Attachment J

Resource Consent Renewal

Moturoa/ Rabbit Island Biosolids Application to Land

Review of potential impacts on birds

NRSBU has requested me to prepare a desk top review on the potential impacts of biosolids discharge to land on birds of Moturoa/ Rabbit Island.

Introduction

The Nelson Regional Sewerage Business Unit (NRSBU) is in the process of renewing consents for continuation of the discharge biosolids to land (forestry blocks) on Moturoa/Rabbit Island. Biosolids have been applied to land at Moturoa/Rabbit Island since 1996; the current consent is due to expire on 8 November 2020.

An assessment of environmental effects is being prepared as part of the application for a renewal of consents.

Biosolids application to land

The current resource consent conditions include specific exclusion zones and designated buffer zones from areas of value.

Condition 6.1 states:

> 6.1 If biosolids meet Class A sludge standards, the following buffer zones (no spray areas) shall be observed:
>
> (a) Around the entire coastal edge of Rabbit Island a buffer zone of 15 metres in from the edge of the forest, or 50 metres from Mean High Water Springs [MHWS], whichever is the greater, is to be maintained. No biosolids disposal is to take place in this buffer zone.
>
> In the event that the biosolids do not meet Class A, the buffer zone is extended to 400m (Condition 6.2).

The fact that the buffer definition relates to MHWS means that the boundary is ambulatory in the event of erosion or accretion, and also is responsive to future sea-level rise which could significantly change the shape of Rabbit Island (Tasman District Council 2020).

The current location of disposal application areas is shown in Figure 1.

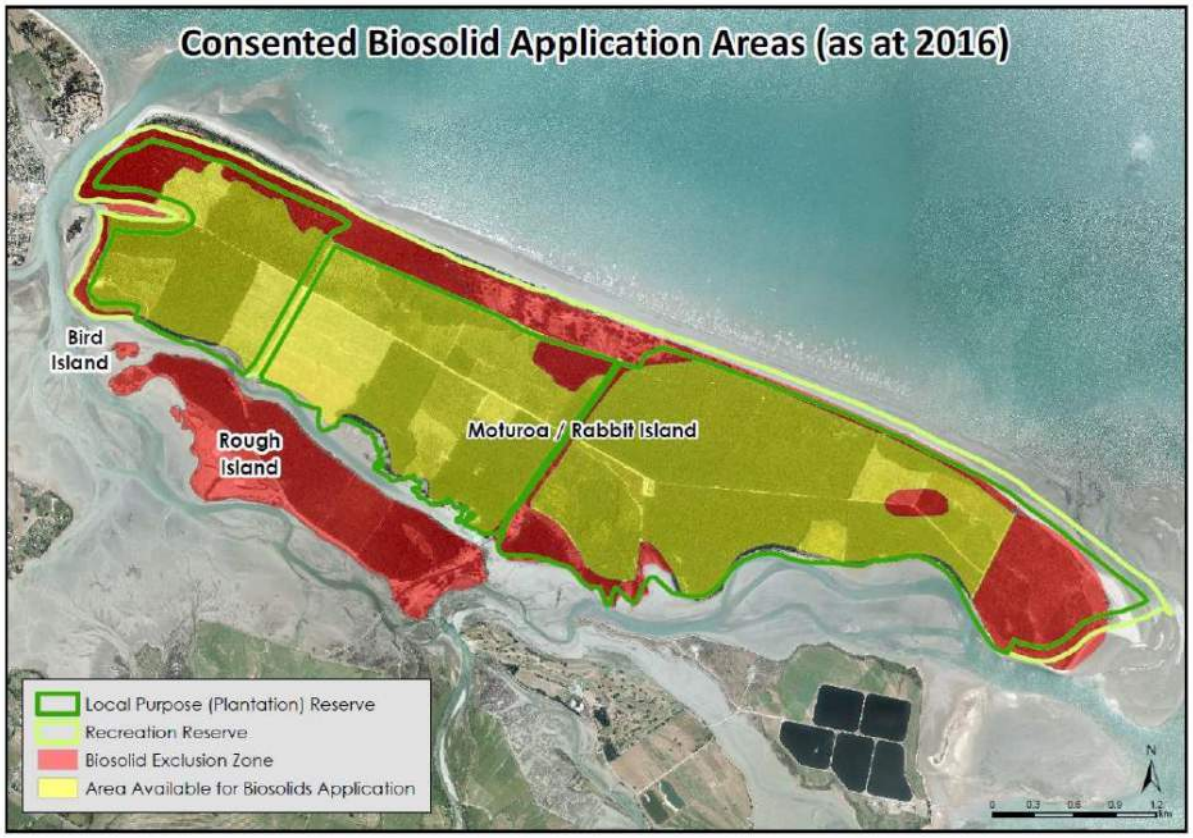

Figure 1. Consented biosolid application areas (as at 2016). Source: Tasman District Council (2016)

The current biosolids programme has the potential to adversely affect birds directly, e.g. physical destruction of nests during spraying. Indirect effects, such as leaching and percolation into the coastal area could impact benthic prey stocks, e.g. through elevated concentrations of trace metals and other contaminants (Gillespie *et al.* 2014), although increased nutrients could potentially increase food supplies for shorebirds (Burton *et al.* 2002). Biosolids disposal could also potentially impact some bird species through nutrients and contaminants affecting plant growth and/or community composition and structure.

The 2014 monitoring programme concluded:

> Overall monitoring results indicate that, during the period April 1996-February 2014, land applications of biosolids from the Bell Island wastewater treatment plant had not resulted in significant adverse effects to the enrichment status of contaminant levels of Rabbit Island intertidal habitats (Gillespie *et al.* 2014).

The report did, however, recognise 'the possibility that some short-term effects may occur', if for example heavy rain occurred after the application of biosolids (Gillespie *et al*. 2014).

Biosolids may also contain a potentially wide array of trace elements and emerging organic contaminants (EOCs). The NRSBU has undertaken tests for per- and polyfluoroalkyl substances (PFAS) in soils at Moturoa/Rabbit Island. Xue (2020) reported negligible levels of perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA) in soil samples from Moturoa/Rabbit Island indicating that 'long-term repeated application of biosolids have not caused appreciable accumulation in the forest soil ecosystem'.

While there is potential for EOCs to impact birds, the monitoring completed to date has identified no accumulation of PFOS and PFOA in the top-soils, as such there is no immediate concern for these substances to pose a risk to birds on Moturoa/Rabbit Island.

The potential effects of pharmaceuticals on birds are little studied, but based on current knowledge do not appear to be cause for concern at present. Biosolids may contain pharmaceuticals such as the anti-depressant fluoxetine (Tremblay *et al*. 2014, Tremblay & Northcott 2015), which has been found to alter the behaviour of some bird species (Bean *et al*. 2014, Whitlock *et al*. 2018). However, experimental studies with fluoxetine have been undertaken on the basis that birds foraged at a sewage treatment plant with trickle filter beds where there is a continual supply of potentially contaminated prey available. This experimental setting is not directly comparable to the occasional application of biosolids to land at Moturoa/Rabbit Island. Fluoxetine has low biodegradability in soils (Monteiro & Boxall 2009) and appears to sorb to biosolids (Gottschall *et al.* 2012).

At Moturoa/Rabbit Island, biosolids are applied within the plantation forests and exclude any significant native habitats for bird species.

Ornithological values of Moturoa/ Rabbit Island

The biodiversity values of Moturoa/ Rabbit Island, including avifauna, are summarised in the *Moturoa/Rabbit Island Management Plan* (Tasman District Council 2016). The most sensitive areas for birds of conservation concern (those classified by the Department of Conservation as 'Threatened' or 'At risk' (Appendix 1)) are the shores of the western and eastern parts of the island (Figure 2).

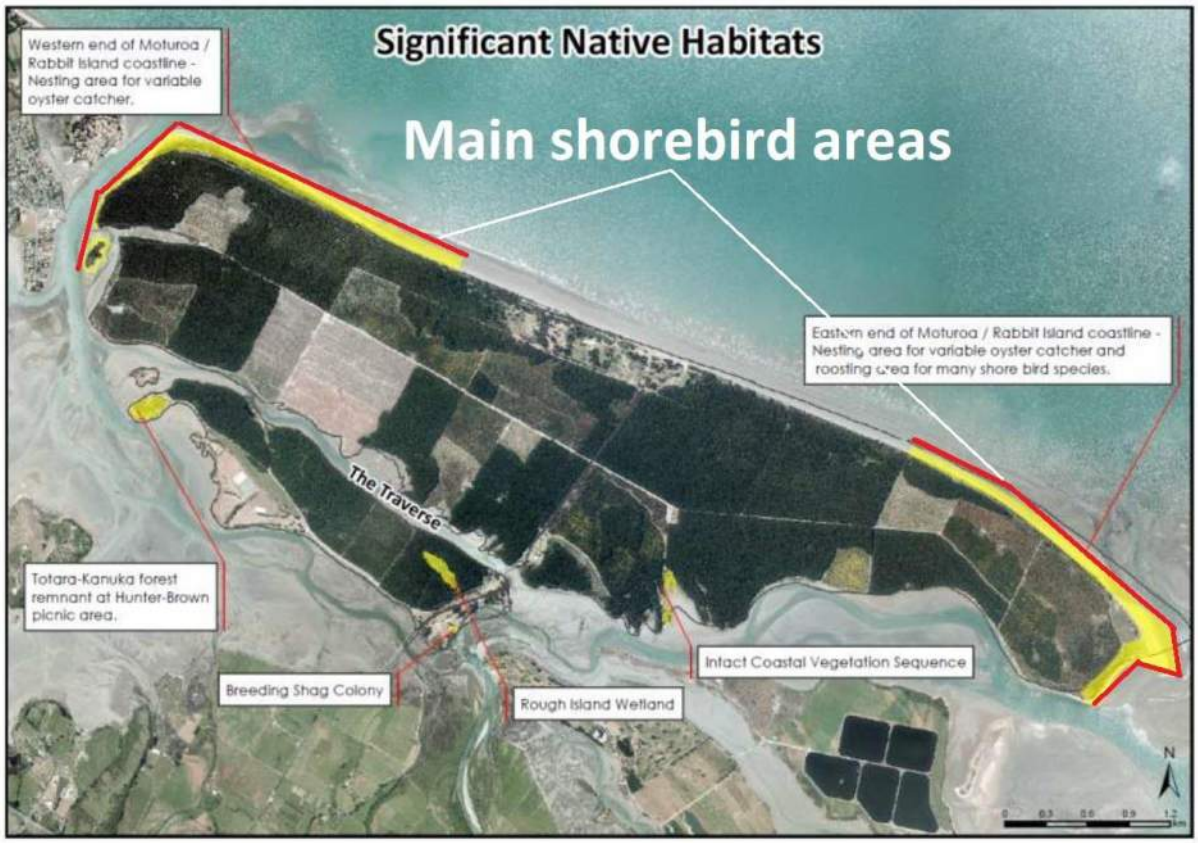

Figure 2. Significant native habitats on Rabbit Island. The main shorebird areas are at the western and eastern ends of the island (red lines). Adapted from: Tasman District Council (2016)

Coastal birds

Moturoa/ Rabbit Island provides valuable habitats for both roosting and nesting coastal birds, and the adjacent intertidal flats and shallow coastal waters provide foraging areas.

Waimea Inlet is of international importance[1] for three waders: Variable Oystercatcher *Haematopus unicolor*, South Island Pied Oystercatcher *Haematopus finschi* and Wrybill *Anarrhynchus frontalis*. It is also of national importance for Bar-tailed Godwit *Limosa lapponica* and Red Knot *Calidris canutus* (Schuckard & Melville 2013). These birds forage on benthic invertebrates, such as polychaete worms and bivalve molluscs, on the exposed tidal flats.

East Waimea Inlet also supports internationally important numbers of Black-fronted Terns *Chlidonias albostriatus* in the non-breeding season.

Roosting

At high tide waders roost at selected sites in East Waimea Inlet, in particular the Bell Island Shellbank, Sand Island and the eastern end of Moturoa/ Rabbit Island (Figure 3). The distribution of birds between these three sites varies depending on weather conditions, the state of the tide and the physical conditions at each site – the dynamic nature of the sand areas in East Waimea Inlet results in considerable variations in patterns of erosion and accretion at both Moturoa/ Rabbit Island and Sand Island, while the saltmarsh on the Bell Island Shellbank is currently subject to erosion and increased inundation (possibly due to seabed subsidence).

Ensuring the integrity of all three roost sites is important in terms of safeguarding Nelson Airport from potential birdstrikes, in particular with South Island Pied Oystercatchers. If the birds have secure roost sites in East Waimea Inlet they are less likely to congregate on the airfield (Melville & Schuckard 2013).

[1] Under the Convention on Wetlands of International Importance Especially as Waterfowl Habitat (the Ramsar Convention) 'A wetland should be considered internationally important if it regularly supports 1% of the individuals in a population of one species or subspecies of waterbird'.

Figure 3. Location of hightide wader roost sites in East Waimea Inlet.

Currently the east end of Moturoa/ Rabbit Island is the most important high tide roost for waders in East Waimea Inlet (Figure 4). This area is well separated from the biosolids application area (approximately 1km) and currently suffers no disturbance impacts.

Figure 4. Part of a high tide roost of ~2,0000 Bar-tailed Godwits, Eastern End of Rabbit Island 16 October 2019. (D.S. Melville). Bar-tailed Godwit is classified as 'At Risk' by the Department of Conservation.

Nesting

The north beach of Moturoa/ Rabbit Island supports nesting Variable Oystercatchers, with up to about 20 pairs present (Ornithological Society of New Zealand, unpublished) – equivalent to about 0.89% of the world population (Wetlands International 2020). Breeding pairs mostly occur at the

western and eastern ends of the island, the centre beach area adjacent to the domain being too disturbed by recreational users for birds to nest. The number and distribution of Variable Oystercatcher pairs has changed somewhat in recent years due to changes in beach topography following storm events, and possibly as a result of increased disturbance to the western area resulting from the development of the Great Taste cycle trail.

The current setback as prescribed by the existing consent conditions of 50m from MHWS means that there is no disturbance impact from the application of biosolids on nesting Variable Oystercatchers.

Figure 5. Nest of Variable Oystercatcher. (D.S. Melville). Variable Oystercatcher is classified as 'At Risk' by the Department of Conservation.

Fernbird

Fernbird *Bowdleria punctata* ('At Risk', Robertson *et al.* 2017) was not recorded from the Waimea Inlet area during the 1999-2004 OSNZ Bird Atlas Project (Robertson *et al.* 2007), but there are populations in Delaware Bay and Wakapuaka sandflats, with occasional records from around Waimea Inlet (Moorhouse 2017, Hutzler 2018).

Hutzler (2018) surveyed the remnant manuka area on Moturoa/ Rabbit Island (North 2008) for Fernbirds in early 2018 but did not record any birds there. The only confirmed record at 15 sites around the margins of Waimea Inlet was a single bird at the O'Connor Creek delta. Hutzler (2018) ranked coastal habitats around Waimea Inlet in terms of habitat 'quality' for Fernbird – the Moturoa/ Rabbit Island site scored '2'. It appears that this is in the mid-range, but her report does not explain how the ranking was undertaken.

The Waimea Community Dam project is required to develop and implement a Biodiversity Management Plan to mitigate ecological impacts.

Condition 18 (c)
The Consent Holder shall undertake works necessary to ensure that a combined total of at least 39 hectares of land is dedicated to the active restoration of vegetation which shall comprise the following components:
a) …
b) Not less than 10 hectares of coastal duneland forest/wetland/estuarine margin restoration (mostly revegetation) on Rough and/or Rabbit Island;

The consent condition (above) allowed for works on Rough and/or Moturoa/ Rabbit Island, but it has been decided that all of the works will be undertaken on Rough Island (RMA Ecology 2019). As such there will be no potential gain in habitat for Fernbirds on Moturoa/ Rabbit Island. The manuka area (identified as 'intact coastal vegetation sequence' in Figure 2) is currently protected by a biosolids exclusion zone (Figure 1).

Birds of the plantation forests

The plantation forests support a mixture of native and introduced birds; the species composition depending largely on the age of the vegetation. Recently felled/replanted sites are used by open country birds, including Skylarks *Alauda arvensis*, and may have breeding colonies of Southern Black-backed Gulls *Larus dominicanus*. As the pines grow and a more shruby community develops birds such as Yellowhammer *Emberiza citronella*, Goldfinch *Carduelis carduelis* and Chaffinch *Fringilla coelebs* occur, while more mature plantation has Fantail *Rhipidura fuliginosa*, Blackbird *Turdua merula* and Dunnock *Prunella modularis*. There are no 'Threatened' or 'At Risk' birds occurring regularly in the plantation forest areas.

Game birds

Shooting of Pheasants *Phasianus colchicus* and California Quail *Callipepla californica* currently is permitted (on a trial basis)[2] in the eastern half of Moturoa/ Rabbit Island on three dates between late June and late August. Hunts are organised by Fish & Game New Zealand (TDC 2016).

