomey has established a strong reputation in the sector by producing timely, high quality, value-adding work.

Authorship

This document was written by:

Ian Twomey	Phone: 04 471 1109, e-mail: ian@haletwomey.co.nz
Steve West	Phone: 04 471 1153, e-mail: steve@haletwomey.co.nz

Please phone or e-mail for further information.

Disclaimer

Hale & Twomey Limited, its contributors and employees shall not be liable for any loss or damage sustained by any person relying on this report, whatever the cause of such loss or damage.

Executive Summary

Petroleum fuels are essential for a modern economy. People and businesses expect to be able to purchase fuel when they need it and there is an expectation that marketers will manage supply chains to keep the fuel flowing. New Zealand has a good record of maintaining supplies over many decades, although there is concern that a single supply system does present risks.

This is especially the case for Auckland supply, where the Marsden Point refinery produces nearly all Auckland's fuel which is supplied via the Refinery to Auckland Pipeline (RAP) to the Wiri Fuels Terminal (Wiri) in Auckland. Disruption to RAP or Wiri will have immediate effect on Auckland supply and consequentially on its economic welfare. During contingency exercises on disruption to RAP, the Ministry of Economic Development (MED) were advised by fuel marketers that severe shortages would occur in Auckland from a long term outage to the RAP/Wiri distribution system.

This report evaluates contingencies that would best re-establish supply to Auckland in a long term disruption. It does not deal with the immediate emergency response which is covered in other reports.[1] The most significant event is expected to be a major disruption to Wiri due to the time needed to repair the terminal. Repairs to RAP disruptions are likely to be much shorter duration (at most weeks whereas Wiri could be 18 to 24 months in a worse-case scenario).

A disruption to the supply system into Auckland, with no other changes except to shift the current fleet to distribute from the nearest terminal, is likely to leave the Auckland market nearly 60% short of petrol and diesel with some disruption to the surrounding regions as a knock on effect (Northland/Waikato). There would be no jet supply to Auckland Airport.

The most cost effective contingencies are those that allow more efficient use of the supply systems that companies already use. This means that Auckland's petrol and diesel supply would come from the road loading facility at Marsden Point (for the north and west) and from Mount Maunganui (for the south and central) along with more intensive use of the Wynyard Wharf facility. While these terminals could handle the additional throughput, the constraint is with truck capacity and driver availability and this is where the most effective contingencies should be focused. These are shown below for petrol and diesel resupply.

Petrol and diesel contingencies	Demand met for Auckland & across region	Cost per litre supplied
Basecase: Current trucks supply from nearest terminal	41% - 61%	-
Loading trucks to capacity: Trucks are not loaded to capacity due to road weight limits. In an emergency allowing them to load to capacity would provide an immediate benefit. - relax limit in wider Auckland region - relax limit in whole country	 58% - 72% 70% - 78%	 0.36 0.37
Above case plus using spare trucking in the country (including weight limit relaxation benefit).	80% - 87%	1.83
Above cases plus customers shifting demand from region (e.g. line haul operators), improved distributor fleet utilisation, loading efficiencies and demand consolidation.	87% - 91%	1.80
Above cases plus obtaining trucks and drivers from offshore.	100%	2.56

[1] Auckland CDEM Fuel Contingency Plan | October 2011

In summary with certain contingencies the total Auckland petrol and diesel demand could be met by trucking from neighbouring terminals. The resupply would not be immediate but would gradually build up to this level. In total the contingencies are calculated to cost $31 million dollars per annum but in the main this would only be spent when required. There are a number of preparations needed so that these contingencies are ready to roll out in an emergency event (Section 9).

Jet fuel to Auckland Airport is more difficult to resupply in a disruption as there are limited alternatives. The nearest terminal is Wellington and the trucking resources are not available. Various options have been assessed and are show in the table below.

Jet contingencies	Demand met	Cost per litre supplied
Basecase: Regional airport demand supplied from Wellington	3%	-
A jet loading facility at Marsden Point. This would give a closer access for supply but substantial trucking and drivers would still be required (probably need to be imported as other resources will be fully deployed)	100%	3.69
Liquigas LPG facility. It may be possible to convert the LPG facility in Wiri to jet and supply it using a small tanker.	52%	3.74
Directly link RAP pipeline to Wiri to Airport pipeline. As a Wiri outage is the main concern this would allow jet to still flow from the refinery to the airport.	100%	0.52-1.56

As extended outages are most likely to be disruptions at Wiri terminal, the most cost effective option is a direct connection from RAP to the Airport terminal. However expenditure would be required to prepare the option otherwise it would take three to six months to put in place.

In the short term there are few alternatives for jet supply into Auckland. The total domestic jet demand could be supplied through Wellington and Christchurch. Also Christchurch could meet around 20-25% of the normal Auckland international demand (i.e. some international planes use Christchurch rather than Auckland). The balance of the demand would need to be tankered into Auckland by airlines (i.e. planes land with enough fuel to leave). This means long haul flights would need to land at a regional airport (e.g. Nadi or Brisbane) before flying to Auckland.

Other options

The more significant contingencies are to duplicate some of the supply facilities. Two possible options are to build a back-up terminal near the current Wiri terminal or to build another Wiri type terminal to the North-West of Auckland. While these would provide almost immediate back up to the Wiri terminal (or in the case of the terminal North-West of Auckland to a RAP disruption south of that point) they are very expensive options expected to cost more than $10 million per year. While this report doesn't look at the economic benefit of maintaining supply, there are more cost effective contingencies that provide a similar back up capability at a much lower cost especially when considering the likelihood of such an event.

Table of Contents

1.0 Introduction

The Refinery to Auckland Pipeline (RAP) supplies around 90% of Auckland and over half of Waikato's petroleum products (about a third of New Zealand's total fuel demand). At a recent contingency exercise it was expressed to officials that a long term disruption to RAP would cause major supply disruptions to the Auckland market.

The RAP connects the Marsden Point refinery with the Wiri Oil Terminal (Wiri) from which supply is made to the Auckland market. Refining NZ (RNZ) owns and operates both the refinery and the RAP. Although concern was expressed about a long term disruption to RAP, the loss of Wiri would have a similar impact on the Auckland market and the mitigation options will be similar.

The Ministry of Economic Development (MED) has asked Hale & Twomey (H&T) to review the likely supply impact from a long term supply disruption to RAP or Wiri and investigate potential fuel contingency measures and mitigation options that could be implemented including likely cost, and the benefit they would provide in terms of additional volume supplied.

The current focus on RAP/Wiri follows earlier work commissioned by MED looking at New Zealand's Oil Security, including its vulnerability to external oil shocks.[2] That work found the greatest risk to New Zealand supply was a disruption to the international petroleum supply although it did identify the refinery/RAP/Wiri infrastructure as the most significant internal risk. As noted above contingency exercises carried out since then have confirmed the difficulty of maintaining supply to Auckland in the event of significant disruption to this infrastructure.

The likely short term response to a supply disruption and how supply to essential infrastructure providers will be maintained is covered in the Auckland CDEM Contingency Plan[3].

This report builds on this earlier work by evaluating contingency options for re-establishing supply to Auckland during a long term disruption in the current infrastructure. Immediate emergency response activities and likely impacts (like panic buying) are not covered in this report.

Report Structure

The report initially summarises current supply arrangements and discusses the potential for supply disruption based on discussions held with interested parties. The report then assesses how much petrol and diesel demand could be met through trucking, looks at options for meeting jet demand and the impact of demand restraint. Following this assessment the report compares the cost benefit for potential contingency options drawing on the earlier work done on supply capability and demand restraint. Lastly the report summarise our findings and recommendations.

The report uses confidential MED and regional authority volume data in its analysis although no explicit confidential data is shown.

[2] Oil Security by Covec and Hale &Twomey | Ministry of Economic Development | February 2005

[3] Auckland CDEM Fuel Contingency Plan | Auckland Engineering Lifelines; Civil Defence; Auckland Council | V2: October 2011

2.0 Overview

Petrol and diesel demand in top half of the North Island accounts for around 50%[4] of New Zealand's total demand (around 4.1 billion litres per year). A supply and demand breakdown for petrol and diesel is shown below.

Region	Terminals	Petrol (% of NZ petrol) [4]		Diesel (% of NZ diesel) [4]	
		Supply	Demand	Supply	Demand
Northland	TLF	4%	4%	5%	5%
Auckland	Wiri, Wynyard Wharf	36%	34%	25%	18%
Waikato	-	0%	9%	0%	10%
Bay of Plenty	Mount Maunganui	18%	11%	17%	13%

This table shows Auckland demand is around a third of New Zealand petrol demand and around a fifth of New Zealand diesel demand. Auckland jet demand accounts for around 76%[4] of the total jet demand in New Zealand. Across all products (including jet), the terminals located in Auckland supply around 45% of New Zealand's total fuel demand.

About 74%[4] of New Zealand's total supply comes from RNZ with about half of this production delivered into the Northland and Auckland markets from the Wiri terminal (Wiri) in Auckland and the Truck Loading Facility (TLF) located next to the refinery. The rest of RNZ's production is shipped to the coastal ports. BP, Chevron, Mobil and Z Energy (the RNZ Customers) have contractual arrangements with RNZ for processing crude supplied by them into the products they require. The RNZ Customers also operate a joint venture shipping company (COLL) to ship products from the refinery to the ports.

