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25th May 2020

To Auckland Council by on-line submission process

Copy by email to: rsignal-ross@tonkintaylor.co.nz

Submission on the resource consent application

by Waste Management NZ Ltd

to construct and operate a new regional landfill

at 1232 State Highway One, Wayby Valley

Application number BUN60339589

This submission is neutral regarding the application.

This submission is concerned with the declared intent to transport all waste to the site by road.

We submit that the Waste-by-Rail option should be urgently revisited, thoroughly investigated and fully costed with a view to implementation at the earliest opportunity to avoid adverse road traffic effects and to provide a low-carbon waste transport option in an economic way.

With regard to the Resource Consent application we seek the following:

- That comprehensive modelling and analysis be carried out on the effect of the proposed landfill on all affected parts of State Highway 1 North (SH1N);
- That comprehensive modelling and analysis of the Waste by Rail option be carried out.
- That, when the road modelling confirms that effects on SH1N are more than minor and unacceptable, then a condition of the landfill consent should be the implementation and commissioning of the Waste-by-Rail option prior to the commencement of landfill operation.

We wish to be heard in support of this submission.

1. THE SUSTAINABLE ENERGY FORUM INC. (SEF)

SEF is a New Zealand membership-based organisation founded with the aim of facilitating the use of energy for economic, environmental, and social sustainability.

2. UNDERSTANDING THE PROPOSAL

Auckland Regional Landfill (ARL) in Dome Valley would have an ultimate capacity to accommodate 50 million tonnes of Municipal Solid Waste (MSW) from the Auckland Region. The present Resource Consent application is for a scheme to use half of the ultimate capacity of the site. At present waste generation rates, the total capacity would be full in about 32 years. If waste minimisation and recycling strategies are successful in reducing the residual waste sent to landfill, then the life of ARL could be significantly longer. Nevertheless, over time, the total MSW transported from Auckland to the proposed ARL would be 50 million tonnes.

The integrated transport assessment only considers road transport of waste. It estimates that under operating conditions there would be 260 waste truck round trips per day. For the purpose of the assessments in this submission we assume 1.6 million tonnes per year of waste in trucks with a 17-tonne payload operating 365 days per year. If each truck does 6 return trips per day, a fleet of at least 50 dedicated road trucks would be required, to allow for maintenance downtime. During the morning and evening 4-hour peak periods the operations would be a total of 30 return trips. Therefore, in off-peak times there would be an average of 15 return truck trips per hour in vehicles with about 33 tonnes gross weight; i.e. one truck every four minutes each way.

The Assessment of Environmental Effects reports discussions between Waste Management (WMNZ) and KiwiRail (see Appendix A). This discussion identified some issues with the Waste-by-Rail option. It states *"Kiwirail advised that they would not consider a new siding at Wayby Station Road"* but gives no reasons. The AEE also states *"Waste Management and KiwiRail will continue to work together in future to identify opportunities should they arise"*

3. SHORTCOMINGS OF THE AEE ADDRESSED IN THIS SUBMISSION

- The ITA does not address the effects of the traffic on SH1N south of the proposed new roundabout, including the steep incline on the southern side of the Dome Valley, nor increased road maintenance costs, nor the effect of the proposed roundabout on existing vehicles on SH1N, which currently do not have to slow and/or stop at that location.
- The AEE does not assess the CO_2 emissions from the vehicles transporting waste from Auckland to the Dome Valley, nor take account of the requirements of the Zero Carbon Act requiring greatly reduced CO_2 emission by 2050, when the landfill would still be operating.
- The brief consideration of the Waste-by-Rail option does not consider the possibility of constructing a branch rail line directly to ARL.
- The waste reception facility at the site is only configured for receiving waste from road trucks. No provision is included in the site layout for receipt of Waste-by-Rail.

This submission addresses these shortcomings of the Resource Consent application documents. From a preliminary scoping assessment, we conclude that the Waste-by-Rail option would be:-

- Highly desirable from the point of view of a traffic flow and safety on SH1N;
- Effective in addressing the requirements of the Zero Carbon Act;
- Practicable, using a 3.2 km rail branch line to the ARL site; and
- Economically attractive over the projected life of the proposed landfill.