Both species are introduced to New Zealand and occur within the plantation areas on Moturoa/ Rabbit Island. Pheasants have an extended breeding season from late July to late March, with most eggs laid October-December, while California Quail from late September to February (Heather & Robertson 2010).

The arrangements for the hunting of game birds were put in place during the current biosolids disposal regime. It could be expected that some nests may be adversely affected if biosolid spraying is conducted during the breeding season. Both species may relay if first clutches are lost, but second clutches may be smaller (Gates 1966, Leopold 1977).

The continuation of biosolids disposal should not adversely affect the current populations of these two species and the opportunities afforded for controlled hunting.

[2] The trial is up for review by TDC, but the timing is uncertain due to the current Covid-19 lockdown. For this assessment it is assumed that organised hunts will continue in future.

The New Zealand Coastal Policy statement

The New Zealand Coastal Policy Statement 2010 includes Policy 11 Indigenous biological diversity (biodiversity), which is:

To protect indigenous biological diversity in the coastal environment:

(a) avoid adverse effects of activities on:

(i) indigenous taxa that are listed as threatened or at risk in the New Zealand Threat Classification System lists;

(ii) taxa that are listed by the International Union for the Conservation of Nature and Natural resources as threatened;

16 bird species listed as 'Threatened' or 'At Risk' (Robertson *et al*. 2013) have been recorded from Moturoa/ Rabbit Island (Appendix 1).

CONCLUSION

The continuation of biosolids being applied to land at Moturoa/ Rabbit Island should not result in adverse effects on any 'Threatened' or 'At risk' bird species provided the operation is subject to consent conditions similar to those currently imposed.

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David S. Melville

30 July 2020

APPENDIX 1

CONSERVATION STATUS[3] OF BIRDS RECORDED FROM RABBIT ISLAND AND IMMEDIATE SURROUNDING AREA

THREATENED

Nationally Critical

Black-billed Gull *Larus bulleri*

Nationally Endangered

Black-fronted Tern *Chlidonias albostriatus*

Nationally Vulnerable

Wrybill *Anarhynchus frontalis*

Red Knot *Calidris canutus*

Banded Dotterel *Charadrius bicinctus*

Caspian Tern *Hydroprogne caspia*

AT RISK

Declining

South Island Pied Oystercatcher *Haematopus finschi*

Red-billed Gull *Larus novaehollandiae*

Bar-tailed Godwit *Limosa lapponica*

White-fronted Tern *Sterna striata*

Fernbird *Bowdleria punctata*

Recovering

Variable Oystercatcher *Haematopus unicolor*

Pied Shag *Phalacrocorax varius*

Naturally Uncommon

Black Shag *Phalacrocorax carbo*

Little Black Shag *Phalacrocorax sulcirostris*

Royal Spoonbill *Platalea regia*

[3] Robertson, H.A.; Baird, K.; Dowding, J.E.; Elliott, G.P.; Hitchmough, R.A.; Miskelly, C.M.; McArthur, N.; O'Donnell, C.F.J.; Sagar, P.M.; Scofield, R.P.; Taylor, G.A. 2017: Conservation status of New Zealand birds, 2016. *New Zealand Threat Classification Series 19*. Department of Conservation, Wellington. 23 p

Attachment K

RMA ECOLOGY LTD

Project No: 2020

28 July 2020

Duncan Cotterill Limited

Attention: Katherine Forward

Dear Katherine,

Moturoa/ Rabbit Island, Tasman: Assessment of lizard habitat for application of biosolids to land programme

We understand that the Nelson Regional Sewerage Business Unit (NRSBU), as the Applicant, is seeking to renew resource consents to continue to apply biosolids to land in designated application areas on Moturoa/ Rabbit Island, Tasman (the site). NRSBU has engaged Duncan Cotterill Ltd (Duncan Cotterill) to assist it with preparing an Assessment of Environmental Effects (AEE) for the overall programme.

Duncan Cotterill has sought information in regard to the quality of lizard habitat within the areas proposed to be disturbed, an assessment of the level of adverse effects that may occur on lizards, and details of how lizards will be managed if potential lizard habitat is present.

This report summarises the results of a desktop assessment for lizard habitat undertaken for the site on 24 April 2020 by Tony Payne, Senior Ecologist of RMA Ecology Ltd[1]. A site survey was not possible due to the New Zealand government's Level 4 COVID-19 restrictions.

1. Background

The biosolids operation was initiated by the NNRSBU in February 1996. Since then, treated sewage sludge (biosolids) from the Bell Island wastewater treatment plant (WWTP) has been applied to ca. 700 ha radiata pine (Pinus radiata) forestry areas on Moturoa/ Rabbit Island[2] (Figure 1). The biosolids are a by-product of sewage processing at the treatment plant. Following treatment, the biosolids are pumped to the island via a pipeline and stored in holding tanks and subsequently transported by tankers to the appropriate forestry areas, where they are then discharged via a travelling spray irrigator (Wilks & Wang 2009).

Biosolids application occurs throughout the year. Where required, restrictions are put in place on public access to certain areas and no application occurs near recreational areas during the summer months (Wilks & Wang 2009). Currently, NRSBU applies biosolids to land after harvest and prior to replanting of pines[3]. The land onto which the biosolids are applied is Crown land vested with Tasman District Council (TDC). The forestry operations are managed by PF Olsen Ltd.

[1] This report has been prepared in accordance with our instruction to proceed dated 28 April 2020.
[2] Wilks P, Wang H 2009. The Rabbit Island biosolids project. New Zealand Journal of Forestry 54(2): 33-36.
[3] Tasman DC 2008. Resource Consent RMNN940379V2. Decision on application to change consent conditions.

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2. Potential lizard habitats

Vegetation communities and lizard habitats within the proposed biosolids application area (biosolids footprint) were assessed by reviewing high-resolution aerial photographs available on Nelson City Council and TDC Top of the South maps (Figure 2).

The natural vegetation communities on Moturoa/ Rabbit Island within the biosolids footprint have been significantly modified through a long history of forestry, and are entirely novel, consisting of various successional stages of managed radiata pine forest. These include mature radiata pine, regenerating areas consisting of a weed scrub (gorse Ulex europeaus, broom Cytisus scoparius, pampas Cortaderia selloana) interspersed within young radiata pines, as well as areas of recently felled radiata pine with post-harvest slash material and weedland.

Vegetation communities on Moturoa/ Rabbit Island outside of the biosolids footprint consist of both novel and naturally occurring communities adapted to saline environments, including planted shrubland, weedland, rank grassland, specimen tree areas, and stands of mature radiata pine that fringe the outer perimeter of Moturoa/ Rabbit Island.

It is acknowledged that, in general, very little is known about the use of plantation forests by native lizards (geckos and skinks), and subsequently what the impacts of application of biosolids and rotational harvesting are on lizards.

Native lizards in the Nelson and Tasman regions are typically scattered in distribution, in low numbers, and are generally limited to skinks and ground-dwelling geckos, rather than to arboreal (tree-dwelling) geckos (see next section).

Native arboreal geckos may occupy well-established, dense vegetation in some saline areas elsewhere in the Nelson and Tasman regions (typically rural areas where environments support dense shrublands or forest) or elsewhere in NZ (where saline communities comprise large expanses of well-connected shrub communities). However, the quality of habitat at Moturoa/ Rabbit Island is poor, and the lack of records of geckos in such environments (especially from coastal areas) suggests that they are unlikely to be present at this site.

Because of their intrinsically slow population growth rates and vulnerability to introduced predators, lizards are not very good at recolonising sites after disturbance. Geckos tend to have long generation cycles and lower fecundity, so will be slower to colonise areas than skinks, even when suitable habitat is present.

By contrast, native skinks are more likely to be present on parts of Moturoa/ Rabbit Island. The presence of favoured refuge plants (e.g. pampas) as well as areas of rank grassland/ weedland, shows that possible habitat for native skinks may be present within the site. Furthermore, some of the smaller more fecund skinks, such as the Northern grass skink (Oligosoma polychroma), are better at recolonising after disturbance relative to other lizard species. However, this is a terrestrial, sunlight-requiring species, so while it may spread to some extent into new forests while the trees are very young, the habitat will not be suitable once the canopy has closed. Overall, the available habitat, and therefore the possible presence of native skinks within sites proposed for biosolids application is likely to be patchy and vary over time with harvesting cycles and as plantation forests grow.

Figure 1. Area on Moturoa/ Rabbit Island consented for biosolids application (highlighted in yellow). Image © Maxar Technologies, Google Earth. Information from Tasman DC (2016).

Figure 2. Aerial imagery illustrating vegetation communities within the proposed biosolids footprint (delineated in yellow) and exclusion zone (red area).

3. Lizard records from the site and surrounds

A total of 30 native lizard species have been recorded within plantation forests in New Zealand[4].

The national lizard, frog and tuatara database managed by the Department of Conservation (Herpetofauna) confirms records of native lizards within 200 m of the site. No lizards are recorded from Moturoa/ Rabbit Island itself, however the northern grass skink (Oligosoma polychroma), and Raukawa gecko (Woodworthia maculata) have been recorded at nearby sites in similar coastal habitats to those present within areas surrounding the biosolids footprint area, indicating that encounters with these species is possible.

Northern grass skinks have been caught at nearby Birds Island and Bell Island. Northern grass skinks can survive in a wide range of habitats, and are certain to be present within areas of rank weedland vegetation, areas of large coarse woody debris (such as pine slash), and vegetation margins on the edges of mature pine forest. It is likely that Northern grass skinks will be present within the proposed biosolids footprint, however any populations are likely to be few in numbers, and restricted to small, discrete areas where refugia is present (isolated areas of rank weedland/ grassland, logs etc). The Northern grass skink is classified as Not Threatened by DOC[5].

Raukawa gecko have been recorded from the Ruby Bay coast line. They occur on coastal sand dunes, rock outcrops boulder beaches; flaxland, kanuka and regenerating shrubland and in old-growth forest. Those habitats are not present within the proposed biosolids footprint, but do occur on the edges of Moturoa/ Rabbit Island. Our assessment is that Raukawa gecko are unlikely to be present within the proposed works area. The species is classified as Not Threatened by DOC.

While there is a paucity of records in the surrounding area of species such as glossy brown skink (Oligosoma zelandicum) and Northern spotted skink (Oligosoma kokowai), these species are within the region and occur in a wide range of habitats within coastal lowland in the open littoral zone, grassland and shrubland, however these species are not known to inhabit pine forest. Our assessment is that glossy brown skink and Northern spotted skink are unlikely to be present within the proposed works area, but may occur on the edges of Moturoa/ Rabbit Island. Glossy brown skink are classified as At Risk by DOC. Northern spotted skink are not classified by DOC, as this species was described in 2017, after the conservation status of New Zealand reptiles was published (2015). This species was previously known as Oligosoma lineoocellatum, which is classified as At Risk.

The history of past vegetation clearance, and production forestry, together with an overall lack of good quality habitat, makes it very unlikely that arboreal geckos (such as forest gecko Mokopirirakau granulatus or starred gecko Naultinus stellatus as species present elsewhere in the Nelson and Tasman regions) will be present at the site.

Lizards previously recorded in the Nelson and Tasman regions and which are potentially on Moturoa/ Rabbit Island are provided in Table 1 below.

[4] Peterson P, Hayman E 2018. Conserving indigenous fauna within production forestry landscapes. Report prepared by Manaaki Whenua – Landcare Research for Gisborne District Council.

[5] Hitchmough, R., Barr, B., Lettink, M., Monks, J., Reardon, J., Tocher, M., van Winkel, D. and Rolfe, J. 2015. Conservation status of New Zealand reptiles, 2015. New Zealand Threat Classification Series 17. 14 p.

Table 1. Lizard species that may be present within the biosolids footprint [1] Oligosoma lineoocellatum used as a surrogate classification.

Scientific Name	Common Name	Threat Status (Hitchmough et al., 2015)	Likelihood of occupying the biosolids footprint	Applicable Habitat on site (van Winkel et al., 2018)
Oligosoma kokowai	Northern spotted skink	At Risk[1]	Very low	Densely vegetated open areas with adequate groundcover such as logs, rocks or long grass.
Oligosoma polychroma	Northern grass skink	Not threatened	High	Densely vegetated open areas with adequate groundcover such as logs, rocks or long grass.
Oligosoma zelandicum	Glossy brown skink	At risk	Very low	A very wide range of habitats including densely vegetated open or sheltered areas with adequate groundcover such as logs, rocks or long grass.
Woodworthia maculata	Raukawa gecko	Not threatened	Very low	A very wide range of habitats including densely vegetated open or sheltered areas with adequate groundcover such as logs, rocks or long grass.

4. Likelihood of disturbance to lizard habitats

Biosolids are proposed to be applied to areas of plantation forest (Figure 2), but will exclude access tracks and a 50 m buffer setback from the mean high-water spring mark.

The application of biosolids within the proposed footprint is undertaken using a travelling irrigator which tracks into forestry rows and sprays a jet of biosolids from a spray gun as it retracts. The physical application of biosolids is unlikely to result in any direct adverse effects to lizards, as the level of habitat disturbance is likely to be minimal.

It is understood that the initial biosolids sludge is treated through Autothermal Thermophilic Aerobic Digestion (ATAD) which heats the sludge to high temperatures for a prolonged period. This digestion process converts sludge to class A biosolids which are suitable for application to land. The biosolids are well pasteurised and reduce pathogen levels to below those considered to pose a risk to human health.

It is also understood (from reference to the NZWAA Guidelines for the safe application of biosolids to land in NZ) that the greatest risk to biodiversity is thought to be via habitat change i.e. increased nutrients may affect vegetation, soils etc.

The NRSBU is required to monitor soils in the application area as a consent condition and results to date show no sign of adverse effects. Nickel shows elevated levels, but this is due to background concentrations of Tasman soils being nutrient rich in this element rather than a result of the biosolids application. The conclusion in the soil expert report is as follows:

“based on a review of the data collected from the broad scale consent monitoring od soils at the operation areas across Rabbit Island, we found no significant adverse effects on the overall soil quality with only a minor increase in heavy metals accumulations in the top soil which were well within the NZWAA guideline limits.”

However, biosolids can contain substances harmful to the environment and possibly to lizards. These include inorganic contaminants (e.g. metals and trace elements), organic contaminants (e.g. polychlorinated biphenyls, dioxins, pharmaceuticals and surfactants) and pathogens (e.g. bacteria, viruses and eggs of parasitic worms). The potential increase of pathogens and toxins in the environment may cause sickness or even mortalities to lizards if they are applied in high enough concentrations, and could result in the degradation of any potential

habitats; none of this has been demonstrated through field observation at other sites, however this is a potential adverse effect that should be taken into account.

In particular, biosolids application may result in the degradation of potential lizard habitat in discrete fringe areas within the biosolids footprint. The highest quality habitat for lizards has been assessed as recently felled areas containing wood slash and weedy complex cover, which adjoin the proposed 50 m buffer setback from the mean high-water spring mark. This 50 m buffer area is likely to contain the most suitable lizard habitat on Motutoa/ Rabbit Island, and therefore, there is likely to be habitat nearby to the discrete fringe areas outside of the proposed biosolids footprint which provides refuge into which lizards may naturally disperse.

In summary, the physical application of biosolids is unlikely to result in direct adverse effects to lizards, as the level of habitat disturbance is minimal, and these species are likely to naturally disperse if direct application is undertaken in areas they occupy.

5. Significance of lizard habitat loss

Overall, when considering the history of disturbance and severe environmental modification within the proposed biosolids footprint, including the application of biosolids since 1996, as well as the periodic disturbance associated with forest harvesting, it is unlikely that ongoing biosolid application within the proposed biosolids footprint will result in any significant additional loss of potential lizard habitat or populations from this area.

The potential habitat proposed to be disturbed by ongoing biosolids application has a paucity of lizard records, and lizards are most likely to occur in less disturbed areas on the Moturoa/ Rabbit Island, including the coastal margins outside of the proposed biosolids footprint.

The significance of the above adverse effects on ecological values can be assessed by considering the rarity value of the species or ecosystem being affected, and the magnitude of its loss at the local (catchment or District) level.

A standard tool used to assess significance of effects is the matrix approach as described by the Environment Institute of Australia and New Zealand (EIANZ). The EIANZ matrix approach, and the guidelines within which it is included, has been developed as a guide for ecologists undertaking effects assessments under the RMA (EIANZ, 2018[6]). The EIANZ guidelines and the impact assessment matrix in particular, provides a robust, concise and consistent approach to effects assessment, whilst ensuring that individual expert evaluation and opinion is preserved.

Table 2. Assessment of significance of ecological effects using the EIANZ matrix method.

Factor	Value of resource[a]	Magnitude of effect[b]	Level of effect[c]
Loss of potential Northern grass skink, and degradation of skink habitat	Low (is a locally and nationally common species)	Low (may have a minor effect on the local population)	Very low

[a] EIANZ matrix tables 5 and 6.

[b] EIANZ matrix table 8; measured in the context of the catchment (streams) or District (terrestrial values).

[c] EIANZ matrix table 10.

[6] Roper-Lindsay, J., Fuller S.A., Hooson, S., Sanders, M.D., Ussher, G.T. 2018. Ecological impact assessment. EIANZ guidelines for use in New Zealand: terrestrial and freshwater ecosystems. 2nd edition.

