BEFORE THE TASMAN DISTRICT COUNCIL

Under the Resource Management Act 1991

In the matter of of an application by **THE NELSON REGIONAL SEWERAGE BUSINESS UNIT** for the resource consents to continue applying biosolids to land on Moturoa/Rabbit Island.

STATEMENT OF EVIDENCE OF CHRISTOPHER (CHRIS) JOHN PURCHAS

FOR THE NELSON REGIONAL SEWERAGE BUSINESS UNIT

11 MAY 2022

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STATEMENT OF EVIDENCE OF CHRISTOPHER (CHRIS) JOHN PURCHAS

Introduction

1 My full name is Christopher (Chris) John Purchas.

2 I hold a Bachelor of Technology with Honours in Chemical Technology from Massey University and am a member of Engineers New Zealand.

3 I have over 25 years' experience working as a regulator, policy maker and consultant within the solid waste sector, including management of organic wastes such as biosolids, in New Zealand, Australia, the Pacific and in the UK.

4 I worked on contaminated land and hazardous waste issues for the Wellington Regional Council in the late 1990's. I then undertook similar work on contract to several consulting firms in the United Kingdom from 1999 to 2001.

5 In 2001 I returned to New Zealand and joined the Ministry for the Environment working on a range of waste and resource recovery related issues. In my 5 years at the Ministry, I led or worked on biosolids management, organic waste recovery, business sustainability and relationships with the community sector.

6 In 2006 I moved into consulting with a focus on waste strategy for public and private sector clients. Initially I delivered several biosolids focused biosolids strategy and alternatives assessment projects for clients in New Zealand (Water Services Limited, Whangarei District Council, Hamilton City Council) and contributed to similar studies Adelaide (from SA Water) while with my previous employer (SKM New Zealand Limited, later becoming Jacobs New Zealand Limited).

7 Since joining T+T in 2015 I have continued to work with local authorities in New Zealand on waste strategy and feasibility work including developing a biosolids strategy for Wellington Water Limited in 2015/16 and multiple feasibility and alternatives assessments for broader organic waste management in New Zealand. I have also worked with clients in Victoria and across the Pacific.

8 My work in the waste and resource recovery sector can be broadly grouped as follows:

8.1 Waste and resource recovery strategy development for local authorities and a range of other organisations. This typically involves setting strategic objectives, identifying, and then evaluating, a range of options to achieve those objectives. For a waste strategy this will involve considering the entire waste management system. This may include:

8.1.1 Education and communication regarding reducing waste.

8.1.2 Information regarding the use of waste management system.

8.1.3 Arrangements for the collection of reusable items, recyclable materials and residual waste.

8.1.4 Arrangements for dropping off reusable items, recyclable materials and residual waste.

8.1.5 Processing of recyclable materials to enable their recycling.

8.1.6 Processing of residual waste to remove recoverable materials, reduce volume, stabilise the material.

8.1.7 Disposal of residual waste.

8.1.8 Where relevant, bulk transport of residual waste and/or recyclable material.

8.2 Project feasibility studies. This typically involves evaluating a range of options to address a specific issue, typically a component of the waste stream. In this context I will evaluate various combinations of collection, processing, market and disposal options against agreed strategic objectives. The evaluation will consider technical feasibility, anticipated costs and the broader commercial environment for waste and resource recovery.

8.3 Waste services and infrastructure procurement. This typically involves developing waste service specifications, supporting formal procurement processes and contributing to the evaluation of proposals. This means that I have a good understanding of waste and resource recovery services available across New Zealand and the cost of these services.

9 Projects of direct relevance to my evidence include:

9.1 In 2006 – 2007 I completed a detailed evaluation of options to manage biosolids produced at Watercare's Mangere Wastewater Treatment Plant. The process involved technical assessments of processing and end markets (including disposal), extensive engagement with Manu Whenua and application of a multi-criteria assessment framework to identify the most appropriate option.

9.2 In 2008 I completed a similar evaluation of options for the management of biosolids for Hamilton City Council. In this case the focus was on technical assessments and qualitative factors workshopped with Council staff.

9.3 2006 I completed an evaluation of the financial aspects of biosolids management options for Whangarei District Council.

9.4 In 2015 I prepared a biosolids management strategy for Wellington Water Limited. This included an evaluation of technology options (at a high level) and end markets. The strategy preparation included modelling of transport logistics and high level costs to establish direction for the management of biosolids form multiple wastewater treatment plants across the Wellington Region.