4. TRAFFIC FLOW CONSIDERATIONS

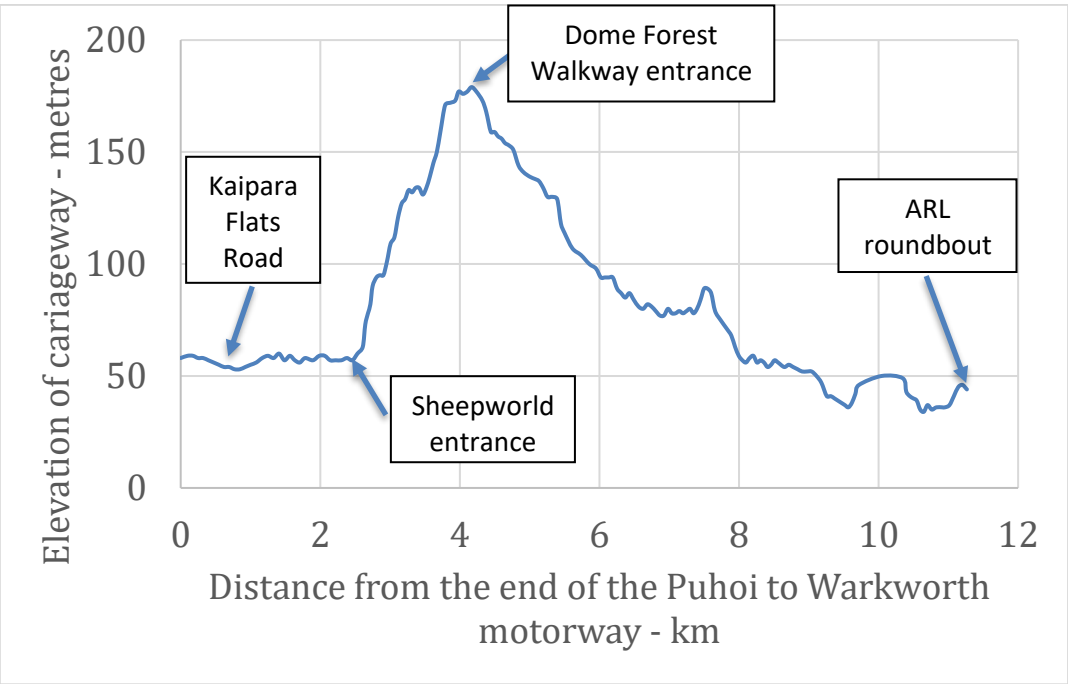
The Integrated Transport Assessment (ITA) concludes *"By way of a summary, it is considered that the ARL facility can be established, subject to the proposed conditions of consent, in such a way that the transportation effects of both the construction and operational phases of the project are suitably managed with minimal adverse effects on the surrounding receiving transport environment."*

However, that assessment only considered the impacts on traffic flow caused by the construction of a roundabout on SH1N at the entrance to the proposed ARL. That assessment did not consider the impacts on traffic flows in the wider road environment, notably the steep incline on SH1N through the southern section of the area known as Dome Valley.

By 2026 the Puhoi to Warkworth motorway will be completed. After leaving the new motorway, fully laden trucks would travel a further 11.3 kilometres on SH1N through the Dome Valley to reach the roundabout at the ARL entrance.

4.1 Dome Valley Incline

Figure 1 Elevations of State Highway 1 through the Dome Valley[1]



[1] Data from GoogleEarth May 2020

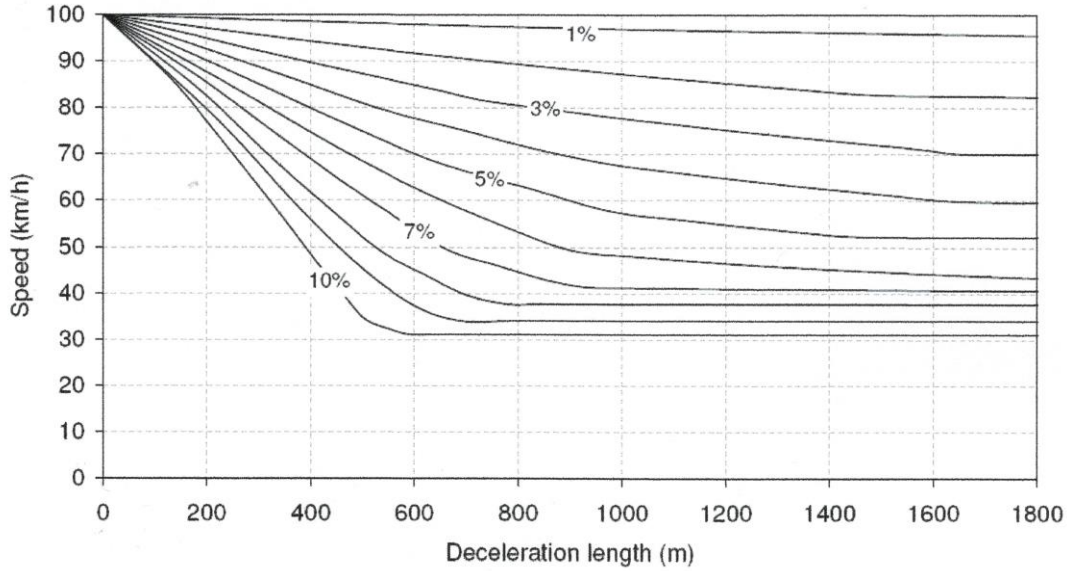
Figure 1 shows the elevations of the carriageway for the 11.3 km section of SH1 through the Dome Valley area. Figure 1 shows that fully laden northbound trucks would encounter a steep climb of 120 metres up the Dome Valley incline over 1.7 km between the Sheepworld entrance and the Dome Forest Walkway entrance. That is a 7.14% incline.