The actual or potential adverse effects on native lizard values that may result from the proposed works programme are considered to be very low (Table 2).

The loss of ecological values corresponds to a 'very low' level of effect, which under the RMA should be interpreted as a negligible ecological effect.

Despite the very low level of effect, native lizards are 'absolutely protected' under the Wildlife Act (1953, s63 (1) (c)), and a permit is usually required from the Department of Conservation (DOC) to destroy or modify habitat supporting native lizards or to engage in activities that may harm native lizards.

6. Management of lizards within habitats proposed for clearance

At this site, native Northern grass skinks may be present in some small, discrete areas proposed for biosolids application.

We understand that NRSBU has discussed this with the local office of the Department of Conservation (DOC), and received advice from DOC that a Wildlife Act permit is not required for this project as DOC regards it not necessary to relocate lizards that may be present within the biosolids application area.

We trust that this provides the information requested by Duncan Cotterill to support the Assessment of Environmental Effects for the proposed application of biosolids on parts of Moturoa/ Rabbit Island.

If you have any further questions, please contact Tony Payne on 027 807 9018 or tony.payne@rmaecology.co.nz.

Yours sincerely,

Tony Payne

Senior Ecologist[7]

RMA Ecology Ltd

28-Jul-20
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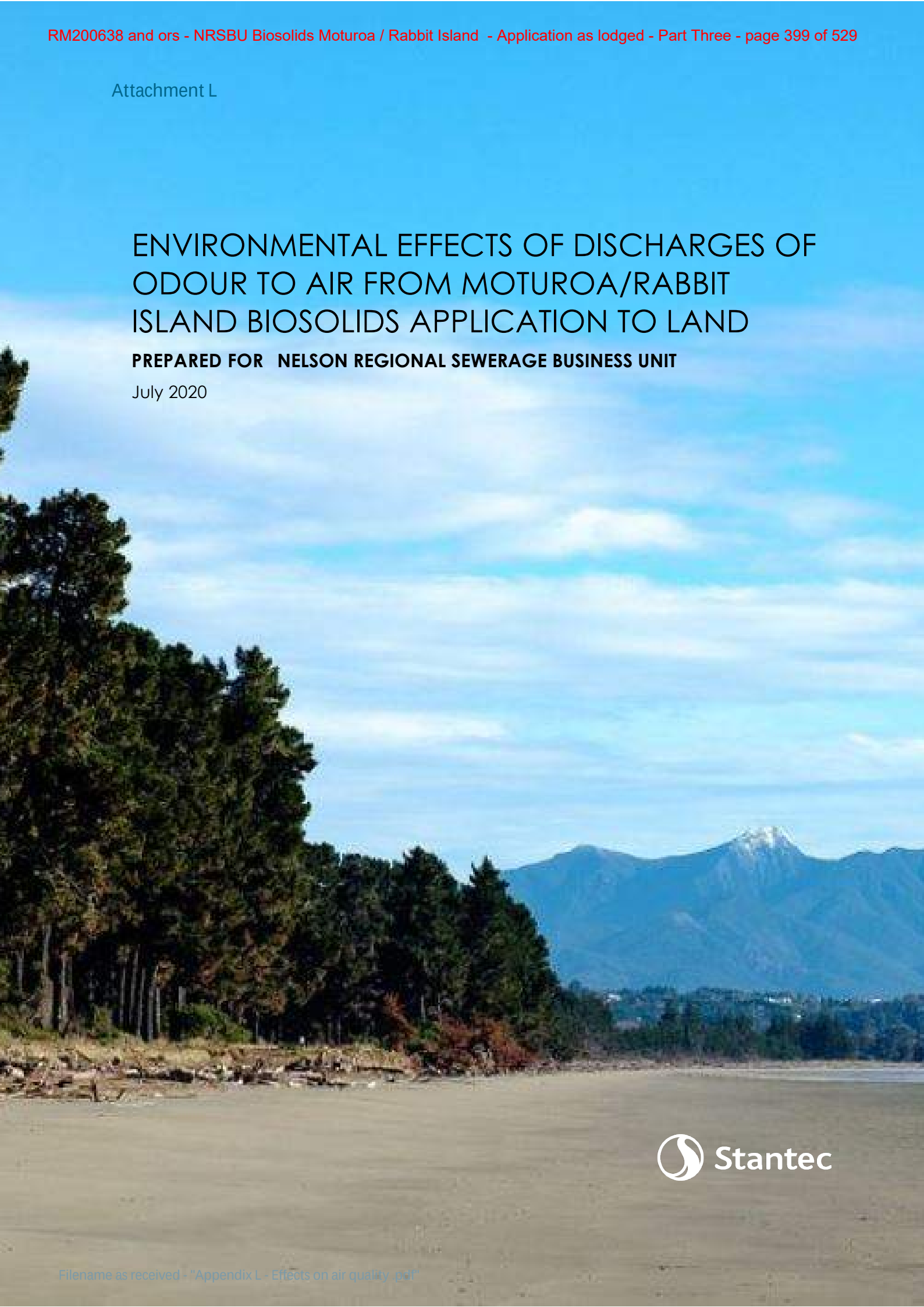
[7] This report has been prepared for the benefit of our Client with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose without our prior review and agreement. Any use or reliance by a third party is at that party's own risk. Where information has been supplied by the Client or obtained from other external sources, it has been assumed that it is accurate, without independent verification, unless otherwise indicated. No liability or responsibility is accepted by RMA Ecology Limited for any errors or omissions to the extent that they arise from inaccurate information provided by the Client or any external source.

Attachment L

ENVIRONMENTAL EFFECTS OF DISCHARGES OF ODOUR TO AIR FROM MOTUROA/RABBIT ISLAND BIOSOLIDS APPLICATION TO LAND

PREPARED FOR NELSON REGIONAL SEWERAGE BUSINESS UNIT

July 2020



Stantec

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REVISION SCHEDULE

Rev No.	Date	Description	Prepared by	Checked & Reviewed by	Approved by
1	5/5/2020	Draft Report	P Heveldt	K Halder	K Halder
2	27/7/2020	Final Report	P Heveldt	K Halder	K Halder

Executive Summary

This report discusses the procedures by which biosolids arising from the Bell Island WWTP are transported, stored and applied to land within the forested areas of Moturoa/Rabbit Island, with the underlying objective being to assess the extent of the accompanying odorous discharges to air associated with the biosolids disposal process and to consider various measures to mitigate the adverse effects of odour releases.

The geographical and topographical features of Moturoa/Rabbit Island and its location with respect to sensitive receptors who may be impacted by odour releases arising from the biosolids application facility (BAF) and application of biosolids into the forests on the Island have been reviewed and described.

The adverse environmental impacts of odour released by the biosolids application process are outlined and have been linked to the prevailing climatic conditions, principally wind speed and direction, that may carry odour plumes towards the sensitive receptor locations. The FIDOL factors, as a means to assess the impacts of odours, have been applied to qualitatively determine the impacts of the biosolids disposal activity.

The extent of odour release is linked to the initial nature of the biosolids received from the Bell Island wastewater treatment plan (WWTP). The biosolids are stored in open tanks at the BAF on Moturoa/Rabbit Island and are then transferred by tanker for application within the forest blocks on the Island. Application of biosolids augments tree growth, principally via the nitrogen content of the biosolids.

The application method has been outlined and it is beneficial that this remains flexible so that further improvements can be made where these may assist to limit odour releases but still achieve the same end results with respect to assisted growth of the forest tree stands.

The extent to which the biosolids are dispersed into aerosol droplets by the application pressure method increases the extent of odorous gases released because of the increase in exposed liquid surface area inherent in droplet formation. However, it is understood that pathogenic organisms within the biosolids are effectively eliminated, with the result that the risk to public health arising from inhalation of infectious organisms associated with the biosolids is less than minor.

As for any wastewater treatment and disposal activities, there may from time to time be emissions of odour that are experienced by sensitive receptors but these are limited in number and duration as evidenced by the limited number of complaints about odour associated with biosolids application on Moturoa/Rabbit Island since commencement of the activity in 1996.

The extent of offensive or objectionable odour arising from such events is similarly limited and the adverse effects can be adequately avoided, remedied or mitigated. Further certainty as to the ongoing effectiveness of odour management from the biosolids operation can be ensured by the adoption or presence of various additional mitigation measures, including:

- the turbulence available from forest tree cover;
- that the application method is managed to reach a balance between the extent of pressure applied to facilitate an efficient biosolids application methodology and any over-pressure which results in excessive aerosol droplet formation;
- the development of a management app to allow proactive and effectively instantaneous management of the biosolids application process with positive implications for effective odour control;
- the planned installation of covers on the holdings tanks at the BAF;
- dual travelling-irrigator kits which promote greater ability for the biosolids operation to adapt to changes in wind direction; and
- an operational commitment to not apply biosolids to those parts of the Island that are frequented by recreational users during the summer months.

The standard "no objectionable or offensive" odour condition along with a robust, detailed and regularly reviewed stand-alone Odour Management Plan (or dedicated section within the Biosolids Management Plan) are recommended as consent conditions that could be applied to the new discharge to air permit to ensure that the minor adverse environmental effects generated by the biosolids operation are reduced to less than minor over a new consent term.

Abbreviations

ATAD	Autothermal Thermophilic Aerobic Digester
BAF	Biosolids Application Facility
BMP	Biosolids Management Plan
FIDOL	[Parameters used in the assessment of odour impacts]
	F = Frequency
	I = Intensity
	D = Duration
	O = Offensiveness
	L = Location (of receptors, with respect to odour source)
MHWS	Mean High Water Springs
NRSBU	Nelson Regional Sewerage Business Unit
OMP	Odour Management Plan
TDC	Tasman District Council
WWTP	Wastewater Treatment Plant

Nelson Regional Sewerage Business Unit

Environmental Effects of Discharges of Odour to Air from Moturoa/Rabbit Island Biosolids Application to Land

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1. Introduction

1.1 Background

The application of biosolids to land in the forested areas of Moturoa/Rabbit Island, within the inner area of Tasman Bay, is a beneficial reuse of a by-product of the wastewater treatment processes at the nearby Bell Island WWTP. The biosolids have a significant positive effect on the growth of the forest trees of the Moturoa/Rabbit Island plantations and the commercial revenue generated upon harvesting these trees is a source of income for TDC and its ratepayers.

The storage and application of biosolids to land gives rise to releases of odour that, depending on pertaining circumstances and particular weather conditions, can have adverse effects on sensitive receptors. Many factors influence the extent of these adverse effects and these are both well known to and are able to be managed and mitigated by the NRSBU, in conjunction with NM Wastes (the biosolids contractor) and the appointed forestry manager.

The existing consents authorising the biosolids operation did not include a specific discharge to air permit and no conditions on the suite of consents that were granted included any considerations with respect to odour releases from the biosolids activity and/or mitigation. A new discharge to air permit is therefore being sought; this report focuses on the environmental impacts of related odour discharges, the physical parameters of biosolids application to land and the currently available and proposed mitigation measures to minimise adverse environmental effects.

1.2 Purpose and scope

This report outlines the geographical and topographical features of Moturoa/Rabbit Island and sets out its location with respect to environmental factors of relevance, particularly the locations of sensitive receptors. The factors influencing the perception of odours are also described.

The biosolids application procedure is outlined and mitigation measures available and proposed with respect to odour are evaluated. The odour complaints record held by the NRSBU has been scrutinised and the extent of complaints ascribable as probably or definitely associated with biosolids activities are discussed. Finally, the report discusses possible conditions that could be applied to the biosolids activity in the event that consent is granted.

1.3 Relevant provisions of the Tasman Resource Management Plan

The Tasman Resource Management Plan (2011) deals with discharges to air in Chapter 34. There are no detailed provisions with respect to odour management.

Policy 34.1.3.1 is a general policy requirement to ensure that any discharges of contaminants to air avoid, remedy or mitigate adverse effects on the environment; i.e.

> ***34.1.3.1*** *To ensure that any discharges of contaminants to air are undertaken in a way that avoids, remedies or mitigates any adverse effects on the receiving environment or surrounding activities.*

At Policy 34.1.3.2, the Plan sets out the policy intentions for "contaminant discharges to air" as follows:

> ***34.1.3.2*** *To allow or regulate contaminant discharges to air in relation to their actual or potential contamination effects, including:*
>
> *(a) adverse effects on human health;*
>
> *(b) adverse effects on amenity values;*
>
> *(c) contamination of adjacent sites;*
>
> *(d) degradation of water quality;*
>
> *(e) the production of objectionable, noxious or offensive odours.*

Further, Policy 34.1.3.4 "provide(s) for management of some actual and potential adverse effects of discharges to air - particularly odour and dust effects - as ancillary to land use activities, and to take them into account when resource consent applications are being considered."

Policy 34.1.3.7 requires the consideration of "other resource management techniques such as buffer areas, separation distances …." as means to manage adverse effects of air discharges, including odour.

There are no specific requirements with respect to odour from wastewater treatment activities. However, the Council's general approach to odour is clarified further at 34.1.30 in the Principal Reasons and Explanation section which provides that "the Council will consider odour and dust emissions as effects of land use activities rather than regulating them as discharges to air to avoid overlaps and to ensure the effects of the odour are considered in the context of where they occur."

This allows for the consideration of odour emissions and their management in the context of each individual odour-emitting industry or activity and provides certainty that consents for discharges of odour to air in the district will be decided on their merits and, by inference, on the proven satisfactory mitigation of adverse effects.

2. Geography/Topography and Environmental Sensitivity

2.1 Physical setting

Moturoa/Rabbit Island lies across the southernmost part of Tasman Bay. The long narrow island runs east-west for 8 kilometres and covers an area of approximately 1,100 hectares. It lies opposite the mouth of the Waimea River, 7 kilometres to the north-west of Richmond. The Island topography is typically that of a sand-based island and the land is generally flat or gently undulating, with little in the way of significant elevated areas.

The Island itself is separated from the mainland by two road bridges, the first of which provides access to the smaller Rough Island, with the access road then passing over the second bridge onto Moturoa/Rabbit Island itself. The Island can also be accessed by boat landing at its south-eastern end and the northern coastline of the Island is classed as Recreation Reserve and is vested in TDC, with free access from Tasman Bay. At the western end of the Island a ferry service provides a regular link to and from the coastal township of Mapua.

The greater part of Moturoa/Rabbit Island is accessible during daylight hours for recreational users and the Island is a key recreational amenity for many people in the Nelson and Tasman regions.

2.2 Sensitivity of the receiving environment

The nearest area of residential development to Moturoa/Rabbit Island is the environs of Mapua township to the immediate north-west and across a short channel about 300m in width.

The residential enclave on Best Island lies to the south-east of the nearest coast of Moturoa/Rabbit Island, immediately south-west of Bell Island and of the WWTP in particular. The Best Island residential area is about 950m from the Bell Island WWTP infrastructural facilities (and slightly closer to the facultative ponds) and is approximately 1,800m from the nearest point of Moturoa/Rabbit Island.

The relative positions of the sensitive receptor populations can be seen in Figure 1 and the prevailing wind directions, as shown diagrammatically in Figure 2, are from the south and south-west and the north and north-east respectively.

Figure 1: Moturoa/Rabbit Island and Environs

Besides the occupants of permanent residences in the Best Island and Mapua areas there are groups of recreational users of Moturoa/Rabbit Island, such as mountain bikers, walkers and beach goers who are also potentially impacted by odour releases from the biosolids application process. The physical demarcations on the Island, including signage, public notices and barriers restrict public access to those areas of the Island where biosolids are applied. The existing consent conditions also require the biosolids operator to maintain clear exclusion and buffer zones which effectively separate recreational users from close contact with the biosolids application activities. It is understood however that the prescribed setbacks from public areas are not specifically aimed at mitigating any odour impacts, as opposed to providing for the health and safety of people on the Island at times when biosolids are being applied to land.

In fact, the short distances of the buffer zone extents will have little effect on the mitigation of odour nuisance in terms of separating the odour source from the susceptible visitors to the Island. It is important to note in this context that the odour complaints record (see section 8) contains no instances of complaints from recreational users of Moturoa/Rabbit Island.

This in itself provides some qualitative evidence that odour associated with biosolids application to the forests on Moturoa/Rabbit Island is limited in extent and adverse effects, although the fact that recreational users on the Island can generally vacate the area where they may be being exposed to offensive or objectionable odour may contribute to the lack of odour complaints from this potentially affected group.

3. Odour as an Environmental Issue and Factors that Affect Odour Emissions and their Dispersion

3.1 The nature of odour and its evaluation

The perception of an odour arises when odorous air is breathed in through the nose and stimulates the human olfacto-sensory system. Knowing the identities of the individual chemical components of an odorous emission gives only limited information about the likely offensiveness and/or intensity of any particular odour. This is because the components may interact with each other in unpredictable ways, and there may be many individual odorous components.

The factors that contribute to the overall evaluation of an odour nuisance are the so-called FIDOL factors, where:

- F refers to the frequency of odour impact;
- I to the intensity;
- D to the duration of exposure;
- O to the extent of offensiveness; and
- L to the location of the nuisance, having regard to the sensitivity of the receiving environment.