9.5 In addition to work focused exclusively on biosolids, I have completed multiple projects focussed on organic materials recovery and reuse in New Zealand. Examples include:

9.5.1 Dunedin City Council (2018)

9.5.2 Nelson City/Tasman District Council (2020)

9.5.3 South Taranaki District Council (2021/22)

9.5.4 Waikato Regional Council (Waikato and Bay of Plenty (current)

9.6 I have also completed multiple resource recovery options analysis, feasibility studies and business cases across New Zealand including for Taranaki, Wellington, Nelson/Tasman, Christchurch, West Coast, Southland and Dunedin. These studies consider a range of materials (typically including organic materials/waste), processing and end markets.

9.7 I have completed waste strategy development including underlying analysis and feasibility studies with similar scope to the projects noted above in Australia (Victoria, Western Australia, NSW and Queensland) and the Pacific (Cook Islands, Fiji, Nauru, Niue, Solomon Islands, Vanuatu, Federated States of Micronesia, Republic of Marshall Islands, Kiribati).

10 The projects noted above have all involved consider a processing, uses and markets for a range of organic waste derived materials. The analysis of options usually considers product quality and including some reflection of market acceptability modelling of cost and performance (waste recovery) alongside technology maturity and risk.

11 In my role as Chair of the WasteMINZ Organic Materials Group (focused on the recovery of organic waste for beneficial use) I work with composters, local authorities and policy makers to address gaps and promote the beneficial use of organic waste. A key aspect of this work is consider uses for organic waste derived materials, typically linked to usability, end market requirements and practical considerations such as transport distance and availability.

12 I provided an analysis of alternatives for the use of biosolids or biosolids derived products form the Bell Island Wastewater Treatment Process in a Technical Report to support the application

for consent. This analysis draws on analysis of treatment options prepared by Nick Berry of Beca[1] and is covered in detail in may evidence below.

13 While this is a Council-level hearing, I acknowledge that I have read and am familiar with the Code of Conduct for Expert Witnesses contained in the Environment Court Practice Note 2014, and that I agree to comply with it. I confirm that this evidence is within my area of expertise, except where I state that this evidence is given in reliance on another person's evidence. I have considered all material facts that are known to me that might alter or detract from the opinions I express in this evidence.

Scope of Evidence

14 In my evidence I will outline the following:

14.1 A summary of my Technical Report documenting the analysis of alternatives for the application of biosolids.

14.2 Comments on Officer's Report.

14.3 Comments on submissions where relevant to my evidence.

Current situation

15 Current treatment and land application

16 I refer to the evidence of Nick Berry with respect to biosolids production. Specifically;[2]

16.1 Current biosolids production (in the year to 30 June 2020) is approximately 2,613 kg DS/d or 89 m3/d at 3% DS as an annual daily average.

16.2 Due to population increases expected through the duration of the consent, it is expected that the biosolids production will increase. It is estimated that, based on current operation the biosolids production could increase to approximately 3,020 kg DS/d, or 100 m3/d at 3%DS over the duration of the consent.

16.3 The actual future production could vary due to changes in trade waste discharges received at the plant and operational management to control the biosolids loads and associated nutrient loads.

16.4 Biosolids from the WWTP have been applied to the Pinus Radiata plantation on Moturoa / Rabbit Island since 1996 via spraying from a heavy-duty travelling irrigator.

[1] Evidence of Dr Berry (Process alternatives), dated 11 May at [17]
[2] See Note 1 at [12]

16.5 Application rates vary depending on the age of the trees in a specific block with current consent conditions specifying nitrogen loading rates in kg of nitrogen per hectare (kg N / Ha). The application rates can be averaged over 3 years and range from 150 kg N / Ha in the first 12 years of tree growth and 100 kg N / Ha after the first 12 years of growth.

16.6 The average nitrogen content of the biosolids produced at Bells Island is 2 kg per m3. This equates to over 58,000 kg in 2018/19. At an application rate of 100 kg N / Ha each year almost 600 Ha is required for land application. This reduces to almost 400 Ha if the application rate is 150 kg N / Ha.

Potential biosolids management options – general comments

17 The objective for the management of biosolids from NRSBU activities is to minimise the quantity of material requiring management, control potential nuisance (odour/insects) and/or to generate a product with value. This may involve:

17.1 Digestion, with aeration (aerobic) or without oxygen (anaerobic) including consideration of advanced (pre-treatment) options

17.2 Mechanical dewatering, using presses or centrifuges

17.3 Thermal drying (with a range of technologies available)

17.4 Vermi-composting (processing organic waste using worms) or composting

17.5 Thermal destruction

17.6 Use of the stabilised product (for example dewatered biosolids, dried biosolids, compost)

17.7 Landfilling the product.

18 The NRSBU targets 100% beneficial reuse of biosolids from the WWTP. This is currently achieved through the application of biosolids at Moturoa / Rabbit Island.