As New Zealand's demand is greater than RNZ's production capability the RNZ Customers and Gull (who doesn't have a contractual arrangement to use the refinery) import their remaining supply requirements, mostly from Singapore and other Asian countries like Korea. Imports typically take two months to arrange (this includes about 16 - 18 days for shipping) although in an emergency situation this could be done in less time (about six weeks)[5].

2.1 RAP

Auckland is primarily supplied by the RAP which connects the refinery with the Wiri terminal (located near Auckland Airport). The RAP is about 170km long and 250mm in diameter. It consecutively pumps petrol, jet and diesel at a maximum rate of 370m^3 per hour but with future upgrades it will ultimately be capable of pumping products at a rate of 415m^3 per hour.[6] Typical throughput is around 320m^3 which is about 85% of current capacity[7]. This suggests that Wiri stocks can increase by around 1.2 million litres per day. At this rate it would take about 40 days to rebuild stocks to normal levels after a long outage.

[4] New Zealand Energy Data File | Ministry of Economic Development | 2010 Calendar Year Edition

[5] Auckland CDEM Fuel Contingency Plan | October 2011

[6] http://www.refiningnz.com/environment--community/environmental-protection/pipeline/rap-facts.aspx

[7] Our Refining Business 2010 | NZRC

RNZ holds over 100m of spare pipe bound ready for use in the ground, a spare pump and has hot tap equipment. For temporary repairs it has large quantities of normal pipe. It also has a contract to access specialist welders if there was a disruption to RAP.

2.2 Wiri terminal[8]

The Wiri terminal is operated by Wiri Oil Services Limited (WOSL) - a joint venture company owned by BP, Chevron, Mobil and Z Energy for supplying customers in the Auckland region.

Product	Average stock (mln litres)	Total tank heels (mln litres)	Total tank tops (mln litres)	Number of tanks
Premium	7	2	16	2
Regular	20	5	41	2
Diesel	14	2	24	2
Jet	20	3	35	3
Total	61	12	116	9

The table above shows that on average Wiri stocks are around 61 million litres (about eight days' supply), but this varies and for individual products the stock will be much lower than shown above just prior to the next batch of fuel arriving from the refinery.

2.3 JUHI

The Joint User Hydrant Interplane terminal (JUHI) at Auckland airport is supplied with jet by pipeline from Wiri (referred to as WAP - Wiri to Airport Pipeline). The JUHI has an underground hydrant system around the tarmac for supplying jet to domestic and international aircraft. Currently the JUHI has limited capability to receive jet by truck (this requires parking near the road beside the JUHI), but have been advised that this will increase to around 100% when a new tank and receiving gantry is built in 2012/2013.

2.4 Wynyard Wharf

Marstel Terminals owns and operates a terminal facility at Wynyard Wharf located in Freemans Bay (central Auckland). While this area is tagged for redevelopment, Marstel has a lease through to 2022 along with a commitment from the Auckland Council to find a viable alternative location prior to the end of the lease.[9]

Z Energy uses this facility to store marine diesel (maximum of ~12 million litres across two tanks) and also bitumen. The small truck loading facility at this terminal is capable of loading two trucks per hour through the single loading gantry[10].

[8] Auckland CDEM Fuel Contingency Plan | August 2011

[9] Marstel press release June 2010| Marstel acquisition of Greenstone Energy terminal at Wynyard Precinct

[10] Z Energy advice

2.5 Mount Maunganui

All five supplying oil companies have bulk storage terminals at Mount Maunganui. This is Gull's only terminal location - their site can store up to 78 million litres[11]. This is also where BP and Mobil distribute their 98 octane petrol from (central and upper North Island for BP and across the North Island for Mobil).[12] MED data shows petrol and diesel supply from Mount Maunganui accounts for around 10 - 15% of supply to Auckland.

Supply from Mount Maunganui will likely cover the Bay of Plenty, Central Plateau and parts of the Waikato regions. Its strong supply capability and relatively close proximity to Auckland (compared to most other ports) means that Mount Maunganui provides an alternative supply option for the Auckland market. But it is still a long haul as typically only two deliveries are able to be made per shift, versus four or five deliveries from WOSL.

2.6 Marsden Point TLF

This terminal is a small facility located next to RNZ with six tanks that contain diesel, regular and premium petrol. The tanks are filled by pipeline from the refinery. The RNZ Customers use this terminal to supply the Northland region. Like Mount Maunganui this terminal plays a backup role to Wiri with trucks delivering into northern parts of Auckland (typically north of the Harbour Bridge) at times of shortage at Wiri.

2.7 Trucking

Most fuel is delivered to customers by truck. These trucks are specially modified with electrical isolation systems and haul purposely built trailer units (these typically deliver 30-35,000 litres). The truck and trailer units may be owned by oil companies, their distributors or by independent transportation firms. Over the last 15 years truck optimisation has improved significantly with more units double shifted and enhancements in scheduling systems - there are fewer vehicles delivering more fuel.

From discussions there's some spare capacity within the trucking fleet, with about 10 spare trucks held by industry across New Zealand and some trucks only operating 12 hours per day, although finding suitably qualified and acceptable drivers to use this capacity could take some time. All companies also indicated that the main fleet has capacity to haul more fuel than currently allowed.

Legislation limits the total laden weight of Tractor Semi-Trailers (a common setup used for hauling fuel) to 39 tonnes. But with trucks getting heavier (from more emissions and safety equipment on-board) the effective fuel carrying capacity is reducing. There are rules which allow high productivity motor vehicles (HPMV) to carry more fuel on approved routes. HPMV permits are issued by NZTA for the state highway network and by the local RCA for local roads, which can make it hard to obtain approval for fuel haulage where approval from NZTA and more than one RCA is required. The decision to issue a HPMV permit takes into account the type and capability of the vehicle as well as the condition of the roads and bridges on the proposed route.

---

[11] http://www.gull.co.nz/fuel-terminals/

[12] Auckland CDEM Fuel Contingency Plan | October 2011

3.0 Potential supply disruption

This report is focused on the contingencies that would help restore supply following a medium to long term disruption to supply into Auckland from RAP or Wiri. While the focus is on restoring supply this section briefly covers potential supply disruptions and their likely effect.

3.1 Loss of RAP

Loss of RAP will immediately limit Auckland supply to the stock available at Wiri and start to back up product at the refinery. Issues around events and likelihood of event were covered in MED's Oil Security Report.[13] This report found that an extended outage of the RAP is unlikely as most events disruption pipeline operation would be able to be quickly repaired. This is also consistent with the recent Maui gas pipeline incident where the pipeline rupture was located and repaired within seven days of the incident occurring.

Updated statistics on pipeline operations in the USA confirm that pipelines are a very secure form of transport - applied to the RAP they would indicate chance of an event of 0.06/year on the RAP (an event every 15-20 years). Most of these events are still relatively minor (relate to spills rather than major pipeline disruption).

Discussions with RNZ and Wiri users confirm that an extended loss of RAP is seen as lower risk than loss of Wiri. Most events that could cause substantial disruptions would cause substantial disruption to the Auckland region itself (e.g. a volcano in vicinity of RAP).

3.2 Loss of WIRI

Loss of Wiri would have immediate impact on Auckland supply as the stock in tank (around 8 days' supply) would not be available. Long term it will have a similar effect to the loss of RAP.

The likelihood of terminal disruption was also covered in MED's Oil Security Report. While the risk of disruption event was not assessed as higher than RAP, the supply impact for a terminal like Wiri was considered to be significantly greater due to the much longer time (up to 18 months) that it would likely take to restore normal operations.

Since the 2005 Oil Security Report there was a major terminal explosion and fire at Buncefield in the United Kingdom (December 2005). This caused all terminal facilities to be re-evaluated for risks along with changes to terminal design and operational practice. The authors have been advised that the lessons learned from Buncefield have been applied to the Wiri terminal and changes made.

3.3 Impact on Refining NZ

As noted above, disruption to RAP or Wiri will have an immediate impact on the refinery. The contingencies discussed in this report look to re-establish supply by different routes. This will involve RNZ supplying more volume through the TLF and over the jetties on to tankers. These increases are manageable with RNZ's current infrastructure as tankage which would normally be required for the RAP would now be available for storing other products between shipments.

---

[13] Oil Security for the Ministry of Economic Development by Covec/Hale & Twomey February 2005 (sections 2.6.2, 2.6.3)

The most immediate impact on RNZ would be the expected build of jet fuel. The jet build up will be partially offset by increased volumes being taken to Wellington/Lyttelton (approximately double). Even with extra volumes going on coastal distribution it is likely that jet will need to be exported from the refinery within two weeks (timing could be extended slightly by diverting some jet to diesel and by reducing throughput slightly). Exports will need to be arranged using ships that are in the region bringing imports to New Zealand or Australia. Keeping the refinery feasible will be important to ensure supply to the rest of the country is maintained.

Three of the RNZ Customers are major multinational oil companies so have large system resources to call on to manage exports and for all the RNZ Customers failure to export jet fuel (causing NZRC to cease production) will instead mean importing all of their finished product requirements. In both cases shipping is paramount, but importing everything would require significantly more shipping capacity (about eight times more) than exporting jet fuel. While finding a ship at short notice will be difficult in an emergency it should be possible (it may be costly). In the worst case jet may need to be exported to Asia but it is conceivable that extra demand at the airports where planes to/from Auckland have been diverted may need imports at short notice.