There is no simple formula which can be used to weight the potential contribution of each of these factors to the overall perceived nuisance created by an odour. Thus short, irregular bursts of strong odour may well be less annoying than lengthy exposure to odours of lower intensity.

The subjective and sensory nature of odour means that it cannot conveniently be assessed by measurement using an instrument. Odorous air must in fact be "sniffed", and its character delineated using the FIDOL factors.

3.2 Odour assessment using the FIDOL factors at Moturoa/Rabbit Island

In New Zealand, the typical means of conducting a semi-quantitative assessment of odour nuisance via the FIDOL factors is by applying the "no offensive or objectionable odour" yardstick. The success of this method of odour assessment in deciding the acceptability or otherwise of an odour emission has resulted in its nationwide adoption as the arbiter of

odour nuisance, to the extent that it is typically the primary condition with respect to odour in essentially all discharge to air consents in New Zealand (where odour is an issue).

The prevailing meteorological conditions at a site and in the environs of an odour-emitting process or facility are critical matters that help to determine the true source of an odour nuisance (if more than one source may be implicated) and to confirm the veracity of complaints received. In the Nelson area, the prevailing wind directions are from the north and north-east and the south and south-west.

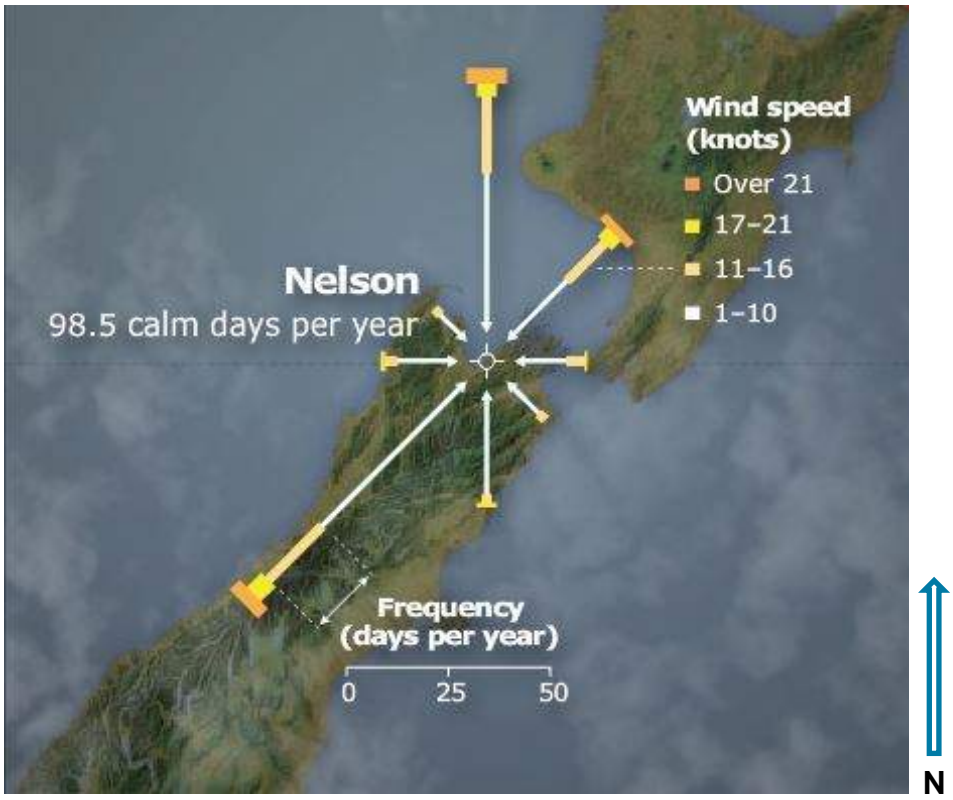

Figure 2: Indicative Windrose for Nelson

Winds from the north-westerly or westerly quarters are relatively infrequent (see Figure 2), although it is these winds that are most likely to disperse an odorous plume arising from biosolids disposal on Moturoa/Rabbit Island in the direction of the sensitive receptors on Best Island.

The adverse impacts of odour depend on a wide variety of physical, chemical and environmental factors and the similarly widely varying responses of impacted humans as receptors of odour emissions. These factors are outlined in the following sections as they relate to the propensity of odour released by the biosolids application process and they are further linked to the prevailing climatic conditions, principally with respect to wind speed and direction, that may carry odour plumes towards the sensitive receptor locations.

These sensitive receptor locations listed above at section 2.2 have the potential to be impacted by odour releases arising from the application of biosolids emanating from the Bell Island WWTP to the forested areas of Moturoa/Rabbit Island.

3.3 Proactive odour management and the standard odour control condition

Individual perceptions of an odour can vary significantly among an exposed group. This variation is typically based on a combination of factors including differences in individual

sensory perceptions, distances from the odour source, and interactions with or interferences from other odour-producing activities or industries. In the latter context, in the general vicinity of the Moturoa/Rabbit Island biosolids application activities we have the Bell Island WWTP itself, a local meatworks plant, a fruit processing premises, the Nelson Pine Industries facility and several other commercial/industrial activities that may, from time-to-time, give rise to odours that themselves may be described as offensive or objectionable. The proximity to the tidal estuary of the Waimea Inlet may also result in odours from the regularly exposed seabed, shellfish beds, seaweeds, algae and similar materials.

The great majority of air discharge consents for New Zealand WWTPs, and also for downstream WWTP processes such as sludge disposal to landfill or, as in this case, to forest, incorporate the standard "no offensive or objectionable odour" condition as the fundament arbiter of the acceptability of a plant's odour discharges. There has been debate about the assessment of the extent of "offensiveness", or how "objectionable" should be judged; these debates follow from the subjective nature of odour and its different psychological and/or physiological perception by individuals that have been noted in section 3.1 of this report.

However, as discussed later in this report, an effective strategy that is widely adopted in New Zealand to manage the adverse effects of odour arising from wastewater treatment processes, including disposal of the biosolids stream, consists of the standard "no offensive or objectionable odour" condition as the key compliance yardstick. In most cases this condition is backed up by a detailed, robust and regularly reviewed/updated Odour Management Plan (OMP) that sets out the key parameters that must be in place, both physical measures and management strategies, to reduce odour emissions to levels that are less than minor.

3.4 Applying the FIDOL factors to odour at Moturoa/Rabbit Island

In most instances, either specifically or by inference, the judgement of degree of offensiveness or whether an odour is indeed objectionable is made by a compliance officer of the regulatory authority, with this sometimes being added as a rider to the fundamental "no offensive or objectionable odour" condition. In making such an assessment, the compliance officer should rely heavily on the FIDOL factors as the yardsticks of odour acceptability.

Considering the applicability of the FIDOL factors to odour emissions from the Moturoa/Rabbit Island biosolids application, we know from the complaints record (discussed in detail in section 8) that the frequency of odour complaints that have definitely been ascribed to biosolids application activities on the Island is limited, and certainly is considerably less than the number of complaints attributed to the immediately adjacent Bell Island WWTP. Similarly, the intensity of odours definitely linked to biosolids application to the forests on Moturoa/Rabbit Island, as judged from the odour complaints record, has generally been described as slight or moderate at worst.

As to duration, the evidence is less clear because the complaints record is limited. It is however apparent that odours from biosolids application are not long-lasting events; this could be related to quite rapid absorption by the applied biosolids into the sandy soils of the Island or, more likely, the effective dispersion of odour releases by turbulence induced in air flows by the forest trees.

As for the other FIDOL factors, the degree of offensiveness is not obvious from the complaints record, although anecdotal evidence suggests that the odours from the biosolids can indeed be described as offensive. The location of the actual odour releases is of course the general environs of Moturoa/Rabbit Island but, from the viewpoint of the application of the FIDOL factors, the location relates to where on the Island the biosolids application activity is being undertaken (i.e. proximity to sensitive receptors, screening

and turbulence created by surrounding forest trees, prevailing wind direction, actual distance from the receptors, etc).

3.5 A consolidated approach to odour management

Wastewater treatment and by-product disposal processes, if properly managed, operated and monitored, can co-exist with their neighbours in a way that leaves the "no offensive or objectionable odour" yardstick as an available backstop that need not be activated, particularly where best management practices are adopted.

In practice, the essentially qualitative approach of the FIDOL factors to odour assessment, intervention and control works well and can clearly be applied with good effect to the odours experienced from the biosolids operation on Moturoa/Rabbit Island. It is however a much-preferred regime if operators of an inherently odorous process themselves take a proactive stance on odour monitoring and ensuing action, rather than acting retrospectively after public complaints and subsequent direction from a compliance officer.

This is exactly the approach proposed for the application of biosolids to the forestry blocks on Moturoa/Rabbit Island. While in past years the odour control steps have been included in the Biosolids Management Plan (BMP) as effectively a quasi-Odour Management Plan, it is now proposed that all relevant odour management should be consolidated within a web-based app that sets out the critical decision-making and operational steps that are essential to effectively and proactively manage odour prior to, during and following biosolids application on Moturoa/Rabbit Island. This is described further in section 6.

Most wastewater treatment and disposal facilities in New Zealand are operated in a manner that, for the most part, achieve the "no offensive or objectionable odour" condition. There are of course exceptions and most operations will, at one time or another, have experienced operational aberrations that have led to odour emissions that are not in compliance with the industry standard condition. The objective must be to reduce these instances of non-compliance to as low a threshold as possible. As discussed above, this is achieved through a combination of pro-active management, continuous monitoring of critical processes, upgrading and maintenance of equipment, and liaison with facility neighbours.

The key is to manage the risks effectively by operating in accordance with best practice, applying consistent and robust operational criteria and utilising check-lists that are incorporated within an OMP, along with open communication with sensitive receptors. This OMP can be, as in this case currently, subsumed within the BMP or, to good effect, it can be a stand-alone document which gives odour management a higher profile and serves as a strong indication of the importance placed on managing odour to the greatest practicable extent.

4. Nature of Biosolids for Application to Land and Relevance to Odour Emissions

4.1 Nature of the biosolids

The biosolids for application to land on Moturoa/Rabbit Island are the by-product of the process known as Autothermal Thermophilic Aerobic Digestion (ATAD).

The Moturoa/ Rabbit Island Consent Application – Biosolids Process Alternatives Assessment, prepared for the NRSBU by Beca Limited, May 2020, concludes that the existing ATAD process achieves the pathogen and VAR requirements of Grade A biosolids as per the "Guidelines for the safe application of biosolids to land in New Zealand", published by Water New Zealand in 2003 (NZ Biosolids Guidelines 2003) and Class A biosolids as defined by the US EPA as required under the existing consent conditions.

This has important ramifications for the potential adverse effects of aerosolised droplets generated during application of biosolids when these are disposed, under pressure, in the forests on Moturoa/Rabbit Island.

The solids content of the biosolids for application to land is between 3% and 4% and it is appropriate therefore to consider the biosolids as a liquid.

4.2 Odour in relation to biosolids application management

While the biosolids leaving the ATAD unit at the Bell Island WWTP are in an aerobic condition the nature of the digestion process does generate odorous and soluble gaseous components. The transfer of biosolids by pumping to the holding tanks at the Biosolids Application Facility (BAF) on Moturoa/Rabbit Island is an enclosed process. However, once discharged into the open-topped tanks at the BAF, the biosolids must be kept stirred and mobile to prevent anaerobic conditions from developing. It Is understood that the NRSBU intends to fit covers to the storage tanks in the near future (see section 5 below). It is considered that this will mitigate the potential for odour emissions from the BAF facility which, in any case, is located within an enclosed forest clearing that is not accessible to the general public (i.e. there are no nearby sensitive receptors to the BAF facility).

For the purposes of biosolids application to land it is necessary to prohibit public access to areas where application is taking place. Biosolids application areas are identified on a rotational basis to meet the operational needs of the forest management operations and the nutrient requirements of the trees. The application areas vary accordingly. At all times there will be parts of the Island that are off limits to the public where biosolids are being applied. These prohibited areas are clearly designated, with physical barriers and signage at key access points (for example, forestry roads) in place as a further deterrent to entry. Public access is restricted to all plantation forestry reserve land on Moturoa/Rabbit Island.

A BMP has been prepared by the NRSBU (the latest version, dated 2017, is currently being updated) and this sets out the various parameters referred to above including the biosolids application procedures, the pre- and post-application checks that are to be carried out, the necessary signage that must be displayed, setbacks from public access areas, exclusion and buffer zones, various check sheets that set out the procedural steps that must be adhered to, and a variety of other matters pertaining to biosolids application procedures that ensure minimum environmental impacts.

In practice it appears that the constraints on use of relatively small parts of the Island at varying times do not cause undue concern to recreational users who are generally well aware and accepting of these access restrictions.

As noted in section 2 of this report, the extents of the buffer zones are generally too limited for these to act as any sort of mitigation of odour impacts on recreational users of the

Island. The fact (as discussed in section 8) that there have been no recorded complaints about odour associated with biosolids operations from recreational users suggests that either the odour impacts are limited or that people are on the Island for a relatively short time and so nuisance impacts are not experienced – or it may be a mix of both of these factors.

The biosolids provide essential nutrients to enhance tree growth and their application to land within the forests on Moturoa/Rabbit Island is a beneficial reuse of a by-product of the wastewater treatment process. The trees themselves, besides their value as a timber resource, also have a positive and important environmental effect by helping, via the turbulence induced in wind flows across the Island, to disperse odours released during the application of biosolids into the forest undercover.

5. Description of the Biosolids Application Procedure

5.1 Outline of the current procedure

Odour is released from two components of the current biosolids operation that have the potential to generate such emissions; these are the storage of biosolids in open tanks at the BAF on Moturoa/Rabbit Island and the application of biosolids to land via a pressurised boom on the existing heavy-duty travelling irrigator kit. This report considers the risk associated with each of these odour sources.

5.2 Biosolids storage and transfer to the application area

There is limited capacity for biosolids storage at the Bell Island WWTP and therefore transfer to the holding tanks at the BAF on Moturoa/Rabbit Island is an important operational necessity. It is understood that the NRSBU is in the process of increasing the volume of each of the holding tanks as a contingency measure to ensure that, in the future, buffer storage volumes are available. It is intended that the holding capacity of each of the four storage tanks will be increased by 50% by raising the sides. This will not result in an increase in odour emissions however as the exposed liquid surface areas will remain the same.

There are at present no covers on any of the four tanks, although these are intended to be provided in the near future. It is also intended to extract air from beneath these covers, once in place, and treat this air in an adjacent biofilter which is to be designed and installed as a further part of the upgrade measures proposed.

It is noted that the BAF is not an area that can be accessed by the general public. Any odour emanating from the currently open-topped tanks is local in its effect and will be rapidly dispersed by turbulence generated within the surrounding forest trees.

The biosolids are transferred from the tanks into purpose-built tankers and conveyed to the pre-selected forestry block location where application will take place.

Figure 3: General view of Biosolid Application Facility (BAF)

5.3 Application of biosolids within the forestry blocks and implications for odour

The biosolids are applied via a pressurized boom which directs jets of liquid biosolids into the tree stands on either side of the travelling irrigator application vehicle (see Figure 4). A more detailed description is given within the AEE but, with respect to odour emissions, the critical factor is the potential generation of aerosolized droplets that occurs when the liquid biosolids are expelled under pressure from the applicator nozzle.

Fine aerosols can travel with the wind and their combined surface area as a total sum over all droplets represents a great increase over the surface area of the bulk liquid itself. Thus, emissions of odorous gases from the droplet surfaces are likely to be significantly enhanced. In the current application method, a balance is struck between pressurization of the biosolids stream to project the liquid over a suitable distance to reach the adjacent trees and, on the other hand, adjusting the pressure so that too fine a spray is not produced. Thus, the droplet sizes produced under the current application method are much larger than mist droplets and this limits their spatial distribution and, in turn, the odour impacts of the pressurized application method.

As previously noted, the tree canopy and foliage will create turbulence to assist mixing and dilution and will also act as an effective barrier to travel of the aerosolized droplets.

Key available mitigation measures are therefore the selection of forestry blocks for biosolids application that take careful account of prevailing weather conditions (especially wind direction and speed), the turbulence and associated mixing and

accompanying dilution that are generated by air currents within the forest tree stands, and the application of biosolids in a "fresh" (i.e. non-anaerobic) state.

Figure 4: Travelling irrigator for biosolids application within a stand of trees on Moturoa/Rabbit Island

Management of the biosolids operation in strict accordance with the BMP, including the requirement to exclude the public from operational areas and to operate with all best practice contingencies, is critical to ensuring that the biosolids are applied with an overriding approach of mitigating adverse environmental effects, in particular odour.

As already discussed, the NRSBU proposes to consolidate all steps related to effective mitigation of odour emissions from the application process into an OMP. This will either be a stand-alone document or may be included as a separate section within the BMP.

5.4 Alternative biosolids application regimes

The NRSBU is investigating alternative approaches to biosolids application and several methodologies are under consideration. Many factors are in play, including the critical requirement that the application rate achieved must be as close as possible to the optimum to maximise forest tree growth.