Figure 2 shows the effect of incline on the steady state speed of a typical laden truck weighing 33 tonnes. This chart shows that an initial speed of 80 kph would be reduced to 40 kph after 0.7 km, and that 40 kph would be the maximum speed achievable over the subsequent 1 km, with only one opportunity to regain some speed. So, the time taken to climb the 1.7 km long incline would be about 2 minutes.

Figure 2 Effect of incline on truck speed

Source:- AUSTROADS' Guide to Road Design Part 3: Geometric Design AGRD03-16 Revised 2017

Figure 3.11: Determination of truck speeds on grade, 19 m semi-trailer (33 t), 12 l diesel carrying an average load (9.7 kW/t)



Outside of peak times there would be one waste truck every four minutes travelling north up Dome Valley. Therefore, other road users would likely encounter a slow waste truck climbing up the Dome Valley incline at about 40 kph 50 % of the time.

There is a short passing lane on the Dome Valley incline climb, which is 300 m long, i.e. only 20% of the total length of the climb. The topography of the area makes it impractical for that passing lane to be extended. Furthermore, damage to the road surface caused by the increased truck traffic would necessitate more frequent road maintenance. Roadworks in that complex terrain would be difficult and would cause major delays to traffic.

4.2 Traffic modelling

We submit that modelling using sophisticated and generally accepted rural midblock traffic modelling software, such as TRARR, must be completed before the effects on SH1N, without Waste-by-Rail, can be accurately assessed. Given the uncertainties with future traffic, such modelling should be carried out for a number of realistic scenarios of future traffic growth.

Appendix C of the ITA says, *"The typically accepted capacity of a single traffic lane is…15,000 - 20,000 vpd (vehicles per day)."* This is not based on a comprehensive analysis that includes the effects of truck numbers, gradients and the inadequate passing opportunities that are a particular feature of SH1N through the Dome Valley.

The last five years of traffic count data, from an NZTA count station close to the proposed ARL, reports a 5% per year increase from 12,000 vpd in 2013 to 15,000 vpd in 2018. At that rate other traffic on SH1N would be 24,000 vpd by 2028. This NZTA data also reports 9.5% heavy vehicles in that traffic flow, i.e. 1425 heavy vehicles per day in 2018. The addition of about 600 heavy vehicle movements per day on ARL business would increase the heavy vehicle traffic on SH1 by over 40%.

When existing heavy vehicles, such as logging trucks, are added to the assessment of waste truck traffic climbing the Dome Valley incline, as assessed above, other road users would likely always encounter a slow truck climbing up the Dome Valley incline at about 40 kph.

4.3 Road safety concerns

The frustration resulting from traffic delays on Dome Valley incline would likely cause an increase in dangerous manoeuvres. The short passing-lane section comprises 20% of the Dome Valley incline climb. Dangerous late-overtaking manoeuvres often occur at that passing lane merge point.

The ITA reports 2 deaths and 12 serious injuries from SH1N crashes in the Dome Valley from 2014 to 2018. The NZTA DSI database reports 4 deaths and 19 serious injuries in the Dome Valley in the years 2016 to 2019. This suggests a deteriorating safety record for the Dome Valley section of SH1N.

4.4 Warkworth to Wellsford Motorway

The opening of the Warkworth to Wellsford section of the SH1 motorway would enable the Dome Valley incline and the existing Dome Valley road to be by-passed. The Notice of Requirement for that next section of the SH1 motorway was lodged in March 2020. The construction of the Puhoi to Warkworth section of the SH1 motorway is taking 8 years from Notice of Requirement in 2013 to the proposed opening in 2021. Therefore, the earliest feasible date by which the Warkworth to Wellsford motorway could be opened is likely to be 2028, probably later.