3.4 Impact on coastal shipping

A disruption to RAP/Wiri will put more load on the coastal shipping task. In addition to the existing task more volume will need to be shipped to Auckland, Mt Maunganui, Miramar (Wellington) and Lyttelton. There is a small amount of excess capacity in the current fleet especially on current voyages to Auckland and Mt Maunganui. However the additional demand may require more shipping resource for an extended disruption.

Ships are readily available in the market with ships suitable for a coastal distribution task regularly coming into this region (Australia/New Zealand). While ships could be chartered to do coastal work there will be issues with crewing as currently foreign crews can only work on the coast for up to 28 days before they become subject to New Zealand immigration laws. Chartering ships is flexible and can be done on a short term or long term basis. Currently ship chartering costs are relatively cheap (approx. US$15,000 day) although to this cost bunker and port costs have to be added to obtain the total cost of shipping.

4.0 Analysis of petrol and diesel trucking capability

This section summarises the likely supply situation for petrol and diesel that would result from an extended outage at Wiri or with RAP and outlines what could be achieved from relaxing system constraints and applying more resources to better manage the situation. The impact for jet is discussed separately in Section 5.0.

To determine the likely impact H&T developed a model of supply and demand. This model uses Local Authority Fuel Tax (LAFT) data and terminal demand data provided by MED to calculate typical supply patterns for Northland, Auckland, Waikato and Bay of Plenty. From this the typical trucking task has been calculated, which gives an indication of the trucking resource applied to the supply task in the region. As petrol and diesel are often supplied on a single vehicle the combined trucking task is assessed rather than considering each product separately.

With the normal supply task defined the supply capability for each response scenario can be estimated; these are summarised below.

4.1 Basecase scenario

In the basecase scenario we assume that where supply from Wiri is not available, supply is instead made from TLF, Mount Maunganui and Wynyard Wharf using the existing Wiri based trucking fleet within normal shift patterns and in compliance with legal road limits. Supply would likely be split with the North Shore and West Auckland (petrol only) supplied from the TLF, with the rest of Auckland supplied from Mount Maunganui and Wynyard Wharf (diesel only).

Supply capability summary

- Average regional supply capability 61%
- Auckland demand met 41%
- Regional demand met (excluding Auckland) 82%
- Effective RAP volume moved 33%
- Volume shortfall ..... 3.3 mlpd

Within the limits of the current fleet and in compliance with legal road limits only 61% of the regions demand could be met, with this weighted towards maintaining a greater level of supply to areas closer to the TLF, Mount Maunganui and Wynyard Wharf (it is more efficient to deliver to nearby locations).

Based on information provided by the oil companies all of the alternative supply locations would have ample capacity to manage the extra truck loadings required in this scenario. The TLF would be operating around 160% of normal capacity and Mount Maunganui around 130%.

Analysis suggests that to meet all of the regional demand (without putting in place other contingency options) a further 40-45 trucking assets would need to be deployed which would be about 175% of current resources.

Even at this level the alternative supply locations have sufficient capacity with the TLF operating around 250% of normal capacity (which during discussions companies considered acceptable and RNZ said they could meet the supply requirement) and Mount Maunganui around 200% (which equates to around 22 extra shipments per year). The extra supply to Mount Maunganui should be able to be supplied through a combination of utilising the spare capacity on the coastal vessels[14] and about one additional shipment per month. In all cases the analysis has limited supply from Wynyard Wharf to less than the current two trucks per hour loading constraint.

4.2 Relaxation of legal road limits around wider Auckland

Discussions with oil companies confirmed that all have capacity to load more fuel on the product tankers if legal road weight limits were relaxed. The increase in capacity would range from 10-30% across the fleet and around 19% on average due to several companies having built in greater capacity in advance of the possible relaxation of maximum road weight limits. This scenario assesses the impact of relaxing the maximum legal road weights for product tankers in the region. The benefit from doing this is that more fuel can be transported without increasing the trucking resources or finding more drivers.

[14] Information provided by some companies shows there is significant spare capacity on these voyages

Supply capability summary

- Average regional supply capability 72%
- Auckland demand met 58%
- Regional demand met (excluding Auckland) 86%
- Effective RAP volume moved 51%
- Volume shortfall ..... 2.4 mlpd

By allowing product tankers in the region to load to their maximum capacity regional supply can reach around 72% of normal demand. There would continue to be significant shortages with the shortfall reduced to around 2.4 million litres per day (0.9 million litres less than the basecase). The alternative supply locations have sufficient capacity for this scenario. In this case the TLF would be operating around 190% of normal capacity and Mount Maunganui around 140%.

4.3 Relaxation of legal road limits across New Zealand

This scenario considers the benefit of allowing all product tankers in New Zealand to load to their maximum capacity. By allowing tankers in other regions to exceed the maximum legal road weights (i.e. carry more) some of the existing trucking fleet can be diverted to assist in supply to the Auckland region. This analysis assumes that only 80% of the New Zealand trucking fleet is able to consistently carry more fuel[15].

Supply capability summary

- Average regional supply capability 78%
- Auckland demand met 70%
- Regional demand met (excluding Auckland) 86%
- Effective RAP volume moved 62%
- Volume shortfall ..... 1.9 mlpd

With product tankers across New Zealand allowed to carry more fuel we estimate that around 78% of the regional demand could be supplied by the existing trucking fleet. This contingency measure would see almost twice the volume supplied versus the basecase. In this scenario the TLF would be operating around 215% of normal capacity and Mount Maunganui around 150%.

4.4 Utilising local trucking resource

Discussions with oil companies has shown that while trucking resources are fairly heavily utilised, that across all companies and third party providers around ten extra trucks with drivers could be employed to help the trucking task. This would give approximately 20% more trucking resource than typically used to supply the Auckland region.

Supply capability summary (no relaxation of road limits)

- Average regional supply capability 71%
- Auckland demand met 57%
- Regional demand met (excluding Auckland) 86%

[15] The assumption is based on advice given – particularly that the older tankers do not have spare capacity

- Effective RAP volume moved 50%
- Volume shortfall ..... 2.5 mlpd

With the likely ten extra trucks utilised to improve supply from the alternative locations regional supply can reach around 71% of normal demand - this is similar to the outcome from allowing product tankers in the region to operate fully loaded (i.e. above the maximum legal road weights).

However, when combining the spare trucking resource with allowing all product tankers across New Zealand to load to their maximum capacity significantly more of the regional demand can be met, this is shown below.

Supply capability summary (with extra trucks and overloading)

- Average regional supply capability 87%
- Auckland demand met 80%
- Regional demand met (excluding Auckland) 95%
- Effective RAP volume moved 78%
- Volume shortfall ..... 1.1 mlpd

As can be seen above, with the likely extra trucks employed and all trucks able to load to their maximum capacity rather than the maximum legal road weights, around 87% of the regional demand could be met through trucking from the alternative locations. There would still be a shortfall in the region but this is now only about 1.1 million litres per day across petrol and diesel, which is about a third of the shortfall seen in the basecase.

The alternative supply locations have sufficient capacity for this scenario with the TLF operating around 230% of normal capacity and Mount Maunganui around 175%.

4.5 Other efficiency gains

Further trucking efficiency gains may also be obtained through consolidation of demand (i.e. some sites may be closed to concentrate on the larger site which can be supplied more efficiently), greater utilisation of distributor trucking resources (these are often underutilised), limiting petrol to 91 only sales, having attended loading at the terminal gantries and getting larger commercial operators to obtain fuel outside of the region. Commercial operators doing line haul work may be able to fill up in locations which are closer to an operating terminal (e.g. Waikato or Bay of Plenty) reducing the distribution task. In addition a small percentage of the population of Auckland would be travelling into regions supplied by neighbouring fuel terminals. With people preferentially filling their vehicles when outside Auckland some demand will shift, reducing the required distribution task. We assume the combined benefit of these measures is about 3-4% of normal demand.

Supply capability summary

- Average regional supply capability 91%
- Auckland demand met 87%
- Regional demand met (excluding Auckland) 95%
- Effective RAP volume moved 85%
- Volume shortfall ..... 0.8 mlpd

The analysis done suggests that around 91% of regional demand (including 87% of Auckland's demand) could be met through allowing overloading of trucks throughout New Zealand, fully utilising spare trucking resources within the country and some other efficiency gains including consolidation of demand and product mix.

Even at this level all of the alternative supply locations have sufficient capacity with the TLF operating around 240% of normal capacity and Mount Maunganui around 180%.

We take confidence in the analysis done from the work done by some oil companies which concluded that a similar level of supply response could be achieved through maximising use of existing trucking resources (i.e. fully utilising spare truck time, loading to maximum capacity and other efficiency measures put in place).

4.6 Obtaining further trucks

For a long term disruption to supply at Wiri more trucks would be required to better supply the demand requirement. These could come from having a pool of spare trucks (a contingency option suggested by MED) or from companies sourcing further trucking resources from offshore (primarily Australia). This section assesses how much more trucking resource would be required to meet 95 - 100% of regional demand.