Different application methods are being investigated with one aim of these being to reduce the extent of aerosolization of the biosolids and thus the release of odours.

It is emphasised that these alternative methods are only in the trial stages at present and there is at present no decision on whether any alternative method of application is viable, given the number of complex variables involved. However, the search for alternatives illustrates a commitment from the NRSBU towards continuous process improvements that will both mitigate odour emissions and improve the biosolids application regime for the ultimate benefit of the forest tree crop.

6. Odour Mitigation Measures

6.1 Beneficial effects of turbulence provided by forest trees

It is important to retain screening trees as much as possible at the margins of Moturoa/Rabbit Island to continue to provide the mitigation afforded by wind-induced turbulence with respect to odour emissions. Notwithstanding the beneficial effect the trees have on odour mitigation, it is inevitable that, from time to time, particular blocks reach maturity and, for economic reasons and often for overall forest health, those trees must be harvested. Careful management is required to maintain some screening by retaining bands of trees while also maximizing the economic returns to be had from the harvested tree crop.

Even in blocks that are some distance from the margins of Moturoa/Rabbit Island the felling of tree stands can make a significant difference by opening up the cut-over areas to the influences of prevailing winds, with the associated potential for odour dispersion without adequate turbulent mixing occurring.

As can be seen in Figure 5 there are a significant number of forestry blocks on the Island that are affected by exclusion and buffer zones adjacent to reserves, public access ways, archaeological sites and around the coastal margin of Rabbit Island. This adds to the complexity of selecting the sequence of blocks for harvesting and increases the difficulty of ensuring, as much as possible, that adequate screening for odour mitigation via tree-induced turbulence is maintained.

Figure 5 provides details about the age of the various blocks, the area of each, the tree type planted (almost entirely *pinus radiata* but with a small stand of eucalypts adjacent to the Moturoa/Rabbit Island Domain) and, by inference based on a 28 year maturity cycle, the approximate year they are likely to be harvested. The areas currently awaiting replanting are also delineated, as are the various sites of archaeological importance, koiwi sites, reserves and other places of interest.

In particular, the map in Figure 5 shows those areas on the southern margin of Moturoa/Rabbit Island where screening stands of trees are still in place and the several areas where recent harvesting has been carried out. It appears that Blocks 10/02, 10/03 and 10/04 may be coming due for harvesting. This will need to be managed with care.

Communication between the forest manager (PF Olsen), the NRSBU and the biosolids contractor is critical to ensure that block selection for biosolids application and harvest consider potential environmental effects. Regular monthly meetings between the parties provide a forum for discussion and forward planning.

In accordance with the resource consent conditions for Bell Island, the NRSBU is required (in collaboration with the Bell Island Stewardship group) to develop a restoration planting programme which will incorporate planting on the perimeter of Bell Island with suitable species to provide permanent stands of screening trees that will assist to mitigate effects on Best Island residents and will further create conditions to mix and disperse odour emissions from the biosolids disposal activities. The most appropriate type(s) of trees is currently under consideration but, in any event, these will not be felled at any point and will provide a dependable extent of turbulent air flow for odour dispersion.

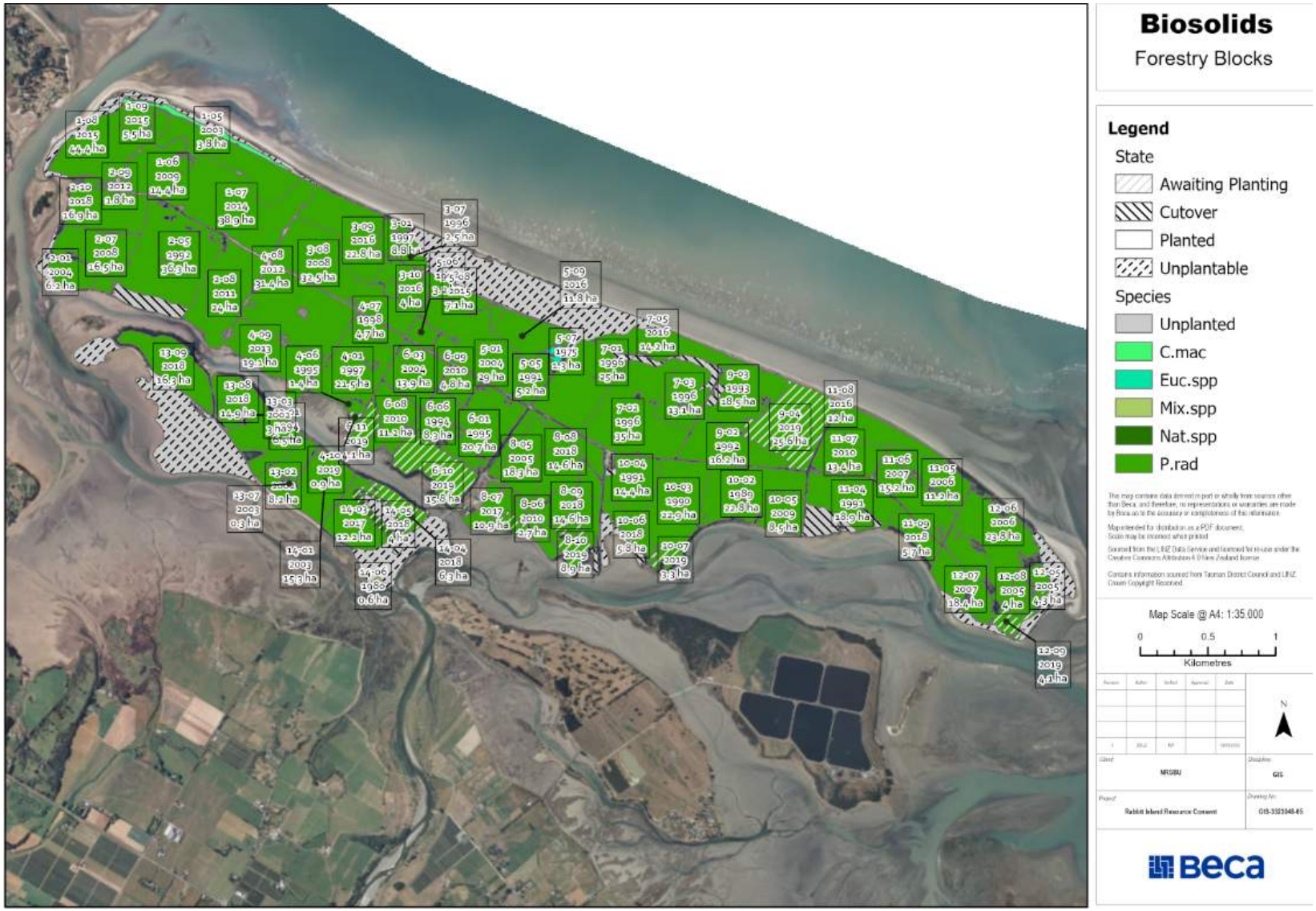

Figure 5: Forestry Management Map for Moturoa/Rabbit Island

6.2 Environmental impacts of aerosols formation and their mitigation

As described earlier the operational characteristics of the ATADs at the Bell Island WWTP result in elimination of pathogens that pose a risk to human health within the biosolids. Thus, aerosol generation, while an inevitable consequence of the pressurized process for application of biosolids on Moturoa/Rabbit Island, will not give rise to droplets that contain pathogens. There is therefore no concern with respect to the potential distribution of pathogenic organisms associated with biosolids within Moturoa/Rabbit Island and beyond the Island's boundaries.

Depending on the pressure of application and the rate of discharge of the biosolids stream from the applicator nozzle, the extent of the formation of aerosols can be controlled to an optimum level; this is the approach adopted in the detailed biosolids application methodology within the BMP and the contractor is continually investigating variations on the application method to further reduce aerosols formation, along with various other improvements.

The current biosolids operation has been running for 24 years using the same application methodology and the contractor has mastered the balance of factors required for efficient application. However, there are always improvements that can be made to optimise environmental outcomes – specifically odour mitigation. The development of an app to manage block selection is an example of the NRSBU proactively seeking out ways to run the biosolids operation more efficiently and to minimise the potential for adverse effects.

6.3 The development of an app to facilitate optimum biosolids application

NRSBU is currently developing an application (app) which will incorporate an extensive list of individual parameters relevant to decision-making about biosolid application, including block selection in particular. This matrix of parameters will include weather information for the day (both real-time and predicted), the application sites (forestry blocks) available for biosolid application, relevant exclusion and buffer zones, time of year, rainfall, distance to nearest sensitive receptors and site status from a forest perspective (i.e. tree age and size). The intent is that the app will interrogate this mix of factors and select the most appropriate site for biosolids application on that day.

Such an approach will reduce subjectivity in the decision-making process and provide a track record of application over time. It will also allow the correlation of biosolids application against odour events to prove or disprove causation and will facilitate a more direct and rapid intervention to cease or adjust the application process.

Once a set of data has been built up over time it would be prudent to review the app, its success in mitigating adverse effects from the biosolids application process and to make any improvements to input parameters that will ensure the ongoing applicability of the tool as an aid in effective, efficient and non-intrusive biosolids application on Moturoa/Rabbit Island.

Stantec supports this initiative to develop a management app for the biosolids application process and considers it to be an important tool with respect to biosolids odour mitigation.

7. Miscellaneous Discharges to Air

The travelling irrigators which are used to apply the biosolids within the forested areas of Moturoa/Rabbit Island are diesel-powered, as are the associated pumps. The discharges to air from the diesel engines and pumps are considered to have less than minor effects on local qir quality for the following reasons:

- The discharges to air are limited under normal operation;
- The discharges occur within forestry blocks in a relatively remote location on Moturoa/ Rabbit Island; and
- Turbulent mixing is available to effectively disperse the combustion products of diesel fuel that are emitted to air.

There are no other discharges to air from the biosolids disposal process.

8. Odour Complaints

8.1 Comments on the complaints record with respect to odour

The complaints records held by NRSBU and by Tasman District Council covering the past three years have been scrutinised in an attempt to obtain an understanding of the extent and nature of complaints about odour, their description (as and where available) and the certainty that the biosolids disposal process is the definite cause of the odour event that elicited the complaint. The TDC complaints process is to record each complaint (but not the relevant details of location, nature or odour, etc) and refer the complaints directly to NELMAC (the wastewater treatment plant site operator) for individual investigation. The TDC complaints record is therefore of little use for this complaints analysis and must be read in conjunction with the NRSBU's own internal records.

Analysis of the NRSBU's odour complaints records shows that, since January 2018 and up to March 2020;

- A total of 33 individual complaints have been received that can be definitely ascribed to odour from the Bell Island WWTP and associated activities.
- Of these 33 complaints a total of 13 complaints were "probably" linked to biosolids application.
- For five of these 13 cases, biosolids application on Moturoa/Rabbit Island was "definitely" the source of the odour complaint.
- Three complaints over the analysis period do not have a cause assigned and one complaint was investigated and found to be related to rotting marine vegetation in the Monaco estuary.

As can be seen, confirmed complaints about odour associated with biosolids application on Moturoa/Rabbit Island are relatively limited in number, certainly as compared to complaints more confidently ascribed to odour from the immediately adjacent Bell Island WWTP.

It is notable that the NRSBU's odour complaints records are punctuated by doubt about the precise cause of many of the individual odour events. Investigation of these events has also often not been able to ascertain a conclusive source of odour. In a considerable number of cases, staff from the WWTP contractor NELMAC sent to investigate a complaint have established that the Bell Island WWTP itself was in fact the actual source of an odour that had initially been described as being "likely to be from biosolids disposal" on Moturoa/Rabbit Island.

While the first desire of the complainants is to have each odour event eliciting a complaint rectified as soon as possible, correct identification of the odour source is of fundamental interest and concern to the biosolids disposal contractor. This knowledge is of great

importance to the focus of mitigation but also to the adjustment of internal protocols that are aimed (inter alia) at minimising odour nuisance from the biosolids operation.

With the proposed improvements to biosolids application management in place, as outlined in section 6, the limited number of complaints about biosolids-related odour ought to reduce further and can provide a high level of certainty that the proposed fundamental consent condition of "no offensive or objectionable odour" can be achieved. This condition will be supported by a comprehensive and regularly updated OMP.

It can be fairly concluded that, in the past, the biosolids application process has on occasion, been inaccurately blamed as being the source of odour events when the evidence (including with respect to wind direction at the time and the lack of actual biosolids application taking place) means that biosolids application is in fact unlikely to have been the reason for the observed odour nuisance.

It is of interest that, as per the NRSBU's odour complaints record which notes the name and location of complainants, there have been no recorded odour complaints from recreational users of Moturoa/Rabbit Island. This may simply reflect the fleeting nature of exposure of these individuals.

8.2 The complaints process and ensuing responses

Complainants may make odour complaints directly to the NRSBU (which are then passed on to NELMAC, as the contractor operating the Bell Island WWTP) or to TDC (who then pass these directly to NRSBU/NELMAC for further action). At present it appears that the procedure for specific complaints about biosolids disposal activities on Moturoa/Rabbit Island is also to lodge these with the NRSBU who in turn pass these to NELMAC for investigation. Due to the competing interests of the two operators the complaints procedure would benefit from NRSBU being the point of contact for the TDC rather than NELMAC. The NRSBU could then be responsible for making the requisite enquiries of both operators, investigating the likely source of any odour emission and ensuring any operational adjustments required are undertaken promptly.

8.3 Summary of the complaints record and its implications for ongoing odour management

It is clear that complaints about odour from biosolids application activities are generally limited and that the preparation of an OMP, either as a stand-alone document or placed within the overarching BMP, will be a sound initiative to apply to an activity that, until now, has not had such a formally constituted blueprint for odour management.

The OMP, when coupled with the proposed "no offensive or objectionable odour" compliance yardstick, will in combination create a strong platform to consolidate and further improve odour management with respect to biosolids application within the forestry blocks on Moturoa/Rabbit Island.

The NRSBU is proactive and has of its own initiative taken steps to minimise the effects of odour from its operations i.e. not spraying certain areas close to the Domain Reserve in summer months, purchasing two travelling irrigator kits for biosolids application to better manage changes in wind direction, and undertaking upgrades at the BAF such as covering the biosolids storage tanks.

It is intended that, going forward, the regular meetings with Best Island residents, as required by a condition in the suite of consents for the Bell Island WWTP, can be utilised as an open forum for residents to discuss all NRSBU operations, including the application of biosolids to the forestry blocks on Moturoa/Rabbit Island.

8.4 Complaints table

The following table sets out those complaints received over the past three years that have definitely or probably been identified as having arisen from the biosolids disposal process on Moturoa/Rabbit Island.

Date	Wind Direction	Wind Speed (km/hr)	Location of Complainant	Comments	Follow-Up
7/1/ 2019	NE	20 – 24	Best Island	[This complaint is a consolidation of five individual complaints about the same event received on the same date] Doubt about exact source of odour; NELMAC operator on Bell Island considered the WWTP was not the source and that the odour was from biosolids disposal on Moturoa/Rabbit Island	Biosolids disposal contractor advised of complaints
13/2/2019	NE	10	Best Island	Operators attended the complainant's house and identified the odour as coming from the Moturoa/Rabbit Island biosolids activities. It could not be confirmed whether this was from the application process or the storage tanks. NRSBU's contracted odour scout confirmed the odour was coming from Moturoa/Rabbit Island	Moturoa/Rabbit Island Biosolids Biosolids disposal contractor advised of complaint
9/8/ 2019	Wind change from NE to SW	7	Best Island	Strong odour from Bell Island WWTP ATAD. On the NW perimeter of Bell Island there was a slight smell of biosolids emanating from Moturoa/Rabbit Island	No action was taken with respect to biosolids disposal
30/12/2019	SSW, changed to N	10 – 20	Best Island	Assessment by the NRSBU's contracted odour scout was carried out. A faint odour was experienced on the eastern end of Bell Island. The odour was described as being "more like that from biosolids rather than the WWTP ponds". However, the spreading of biosolids on the eastern side of Moturoa/Rabbit Island had ceased by then and so no aerosols would have remained airborne to potentially release odours.	It was noted that "Moturoa/Rabbit Island biosolids tanks are due north from Best Island" – presumably assumed to be evidence that the odour experienced was from biosolids disposal activities. It is not clear what if any further action was taken
4/2/ 2020	NW	48	Best Island	No odours could be detected anywhere at the Bell Island WWTP. In lieu of any other apparent cause or source it was concluded that the odour must have been from Moturoa/Rabbit Island biosolids disposal activities.	Moturoa/Rabbit Island biosolids "spray yard" was specifically mentioned as the presumed source but no evidence for this conclusion was put forward.
21/2/2020	NW	25 – 30	Best Island	Assumed to be from biosolids storage facility on Moturoa/Rabbit Island – because no Bell Island WWTP-related source could be identified.	"Likely to be from Moturoa/Rabbit Island storage yard"
24/2/2020	NW	15	Best Island	Assumed to be from Moturoa/Rabbit Island biosolids disposal – but no further evidence put forward	"Likely to be from Moturoa/Rabbit Island storage yard"
25/2/2020	NW	15	Best Island	Assumed to be from Moturoa/Rabbit Island biosolids disposal – but no further evidence put forward	"Likely to be from Moturoa/Rabbit Island storage yard"
27/2/2020	NW	Not recorded	Best Island	Complained about the smell on Moturoa/Rabbit Island from spreading of biosolids	"Likely to be from Moturoa/Rabbit Island storage yard"

Note: No complaints ascribable to biosolids disposal on Moturoa/Rabbit Island were recorded throughout 2018
Also, no complaints from any location other than Best Island appear in the odour complaints record

Table 1: Odour Complaints Associated with Biosolids Disposal at Moturoa/Rabbit Island

9. Comments on Possible Consent Conditions

The standard "no offensive or objectionable odour" condition is suggested as the proposed basis of possible conditions to be placed on the discharge to air consent being sought as part of the current suite of applications. The Ministry for the Environment's "Good Practice Guide for Assessing and Managing Odour" (2016) suggests that the standard odour condition should include the words "no noxious, dangerous, offensive or objectionable" as adjectives to describe the nature of odours.