19 Options for processing are covered Nick Berry's evidence[3] and are not repeated here.

20 Only a small portion of biosolids are applied to land in New Zealand (approximately 16%). In comparison the UK and Australia apply approximately 80% of biosolids to land. Biosolids can be applied to land in multiple forms. Examples include:

20.1 in liquid form as a slurry (with less than 3% dry solids)

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[3] See note 1 at Table 2

20.2 as a dewatered 'cake' (around 20% dry solids)

20.3 as a dried product (typically around 95% dry solids)

20.4 in a compost or vermi-compost product

21 Application on land that is accessible by public or used for production requires biosolids that meet relevant requirements. In New Zealand the relevant guidance in the Biosolids Guidelines 2003 (note a draft update was published in 2017 but has yet to be finalised) The guidelines specify Grade A (pathogen reduction, reducing vector attraction) for public or production land.

22 Even with demonstrated pathogen reduction potential end users may be concerned about the use of sewage derived products. Examples include restrictions on the use of biosolids on dairy grazing land and unclear requirements in the EurepGap standards (which primarily address food quality and safety) for primary producers exporting to the EU.

Potential biosolids management options

23 Land application of slurry

23.1 Application of biosolids in slurry form involves irrigation, in some cases with soil incorporation. The only example of land application of a biosolids slurry in New Zealand is the application of biosolids to forestry at Moturoa / Rabbit Island in Tasman.

23.2 Slurry application is likely to be viable where:

23.2.1 The biosolids meets quality requirements - for example pathogen reduction and contaminant levels.

23.2.2 It is straightforward and cost effective to transport the biosolids from the wastewater treatment plant where they are generated to the location for application.

23.2.3 It is possible to apply the slurry safely and in a way that minimises adverse environmental effects, for example avoiding the potential for liquid biosolids to flow into waterways.

23.2.4 The nutrients provided by the biosolids provide value, for example offsetting fertiliser inputs.

24 Land application of dewatered biosolids ('cake')

24.1 The application of dewatered biosolids to land is a common approach internationally with a large proportion of biosolids applied to land in Australia and the USA being dewatered biosolids. Processing needs to provide assurance of adequate pathogen reduction through elevated temperature, extended processing time and/or other means.

24.2 There are no current examples of the land application of dewatered biosolids in New Zealand. Christchurch City Council completed a land application trial at Bottle Lake Forest in the early 2000's and holds resource consent to discharge dewatered biosolids to selected forestry sites around Canterbury, although it is understood that this is no longer in use. Christchurch now dry biosolids at their Bromley wastewater treatment plant (see Section 2.4.4).

25 Land application of a dried biosolids

25.1 Adequate drying of biosolids can result in Grade A pathogen reduction, potentially making the product suitable for application to land. There are several locations where dried biosolids are produced in New Zealand.

25.2 In New Plymouth dewatered solids are dried using gas heated drum drying technology to produce a hard granule fertilizer. The product is marketed under the brand name Bioboost. Bioboost has successfully developed a local end market in general garden use (commercial and residential), lawns, broad acre cropping, turf and forestry.

25.3 Solar drying of biosolids has been implemented in Selwyn. This process results in a biosolid product that is 93% solids. The land surrounding the Pines Wastewater Treatment Plant has been consented to allow the disposal of Grade Aa biosolids, however dried solids are currently being trucked off site for disposal at landfill. Disposal to adjacent pasture land is anticipated in the future once testing has been undertaken to see if biosolids can achieve a Grade Aa standard.

25.4 The Biosolids drying facility Christchurch City Council's Bromley Wastewater Treatment Plant is a large scale wood fired belt drying plant resulting in biosolids that are over 95% solids. The product is able to meet the class Ab classification for biosolids, which means that it is suitable for reuse on land. Christchurch City Council has a relationship with the operators of Stockton Mine on the West Coast and biosolids have been beneficially reused to rehabilitate areas at the Mine.

25.5 Biosolids at the Hutt Valley Wastewater Treatment Plant (Lower Hutt) are dried to around 95% solids in a gas fired dryer. The biosolids are largely disposed of to landfill but have been used on forestry land in the Manawatu.

26 Land application of compost containing biosolids

26.1 Dewatered sludge can be used as feedstock for composting to produce a soil amendment product. Key to the success of this process is achieving a suitable carbon to nitrogen ratio to facilitate the process and achieve a suitable nutrient balance in the product. For biosolids this requires the use of a carbon rich bulking agent, generally at a 2 - 4:1 blending ratio. Potential bulking agents include green waste, wood chip, sawdust and bark.