Supply capability summary	**95%**	**100%**
Extra trucks obtained (above those located in NZ)	6	12
Average regional supply capability	95%	100%
Effective RAP volume moved	91%	100%
Volume shortfall	0.4 mlpd	0 mlpd

To supply 95% of the regional demand we estimate a further 6 trucks would be required above the 10 estimated to be available in New Zealand. To achieve 100% supply a further 12 trucks would likely be required at a minimum (more may be required to give some contingency). In both cases and regardless of where the extra trucks are sourced from a key issue for companies would be finding enough suitably qualified drivers to operate the extra trucking resources.

While the alternative supply locations will continue to have sufficient capacity overall, some supply into West Auckland may have to come from Mount Maunganui rather than the TLF as the TLF gantry will (at times) now be close to capacity. For the 100% scenario the TLF would be operating around 250% of normal capacity and Mount Maunganui around 200%.

4.7 Drivers

If additional trucks are used or existing truck utilisation is increased, further drivers will be required to operate these vehicles. Comments received indicate that finding suitably qualified drivers could be difficult and take time (around six to eight weeks to find and train). Many companies commented that many drivers with heavy transport licences are not suitable for dangerous goods (would not pass their testing).

It is worth noting that allowing trucks to overload the current road weight limit will allow the existing fleet and drivers to carry more fuel.

4.8 Conclusions

From the analysis it is clear that in the basecase (from a long term disruption to RAP/Wiri) supply would be severely compromised (61% of regional demand met), but through a combination of employing spare trucking resources and allowing all product tankers in New Zealand to load to their maximum capacity rather than the maximum legal road limits the supply situation can be dramatically improved (around 90% of regional demand met).

The impact of each measure is summarised in the table below.

Table 1: Summary of supply for contingencies

	Basecase	Overload (regional)	Overload (NZ)	With spare local trucks	With other gains[16]
Average regional supply capability	61%	72%	78%	87%	91%
Auckland demand met	41%	58%	70%	80%	87%
Regional demand met (excl. Auck.)	82%	86%	86%	95%	95%
Effective RAP volume moved	33%	51%	62%	78%	85%
Volume shortfall	3.3 mlpd	2.4 mlpd	1.9 mlpd	1.1 mlpd	0.8 mlpd

To further close the gap between supply and demand for petrol and diesel in the region around 6 to 12 extra trucks would be required. These would likely be imported from offshore along with qualified drivers to operate them, but could take a number of weeks to put in place.

The alternative supply locations will continue to have sufficient capacity overall, with supply north of the Auckland Harbour Bridge and most of West Auckland likely to be supplied from the TLF (the terminal would be operating around 250% or normal capacity) and the rest of Auckland from Mount Maunganui (this terminal would be around 200% of normal capacity). Supply in the rest of the North Island is also expected to extend further north than currently is done.

5.0 Analysis of jet supply capability

For jet fuel alternative supply options are more limited. In the North Island jet is only supplied to Wiri / JUHI and into Wellington (some at Seaview, but most to Miramar / Wellington Airport). The current demand at Wiri / JUHI is around 2.7 million litres per day, which is equivalent to about 75 truckloads per day.

Currently the JUHI is able to receive about 50% of its current demand via truck through a single discharging facility, but with a new tank being built (2012/2013) along with more truck receiving capability the JUHI should be able to receive 100% of its demand (assuming trucking capacity to do so). This additional receiving capacity is probably more useful for covering disruption to the WAP where trucking distances between Wiri and the JUHI are short (about 15km round trip).

[16] Measures include demand consolidation, improved distributor fleet utilisation, only selling 91 octane petrol, attended loading and getting line haul operators to pick up elsewhere.

Table 2: Demand split by channel

	Annual volume (ml)	Daily volume (kl)	% of demand
Regional airports	30	82	~ 3%
Domestic from JUHI	115	316	~ 12%
International from JUHI	845	2,320	~ 85%

Table 2 shows jet demand from Wiri / JUHI by channel. This indicates that around 85% of the jet fuel demand at Wiri / JUHI is for international flights and only 15% used domestically either at the JUHI or the regional airports (Hamilton, Rotorua, Tauranga and to a lesser extent Whangarei). Jet supply to the regional airports is supplied by truck from Wiri. These trucking units are specially designed for carrying jet fuel (e.g. have low point drain systems). We understand that for normal product tankers to be used they would need to be modified for jet service.

5.1 Alternative supply

Alternative supply options are more limited with jet. From discussions held with the oil companies and airline representatives likely alternative supply routes for each channel are discussed below. Alternative contingency ideas such as having truck loading capability near the refinery are discussed separately in Section 5.2.

Regional Airports

Most of the regional airport demand will be for the smaller link services and it could be difficult to shift much of this volume to Wellington or Christchurch airports, instead this volume would need to be trucked from Wellington to the regional airports. Based on the demand we estimate this task would require about three trucks in total along with sufficient qualified drivers.

Domestic JUHI demand

For the rest of the domestic demand at the JUHI this could be mostly be tankered by the aircraft from Wellington and Christchurch airports, which would result in higher demand at these airports. Information provided shows that both locations would have sufficient capacity to easily handle the extra volume requirements from a shift in domestic demand. Across both locations around 9 million litres extra would need to be supplied each month which should have limited impact on coastal shipping operations. Although for Christchurch airport (which is supplied via truck out of the inland Woolston terminal) more drivers and terminal staff at the airport terminals may be required from the existing trucking resources being double shifted.

International JUHI demand

The size of the trucking task for bridging jet to the JUHI to meet international demand is significant (around 65 loads per day) and given the alternative supply location options are limited it seems unlikely that this would occur. We conclude that tankering by the aircraft will provide the best alternative supply option.

For the larger trans-Tasman aircraft (i.e. 767) these could do a return flight without refuelling in New Zealand, but the smaller 737 and A320 would need to refuel at Wellington or Christchurch prior to making the return trip, unless these were replaced with the larger aircraft.

For the long haul flights these will need to make a stopover to refuel prior to arriving in Auckland. Likely stop over points would be Nadi or East Coast of Australia (possibly Brisbane).

Some international demand could be supplied through Christchurch airport. Based on information provided by companies around 20 - 25% of international JUHI demand (about 200 million litres per year) could be supplied by the current trucking fleet but this would require about two additional jet shipments to Lyttelton per month, which is manageable if there is extra coastal shipping resources in place. Other issues include whether a local product quality testing laboratory would be required to speed up product acceptance and release (currently samples are sent to the laboratory at Marsden Point) and traffic management (including use of the Lyttelton tunnel).

5.2 Alternative contingency ideas

A number of other ideas have been suggested for addressing jet supply to the JUHI from a long term disruption to supply to Wiri. This section summarises each of these ideas.

New jet gantry located near the refinery

Providing a jet loading gantry near the refinery (either at RNZ or at the TLF) has been suggested as option for providing a closer alternative supply option for the JUHI.

From discussions with RNZ and the companies who use the TLF it seems that this could be done either at the TLF or just outside of the refinery fence on some refinery land near the finished jet tanks. The refinery option would see a pipeline from one of the finished product tanks taken to the nearby land with the companies then providing a jet loading gantry. The refinery has advised that providing a pipeline "through the fence" would be easy to do, so the likely delay in setting up something would be the speed at which the land could be prepared and a loading gantry built. This led to a suggestion about whether there should be a pre-built containerised gantry that could be deployed in this situation or elsewhere as required.

The location for a loading gantry near the refinery's finished jet tanks but outside the fence is seen as the most appropriate as the TLF would be close to maximum utilisation supplying petrol and diesel and having it outside the refinery gate would avoid vehicle congestion with the normal refinery traffic.

For this new supply option we calculate the following trucking task:

- To meet regional demand: ~2 trucks
- To meet 50% of current JUHI demand ~13 trucks
- To meet 100% of current JUHI demand ~25 trucks

To meet around 50% of the JUHI demand (the current maximum receiving capability of the JUHI) would require around 13 more trucks with capability to carry jet fuel[17]. While it would be possible to truck this, the impact on petrol and diesel supply may be significant (this would tie up trucking resources). With airlines able to tanker fuel it is difficult to see why oil companies would to use trucking resources for jet supply when these could be used for petrol and diesel supply instead.

If only regional airport jet demand is being trucked the current option of trucking from Wellington would seem to provide a viable alternative supply option. The benefit from having a gantry near the refinery would be limited, only saving about one truck.

[17] Jet fuel units are specially designed with low point drains and other design features to minimise fuel contamination.

Connecting the RAP into WAP

Partial or total loss of the Wiri terminal will have a much longer term impact on supply than damage to the RAP. Assuming no regulatory hurdles RNZ has indicated that the RAP could be repaired and operating (albeit with temporary pipe repairs in some scenarios) within a week, whereas substantial damage to Wiri could take 18 to 24 months to repair.