Stantec does not agree with this suggestion and believes that any reference to "noxious" and/or "dangerous" as words describing odour relate more to toxicity matters than to any measures by which the degree of nuisance caused by an odour can be realistically assessed. We therefore favour a simple "no offensive or objectionable" condition, with the yardstick of what truly constitutes "offensive or objectionable" being decided by application of the FIDOL factors, as discussed in section 3 of this report. This was the argument advanced during the Bell Island WWTP Hearing; it was supported by the Commissioners hearing that application and was duly reflected in the relevant adopted consent condition.

It is usual to add "beyond the boundary of the subject site" to this standard condition to establish its spatial applicability. In this context therefore it would be appropriate to consider "the boundary of the site" to be the coastline of Moturoa/Rabbit Island at Mean High Water Springs (MHWS).

In consent conditions that seek to mitigate odour emissions and, particularly, their adverse effects it is best practice to include the need for a formal OMP in some form. As discussed above, this could be a dedicated section in the BMP, or be a stand-alone document. Whatever its format it should set out in detail those aspects of biosolids disposal that may give rise to odour releases if particular physical or management processes are not followed. Typical aspects that are usually included in an OMP include:

- A detailed description of the activities that may give rise to odour emissions, including discussion of the individual processes, equipment or plant elements and their function
- A statement of the consent conditions with respect to odour management so that compliance requirements are explicit
- On-site odour monitoring requirements and any boundary surveys necessary to confirm the continuation of compliance
- All management procedures relevant to odour control (the BMP would provide these)
- Contingency measures to deal with plant malfunctions and maintenance requirements
- Staff responsibilities and training
- A complaints procedure, including actions on receipt of complaints and associated reporting requirements
- Provisions for review of the OMP

Stantec has considered the possible value of setting up a meteorological station on Moturoa/Rabbit Island to provide data to supplement the management of biosolids disposal activities but we believe that utilizing the information now available from the recently installed station at the Bell Island WWTP, particularly with respect to wind speed and direction, will provide a satisfactory set of data that is applicable to the weather conditions on Moturoa/Rabbit Island, given that it is only 1km away. The newly established station will thus be a suitable proxy and no consent condition with respect to establishing a meteorological station is considered necessary.

The usefulness of the "odour scout" concept for the investigation of odour complaints thought to be emanating from biosolids disposal activities on Moturoa/Rabbit Island has been considered by Stantec. It is not clear that such an approach would serve any useful purpose in this case, given that the biosolids application into the forestry blocks on Moturoa/Rabbit Island has been undertaken for the past 24 years and has elicited only a limited number of odour complaints during that time.

However, consideration could be given to utilising the odour scout concept already in place for odour complaints from the Bell Island WWTP on a limited basis for assessing odour nuisance from biosolids disposal on Moturoa/Rabbit Island. Monthly odour monitoring by the scout could take place at defined locations at the Boat Ramp on Moturoa/Rabbit Island, at the nearest point on the Greenacres Golf Course land to Moturoa / Rabbit Island and at a specific location on Ken Beck Drive near the south-eastern shoreline.

Notwithstanding this suggestion of regular monitoring by an odour scout, if the current management regime via the procedural steps detailed within the BMP, supplemented by an included (or possibly stand-alone) OMP, is maintained and the standard "no offensive or objectionable odour" condition is adopted as the yardstick of compliance with respect to odour, then the biosolids application activity can be continued with adverse environmental impacts from odour remaining at acceptably low levels.

10. Summary and Conclusions

This report discusses the procedures by which biosolids arising from the Bell Island WWTP are transported, stored and applied to land within the forested areas of Moturoa/Rabbit Island. The underlying objective is to establish the extent of the accompanying odorous discharges to air associated with the biosolids application process and to consider various measures to mitigate the adverse effects of odour releases.

The key sensitive receptors who may be impacted by odour releases arising from the application of biosolids into the forests on the Island are the recreational users of Moturoa/ Rabbit Island (although the odour complaints register identifies no complaints from this group), Mapua residents during easterly and south-easterly winds (again the odour complaints register identifies no complaints from this group), and the Best Island residents although winds from the north-westerly or westerly quarters are relatively infrequent.

The adverse environmental impacts of odour have been outlined in relation to odours released by the biosolids application process and have been further linked to the prevailing climatic conditions, principally with respect to wind speed and direction, that may carry odour plumes towards the sensitive receptor locations. Based on the limited complaints history, and the successful operation of the biosolids activity over a 24-year period with an exemplary environmental record, the adverse effects of odour emissions from the activity can fairly be described as minor.

As for any wastewater treatment and disposal activity, there may from time to time be emissions of odour that are experienced by sensitive receptors; however, these are generally limited in number and duration. The extent of offensive or objectionable odour arising from such events is similarly limited and the adverse effects can be adequately avoided, remedied or mitigated.

The application method has been outlined and it is beneficial that this remain flexible so that further improvements can be made where these may assist to limit odour releases but still achieve the same end results with respect to assisted growth of the forest tree stands.

Further certainty as to the ongoing effectiveness of odour management from the biosolids activity can be assured by the NRSBU developing the proposed OMP, which will be supplemented by the adoption of various additional mitigation measures, including:

- Active management of the application method to reach a balance between the extent of pressure applied to facilitate an efficient biosolids application methodology and any over-pressure which results in excessive aerosol droplet formation;
- The development of a management app to allow proactive and effectively instantaneous management of the biosolids application process with positive implications for effective odour control;
- The planned installation of covers on the holdings tanks at the BAF;
- Dual travelling-irrigator kits which promote greater ability for the biosolids operation to adapt to changes in wind direction; and

- An operational commitment to not apply biosolids to those parts of the Island that are frequented by recreational users during the summer months.

Complaints about odour associated with biosolids application on Moturoa/Rabbit Island are limited, particularly as compared to complaints more confidently ascribed to odour from the immediately adjacent Bell Island WWTP.

The standard "no objectionable or offensive" odour condition along with a stand-alone OMP (or section within the BMP) are recommended as conditions that could be applied to the discharge to air consent.

In summary, provided the above measures are adopted Stantec considers that the minor adverse environmental effects generated by the existing operation will result in circumstances where the adverse effect of odour emissions from the biosolids activity will be less than minor.

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Please visit **www.stantec.com** to learn more about how Stantec design with community in mind.

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Attachment M

Moturoa/Rabbit Island: Application of biosolids to land

Appendix J: Public health risks

Prepared for Nelson Regional Sewerage Business Unit

July 2020

Prepared by:
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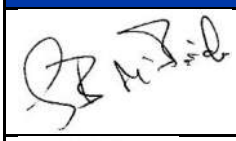
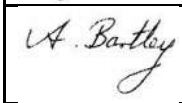
Quality Assurance Statement		
	Reviewed by:	Graham McBride
	Formatting checked by:	Alison Bartley
	Approved for release by:	Michael Bruce

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Executive summary

The Nelson Regional Sewerage Business Unit (NRSBU) is responsible for the treatment and disposal of wastewater at the Bell Island wastewater treatment plant (WWTP), jointly owned by the Nelson City Council (NCC) and Tasman District Councils (TDC). The treatment process includes management and treatment of biosolids derived from the wastewater treatment process. Since 1996, stabilised biosolids derived from the Bell Island WWTP have been sprayed onto plantation forestry on Moturoa/Rabbit Island using customised equipment. The resource consent that allows this activity to proceed subject to conditions under the Resource Management Act 1991 (RMA) expires on 8 November 2020. NRSBU wishes to renew the resource consent for biosolids application to land.

NIWA was engaged to assess the human health risks arising from the application of stabilised biosolids to forested areas on Moturoa/Rabbit Island. After considering previous hydrodynamic modelling of the Waimea Inlet, review of routine monitoring of river inflows to Waimea Inlet and of seasonal recreational data, we found:

Contaminants entering Waimea Inlet are transported in a west-east direction, and contaminants entering groundwater, as a consequence of land application of biosolids on Moturoa/Rabbit Island, have the potential to impair water quality at the Moturoa/Rabbit Island Main Beach and Back Beach sites. We found no evidence of contamination from this source at the Main Beach or Back Beach sites, a result which is consistent with that suggested by the hydrogeological assessment and the assessment of ecological effects.

Recreational water quality at these two sites is generally good to very good:

- the Main Beach site has the highest recreational water quality ("very good") in the Nelson-Richmond area (of the sites assessed), and
- recreational water quality at the Back Beach site is likely to be influenced by the Waimea River, but despite this influence, is of similar quality to that at Monaco Beach and Tahunanui, Nelson.
- Under typical conditions, health risks range from:
  - "no observable adverse effect level" (Main Beach site) to
  - 1–5% gastrointestinal illness risk, 0.3–1.9% acute febrile respiratory illness risk at the Back Beach site (consistent with "good" recreational water quality);
  - although the potential exists for influence by the discharge of treated wastewater from Bell Island, the available recreational data does not indicate such impact.

The biosolids applied to land on Moturoa/Rabbit Island are subject to Autothermal Thermophilic Aerobic Digestion (ATAD). The process heats and maintains the biosolids at approximately 65 °C for a 14-day period; although this is not pasteurisation in terms of the New Zealand Guidelines for the Safe Application of Biosolids to Land in New Zealand 2003 ("NZ Biosolids Guidelines 2003"), these conditions are highly likely to consistently meet the Grade A characteristics for biosolids. The long stabilisation process appears to produce biosolids of a consistent or uniform nature, evidenced by relatively uniform (generally very low) concentrations of pathogenic organisms over time:

- Concentrations of key viral pathogens are less than the analytical limit of detection, and meet the relevant guideline value (NZ Biosolids Guidelines 2003).
- Recent *E. coli* concentrations have consistently met the guideline, and measurable effect on coastline water quality is very unlikely.
- *Salmonella* concentrations are consistent and low (<10 MPN/g), but the sensitivity of the analytical test do not allow us to determine whether the recommended guideline value is being met.
  - This is not considered a serious limitation – several international studies have indicated that *Salmonella* have similar sensitivity to elevated temperatures as *E. coli.*
- Protozoan cyst concentrations (*Giardia* and *Cryptosporidium*) are likely to be reduced substantially through the stabilisation process, but no "before" data exist to assess removal efficacy, and no guideline value exists for assessment.
  - This is not considered a serious limitation – several international studies have indicated that concentrations of protozoa are likely to be reduced substantially through the stabilisation process.

From the data and information available, we conclude that the application of stabilised biosolids to forests on Moturoa/Rabbit Island have not had a measurable effect on coastal microbial water quality and that this activity does not create a detectable risk to recreational water users in Waimea Inlet or southern Tasman Bay.

The biosolids applied to the forest have a low solids content and are applied using coarse nozzles at relatively low pressure. The stream of biosolids travels up to approximately 25 m during application, suggesting a small proportion of aerosol formation. The biosolids treatment process, and relatively large droplet size combine to reduce the potential for inhalation of pathogens. The public is further protected from exposure to material applied to the forest by erection of physical barriers and signage, and through the use of buffers and setbacks from application areas. As a consequence, and despite absence of quantifiable information, we consider the risks to public health arising from inhalation of materials derived from the biosolids to be less than minor.

Opportunity exists to improve the available information to ensure that the low health risk is maintained and can be demonstrated more frequently.

- There is opportunity to analyse samples of shallow groundwater over a relatively short period as a discrete survey to demonstrate that very low concentrations of Faecal Indicator Bacteria exist in groundwater that will ultimately discharge into coastal waters.
- More frequent monitoring of the stabilised biosolids is warranted, to make monitoring consistent with what is identified in the NZ Biosolids Guidelines 2003; these recommend at least weekly sampling of *E. coli* in Grade A biosolids.
- Measurement of *Campylobacter* could be considered – it is one of the primary causes of reported food-borne illness in New Zealand, and as such is recognised in the NZ Biosolids Guidelines 2003 guidelines with a concentration value. I note that

measurement of *Campylobacter* in terms of the guidelines applies only to Grade A biosolids where product verification following process change is required, or where non-compliance of routine samples occurs.

- Although guideline values are not provided for protozoan pathogens, consideration could be given to assessment of before and after stabilisation samples, to demonstrate the efficacy of the stabilisation process. This too could be undertaken as a short-duration discrete survey.

Several of these recommended actions are incorporated in draft consent conditions, which were also reviewed. The timing, frequency and selection of variables proposed for monitoring are appropriate. The information that will be derived from the monitoring proposed in these draft conditions is likely to directly minimise health risks arising from application of biosolids to land.

1 Introduction

The Nelson Regional Sewerage Business Unit (NRSBU) is responsible for operating the Bell Island wastewater treatment plant (WWTP), jointly owned by the Nelson City Council (NCC) and Tasman District Councils (TDC). A consent to discharge treated wastewater from the plant was recently granted.

Sludge derived from the WWTP is stabilised in digesters at the WWTP and the resultant biosolids are pumped to the Biosolids Application Facility (BAF) on Moturoa/Rabbit Island, north of Bell Island. The biosolids are stored temporarily in tanks at this facility prior to being sprayed onto plantation forestry on Moturoa/Rabbit Island. Specially modified trucks, tankers and spray units are used for this purpose. These activities are subject to the conditions of a resource consent, granted under the Resource Management Act 1991 (RMA). This consent (NN940379V31) – issued by TDC in 1995– expires on 8 November 2020. NRSBU wishes to renew the resource consent for biosolids application to land.

Scope of work

NIWA was engaged by NRSBU to undertake a technical assessment of actual and potential effects of the application of biosolids to land at Moturoa/ Moturoa/Rabbit Island on public health. Specific tasks would include:

- Preparation of an independent technical report on public health effects in accordance with industry good practice and RMA requirements, considering and assessing the following:
  - Relevant industry guidelines, including but not limited to “Best Management Practices for Applying Biosolids to Forestry Plantations in New Zealand” (Scion 2010), and “Guidelines for the Safe Application of Biosolids to Land in New Zealand” (NZWWA 2003).
  - Proposed biosolid application rates, exclusion zones, buffer zones as required to appropriately manage public health effects.
  - Relevant monitoring requirements.
  - Other tasks on an as required basis to include assisting the project team through the pre consenting engagement stage and guidance on appropriate consent conditions, particularly in relation to any change required to existing exclusion areas and buffer zones.

It was anticipated that this assessment would draw on the findings of the water and air quality workstreams, and existing Bell Island WWTP consenting work. Several approaches exist for undertaking this work, including a Quantitative Microbial Risk Assessment (QMRA) modelling exercise. Given that the proposed activity is considered to have less than minor effects on public health, the QMRA approach was considered excessive, and a more qualitative approach was followed, making use of relevant existing data and information.

2 Materials and methods

The following technical reports were reviewed:

- "Best Management Practices for Applying Biosolids to Forestry Plantations in New Zealand" (Scion 2010).
- "Guidelines for the Safe Application of Biosolids to Land in New Zealand" (NZWWA 2003), "Bell Island Wastewater Treatment Plant: Quantitative Microbial Risk Assessment" (McBride 2017).
- Reports arising from previous QMRA studies, including "Quantitative Microbial Risk Assessment for Waimea Inlet, Nelson: Sewer pump station overflows" (Hudson and McBride 2017), "Quantitative microbial risk assessment for Waimea Inlet, Nelson. Spatial assessment of risk" (Hudson and Wadhwa 2017), and "Waimea Inlet: microbiological water quality context" (Hudson 2017).

Features associated with wastewater treatment and biosolids management are shown in Figure 2-1.

Selected freshwater quality data derived from recreational water quality monitoring by TDC and NCC were retrieved from the LAWA data base for seven sites. Details of these data are summarised in Table 2-1.