In view of these traffic flow considerations we conclude: -

- **That transporting waste to ARL by road would NOT have a "*minimal adverse effects on the surrounding receiving transport environment.*" as stated in the ITA.**
- **That the modelling work described in the ITA is inadequate to draw firm conclusions about the impact of the increased traffic flows on the receiving transport environment**
- **To avoid major adverse effects on the receiving transport environment, consent for transporting waste on SH1 to the ARL should be delayed until after the Warkworth to Wellsford SH1 motorway is open or Waste-by-Rail is implemented.**

5. CO_2 EMISSIONS ASSESSMENT

The Climate Change Response (Zero Carbon) Amendment Act 2019 (ZCA) sets a target that will require consumers to plan future energy systems that achieve zero net emissions of all greenhouse gases in New Zealand by 2050. Since the ARL will still be operating in 2050, the ZCA targets will apply to ARL.

The ZCA objective would primarily be achieved by using renewable electricity instead of diesel fuel for transporting waste from Auckland to ARL. The greenhouse gas consequences of alternative waste transport options are detailed below and presented in Table 1.

Table 1 Comparison of greenhouse gas emissions

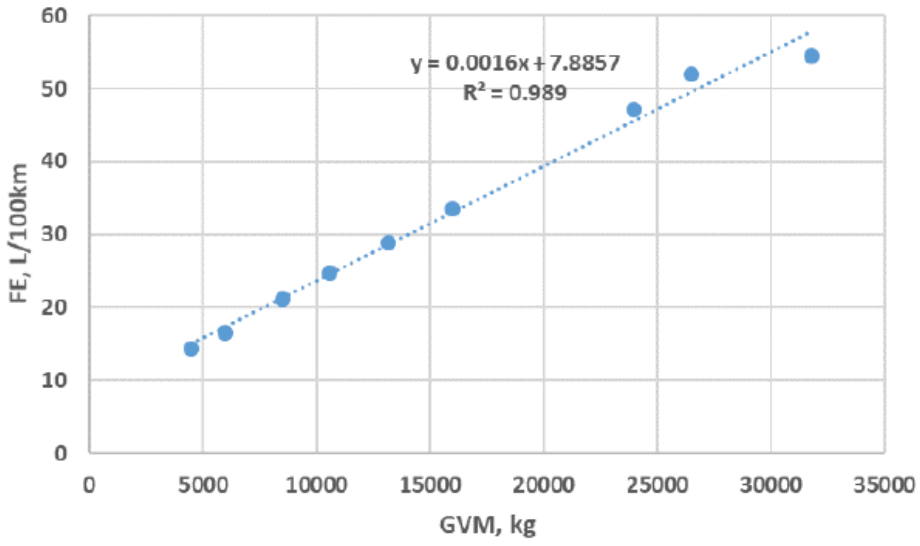
Transport technology	Energy use per year	Fuel TJ	CO_2-eq emissions tonnes per year
Diesel trucks	7.4 million litres	281	21,218
Electric trucks	44 GWh	158	4,706
Hydrogen trucks	1595 tonnes H_2	226	11,200
Diesel trains	2.0 million litres	76	5,735
Electric trains	10.7 GWh	38.5	1,145

These assessments, detailed below, show that Waste-by-Rail using an electrified railway would comply best with the objectives of the Zero Carbon Act; at 5.4% of CO_2-eq emission of diesel trucks on the road.

5.1 Diesel trucks

Figure 3 shows how fuel consumption of heavy trucks depends on the Gross Vehicle Mass.

Figure 3 Real world fuel economy of heavy trucks[2]



[2] H Wang, NZ Ministry of Transport, Transport Knowledge Conference December 2019

Figure 3 shows that an empty truck and trailer unit weighing 17 tonnes would consume 35 litres of diesel per 100 km. When loaded with 17 tonnes of waste the fuel consumption would increase to 62 litres per 100 km.

The annual greenhouse gas emissions from a fleet of 50 trucks delivering waste from Auckland to ARL would be 21,218 tonnes of CO_2-eq per year, based on the assumptions listed in the box below.

- 260 return truck trips per day (ITA Table 5.1);
- 365 days per year;
- 1.6 million tonnes per year of waste transported;
- Therefore, 17 tonnes of waste per truck trip;
- 17 tonnes unladen truck weight;
- 80 km distance from Auckland bulk transfer station to ARL;
- 62 litres diesel per 100 km for laden truck (MoT);
- 35 litres diesel per 100 km for unladen truck (MoT);
- Therefore, 7.4 million litres of diesel per year;
- 38.1 MJ_{hhv} per litre of diesel;
- Therefore, 281 TJ of purchased energy in diesel;
- 68.7 kg CO_2 per $GJ_{hhv;}$
- 10% CO_2-eq emissions from diesel production vs combustion;
- Therefore, 21,218 tonnes of CO_2-eq per year.