One idea is that the RAP could be diverted into the WAP which would then allow jet fuel to be pumped directly to the JUHI, bypassing Wiri terminal. While this sounds easy discussions have highlighted that this could be technically difficult any may take months to do (estimated at three to six months). Comments and issues raised by RNZ and the oil companies who use Wiri and WOSL include:

- The Wiri board has done some work on the practicality of connecting the RAP to the WAP.
- The WAP and RAP pipeline have been designed for and operate at different pressures.
- The WAP doesn't have the required pressure let down equipment or control equipment in place - these are required for the pipeline to operate. The current equipment is located inside the potential blast zone so could be destroyed in a major incident.
- The lead time for procuring the required control equipment (to install on the WAP) could be three to six months.
- The residual contents of the RAP (around 9 million litres) would need to be displaced with jet prior to starting jet supply to the JUHI. Some suggested this could be done by using one of the jet tanks at the JUHI, but others questioned if this would be practical and suggested that rather contaminate the JUHI system that having a way to flare the product may provide a better way to manage this.
- Wiri does have a remote "bunker room" from which it is possible to remotely operate the terminal (assuming control equipment is functioning). This could also be used as a base for operating the RAP to WAP if this was set up.
- One company indicated that it would be possible to join the RAP and WAP away from Wiri (i.e. outside of the possible blast zone) and suggested that it may be sensible to have a "turnkey" operation in place or at least do the design, get land access rights, obtain consents and procure long lead time items.
- Cost estimates provided by companies for this work ranged from 5 to 15 million dollars[18].

Having a way to supply jet fuel directly to the JUHI seems sensible and would mitigate the impact to refinery operations. Based on current Wiri / JUHI demand and RNZ tankage we estimate the refinery has about two weeks storage capacity from normal operating levels (accounting for coastal ship offtakes) which suggests companies would need to export a MR sized cargo every two weeks if jet couldn't be supplied to the JUHI (such a large cargo would need to load two parcels separately to allow finished product tanks to settle and be tested).

Manukau LPG pipeline

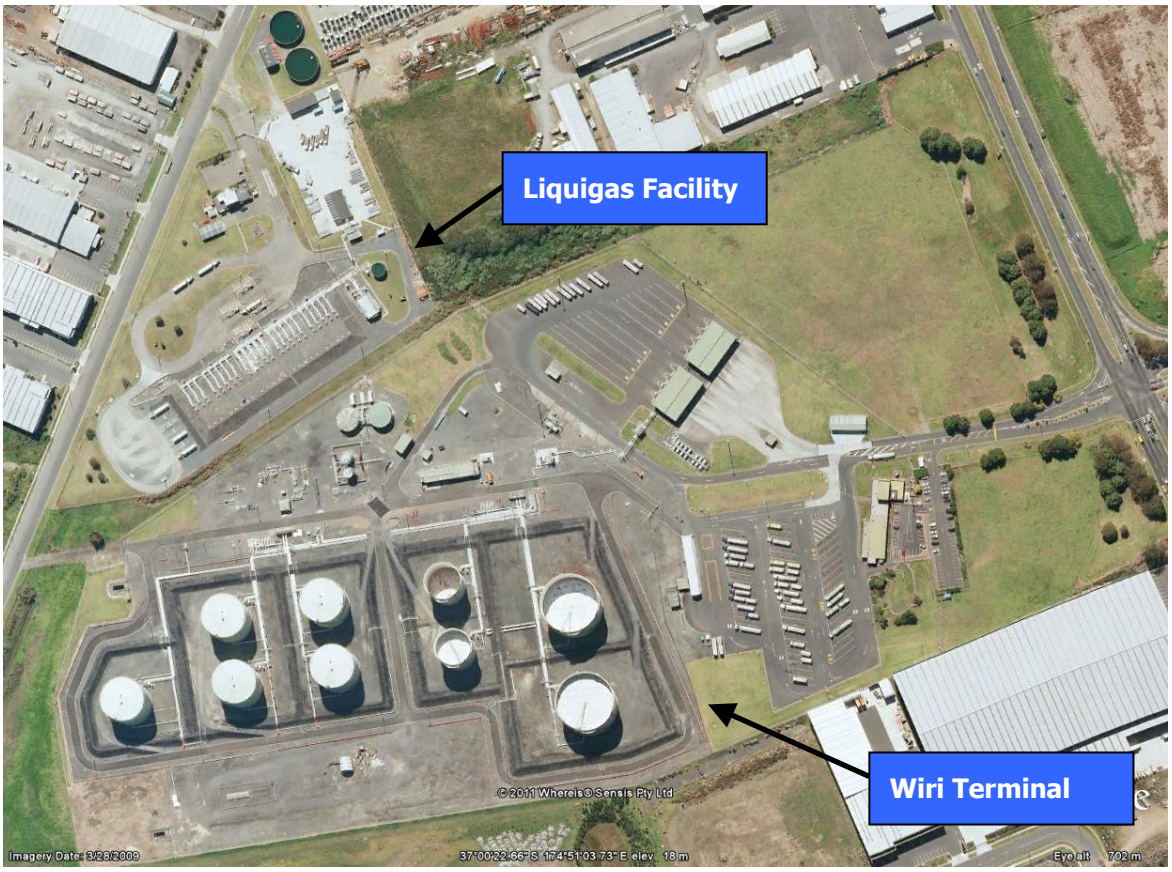
Liquigas has a facility located next to the Wiri terminal (refer Figure 1). We understand that this facility has four million litres of storage and when used is supplied via a pipeline from the wharf structure located in Manukau Harbour. Vessels are limited to a maximum draught of around 6m

[18] There was no detail given except mention that the higher end figure may include the cost of disposing of the pipeline contents.

and an overall length of around 135m[19], vessels of this size will typically hold around 3-4,000 tonnes of fuel, which is similar to the storage capacity at the terminal.

One suggestion is that the LPG pipeline and facility could be used for supplying jet in the event of a long term disruption to supply at Wiri. However, as can be been in Figure 1 the LPG facility is located next to the Wiri terminal so might be impacted by whatever event has affected Wiri. If the long term outage was caused by a major incident at Wiri it is likely that the LPG facility may not be immediately available although it might be able to return to service much more quickly (the LPG tanks themselves are buried so more likely to survive a blast).

Figure 1: Liquigas and Wiri terminals



There does not appear to be any issue that would prevent jet being stored in the LPG facility although it would take some time to put in the jet specific equipment required. In addition a small 3-4,000 GRT tanker would need to be secured (from Asia) and Refining NZ would need to install jet loading equipment on their small jetty 3 which handles vessels of this size (currently only fuel oil can be loaded on this jetty). All this is likely to take two to three months so this is not an immediate solution. However one tanker operating continuously between the refinery and this facility could meet about 50% of the normal demand into Auckland Airport and the trucking would be available to do the short trip between the terminal and the Airport JUHI.

Whenuapai and Ohakea airports

While there was some suggestion of using Whenuapai and Ohakea as alternative airport locations the jet fuel storage capacity will likely be similar to JUHI storage and would require the fuel to be

[19] ARC | Harbourmaster's Direction 5-06 | Vessel Operating Requirements

trucked in. With airlines able to tanker fuel it is difficult to see why using these alternative airports would be viable as doing so will use up trucking resources for jet supply when these could be used for petrol and diesel supply instead.

5.3 Conclusions

The biggest risk for jet supply will more likely be from loss of Wiri rather than loss of RAP, as the time needed to reinstate Wiri would be much longer than for RAP.

Currently the best alternative supply option is for regional airports to be supplied from Wellington, other domestic demand to be tankered from Wellington and Christchurch and the rest of the JUHI demand (international) to be tankered by the airlines.

While a number of ideas have been suggested for alternative jet supply into Auckland including having ability to load jet near the refinery, using the LPG facility in Manukau or using alternative airports, the idea that appears to provide most merit is having the ability to connect the RAP to the WAP in an area remote to the Wiri terminal.

6.0 OERS

The New Zealand Government has an Oil Emergency Response Strategy (OERS) that outlines the broad policy and possible operational responses that could be taken by Government to aid in the event of a supply disruption. It is clear from the document that primary responsibility for responding to any disruption remains with the oil company(s). There are two key pieces of legislation from which the Government can take action, these are:

- International Energy Agreement Act 1976
- Petroleum Demand Restraint Act 1981

The most likely legislation to be used from a supply disruption to Wiri would be the Petroleum Demand Restraint Act which gives authorities power to make regulations to restrain demand, reduce consumption or ensure equitable distribution of petroleum products in New Zealand. A Government response could also be taken under the Civil Defence Emergency Management Act 2002 where the supply disruption forms part of a wider emergency situation.[20]

6.1 OERS measures

The OERS outlines six measures for improving supply and restraining demand. These are discussed below along with their likely application for a long term Wiri disruption event.

Draw down of stocks from New Zealand's petroleum reserves

This response strategy would see the Government assist oil companies by monitoring draw down of commercial stocks or in the event of an IEA emergency releasing some of its reserve stocks. For a disruption at Wiri, the issue won't be lack of supply in New Zealand, but a lack of supply into Auckland. Therefore in this situation this measure is unlikely to provide any benefit.

[20] Oil Emergency Response Strategy | Ministry of Economic Development | July 2008

Surge Production

For this option the Government could direct permit holders to have indigenous oils processed in New Zealand, but similarly to the stock drawdown option this measure is unlikely to provide any benefit for supply into Auckland.

Relaxation of fuel specifications

The final supply response strategy would be for the Government to relax some of the fuel specifications for petrol and diesel. While this idea won't directly help with supply into Auckland there could be some benefit from allowing some of the jet fuel that would normally be pumped to the JUHI to be blended into diesel instead. If done this could reduce the frequency of jet exports or improve crude selection options to assist with optimising refinery production to the new demand requirements.