Table 2-1: Selected freshwater water quality monitoring sites. The location of these sites is indicated in Figure 2-2. Data derived from the LAWA database.[1]

Site	Start date	End date	No. *E. of coli* results
Bor Ck d/s Queen St	20/01/2009	4/12/2018	61
Jenkins Ck at Pascoe St	9/02/2004	2/12/2018	92
Neimann Ck u/s Lansdown	7/07/2013	4/12/2018	41
Orphanage Ck. at Saxton	9/02/2004	2/12/2018	91
Poorman Ck at Seaview R	9/02/2004	2/12/2018	91
Reservoir Ck d/s Salisbury Rd	16/05/2004	4/12/2018	78
Waimea River @ SH60	9/05/2004	4/12/2018	111

Water quality data derived from recreational water quality monitoring by TDC and NCC were retrieved from the LAWA data base for five sites.[1] Details of these data are summarised in Table 2-2.

[1] Dr Carlos Campos , Cawthron Institute, email Fri 17/04/2020 16:09

Table 2-2: Selected freshwater recreational water quality monitoring sites. The location of these sites is indicated in Figure 2-2.

Site	Start date	End date	No. of enterococci results
Mapua Leisure Park Beach	21/11/2016	24/02/2020	94
Monaco Beach	28/11/2016	22/03/2020	88
Moturoa/Rabbit Island at Main Beach	21/11/2016	24/02/2020	86
Moturoa/Rabbit Island, Back Beach	4/12/2017	29/12/2019	23
Tahunanui Beach	28/11/2016	22/03/2020	90

Consent-related data associated with sludge and biosolids derived from the Bell Island WWTP and the Moturoa/Rabbit Island Biosolids Application Facility were retrieved from the internal NRSBU database and provided by Tonkin & Taylor.[2] Details of these data are summarised in Table 2-3.

Table 2-3: Moturoa/Rabbit Island WWTP – selected biosolids monitoring results.

Pathogen	Units	Start date	End date	No. of samples
Adenovirus (presumptive)	(MPN/4 g)	20/11/2014	27/11/2019	22
Cryptosporidium	(CS rec, %)	20/11/2014	27/11/2019	22
Giardia	(CS rec, %)	20/11/2014	27/11/2019	22
Enterovirus (presumptive)	(PFU/4 g)	20/11/2014	27/11/2019	22
Escherichia coli	(MPN/g)	20/11/2014	27/11/2019	22
Faecal coliforms	(MPN/g)	20/11/2014	27/11/2019	22
Helminths	(ova/4g)	20/11/2014	27/11/2019	22
Salmonella	(MPN/g)	20/11/2014	27/11/2019	22
Total coliforms	(MPN/g)	20/11/2014	27/11/2019	22

Geospatial analyses and spatial presentation of data was undertaken using QGIS v3.10.4.

Data were analysed using Systat v13.2 for Windows, which was also used for calculating summary statistics and preparation of graphs.

Box and whisker plots generated using Systat are used to summarise datasets according to specific conventions. An example plot which explains the specific conventions used by Systat is shown in Appendix A.

Systat generates percentiles according to several user-selected methods; the method of Tukey ("Cleveland percentiles") are used in this assessment – these are identical to the Hazen method recommended in the MfE recreational guidelines (MfE/MoH 2003), and used in providing guidance regarding the National Objectives Framework (McBride 2016).

[2] Mr Jeremy Bennet, Tonkin & Taylor, email Thu 16/04/2020 10:16

Figure 2-1: Moturoa/Rabbit Island and wastewater treatment related sites.

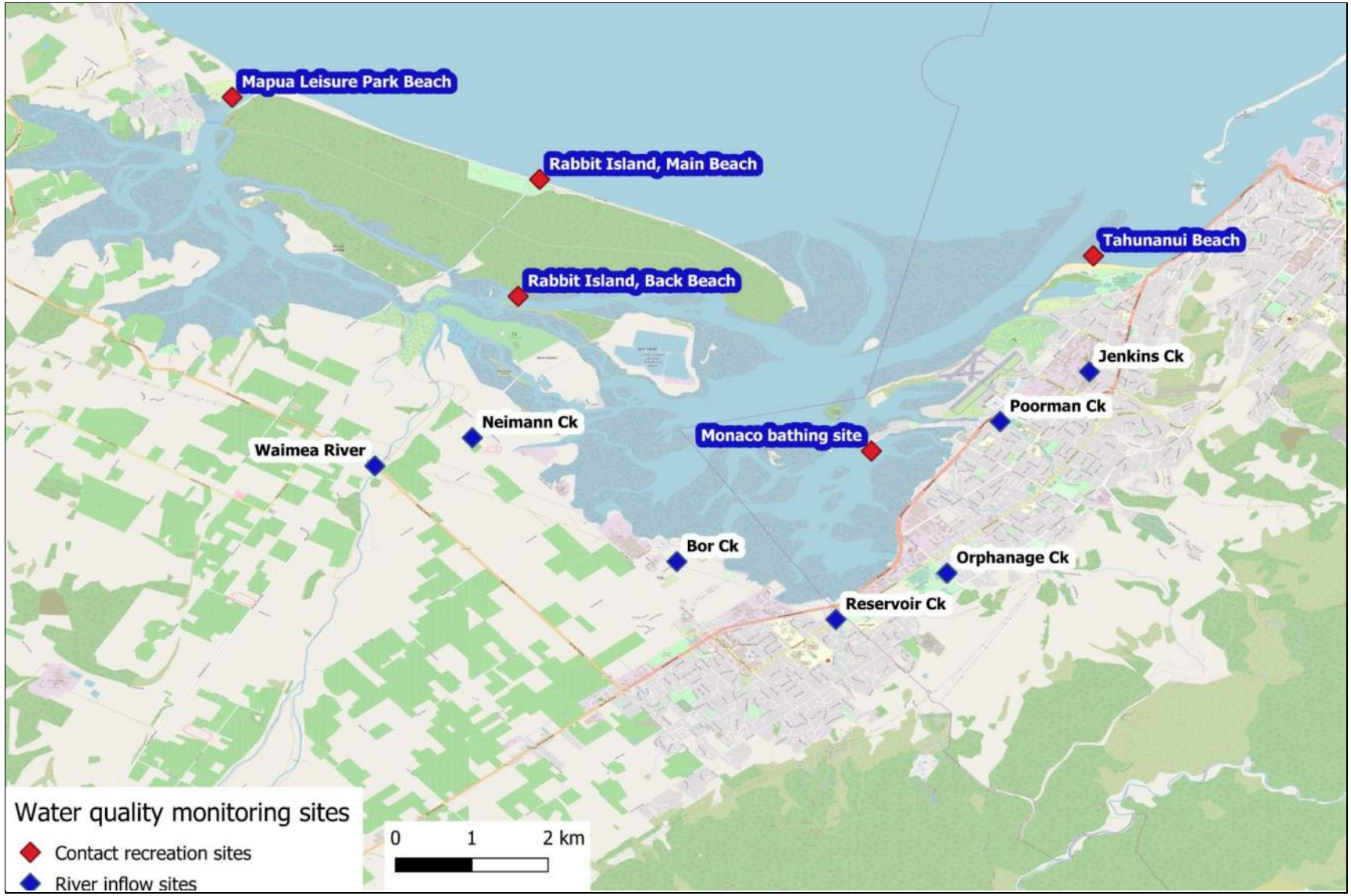

Figure 2-2: Recreational water quality monitoring sites and river monitoring sites.

3 Human health risk assessment and microbial contaminants of concern

Risk assessment is applied to a diverse range of activities, including workplace health and safety, the design of structures, the planning and operation of space missions. Despite the diversity of these activities, several common factors need to be considered, and are provided here as definitions to guide the reader:

- **Hazard** - anything (e.g., work materials, equipment, methods, practices or activities) that has the potential to cause harm. In this case, the hazard is a treated wastewater derived by-product, namely biosolids.
- **Risk** - the chance, high or low, that somebody may be harmed by the hazard. Risk is sometimes defined as **chance + hazard + exposure + consequence**, or "the likelihood of identified hazards causing harm in exposed populations in a specified time frame, including the severity of the consequences".[3] By its nature, risk is probabilistic and estimating risk requires the development of quantitative information.
- **Risk assessment** - the process of evaluating risks to individual safety and health arising from the hazards. It is a systematic examination of all aspects of an activity that considers:
  - what could cause injury or harm
  - whether the hazards could be eliminated, and if not
  - what preventive or protective measures are, or should be, in place to control the risks.

Human health risks arising from exposure to microbial contaminants during recreational activities are generally assessed using recreational bathing monitoring programmes. The Ministry for the Environment and Ministry of Health "*Microbiological Water Quality Guidelines for Marine and Freshwater Recreational Areas"* (MfE/MoH 2003) (MfE/MoH Guidelines) provide guidance regarding establishment and operation of recreational water quality monitoring programmes, and when interpreting the results derived from monitoring. Monitoring recreational water quality generally relies on use of faecal indicator bacteria (FIB) – enterococci is favoured in saline waters.

The MfE/MoH Guidelines are quite clear, however, that they should not be used under several circumstances or for specific purposes:

1. "to directly determine water quality criteria for wastewater discharges because there is the potential for the relationship between indicators and pathogens to be altered by the treatment process. The relationship between indicator bacteria and disease-causing bacteria, viruses and protozoa in the discharge needs to be established" (p 3).
2. "to assess the microbiological quality of water that is impacted by a nearby point source discharge of treated effluent without first confirming that they are appropriate …… when

[3] http://qmrawiki.canr.msu.edu/index.php/Quantitative_Microbial_Risk_Assessment

planning the location and degree of treatment for wastewater treatment plants to recognise that the guideline values are not necessarily a guarantee of safety" (p 3).

3. during periods of "exceptional circumstances", such as when there is a major outbreak of a potentially waterborne disease in the community, and where that community's sewage contributes microbiological contaminants to receiving waters (p D9).

When the circumstances or conditions prevail, alternate methods are required to assess human health risks arising from possible exposure to pathogens. These risks may be calculated using Quantitative Microbial Risk Assessment (QMRA) techniques, as explained hereafter.

QMRA is a framework and approach that brings information and data together with mathematical models to describe or predict the spread of microbial agents through environmental exposures and to characterise the nature of the adverse outcomes. Although most microbes are harmless or beneficial, some are extremely dangerous – these are termed pathogens or Biological Agents of Concern (BAC). Although these have the potential to cause serious or fatal illness, they differ greatly in their physical characteristics, movement in the environment, and process of infection. These characteristics and the differences between potential pathogens are considered in the risk assessment process, to ensure that appropriate "model" pathogens are selected to assess human health risks.

Although this report is a qualitative assessment rather than a QMRA, it is helpful to explain the requirements for undertaking a QMRA, including data regarding receiving environment conditions and the choice of pathogens to justify why a qualitative assessment is preferred in this instance.

3.1 Microbial contaminants of concern

To select appropriate pathogens we first need to consider the water-related diseases that may arise. Microbiological water quality guidelines developed both in New Zealand (MfE/MoH 2003) and internationally (WHO 2003) are based on investigations indicating that risks associated with wastewater-contaminated water comprise two types of infection and illness:

4. Gastrointestinal disease, via ingestion during recreational water-contact, and consumption of raw shellfish flesh.

5. Respiratory ailments, via inhalation of aerosols formed when water-skiing, surfing or by nearby breaking waves.

Table 3-1 lists potential waterborne diseases and their aetiological agents (i.e., pathogens), derived from the ANZECC guidelines (ANZECC & ARMCANZ 2000). This list is consistent with those likely to be encountered in sewage sludge and biosolids (Arthurson 2008; Romdhana et al. 2009; Al-Gheethi et al. 2018).

Table 3-1: Screening of treated wastewater-borne microorganisms of public health significance.

Pathogen	Include?	Main disease caused	Rationale
Bacteria			
Campylobacter spp.	No	Gastroenteritis	Poor survival in seawater
Pathogenic *E. coli*	No	Gastroenteritis	Low concentration expected in treated wastewater
Legionella pneumophila	No	Legionnaires' disease	No evidence of environmental infection route
Leptospira sp.	No	Leptospirosis	Low concentration expected in treated wastewater
Salmonella sp.	No	Gastroenteritis	Low concentration expected in treated wastewater
Salmonella typhi	No	Typhoid fever	Rare in New Zealand
Shigella sp.	No	Dysentery	Low concentration expected in treated wastewater
Vibrio cholerae	No	Cholera	Rare in New Zealand
Yersinia enterolitica	No	Gastroenteritis	Low concentration expected in treated wastewater
Helminths			
Ascaris lumbricoides	No	Roundworm	Rare in New Zealand
Enterobius vernicularis	No	Pinworm	Low concentration expected in treated wastewater
Fasciola hepatica	No	Liver fluke	Rare in New Zealand
Hymnolepis nana	No	Dwarf tapeworm	Rare in New Zealand
Taenia sp.	No	Tapeworm	Rare in New Zealand
Trichuris trichiura	No	Whipworm	Rare in New Zealand
Protozoa			
Balantidium coli	No	Dysentery	Low concentration expected in treated wastewater
Cryptosporidium oocysts	No	Gastroenteritis	Likely to be removed by wastewater treatment processes
Entamoeba histolytica	No	Amoebic dysentery	Rare in New Zealand
Giardia cysts	No	Gastroenteritis	Likely to be removed by wastewater treatment processes.
Viruses			
Adenoviruses	Yes (SW only)[4]	Respiratory disease[5]	Very infective. Significant concentrations may be present in wastewater
Enteroviruses	Yes (SW and SF)	Gastroenteritis	Less infective, but health consequences can be more severe than for exposure to adenovirus
Hepatitis A virus	No	Infectious hepatitis	Minimal concentration in treated wastewater; very infective. Can affect recreational water users in contaminated waters
Noroviruses	Yes, exploratory only (SW & SF)	Gastroenteritis	Increasing evidence of its prevalence in treated wastewater. Clinical trials and dose-response now available. However, it hasn't been possible to culture in the laboratory until now.[6] This makes assessment of treatment efficacy problematic.
Rotavirus	No	Gastroenteritis	Limited evidence of waterborne infection in NZ; infection in children would be of concern.[7] Difficult to translate units used in clinical trial (Focus Forming Units, FFU, Ward et al. 1986) to those used in culture methods.

In general terms, for sites impacted by WWTPs processing well-treated human-derived wastewater (e.g., Mangere WWTP), there is widespread agreement that human viruses are the principal aetiological agent causing gastrointestinal disease among water users and consumers of raw shellfish (Lodder and de Roda Husman 2005; Sinclair et al. 2009).[8] More information regarding candidate viruses is included in Table B-1.

When considering risks from exposure to biosolids derived from wastewater plants treating human wastes, it is appropriate that viruses should be considered as infections agents, as well as other pathogens.

3.2 Guidance documents

The "Best management practice guidelines" (Scion 2010) indicate the importance of treating municipal biosolids adequately before land application, but note that treatment efficacy is variable. Some of these processes are described as "……effective at reducing …. pathogens (such as *E. coli*, *Giardia intestinalis* and *Salmonella……*".

The "Guidelines for the Safe Application of Biosolids to Land in New Zealand" (NZWWA 2003) relate the level of treatment to the microbial guideline concentrations that should be achieved in the treated biosolids. Measured concentrations are discussed in section 4.3; here we list the pathogens identified in the guidance document: *E. coli*, *Campylobacter, Salmonella spp.*, enteric viruses, and helminth ova. For a quantitative risk assessment, typical measured concentrations of these (and other candidate pathogens) should be considered.

3.3 Conventional QMRA modelling

A typical QMRA consists of five basic steps:

A. Selection of the hazard(s), i.e., the pathogen(s) of concern—exposure to which can give rise to illness.

B. Assessment of exposure to the pathogen(s) at key sites (in terms of pathogen concentrations and duration of exposure).

C. Characterisation of human response to pathogen dose (creating suitable dose-response curves).

D. Calculation of the health risk (in terms of infection and/or illness).

E. Communication of health risk, identifying appropriate response and mitigation actions.

Several components associated with or required for steps A-E are described in the schematic in Figure 3-1.

[4] "SW" = swimming; "SF" = shellfish.
[5] Adenoviruses can also cause pneumonia, eye infections and gastroenteritis.
[6] A new culture-based method has recently been published—Jones et al. (2014): http://www.ncbi.nlm.nih.gov/pubmed/25378626.
[7] Rose & Sobsey (1993) have documented a rationale for concern about potential contamination of shellfish by rotavirus, but risk appears to have been over-estimated (they equated FFU with actual numbers of virions).
[8] This is not necessarily true for agricultural wastes in rural settings, where bacteria and protozoa predominate—with few exceptions (hepatitis E, some rotaviruses), animal viruses are not pathogenic to humans.