26.2 Potential end users for a biosolids derived compost within the Tasman/Nelson Region include the two Councils and application to the parks and reserves under their control, local golf courses, schools or members of the public/ operators who wish to apply the product for gardening fertilisation or soil improvement purposes. The agriculture industry (excluding food crop or stock grazing) could also potentially use the product for soil amendment of fertiliser.

26.3 There have been several examples of biosolids composting occurring in New Zealand although none of those currently operating produce compost for general use. Palmerston North City Council compost biosolids and green waste with the resulting product used to build up a topsoil layer on a closed landfill (Awapuni Landfill).

26.4 Typically, a biosolids composting operation will employ enclosed composting technology including the ability to treat odours generated during handling and composting. A key challenge for these operations has been securing sustainable markets for the compost product. Between 1999 and 2008 dewatered sludge from Wellington City Council's Moa Point wastewater treatment plant was composted by the Living Earth Joint Venture plant at the Southern Landfill site. The operation was an enclosed tunnel composting facility with materials handling and process areas vented to atmosphere via a biofiliter. The facility cost $17M to build but struggled to develop and maintain a sustainable market for the compost product and generated a significant number of odour complaints from nearby properties.

26.5 Thames Coromandel District Council ran a biosolids composting trial that was unsuccessful and decommissioned in October 2017. The Council acquired an aging asset with high maintenance costs that were not offset by fuel, transport and landfill disposal costs that did not increase as predicted.

26.6 Similarly, Rotorua District Council built and ran a biosolids composting facility that eventually was closed down.

27 Land application of vermi-compost

27.1 Vermi-composting has similar opportunities and barriers as conventional composting in that achieving a suitable carbon to nitrogen ratio through the secure supply of a bulking agent is crucial.

27.2 A number of biosolid vermicomposting sites exist in New Zealand ranging from small communities with onsite small scale systems (i.e. Maketu in the Bay of Plenty) to full scale centralised vermi-composting operations (i.e. those managing biosolids from Rotorua, Hamilton and Taupo). All of the larger large sites have access to pulp mill wastewater treatment solids which are used as the bulking agent and carbon source. Some also combine wastewater treatment sludge from local milk processing plants as a feedstock. Sludge is generally anaerobically digested and dewatered before being vermi-composted.

27.3 Vermicast has a number of end markets in the central north island including land application to maize crops, orchards, forestry and pasture.

28 Potential land application locations in Nelson/Tasman

28.1 In addition to Moturoa / Rabbit Island, it may be possible to apply biosolids to horticultural land –

28.1.1 Compost is often used in tree and vine based horticulture applications for weed suppression and sustained nutrient delivery. Compost can also be used to maintain soil structure and health for heavy rotation cropping systems. Subject to meeting appropriate quality requirements there is potential for other biosolids products to be used in a similar way.

28.1.2 Dewatered biosolids can be incorporated during soil preparation, but this would be subject to stand down periods that are likely to make this impractical.

28.1.3 Dried biosolids can be used in the same way as a compost product.

28.2 Biosolids or biosolids containing products could be used on other forestry land. Use of biosolids on forestry land would most likely be viable at re-sowing i.e. incorporate biosolids (dewatered, dried, compost or vermi-compost) prior to planting. This means that a large area would be required with a 20-30 year rotation of blocks requiring biosolids application once per rotation.

28.3 It could also be possible to sell a biosolids derived product on the open market. Bioboost (dried biosolids) from New Plymouth is a current example of this approach. Biosolids compost produced in Wellington was sold to landscapers and the general public while the facility operated.

28.4 Key considerations when evaluating potential land application locations include:

28.4.1 Total land area required - 600 Ha per year or more.

28.4.2 Location ideally in close proximity to the Bell Island WWTP to minimise transport costs.

28.4.3 Land use - in general land used in a way that avoids public access or allows access to be controlled immediately after biosolids application will be preferred.

28.4.4 Produce - while it is technically feasible to manage risks associated with biosolids, applying biosolids to land used for food production is unlikely to be preferred.

28.4.5 Topography - flat to gently rolling land is likely to be preferred to steep country.

28.4.6 Ownership - sites controlled by the biosolids producer are likely to be preferred due to the ability to control land use and access.

28.5 Spatial analysis was used to identify potential suitable land in the Nelson Tasman Regions. Key points to note include from this analysis include:

28.5.1 There is approximately 100,000 Ha of planted production forest in the Nelson and Tasman Regions. This tends to be on steep country (unsuitable for biosolids application) on the hills surrounding the Waimea Plains.