Fuel switching

Due to the limited use and availability of alternative fuels (particularly ones that don't require trucking by the petroleum tankers) there is unlikely to be much benefit from fuel switching.

Voluntary demand restraint

The Government could establish an information campaign to encourage the public to voluntarily reduce demand. This campaign could target the affected region which would help close the gap between supply capability and demand, but could also be a nationwide campaign as reduced demand in other locations may allow some further trucking resource to be reallocated. Ideas for reducing demand are included in the OERS and include encouraging speed reduction, car-pooling, telecommuting (i.e. working from home), use of public transport, etc. If supply to Auckland was constrained this would probably result in some demand destruction from the public electing to conserve their fuel supplies for more important activities.

Mandatory demand restraint

Government compulsion could also be used to mandate demand restraint, e.g. through a rationing scheme. The cost of administering such a scheme is not mentioned, but the OERS indicates that there would be significant cost in setting up and administering a scheme.

6.2 Impact on supply capability

Of the OERS measures listed above the demand restraint options are most likely to provide benefit to help manage supply into the greater Auckland region if there was a significant disruption to Wiri supply. In any disruption event the shortage of product is likely to be most acute in the week or two after the event as companies look to redeploy their resources and establish alternate supply routes. Given the short term nature of the most acute shortage, it would seem unlikely that the Government would implement a mandatory rationing scheme which takes time to implement. Therefore we consider the likely impacts from regional and nationwide campaigns.

A recent report[21] done for EECA confirmed overseas experience that around 10% saving in fuel use could be achieved through improved driver behaviour, reduced vehicle speed, reduced air conditioning use, engine maintenance and having correct tire pressures. While this is theoretically

[21] Fleet Fuel Efficiency: A Win-Win Opportunity | TERNZ | 2009

possible the likely impact will be less. There will also be some demand destruction from consumers electing to not travel (at times) and from the general lack of supply in the region.

For the purpose of this study we have assumed greater demand restraint in Auckland (the region likely to be most affected), a reasonable level of restraint for the neighbouring regions and for the nationwide campaign a small level of demand restraint across the rest of New Zealand. In all cases we assume the level of restraint is slightly higher for petrol than diesel.

Table 3: Demand restraint assumptions

Region	Petrol	Diesel	Weighted average
Auckland	7.5%	5.0%	6.7%
Surrounding region	5.0%	2.5%	3.7%
Rest of New Zealand	3.0%	2.0%	2.5%

For the nationwide campaign the impact from this level of demand restraint is a demand reduction of around 230 million litres, which is about 4% of New Zealand's demand and 7.5% of the regional demand. For the regional campaign the impact is less with the demand destruction estimated to be around 150 million litres, which is about 5% of the regional demand.

While the regional campaign would be necessary there is some debate about the value of the national campaign, particularly whether these small savings would enable trucking resources to be freed up and (as supply is available) that the rest of the country could be incurring an economic cost (from reduced use) for little benefit.

Supply capability summary (nationwide campaign)

- Extra trucks obtained (above those located in NZ) 4
- Average regional supply capability 92.5%
- Effective RAP volume moved 87%
- Demand destruction ..... 0.6 mlpd

Building on the work done in Section 4.0 if national demand was reduced by 230 million litres per year (i.e. equivalent to 7.5% reduction in regional demand) a further four trucks (above those already in New Zealand) would be required to fully supply the region.

6.3 Using price to reduce demand

During discussions with companies some suggested that the Government could use regional taxes as a way to encourage consumers to reduce demand or force demand to shift away from Auckland. Anecdotal comments received suggested that when retail prices have been above $2.00 that fuel demand seems to drop, particularly for petrol. So while imposing some form of regional fuel tax would give price incentive for consumers to change their demand requirements it would probably be an unwelcome tax at a time when obtaining fuel could be difficult, which suggests that the Government would not want to impose this.

Alternatively public transport could be encouraged by providing a discount for using public transport as a proactive encouragement, but this would require funding.

7.0 Contingency options - benefit analysis

A number of contingencies have been suggested including options for maximising trucking usage, managing jet stocks and more structural arrangements including having a pool of spare trucks or an alternative terminal located elsewhere in Auckland (e.g. North Shore or West Auckland). The relative benefits for each of the contingency options are shown below.

To assess the relative benefits for each of the contingency options, the volume benefit gained for each option versus the basecase supply option has been calculated and compared to the cost of implementing the contingency. This is then shown as a cost benefit in cents per litre - a lower unit cost means a cheaper outcome per litre of benefit gained.

7.1 Petrol and diesel trucking contingency options

Section 4.0 outlines various trucking contingency options that could be implemented to maximise the delivery capability of the local fleet (both those currently in use and the spare units). The cost benefit for these contingency options are summarised in Table 4 below. The data used for this analysis draws on H&T's trucking cost model, cost information provided by the companies and some assumptions for the likely cost of extra terminal staff.

Table 4: Summary of cumulative cost benefit for trucking options

	Overload (regional)	Overload (across NZ)	With spare local trucks	With other gains [22]
Volume benefit vs basecase (mlpa)	330	515	810	920
Remaining shortfall (mlpa)	865	680	385	275
Cost of contingency ($ mln pa)	1.2	1.9	14.8	16.9
Cost benefit (cpl)	0.36	0.37	1.83	1.80

This analysis shows that allowing the existing trucking fleet to load to full capacity rather than the maximum legal road limits can make a significant volume impact (around 515 million litres on an annualised basis) for relatively little direct cost (around two million dollars). The cost benefit for overloading the trucks is around 0.4 cents per litre of benefit gained. The low cost of this contingency versus the volume benefit gained makes sense as effectively the same fleet is delivering more volume for the incremental cost of RUC, fuel and other wear and tear items.

The next level of response where spare New Zealand trucking resources are contracted in and other efficiency gains (such as attended loading) are put in place costs significantly more (around 17 million dollars). The cost benefit for taking these steps is higher, around 1.8 cents per litre.

7.2 Jet contingency options

Section 5.0 outlines a number of contingency options that could be implemented to manage jet fuel demand from an on-going supply disruption to RAP/Wiri. The cost benefit for these contingency options are summarised in Table 5 below and are based on the JUHI having completed the tank expansion which gives capacity to truck in 100% of JUHI demand. The data

[22] Measures include demand consolidation, improved distributor fleet utilisation, only selling 91 octane petrol, attended loading and getting line haul operators to pick up elsewhere.

used for this analysis draws on H&T's trucking cost model and cost information provided by the companies on the potential cost for capital expenditure items.

In the basecase (which each contingency option is compared to) we assume regional airport demand (Hamilton, Rotorua and Tauranga) is supplied by truck from Wellington with the rest of the demand tankered from Wellington and Christchurch for domestic and some trans-Tasman flights and from offshore for remaining international demand.

Table 5: Summary of cost benefit for jet fuel options

	Gantry near refinery	RAP to WAP (low est.)	RAP to WAP (high est.)	Using LPG facility
Volume benefit vs basecase (ml)	960	960	960	440
Remaining shortfall (mlpa)	0	0	0	520
Cost of contingency ($ mln)	35.5	5.0	15.0	16.6
Cost benefit (cpl)	3.69	0.52	1.56	3.74

The analysis shows that building a gantry[23] near the refinery for trucking jet to JUHI or using the LPG facility (which would only meet around half of the jet demand at JUHI) is less attractive than the RAP to WAP option. Around half of the cost for the LPG option is for shipping jet from the refinery to the facility. Some companies have also questioned the LPG facility's close proximity to Wiri and the likelihood of this being available if there was a major Wiri incident.

The option of connecting the RAP to the WAP has a significantly better cost benefit than the other options and would see 100% of JUHI demand met. However this option is only suitable for an extended outage of Wiri - it would not assist with shorter term outages on RAP. Cost estimates received from companies for this work have ranged from 5 to 15 million dollars. Using this cost range the cost benefit is around 0.5 to 1.6 cents per litre.

7.3 Other contingency options

A number of other contingencies have been analysed and are summarised below.

OERS

For a long term disruption to supply from RAP/Wiri, more trucks than those currently available in New Zealand would be required to meet the demand requirement. The number of extra trucks will depend on whether there is any petrol and diesel demand restraint. To assess the cost benefit of a regional or national voluntary demand restraint campaign we compare the cost of these (including campaign and trucking costs) against trucking cost for supplying 100% of the demand.

The analysis done is based on the extra trucks being imported from offshore. As with earlier analysis the data used draws on H&T's trucking cost model, cost information provided by companies and some assumptions for the likely cost of extra terminal staff. The analysis also includes an estimated cost for running a voluntary demand restraint campaign[24].

[23] We understand that a gantry would cost around $4 million

[24] The campaign cost assumed is $7.5m for regional and $15m for nationwide.

Table 6: Summary of cost benefit for OERS options

	No campaign	Regional campaign	Nationwide campaign
Extra trucks required	12	6	4
Volume benefit vs basecase (mlpa)	1,195	1,045	965
Reduced demand benefit (mlpa)	0	150	230
Cost of contingency ($ mln pa)	30.7	30.9	35.7
Cost benefit (cpl)	2.56	2.58	2.98

This suggests that while running a voluntary demand restraint campaign will reduce demand the cost of doing this (regionally or nationwide) has a higher cost and lower cost benefit per litre than applying more trucks to the task.