5.2 Battery Electric trucks

Electric trucks have been developed for short haul applications, which could be suitable for the Auckland to ARL duty. Volvo launched the 16-tonne FL model in 2019 with a 300 kWh battery and a range of 300 km. Daimler are introducing an electric version of their Cascadia semi-truck with a 550 kWh battery, 750 HP maximum power, 250 mile (400 km) range and 15 tonne GVW, which can recharge 80% of the battery capacity in 90 minutes. A truck with that specification would be able to sustain 80 kph up the Dome Valley incline.

2 trucks of this size might be required to deliver 17 tonnes of waste so there would be twice the number of return trips and hence twice the number of truck drivers required. Two 80 km each way return trips might be achieved on one charge using 80 % of the battery capacity. Two return trips might be achieved in 8 hours, plus a further 2 hours for recharging. So, a fleet of over 100 electric trucks would be required.

The annual greenhouse gas emissions from the power generated for a fleet of over 100 battery electric trucks delivering waste from Auckland to ARL would be 4,706 tonnes of CO_2-eq per year, based on the assumptions listed in the box below.

- 520 return truck trips per day;
- 400 km range;
- 550 kWh battery;

- 95% battery charging energy efficiency;
- Therefore, 1.45 kWh per km;
- Therefore, 44 GWh per year electricity purchase for vehicle charging;
- Therefore, 158 TJ of purchased energy per year;
- 0.107 tonnes CO_2-eq per MWh (based on 2020 electricity generation data);
- Therefore, 4,706 tonnes of CO_2-eq per year.

This assessment indicates that the electric trucks would result in 22% of the greenhouse gas emissions of diesel trucks.

5.3 Hydrogen trucks

An alternative truck technology, which would allow more rapid refuelling, involves the use of hydrogen fuel cell technology. A hydrogen truck would require a very high-pressure hydrogen fuel tank and a fuel cell for converting hydrogen into electricity. The truck would also require an electric vehicle battery to permit load following. The hydrogen trucks would likely be the same size as battery electric trucks, with half the capacity of large diesel trucks. The capital cost of hydrogen trucks would likely be 2-3 times the price of the same size of diesel trucks.

The hydrogen fuel could either be made from electricity (green hydrogen) by electrolysis or from natural gas (brown hydrogen) by steam methane reforming (SMR). The SMR process produces CO_2 emissions, which would amount to 40% of the CO_2 emissions from an equivalent diesel-based vehicle system. However, the supply of natural gas is declining in New Zealand and will continue to decline because of the moratorium on new oil and gas exploration. So, hydrogen production at scale from natural gas by SMR will not be feasible.

The production and storage of hydrogen from electricity by electrolysis at hydrogen refuelling depots would be feasible, although there are safety concerns. The cost of refuelling a hydrogen vehicle would be more than three times the cost of recharging an equivalent electric vehicle. The annual greenhouse gas emissions from a fleet of over 100 hydrogen-fuelled trucks delivering waste from Auckland to ARL would be 4,866 tonnes of CO_2-eq per year, based on the assumptions listed in the box below.

- 44 GWh per year electricity purchased for charging battery of electric vehicle;
- 70% fuel cell energy efficiency;
- Therefore, 62.8 GWh of hydrogen purchase = 226 TJ;
- 141.8 GJ_{hhv} per tonne of hydrogen;
- Therefore, 1595 tonnes of hydrogen per year;
- 60% energy efficiency of electrolysis plant;
- Therefore, 104.7 GWh electricity purchased for water electrolysis;
- 0.107 kg CO_2-eq per kWh (based on 2020 electricity generation data);
- Therefore, 11,200 tonnes of CO_2-eq per year.

This assessment indicates that the hydrogen trucks would halve the greenhouse gas emissions of diesel trucks. However, twice as many trucks would be required, at twice the price each, requiring twice as many truck drivers and losing half of the electrical energy purchased.

5.4 Diesel trains

The diesel consumption for hauling freight by rail is about 3.7 times less than the diesel consumption for road haulage on a km-tonne basis. Therefore, the annual greenhouse gas emissions from a fleet of 5 diesel trains delivering waste from Auckland to ARL would be 5,735 tonnes of CO_2-eq per year.

5.5 Electric trains

If the rail line is electrified, the electricity consumption relative to equivalent diesel consumption in a tractor unit is assumed to be the same as for both truck or train, except that the 90% round trip efficiency through the electric vehicle battery would be absent. Therefore, the annual greenhouse gas emissions from a fleet of 5 electric trains delivering waste from Auckland to ARL would be 1,145 tonnes of CO_2-eq per year.