28.5.2 Council owned forestry land comprises over 3,000 Ha, all on relatively steep country (unsuitable for biosolids application).

28.5.3 There is around 23,000 Ha of horticultural land in the Nelson and Tasman Regions, predominantly on the Waimea Plains.

29 Landfill disposal of dewatered biosolids

29.1 It is estimated that 27% of biosolids in New Zealand are placed directly into Class 1 landfills. An additional 4% is used for landfill cover, 5% is stored at wastewater treatment plants and 45% is used for quarry rehabilitation in a biosolids mono fill in Auckland. In comparison to international trends (Europe, Australia and the U.S.)

29.2 New Zealand has maintained high landfill disposal rates. This is due to a range of factors that are likely to include:

29.2.1 Potential user concerns about sewage derived products.

29.2.2 Relatively low cost landfill disposal in most parts of New Zealand.

30 Reasons to consider alternatives to landfill disposal in New Zealand have become more compelling in recent times. Significant factors include:

30.1 Increasing cost of disposal as new landfill facilities are developed.

30.2 The need to blend dewatered biosolids with general waste to meet typical consent conditions and to maintain the stability of the landfill.

30.3 Recognition of the nutrient value of biosolids that could be usefully utilised.

31 Policy incentives to divert waste from landfill and prioritise reuse including the Emissions Trading Scheme charges and the landfill levy.

32 Watercare Services Limited disposes of limed, dewatered biosolids at Puketutu Island in Mangere. The disposal process will ultimately restore an area that has been quarried. There also examples of sludge 'mono fills' associated with pulp and paper manufacturing sites in New Zealand.

Approach to evaluating options

33 The biosolids management options identified were considered from the perspective of technical feasibility (they have been shown to work, but not in New Zealand for biosolids) and technical viability (have been shown to work in New Zealand for biosolids at a commercial scale).

34 A short list of technically feasible and viable options were then considered in more detail considering:

34.1 Technical risk/viability - a qualitative assessment of the comparative technical risk associated with the option i.e. what are the chances of failure due to technical issues. Look for options with demonstrated success in New Zealand or similar.

34.2 Market risk - a qualitative assessment of the market risk associated with the option i.e. what are the chances of failure due to difficulties with the final disposal or reuse component of the option.

34.3 Resilience risk - a qualitative assessment of the resilience of the option to various disruptions including low probability, high impact events, for example forest fire on Moturoa / Rabbit Island.

34.4 Local environment impacts - a qualitative assessment of likely net local environmental impact of the option (i.e. odour, groundwater, coastal water). In this context local refers to the activity site and surrounding land uses.

34.5 Greenhouse gas impacts - a high level qualitative assessment of potential greenhouse gas emissions from each option, considering processing, transport and disposal.

34.6 Community impacts - a qualitative assessment of likely community support or opposition for the option, likely associated with local environmental impacts but also considering cultural impacts. Note the Cultural Impact Assessment (REFERENCE) supersedes any high level assessment in this regard.

34.7 Cost - comparative costs.

Short list evaluation

35 The table below considers the technical feasibility and viability of the potential biosolids management options. This assessment was used to develop a short list of options for more detailed consideration.

Biosolid product	End use/disposal	Comment	Viable
Grade A slurry	Moturoa /Rabbit Island	Current approach	✓
	Other forestry/ horticulture	There are no suitable alternative locations close to Bell Island, slurry is unlikely to be suitable for horticulture due to stand down period after application. Soil injection could be possible on NRSBU or other farm land with 600 Ha or more required.	✗
Grade A dewatered	Moturoa /Rabbit Island	Requires new application approach and investment in new processing at Bell Island (digestion, pasteurisation, dewatering). Potential for odour issues similar to slurry.	✓
	Other forestry/ horticulture	Requires new processing at Bell Island (digestion, pasteurisation, dewatering). There are no suitable alternative locations close to Bell Island, dewatered biosolids are unlikely to be suitable for horticulture due to stand down period after application.	✗
Grade B dewatered	York Valley Landfill	Requires dewatering at Bell Island, transport and disposal charges are likely to be significantly more expensive than the current costs.	✓
Grade A dried	Moturoa /Rabbit Island	Potential to spread dried biosolids with conventional fertiliser spreader and existing tracks. Low odour product. Requires investment in new processes at Bell Island (dewatering and dryer).	✓
	Other forestry/ horticulture	Potentially suitable locations (horticulture) but likely to be concerns about sewage derived product. Potentially viable to transport dried product to suitable forestry block. Requires investment in new processes at Bell Island (dewatering and dryer).	✓
	Open market	Contaminant levels likely to preclude general sale. Likely to be concerns about sewage derived product. Requires investment in new processes at Bell Island (dewatering and dryer).	✗