Given the time it is likely to take to get extra trucking resource and drivers in place, it is likely that a voluntary demand restraint campaign would provide a good short term option but in the medium to longer term it is better to meet the demand that is there.

Extra trucking resources

As noted in Section 4.6 options for providing more trucking resource includes having a pool of spare truck and trailer or trailer units or from companies sourcing these from offshore (primarily Australia). For the pool of trucking resources there will be an initial purchase cost plus on-going costs for maintaining the fleet and replacing this over time, but the speed of response would be quick in comparison to finding and importing trucks from offshore. Information provided indicates that truck and trailer units cost at least $500k each and trailer units at least $250k each.

For this analysis we assume 12 extra trailer units will be required (i.e. that there is no OERS campaign in place and that petrol and diesel demand is 100% of normal and in the event these are required suitable truck units will be found) and that these will be located away from Wiri in a leased warehouse (or similar). The data used is the same as above.

Table 7: Summary of cost benefit for extra trucking resources

	Truck pool (steady state)	Truck pool (disruption)	Imported trucks (disruption)
Extra trucks required	12	12	12
Volume benefit vs basecase (mlpa)	0	1,195	1,195
Cost of contingency ($ mln pa)	1.9	26.6	27.2
Cost benefit (cpl)	-	2.22	2.27

In the case of significant disruption to RAP/Wiri supply, having a pool of trucks will result in a faster supply response and the cost benefit for this will be slightly less as there won't be the cost of importing trucks, but having this capability will cost around $1.9 million per year. Most of this annual cost is related to the capital recovery from the investment, but there are on-going maintenance costs and the lease cost for storing these units.

With the cost benefit for importing trucks similar to having a pool of trucks and avoids on-going costs it seems better for companies to import trucks if required. As a contingency plan having arrangements in place to expedite truck imports from offshore should be sufficient.

Alternative Auckland terminal

In 2006 the Government issued a request for proposal for companies in New Zealand to propose options for holding reserve stock in New Zealand that would help in meeting New Zealand's obligation to the International Energy Agency (IEA). One of the responders was WOSL who proposed providing approximately 44,000 tonnes of storage near the current Wiri terminal.

The proposal was for four tanks with petrol, jet and diesel held (two jet tanks, one of each other fuel) integrated with the current Wiri operation so the product could be tuned over as required. In their proposal WOSL noted, "The WOSL Board believes that this proposal has significant benefits to the Government as it provides a large emergency stock of fuel in New Zealand's largest fuel market and close to Auckland Airport, while maximising the use of existing fuel infrastructure".

The location for this additional storage was within the current Wiri boundaries but completely separate to the current tank area. We understand from the WOSL shareholders that increases to the separation distances required between tanks since 2006 and construction on neighbouring properties means the proposed site would no longer be suitable for the tanks. However there is nearby farm land which if purchased could be used for a similar concept.

While a backup Wiri terminal would not give protection for a RAP issue, it would give protection for a Wiri terminal disruption as it would be separately connected into the RAP pipeline (it would also have pipeline links to the current Wiri terminal).

The report on Oil Security for MED in 2004 analysed the cost of developing various reserve stock terminals. These costs (by a petroleum engineer) were updated late last year when MED reviewed its IEA petroleum reserves strategy. The cost developed by the engineer was for a much larger 140kt terminal near Wiri – the proposal from WOSL for a 44kt would be much more suited as a backup terminal. The costs that MED has from this work can be adjusted to estimate a cost for the 44,000 terminal. This cost is approximately $44 million ($1,000/tonne). This includes associated pipework connections but does not include a duplicate truck loading facility.

Another alternative discussed when there was concern that the RAP pipeline would reach capacity was to build a new terminal to the north-west of Auckland with only jet pumped to Wiri. Such a terminal would increase the integrity of supply into Auckland. While such a terminal was seen as an option for relieving constraints on the RAP it is not in any current plans as the capacity of the RAP/Wiri pipeline system is now not expected to reach capacity for the foreseeable future.

For the purposes of this exercise we assume that a second terminal would be near the RAP Kumeu pumping station (near the intersection of the north-western motorway and upper harbour motorway). We assume that the terminal would have six product tanks (total 50kt) and be an operating terminal with truck loading facility. All products would continue to be supplied to Wiri as well. In an event that disrupted the RAP pipeline south of this point or Wiri itself, the two diesel tanks would be converted to jet and the two premium tanks to diesel (premium dropped). This would give a source of jet closer to the airport. This terminal would be more expensive than the backup Wiri terminal because of the extra facilities required (e.g. truck loading facility).

Both terminals would provide some benefit to the Government in that the stock would offset the requirement for petroleum reserves and in the case of a new terminal north-west of Auckland

some benefit to industry due to greater trucking efficiencies. Offsetting this would be higher operating costs with an extra terminal to operate.

Table 8: Alternative terminals cost summary

	Wiri Backup terminal	Terminal north of Auckland	Comment
Cost of terminal (NZ$M 2011)	44	57	
Annual cost of terminal	$5.2	$6.7	Based on 20 year recovery and 10% return.[25]
Annual cost of holding extra stock	$6.4	$5.0	Based on 10% return.
Savings from reserve stock	($0.9)	($0.7)	Assuming current rates of international ticket contracts.
Annual operation cost	$0.2	$0.5	H&T estimate.
Annual trucking cost savings	-	($1.0)	Delivery cost to West and North Auckland would be reduced.
Net annual cost	$10.9	$10.5	

The annual costs of these options are very substantial. Given the risk of outage is low and there is the ability to respond with trucking (except for jet), it would seem that the cost of such insurance is not justified.

Temporary terminal at Ports of Auckland

During contingency exercises, an option for restoring supply proposed setting up a temporary terminal at Port of Auckland. This would involve a ship stationed permanently (until it needed to be refilled) at a berth and acting as floating storage. Some sort of temporary storage facility on shore would then be required to allow loading direct to product tankers.

While this proposal sounds feasible, during discussions companies had significant issues with it particularly around the safety, environmental and quality aspects. The expectation for such an operation would be that they would have to make major compromises to the standards they normally operate to and they would be unwilling to do this. Certainly the Government would have to give a number of exemptions to current legislation to allow such as operation to happen.

Due to this feedback given on this option, this has not been assessed in more detail.

7.4 Benefits summary for likely contingency options

The combined potential benefit for some contingency options considered above has been analysed. Table 9 summarises the combined options considered and the cost benefit of these options. In the basecase we assume all local trucks (including spare units) are loading to maximum capacity but only regional jet demand is being trucked, that is domestic and international jet fuel would be tankered from other airports.

[25] The investment is assumed to be a financed infrastructure model rather than normal industry investment.

Table 9: Summary of combined cost benefit

Contingency	Cost benefit (cpl)	Total cost of options ($ mln pa)	Petrol / diesel shortfall (mlpa)	Jet shortfall (mlpa)
Basecase	1.84	16.9	275	965
Scenario one: Basecase plus extra imported trucks	2.56	30.7	0	965
Scenario one plus LPG facility (~50% of JUHI jet)	2.88	47.2	0	520
Scenario one plus RAP to WAP (mid cost est.)	1.88	40.7	0	0
Scenario one plus gantry by the refinery	3.07	66.2	0	0

The analysis done shows that the best combined contingency option is where all local trucks are loaded to maximum capacity, the trucking shortfall made up with imported trucks and the RAP connected to the WAP. This option would see all of the current demand met.

Other options result in a less optimal outcome. For some, the volume supplied would be insufficient to meet demand and for others the cost is higher (e.g. the gantry located near the refinery). If there was an alternative Auckland terminal in place we expect all of the regional demand could be supplied by the existing trucking fleet. But the cost for these options is high at over $10 million per annum. Even though the other contingencies are expensive they are substantially cheaper than an alternative terminal (e.g. the gantry by the refinery plus trucking is only 3-4 years of the annual cost of an alternate terminal - given the small likelihood of a major event (<1 in 50 years) it would not be a sound economic decision).

8.0 Conclusions

Supply of petrol and diesel into Auckland and Waikato is heavily reliant on the RAP (around 85% for Auckland and over 50% for Waikato). The RAP also supplies all of the jet demand at Auckland airport. Individual discussions with companies have confirmed that the RAP is critical to their supply arrangements. This report has considered the potential impact to supply from major disruption to supply to RAP/Wiri and contingency options that could be used to mitigate the effect while normal supply is re-established.

There are more contingency options for petrol and diesel than jet with alternative supply able to be made from the TLF and Mount Maunganui terminals, to the extent trucking resources permit. Jet options are more limited with the nearest alternative terminal being Wellington.

Petrol and diesel

Without any contingency options about 41% of Auckland's petrol and diesel demand and 61% of the regional demand could be met. By fully utilising the trucking resources in New Zealand and allowing these to load to their maximum carrying capacity rather than the maximum legal road limits supply can be increased to around 87% of Auckland demand and 91% for the region. The ability to overload the trucks is an important contingency measure.

To fully meet current petrol and diesel demand a further 12 trucks would be needed. The analysis done showed that rather than having a pool of spare trailer units (which could cost around $1.9 million per year for the contingency and more if actually used) it would more cost effective to import some trucks if required (these would probably be sourced from Australia).