6. WASTE BY RAIL DESIGN CONSIDERATIONS

The discussions of the Waste-by Rail option, as reported in the Resource Consent documentation, only considered adding rail sidings adjacent to the existing Northern Rail line at either Wayby Station Road or in Wellsford. These two locations would require trans-shipping of waste containers from rail to road trucks for the final trip to the landfill, of 3.5 km or 6 km respectively. Those rail terminals are dismissed as impractical.

Instead, we propose construction of a new 3.2 km long rail branch line, as a spur off the Northern Rail line. It would allow trains to deliver waste directly to the ARL reception area. An outline alignment for a rail branch line is suggested here for further evaluation. An indicative plan of a rail branch line to ARL is presented in Figure 3. An approximate alignment is suggested taking account of land elevations, determined with GoogleEarth. Further south the land is too high. An elevation view is shown in Figure 4.

The suggested branch line would fork off the Northern Rail Line just north of the Wayby Station Road crossing. The rail line would head in a northeast direction to the north of Wayby Station Road. The line would then head east through a 500-metre cutting with a maximum depth of 12 metres, including bridges for Wayby Station Road and a private driveway. In the cutting, the branch line would have an elevation of 50 metres. The line would then turn southeast, and the elevation would reduce to 40 metres before turning to the east for a rail bridge 7 metres above SH1. After crossing SH1 the branch line would drop down to ground level and would proceed on the east side of SH1 to the ARL waste reception area.