Biosolid product	End use/disposal	Comment	Viable
Grade A compost/ vermi-compost	Moturoa /Rabbit Island	Requires new application approach, requires investment in new processing at Bell Island (dewatering, enclosed composting or vermi-composting). Requires a source of bulking agent (for example green waste or sawdust). Addition of bulking agent means there will be significantly more material to apply i.e. Moturoa / Rabbit Island may not be large enough.	✘
	Other forestry/ horticulture	Requires new application approach, requires investment in new processing at Bell Island (dewatering, enclosed composting or vermi-composting). Requires a source of bulking agent (green waste, sawdust, …). Potentially suitable locations (horticulture) but may to be concerns about sewage derived product. Potentially viable to transport compost/vermi-compost product to suitable forestry block.	✘
	Open market	Requires new application approach, requires investment in new processing at Bell Island (dewatering, enclosed composting or vermi-composting). Requires a source of bulking agent (green waste, sawdust, …). Potentially suitable locations (horticulture) but may to be concerns about sewage derived product. Potentially viable to transport compost/vermi-compost product to suitable forestry block.	✘

36 The options (combining treatment and end use) carried through for further assessment were:

1a	Autothermal Thermophilic Aerobic Digestion (ATAD) - Class Ab biosolid slurry to Moturoa / Rabbit Island
1b	Thermal pre-treatment, anaerobic digestion - Class Ab biosolid slurry to Moturoa / Rabbit Island
1c	Thermal pre-treatment, anaerobic digestion, aerobic digestion - Class Ab biosolid slurry to Moturoa / Rabbit Island
2	Anaerobic digestion, dewatering - Class Bb dewatered biosolid to York Valley Landfill
3	Thermal pre-treatment, anaerobic digestion, dewatering - Class Ab dewatered biosolid to Moturoa / Rabbit Island
4	Thermal pre-treatment, anaerobic digestion, drying - Class Ab dried biosolid to Moturoa / Rabbit Island
5	Thermal pre-treatment, anaerobic digestion, drying - Class Ab dried biosolid to other forestry/horticulture

37 Evaluation results are summarised in Table 3.3. Each of the options were scored against each of the options assessment criteria noted above. For each criteria options are ranked as high, medium or low and colour coded accordingly. Low (risk, impact of cost) is preferable to medium or high, reflected by the green colour coding.

Table 0.1: Options assessment summary matrix for biosolids treatment and end use /disposal.

	1a ATAD + Slurry (Moturoa)	1b Thermal + Anaerobic Digestion + Slurry (Moturoa)	1c Thermal + Anaerobic Digestion + Aerobic Slurry (Moturoa)	2 Anaerobic digestion + landfill	3 Thermal + Anaerobic digestion + Dewater (Moturoa)	4 Anaerobic Digestion + Drying (Moturoa)	5 Anaerobic Digestion + Drying (Moturoa)
Technical risk/viability	Low	Medium	Medium	High	Low	low	Medium
Market risk	Low	Low	Low	Medium	Low	Low	Medium
Resilience risk	*High*	*High*	*High.*	*Medium*	*High*	*Low*	*Low*
Local environmental impacts	Low	Medium	Low	Medium	Low	Medium	Low
Greenhouse gas impacts	Low	Medium	Medium	High	Low	High	High
Community impacts	Medium	Medium	Low	Medium	Low	Medium	Medium
Cost	Medium	Medium	Medium	High	High	High	High

38 Options with a high proportion of green are preferable to those with a higher proportion of orange and red coding. There is no weighting of the criteria. The evaluation of community impacts is preliminary only and should be tested through engagement with key stakeholders.

39 Option 1a (application of slurry from the existing ATAD process) is the preferred option. This reflects a secure 'market', relatively low energy inputs and relatively low cost. This option requires careful management of odour risk. The evaluation considers community impacts are low and reflects 24 years of experience with land application of biosolids, no significant adverse

effects and balanced by the positive view of beneficial use of the nutrients present in the biosolids.