Jet

The likely basecase for alternative supply would be the regional airports supplied from Wellington and the rest of the jet being tankered by the airlines from other domestic or international airports.

A number of contingency options have been considered in the report including having a gantry located near the refinery, using the LPG facility and being able to connect the RAP to the WAP. From the information provided having the ability to pump jet fuel directly from the refinery to the JUHI provides the best solution for supplying the JUHI in the case of an extended outage of the Wiri terminal.

Alternative Auckland terminal

Having an alternative Auckland terminal would provide a secure back-up option but the cost of providing such a facility is estimated to be around $11 million per year. The cost for having an alternative terminal in Auckland as a contingency would be significantly more expensive than using trucking and having the RAP to WAP capability to meet demand.

Government support

From the analysis done and the discussions held, maximising trucking is a key requirement in meeting demand from a RAP/Wiri outage. Being able to utilise the spare capacity within the trucking fleet and having sufficient qualified drivers is key to ensuring a rapid response. With supply being made from alternative terminals more coastal ships will also be required.

For oil companies to be able to act swiftly they will need Government assistance. This could include (with preparations having been made in advance):

- Obtaining approval to load the product road tankers to their maximum loading capacity
- Prompt approval of suitably qualified drivers from offshore
- Help with importing trucks
- Ability for foreign crewed ships to trade on the coast for an extended period of time
- Possible assistance with traffic management
- To enable prompt repairs to re-establish normal supply as quickly as possible companies will require Government assistance to obtain required consents efficiently

9.0 Recommendations

The work done indicates that while loss of supply to Wiri would be significant, there are likely to be alternative supply options that could be put in place relatively quickly and cost effectively to restore supply. We recommend that MED consults with industry and other major stakeholders on the findings of this report and the options that should be pursued to enhance contingencies along with the processes that need to be put in place to ensure they can be promptly implemented. The options and processes that are assessed as providing the best contingency are listed below for consideration in the consultation.

1. That Government reviews the practicality of allowing trucks to overload for a specified period during an emergency event and whether this is feasible for supply into Auckland from Marsden Point and Mt Maunganui or the whole country.
2. Depending on the outcome of 1, put in place the processes which would enable officials or Ministers to allow product tankers to maximise load capacity in the event of major disruption.
3. To ensure the contingency is available, all new product tankers be required to have spare capacity so these can be used to carry more fuel in the event of major disruption.
4. The Government investigates whether Australian dangerous goods driver licences are able to be accepted as being suitable in an emergency (and out in place processes to allow this to happen if required).
5. That Government ensures they have the capability to allow foreign vessel to trade on the New Zealand coast for an extended period of time in an emergency.
6. The Wiri Board and Refining NZ fully investigate the option of connecting the RAP to WAP and (assuming this remains a cost effective option) does sufficient design and construction work to enable this contingency to be fully implemented within a reasonable timeframe.
7. That oil companies have arrangements in place to access offshore drivers and trucks.
8. The Government could hold and maintain a register of spare trucks and drivers.
9. The Government has the processes in place to ensure it can assist companies with getting the necessary consents efficiently to restore normal supply as quickly as possible.
10. That contingency plans are regularly reviewed to ensure that they remain available as assumed in this report (e.g. required contingencies will change if Wynyard wharf closes and there is no diesel supply from Port of Auckland).

Appendix 1 - Discussions

Prior to doing the analysis on likely supply capability from a long term outage affecting the Wiri terminal discussions were held with various participants and interest groups including:

- Air New Zealand
- Board of Airline Representatives New Zealand (BARNZ)
- BP Oil New Zealand
- Chevron New Zealand
- Gull Petroleum
- Mobil Oil New Zealand
- Refining NZ
- Wiri Oil Services (via Chairman of the board)
- Tranzliquid Logistics
- Z Energy

The comments and advice received has been valuable when doing the analysis. As well as providing information on supply capability, ideas on response options, likely demand effects and a number of issues and concerns were raised. These have been grouped and summarised below.

Trucking

- All companies could load more fuel than allowed by the maximum legal road limits, but were unclear about how they would get approval to do this and were not sure if Government could do this unless there was a national state of emergency. There could also be an issue with RUC compliance (from any already purchased RUC) for the overloaded vehicles.
- A number of trucks are only operating 12 hours per day, but double shifting these units would require further drivers.
- Most companies have outsourced trucking requirements to specialist third party operators.
- Across industry there seems to be about 10 spare product tankers. Other options could include the Whirinaki Power Station trucks and those used for hauling crude oil to Taranaki.
- Having a pool of spare product tankers was seen as problematic by some with on-going maintenance of particular concern (e.g. seals could dry out through lack of regular use).

Drivers

- Companies have screening processes for finding suitable drivers and for those who are acceptable training takes several weeks. Only suitable drivers who have passed the required training would be used.
- A likely source of drivers would be already qualified drivers from Australia, but this would require New Zealand authorities to recognise the Australian Dangerous Goods licences.
- Other possible pools of drivers could include the driver trainers, qualified defence force personal and those who have recently retired, but for these to be used they would need to have retained the Dangerous Goods Licences. Some suggested that retiring drivers could be paid to retain their licenses for a period of time (e.g. five years).
- There was no interest in being able to extend driver hours as drivers already do fewer hours than legislated for safety reasons. Companies seemed unlikely to relax this requirement.

Supply and delivery issues

- Trucking efficiency can be eroded by traffic congestion particularly at peak times around the Auckland Harbour Bridge and roads around Wynyard Wharf. Some suggested that having priority access arrangements could be used to minimise these impacts.

- With higher demand at alternative locations a third coastal vessel may be required. A vessel could be chartered quite quickly but would likely be foreign crewed, so for this to remain on the coast for more than 28 days immigration issues would need to be addressed.
- Delivery boundaries across the North Island would likely change with trucks located in New Plymouth, Napier and Wellington delivering further north than usual depending on the cost of trucking further versus supply costs from other locations.

Wynyard Wharf

- The Wynyard Wharf terminal will likely play an important part of any response, but truck loading is limited to two trucks per hour and is reliant on the single gantry not requiring any maintenance throughout the disruption.
- By 2022 the Wynyard Wharf terminal must have exited this location but the terminal owner (Marstel) has publicly announced that it has a commitment from the Auckland Council to find a viable alternative to Wynyard prior to the end of the current lease.[26]
- While floating storage has been raised previously there would be a number of complications including how to provide intermediate storage between the ship and gantry system, providing a gantry to load trucks, finding a suitable wharf to use and that this couldn't be used for jet fuel due to the inability to recertify the fuel. Some companies suggested that it would be better to optimise the existing Wynyard Wharf terminal than create a temporary facility.

Other efficiency gains

- Some companies suggested that consolidating demand into fewer sites and limiting petrol sales to the 91 octane grade only may provide some benefit.
- Another idea was getting larger commercial users (such as line haul operators) to buy fuel outside of the region. These trucks often have a range of around 600-700 km.
- Gantry congestion could become an issue, although one company suggested this could minimised by staggering shift start times and another company suggested having attended loading which may also speed up loading time and improve driver hours utilisation.

Refinery contingency plans

- To mitigate the risk of a RAP disruption the refinery holds over 100m of spare pipe, a spare pump, hot tap equipment and has a contract to access specialist welders. The speed of reinstatement would depend on the level of regulatory hurdles, but assuming no delays Refining NZ indicated that the RAP would likely be operating in less than a week.
- The refinery has its own fire fighting equipment and also has reciprocal fire fighting arrangements with Wiri Oil Services Limited (the operator of the Wiri Terminal).
- Refining NZ also regularly reviews the Wiri terminal operations (as asset owner) to ensure the terminal remains well maintained and that operations meet best practices.

Jet fuel and JUHI issues

- Airlines require prompt advice for supply disruptions so they can make immediate plans to ensure planes will be able to continue flying.
- Trucking jet to the JUHI is constrained to about 50% of demand is expected to reach around 100% in 2013 when some new tankage and truck discharging facility is built.
- While it's possible to truck jet to the JUHI, supplying companies thought that jet would likely be tankered by the airlines. Some also commented that a lack of petrol and diesel in the region would see passenger numbers reduce, suggesting that jet supply is a lower priority.

[26] Marstel Media Release

Other ideas and concerns

- While companies thought this work on preparing contingencies was valuable and needed to be done, they also noted that the focus (and most of the spend) was on preventing an incident through maintenance and best operating practice.
- Some suggested that the New Zealand Defence Force bases may give alternative supply options, but were unclear about what storage facilities existed and if these could be utilised.
- The LPG pipeline in Manukau Harbour was also raised as an option, but little was known about this other than the tank being about 4 million litres and that small vessels are required.
- Some questioned if a containerised loading gantry should be held. This could be deployed at the refinery for loading jet, Wynyard Wharf as backup or at other locations as required.
- Demand destruction was also mentioned. Ideas generated focused on ways the Government could encourage use of public transport, working from home and off peak travel.
- Some also mentioned previous work done on whether there would be benefit in having an alternative "Wiri" terminal on the North Shore or West Auckland. This would likely result in supply continuing relatively uninterrupted so supply capability has not been analysed, but the benefits of these options are considered in Section 7.0.