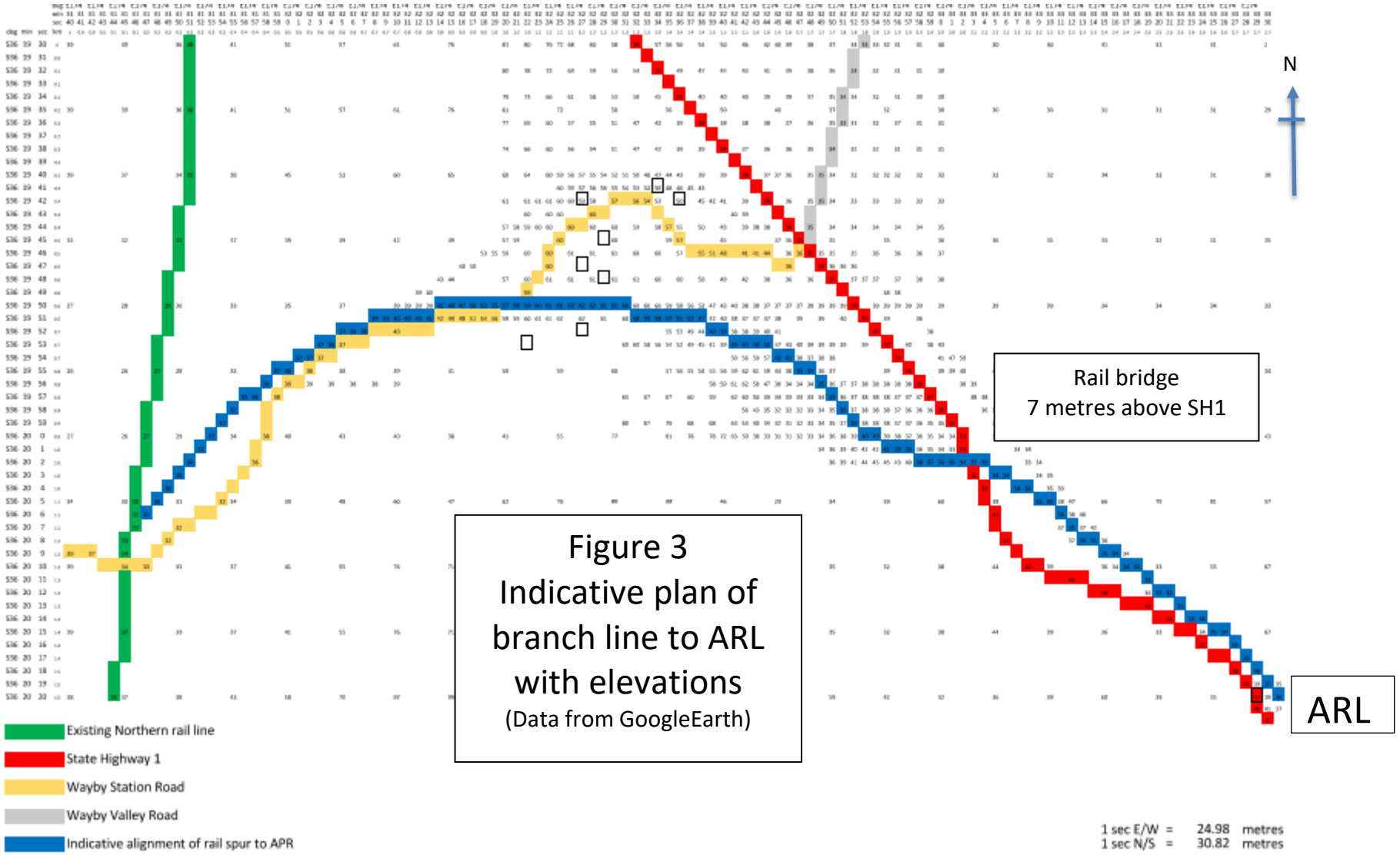
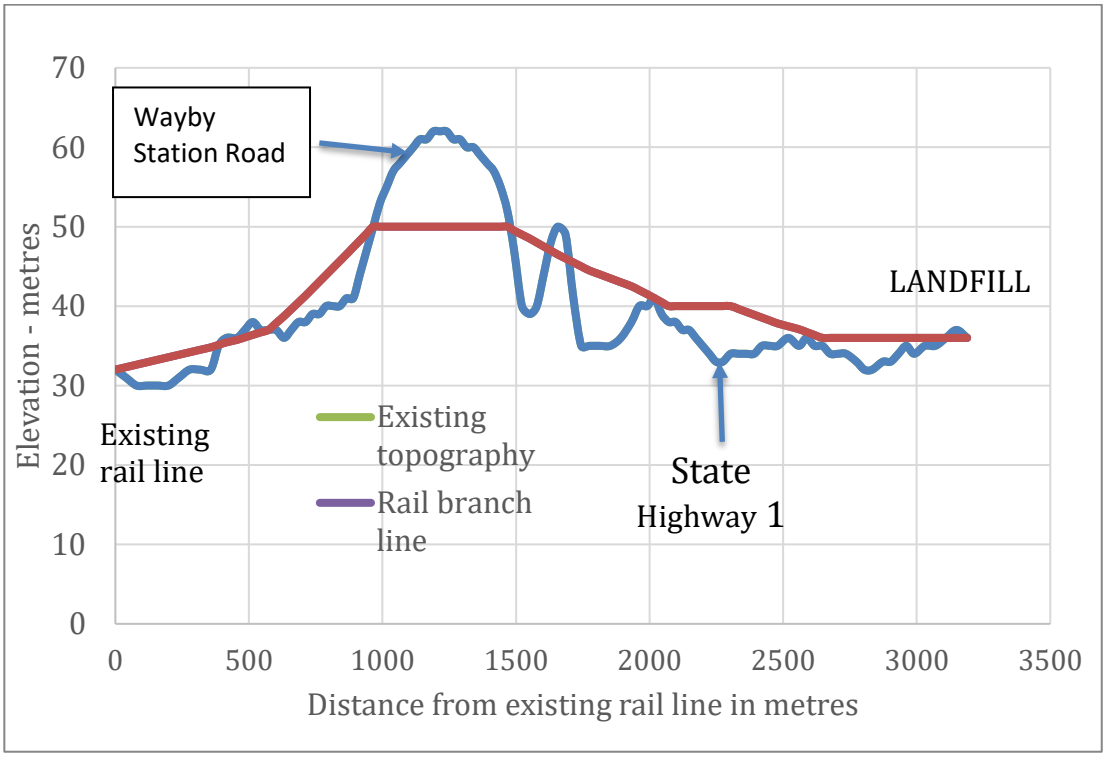


Figure 3
Indicative plan of branch line to ARL with elevations
(Data from GoogleEarth)

Figure 4 Elevations of suggested rail line alignment



7. Other Waste-by-Rail considerations

In September 2019, a $95 million Government programme was announced to upgrade the rail line between Whangarei and Auckland. The explicit purpose of this work programme is to get freight off the road. The planned work will include replacing or upgrading almost a third of the line, maintenance work on 13 tunnels, replacing five aging bridges, improving numerous drains and culverts, and strengthening embankments. This work programme will make the transporting of Waste-by-Rail from Auckland viable.

This planned upgrade of the northern rail line does not include enlarging tunnels to take the largest ISO containers, as might be required if major port activity is relocated to Northport. However, the dedicated rolling stock required for transporting waste by rail to ARL could be designed to fit within the existing tunnels between Auckland and ARL.