40 Option 1b (application of slurry from a new process involving thermal pre-treatment and anaerobic digestion of wastewater solids) is not preferred. This reflects the additional capital cost (for thermal pre-treatment and anaerobic digestion), additional energy for processing and minimal changes to the product being applied to land at Moturoa / Rabbit Island. Anaerobically digested slurry also presents an increased risk of odour during application due to the presence of sulphides. The evaluation considers community impacts are medium reflecting potential concerns about the increased odour potential from anaerobic material and while this is somewhat balanced by the positive view of beneficial use of the nutrients present in the biosolids, there is an increased risk.

41 Option 1c (application of slurry from a new anaerobic digestion with post aerobic digestion of wastewater solids) is not preferred. This reflects the additional capital cost (for thermal pre-treatment and anaerobic digestion), additional energy for processing and minimal changes to the product being applied to land at Moturoa / Rabbit Island. The evaluation considers community impacts are low reflecting lower concerns about the odour potential from aerobic material. This option is unproven in NZ and the performance improvement is unclear.

42 Option 2 (application of dewatered anaerobic digestion sludge at York Valley Landfill) is not preferred. This reflects the fact that the Nelson Tasman Regional Landfill business unit is actively working to reduce its carbon emissions, and one of the aspects being worked on in the Nelson Region is organics diversion from the landfill. This option would also incur additional costs (for anaerobic digestion, dewatering, transport and landfill charges including landfill levy and Emissions Trading Scheme Charges) and greenhouse gas impacts (associated with transport and landfill disposal). These factors are potentially offset by reduced local environmental impacts (although there are limited impacts known at this time) as a result of no application on Moturoa / Rabbit Island. The evaluation considers community impacts are high reflecting potential concerns about the landfill disposal of biosolids, these are exacerbated by reducing the beneficial reuse of nutrients.

43 Option 3 (application of anaerobically digested and dewatered sludge at Moturoa/Rabbit Island) is not preferred. This option would also incur additional costs (for anaerobic digestion, and dewatering) but would reuse a significant portion of the current infrastructure. An alternative application vehicle would need to be used for the application. This option would significantly reduce the nutrient concentration in the biosolids being applied and therefore increase the mass able to be applied to the land area. These factors are offset by reduced local environmental impacts as a result of less odour potential on Moturoa / Rabbit Island. The evaluation considers community impacts are similar to Option 1b but reflect less potential for odour related concerns. A dewatered product is less beneficial as a reuse fertiliser leading to less benefit realised from

increased tree growth. Cost for operations would increase but would be capable of reusing a significant portion of the current infrastructure.

44 Option 4 (application of dried biosolids at Moturoa / Rabbit Island) is not preferred. This reflects the high cost (for thermal pre-treatment, anaerobic digestion and drying) and additional energy for processing. A dried product is less beneficial as a reuse fertiliser leading to less benefit realised from increased tree growth. These factors are offset by access to a secure market and reduced odour risk during application. The evaluation considers community impacts are medium reflecting potential concerns about the land application of sewage derived material and balanced by the positive view of beneficial use of the nutrients present in the biosolids.

45 Options 5 (application of dried biosolids at another forestry or horticulture location) is not preferred. This reflects the high cost (for thermal pre-treatment, anaerobic digestion and drying), additional energy (processing, transport) and lack of secure markets. A dried product is less beneficial as a reuse fertiliser leading to less benefit realised from increased tree growth. These factors are offset by reduced local environmental impacts as a result of no application on Moturoa / Rabbit Island. The evaluation considers community impacts are medium reflecting potential concerns about the land application of sewage derived material and balanced by the positive view of beneficial use of the nutrients present in the biosolids.

Best Practicable Option

46 The RMA requires that the discharge of a contaminant be undertaking utilising the Best Practicable Option. This is defined in Section 2 of the RMA as:

best practicable option, in relation to a discharge of a contaminant or an emission of noise, means the best method for preventing or minimising the adverse effects on the environment having regard, among other things, to—

a the nature of the discharge or emission and the sensitivity of the receiving environment to adverse effects; and

b the financial implications, and the effects on the environment, of that option when compared with other options; and

c the current state of technical knowledge and the likelihood that the option can be successfully applied.

47 Regarding the nature of the discharge or emission and the sensitivity of the receiving environment to adverse effects (a), the application of biosolids at Moturoa / Rabbit Island can be managed to minimise potential adverse effects including:

47.1 Odour during application - through careful application, appropriate buffer zones and excluding the public from areas where biosolids are being applied.

47.2 Elevated nutrients or contaminants in soil or groundwater - through working within defined application rate thresholds based on applying nitrogen at a level that will be used by the growing pine trees. These application rates also limit the trace contaminants applied, avoiding the potential to accumulate trace contaminants in solids to an unacceptable level.

48 This is discussed in detail in the Assessment of Effects on the Environment and proposed to be managed by conditions of consent.