The rail line from Auckland to ARL comprises the southern half of the rail line from Auckland to Whangarei. The Government's North Auckland Line business case (March 2019) identified a potential 1.8 to 2.5 million tonnes per year of rail freight demand. The addition of the transport of 1.6 million tonnes per year of waste from Auckland to ARL on the North Auckland Line would substantially increase the utilisation of that committed rail infrastructure expenditure. This additional traffic for the North Auckland Line was not included in the business case. Adoption of the Waste-by Rail option would provide KiwiRail with a long-term, consistent, high volume, base-line customer.

The proposed 15 km rail spur from Oakleigh to Northport is estimated to cost in the order of $330 million. Using a cost scaling exponent of 0.8, the capital cost of a 3.2 km rail branch

line to ARL would likely be less than $100 million. In contrast, the capital cost of extending SH1 to Wellsford, as a potential solution to the problem of transporting waste by road to ARL, was estimated in 2017 to be $1.4 billion to $1.9 billion.

260 return truck trips per day from Auckland to ARL, would require a crew of about 130 heavy vehicle drivers. That additional demand for truck drivers in the Auckland region could be difficult to meet. In contrast, ten return rail trips per day by 800m long trains carting 442 tonnes each would be needed. That would require a crew of 10 working 5 trains in a 2-man operation.

8. Transition Engineering considerations

The consequences of the decisions that we make today, commit New Zealanders for several decades to systems that must be fit for purpose in the long term. Fit for purpose from 2020 forward means lowest possible energy use, the best outcomes for people living and visiting the region of the landfill, and best environmental condition and best resilience for the whole waste management system for Auckland. The Waste-by-Rail system is not exposed to several critical risks faced by road transport over the lifetime of the landfill, including the price and availability of diesel fuel, and availability of truck drivers.

The price of diesel fuel has become wildly unstable as the international oil supply system has become fractured by war, environmental disaster, climate change, and supply decline. Periodic fuel supply shortfalls are inevitable over the life of the landfill. When a crisis occurs, the ability to move waste out of the city will be essential and cannot be interrupted. Thus, building the Waste-by Rail infrastructure now would be a responsible move.

The current plan does not recognize the critical truck driver shortage in New Zealand. According to evidence presented by multiple industry representatives to the Upper North Island Supply Chain Study Working Group, the driver shortage is already acute and will continue to become critical in Auckland. There is no way to alleviate the shortage, so it must be factored into any future planning that would depend on truck drivers.

The recently announced rebuild of the NAL post-dated the preparation of the Resource Consent application and was not been factored into the supporting discussion. Now that the rapid development of the NAL is signalled, the feasibility of the rail branch line to ARL must be moved to the top of the list of considerations.

In Summary we conclude that the Waste-by Rail option would be: -

- **Highly desirable from the point of view of a traffic flow and safety on SH1N;**
- **Effective in addressing the requirements of the Zero Carbon Act;**
- **Practicable, using a 3.2 km rail branch line to the ARL site.**
- **Economically attractive over the projected life of the proposed landfill.**

S.H Goldthorpe, Convenor. On behalf of the Sustainable Energy Forum Inc

Appendix A Extract from AEE

12.7 KiwiRail Holdings Limited

KiwiRail Holdings Limited (KiwiRail) is a state-owned enterprise responsible for the infrastructure and operation of rail in New Zealand. KiwiRail operate the Northern Rail line which runs from Auckland to Whangarei, and passes approximately 2.5 km away from the site at its closest point. WMNZ have worked with KiwiRail previously to trial 'waste by rail' in New Zealand, delivering waste from the Thames Coromandel District to Redvale Landfill. However, this trial was not successful in demonstrating commercially viable 'waste by rail' at that time.

Subsequent to interest and questions raised by stakeholders, WMNZ met with KiwiRail on 24 January 2019 to discuss the project and the possibilities of developing 'waste by rail' for the Auckland Regional Landfill site. The outcome of the meeting was that at this stage it is unlikely that 'waste by rail' could be accommodated on the Northern Rail Line due to commuter rail timetables in Auckland, limits on train tonnage and insufficient heights of existing tunnels. KiwiRail also noted that they currently only work with 'point to point' freight, which would cause difficulties with loading and unloading trains. In Auckland, trains can only be loaded at Southdown, which is already a high congestion area. Unloading trains at Wellsford, if KiwiRail were prepared to increase infrastructure to accommodate this, would increase traffic and congestion within central Wellsford. KiwiRail advised they would not consider a new siding at Wayby Station Road.

The Ministry of Transport is currently working on a business case to upgrade rail infrastructure in Northland. If the Government decides to proceed with the investment there would be opportunity to grow rail services and consider the potential for waste by rail. In the interim, WMNZ and KiwiRail will remain in contact to identify opportunities should they arise.

WMNZ and KiwiRail will continue to work together in future to identify opportunities to explore waste by rail.