49 Regarding the financial implications, and the effects on the environment, of the application of slurry to land at Moturoa / Rabbit Island when compared with other options (b), my analysis evaluated a range of options considering cost and effects on the environment alongside risk (technical, market, resilience). The conclusion of that assessment is that Option 1a (aerobic digestion of wastewater solids, application of biosolids slurry at Moturoa / Rabbit Island) is the preferred option (Best Practicable Option).

50 Regarding the current state of technical knowledge and the likelihood that the option can be successfully applied (c) the evaluation included consideration of a wide range of options for processing (documented in the Beca Process Alternatives Assessment) and end use or disposal. This considered the technical feasibility and viability of a range of options. Options identified include technically feasible options (that have been demonstrated at full scale) and short-listed those evaluated as technically viable (operate at a similar scale, process similar materials and operating commercially). The preferred option is proven in operation at Bell Island wastewater treatment plant and Moturoa / Rabbit Island.

Conclusions and recommendations

51 My analysis involved an evaluation of potential end uses of biosolids produced by the Bell Island WWTP. The evaluation has considered a range of factors in identifying a preferred option.

52 The evaluation concluded that aerobic digestion of wastewater solids to produce a biosolids slurry followed by the application of the slurry to land at Moturoa / Rabbit Island is the preferred and best practicable option.

53 The evaluation results also suggest that If Moturoa / Rabbit Island is no longer an option for land application then landfill disposal or application of a dried biosolids elsewhere are the most viable options. It should be noted however that:

53.1 Landfill will be expensive and increasingly so with anticipated increases in the Landfill Levy and emissions trading costs.

53.2 Drying will be more attractive if low-cost energy can be accessed (e.g. solar) and secure markets are available or can be developed over time.

54 The evaluation also noted that a change from the current approach would increase costs with funding of capital investment, transport of biosolids to alternative disposal or land application sites and operating costs all considered.

55 Given the changing nature of biosolids management in New Zealand and globally it is recommended that end use options for biosolids produced at the Bell Island WWTP are periodically re-evaluated. I consider this to be addressed by condition 9(e) - (f) and 10 of the officers report.

Comments on the officers report

56 The officers report notes that submitters have suggested there has not been adequate consideration of alternatives to disposing of biosolids at Moturoa/ Rabbit Island.

57 My assessment, as summarised in my evidence and the accompanying technical report, sets out the range of alternatives that have been considered.

58 This includes vermiculture as noted in the Officer Report (7.53). I agree that there is no apparent 'bulking agent' available in the Nelson/Tasman area that would enable this approach to be applied for the biosolids that are the subject of this application.

59 I also agree with the officers assessment that drying with subsequent land application 'gives a similar outcome'. I am interpreting this comment as referring to the application of biosolids slurry to land.

60 I also agree with the officers comment that land application of biosolids (making use of nutrients and discussed in the evidence of Dr Xue and reflected in 7.98 of the Officers Report) is 'significantly better, than landfilling' dried (or dewatered) biosolids.

Comments on submissions where relevant to my evidence.

61 The submissions I have reviewed are largely focussed on matters outside the scope of my evidence.

62 Te Runanga o Ngāi Rarua have noted however that the assessment of alternatives focussed on alternative approaches to treating biosolids before application to land on Moturoa / Rabbit Island. I note that my analysis has:

62.1 Considered a range of treatment processes with associated resulting biosolids 'product (Refer Para 17 – 28 of this evidence and Section 2 of my Technical Report as well as Nick Berry's evidence and Technical Report).

62.2 Identified potentially suitable land application locations with the Nelson and Tasman Regions (recognising the impact of transporting biosolids further). My Technical Report notes that:

While there is a significant amount of potentially suitable land for the application of biosolids in the Nelson and Tasman Regions it is unlikely to be suitable for slurry or dewatered product. This is due to a combination of:

(a) *Transport costs.*

(b) *Current land use - biosolids is unlikely to be suitable for application to land used for growing crops for human or animal consumption.*

(c) *Land ownership (very little of the land is owned by the Councils).*

(d) *Surrounding land use that is likely to be sensitive to potential odour impacts.*

(e) *Topography, making access and management of run-off difficult.*

62.3 I note that dried biosolids could feasibly be transported further if suitable locations for land application can be identified.

62.4 My analysis concluded based on a range of factors that continuing application of biosolids slurry at Moturoa / Rabbit Island was the preferred option when compared with land application of a range of biosolids 'products' at various locations including, but not limited to Moturoa / Rabbit Island.

Chris Purchas

11 May 2022