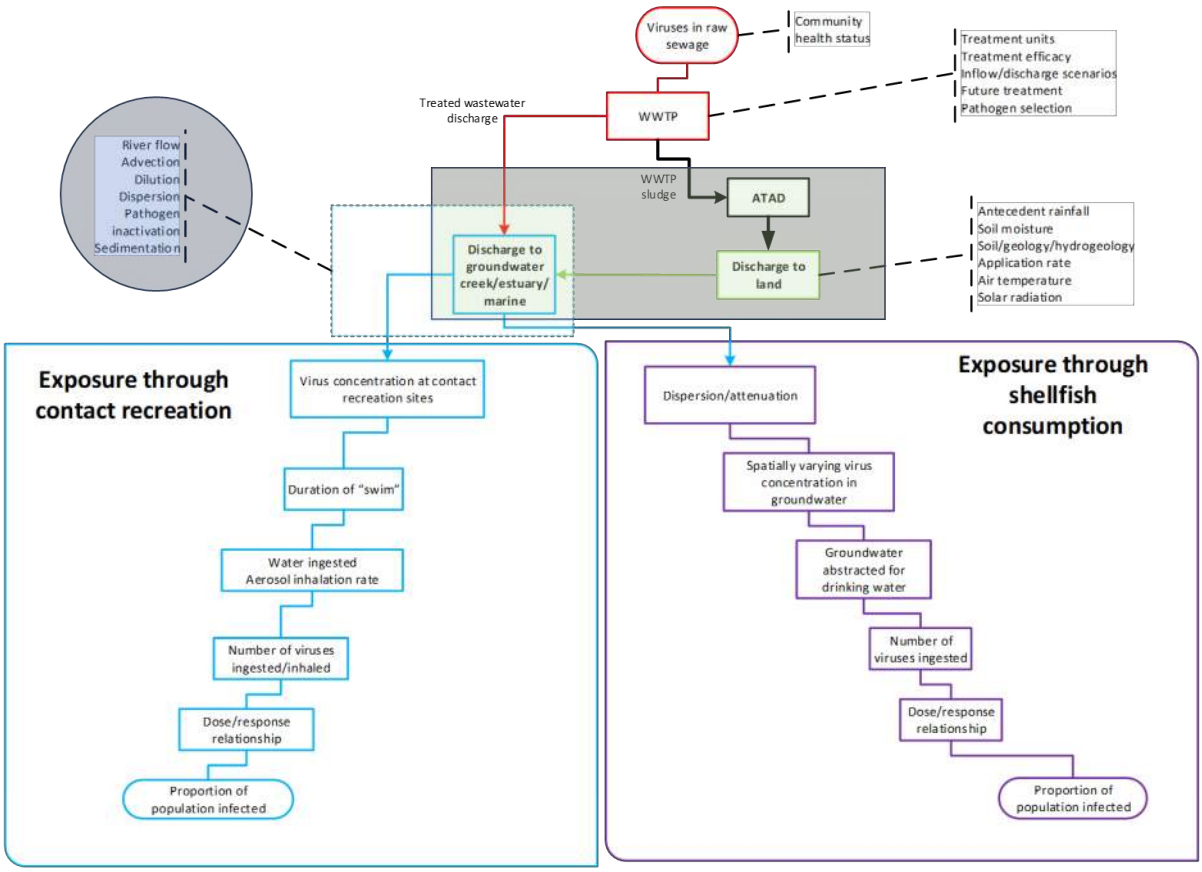

Figure 3-1: Process followed to relate human health risk to pathogen-contaminated surface waters or shellfish. This risk assessment is focussed on activities in the green shaded box. Several items in the blue circle are not available for this health risk assessment.

- This risk assessment is focussed on activities in the green shaded box, specifically the path shown by the black line, which identifies the sludge discharged from the WWTP, the ATAD process, and eventual application of biosolids to land.
- The red lines and boxes in Figure 3-1 indicates the path followed from source ("Viruses in treated waste"), to the numbers of individuals likely to become infected or ill following contact with treated wastewater. We are not concerned with the treated wastewater.
- Callout boxes and red text indicate the type of information or data required to make the modelling process work.
- Key data included in the blue shaded circle are not available, however as discussed above, given that the proposed activity is considered to have less than minor effects on public health, obtaining additional data is considered unnecessary.

3.4 Ability to undertake a QMRA

In section 3.1 we identified four key steps when undertaking a QMRA (Items A–D). Items A) and C) above may be addressed using reported data, values from the scientific literature, or other

information that is relatively easily available. As indicated above, however providing the information required for Item B) is problematic (which limits our ability to undertake D)).

Review of existing information indicates that robust, quantitative data are not currently available regarding the likely dispersion and dilution of materials discharged to land as component of the treated biosolids and in the case of Moturoa/Rabbit Island, the biosolids are applied to land, rather than a direct discharge to water. This makes it impossible to estimate the concentrations of pathogens (if any) in receiving waters with the required certainty. As a consequence, estimating the dose of pathogens to which human receptors may be exposed is even more uncertain.

Previously Palliser and Hudson (2018) attempted to estimate risks using information derived from expert opinion, information derived from other work (including advection, fate of sediment and likely impact of other contaminants on water), but the uncertainty arising from absence of key information makes such assessments overly conservative. While it is good to be cautious when considering risks arising from pathogen exposure (where the consequences can be severe), overly conservative risk estimation is likely to be unrealistic, alarmist and unhelpful when assessing human health risk.

When assessing the risks to recreational water users or individuals walking near biosolids application areas, we adopted a less formal risk assessment approach, but one which made use of existing data and information as far as possible. The potential for health risk arising from biosolids management was investigated using three inter-related procedures:

1. The status of freshwater inflows to the Waimea Inlet was assessed using data derived from routine water quality monitoring. This provides a context of faecal contamination arising from non-wastewater sources (Table 2-1).

2. The existing risk to recreational users was assessed using data derived from routine, seasonal recreational water quality monitoring (Table 2-2).

3. The likely risk posed by the biosolids applied to land was assessed using available pathogen data. This assessment draws on the findings of separate hydrogeological (Tonkin & Taylor 2020) and air quality (Heveldt 2020) assessments.

We describe the results of the assessment undertaken in this fashion in section 4.

4 Results

4.1 Freshwater inflows to Waimea Inlet

Seven rivers and streams that flow into the Waimea Inlet were identified in Table 2-1 and their locations identified in Figure 2-2. *E. coli* concentration data derided from grab samples are available for these sites.

Data for these seven sites (Table 2-2) are summarised as box and whisker plots for the period January 2016- December 2018 inclusive, and as annual summaries in Figure 4-1 (A and B respectively). These figures indicate limited year-to year variability within sites, and consistent difference between sites, either for the three-year period, or for individual calendar years. Ideally comparison of these data would include flow adjustment. Typically this is done by multiplying measured flows with measured concentration to provide an estimate of instantaneous load or flux at the time of sampling, which allows the relative magnitude of the inflow to be more accurately assessed. Flow data are not available for five of the seven sites.

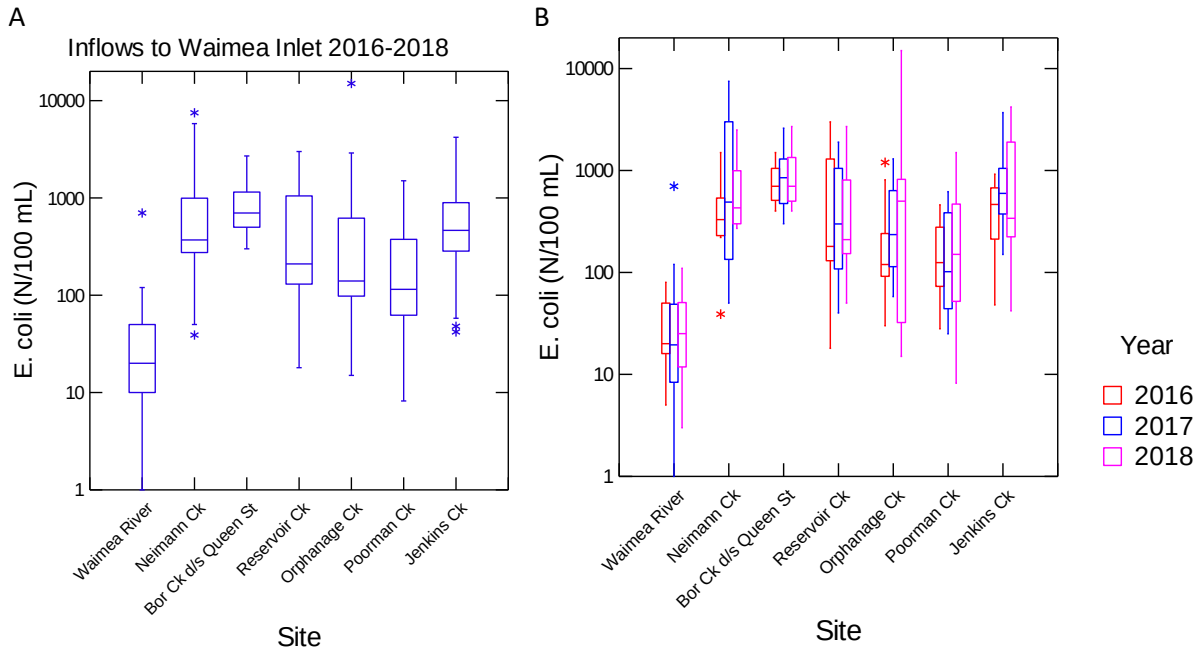

Figure 4-1: *E. coli* concentrations at water quality monitoring sites 2016-2018 inclusive (left), and annually (right).

Despite this limitation, we can conclude:

- Multiple river and stream inflows may impact on the microbiological water quality of the Waimea Inlet. This is important because it allows the relative effect of general surface water runoff to be compared with that of activities such as biosolids application on Moturoa/Rabbit Island.
- Smaller, urban streams generally have the poorest microbial quality.
- *E. coli* concentrations in the streams with poorest quality are generally in the range 100 – 1000 *E. coli*/100 mL (25th to 75th percentile values).

The impact of these (and other, un-measured) inflows may be determined by considering recreational water quality in the Waimea Inlet and southern Tasman Bay. Hydrodynamic modelling undertaken when assessing health risks arising from the Bell Island discharge indicated that water in the Waimea Inlet (including treated wastewater) was transported out of the Inlet in a north-easterly direction, as shown in the model output presented in Figure 4-2.

Poor quality water in the streams and rivers are therefore unlikely to generally impair water quality observed at the two recreational monitoring sites located on the north or south coast of Moturoa/Rabbit Island.

We consider coastal recreational water quality in section 4.2.

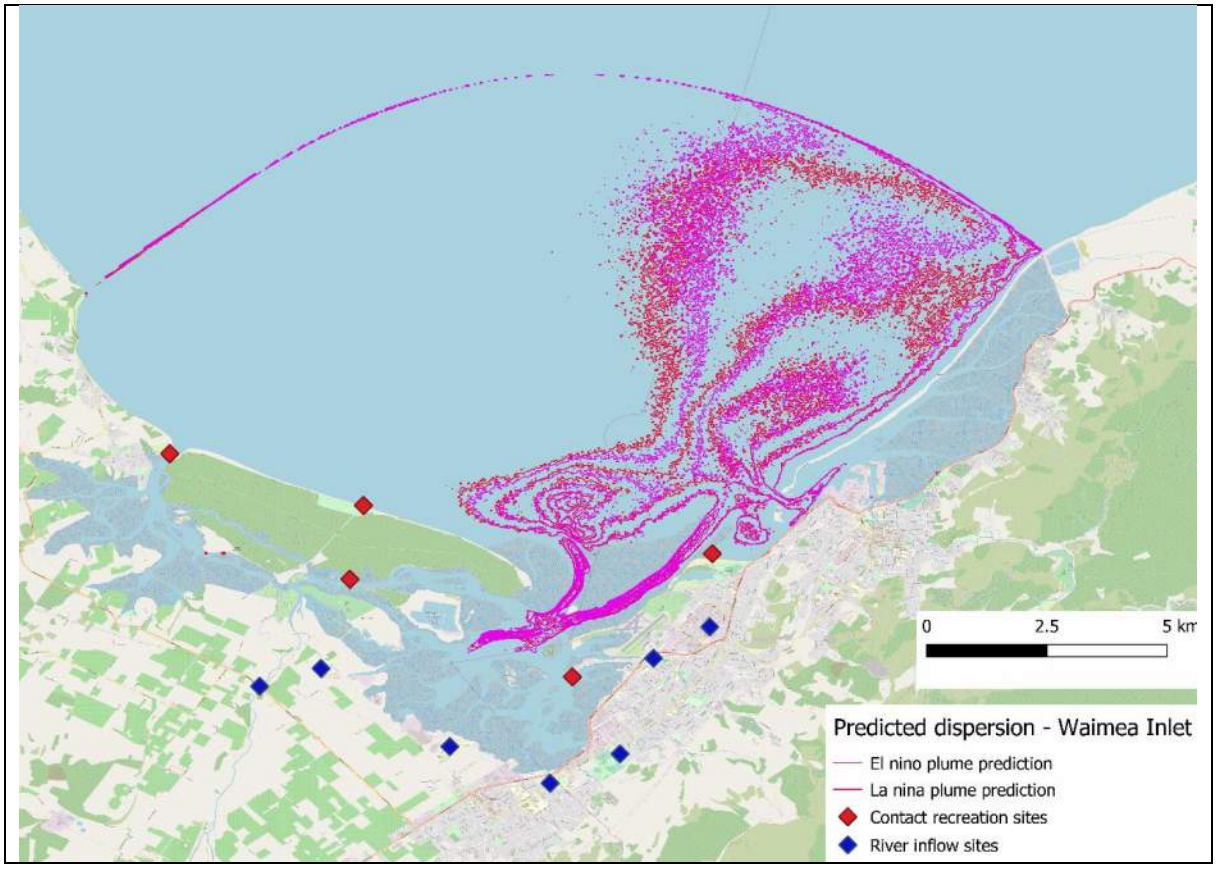

Figure 4-2: Direction and extent of plume of water from Waimea Inlet. The extent of the plume is indicated by the magenta and red dots for El nino and La nina conditions respectively. The extent of the model domain is defined by the semi-circle of dots. From MetOcean (2017).

4.2 Recreational water quality

Recreation water quality data are collected during the recreation season, which typically extends from late October to late March annually. During each season, grab samples are collected from designated sites each week. If grab sample concentrations exceed defined thresholds, specific actions occur, including re-sampling and, in some cases, more frequent sample collection over an extended period. At the conclusion of a season the approximately 25 sample results may be used to assess the likely human health risk to recreational water users. These processes are described in full in the New Zealand "Microbiological Water Quality Guidelines for Marine and Freshwater

Recreational Areas" (MfE/MoH 2003). Tables D1 and H1 of the MfE/MoH guidelines relate calculated 95th percentile enterococci concentrations to estimated health risks. These are summarised in Table 4-1 below, and the first column relates risk to measured 95th percentile concentrations in Figure 4-3 using an assigned grade.

Table 4-1: Extended table H1 of the New Zealand recreational water quality guidelines. (MfE/MoH 2003). The grading is applied to measured data in Figure 4-3. GI is gastrointestinal illness risk, AFRI is acute febrile respiratory illness risk, NOAEL is "no observable adverse effects level", LOAEL is "low observable adverse effects level".

Grade	95th percentile value (enterococci/100 mL)	Basis of derivation	Estimated risk
A	≤ 40	This value is below the NOAEL in most epidemiological studies.	**< 1% GI illness risk, < 0.3% AFRI risk.** This relates to an excess illness of less than one incidence in every 100 exposures. The AFRI burden would be negligible.
B	41–200	The 200/100 mL value is above the threshold of illness transmission reported in most epidemiological studies that have attempted to define a NOAEL or LOAEL for GI illness and AFRI.	**1–5% GI illness risk, 0.3–< 1.9% AFRI illness risk.** The upper 95th percentile value of 200 relates to an average probability of one case of gastroenteritis in 20 exposures. The AFRI illness rate at this water quality would be 19 per 1000 exposures, or approximately 1 in 50 exposures.
C	201–500	This level represents a substantial elevation in the probability of all adverse health outcomes for which dose–response data is available.	**5–10% GI illness risk, 1.9–3.9% AFRI illness risk.** This range of 95th percentiles represents a probability of 1 in 10 to 1 in 20 of gastroenteritis for a single exposure. Exposures in this category also suggest a risk of AFRI in the range of 19–39 per 1000 exposures, or a range of approximately 1 in 50 to 1 in 25 exposures.
D	> 500	Above this level there may be a significant risk of high levels of minor illness transmission.	**> 10% GI illness risk, > 3.9% AFRI illness risk.** There is a greater than 10% chance of illness per single exposure. The AFRI illness rate at the 95th percentile point of 500 enterococci per 100 mL would be 39 per 1000 exposures, or approximately 1 in 25 exposures.

Comparing the data summarised in Figure 4-3 with the guideline values in Table 4-1, we conclude:

- In three of the previous four seasonal periods, water quality at the Main Beach site was as good or better than water quality at other sites in the area (Mapua Leisure Park Beach, Monaco Beach, Moturoa/Rabbit Island, Back Beach and Tahunanui Beach).
- In the one season when water quality was noticeably poorer at the Main Beach site than in other years, water quality was impaired at all recreational sites, indicating a region-wide driver or influence.
- Although fewer data exist for the Moturoa/Rabbit Island Back Beach site, it has similar (good) water quality as the other three sites (Mapua Leisure Park Beach, Monaco Beach, and Tahunanui Beach).

- These data suggest that application of biosolids (and associated residual microbial contaminants) does not have a measurable effect on recreational water quality (particularly at sites on Moturoa/Rabbit Island), and therefore does not increase the risk of infection or illness to recreational water users at these two representative sites, or further afield.

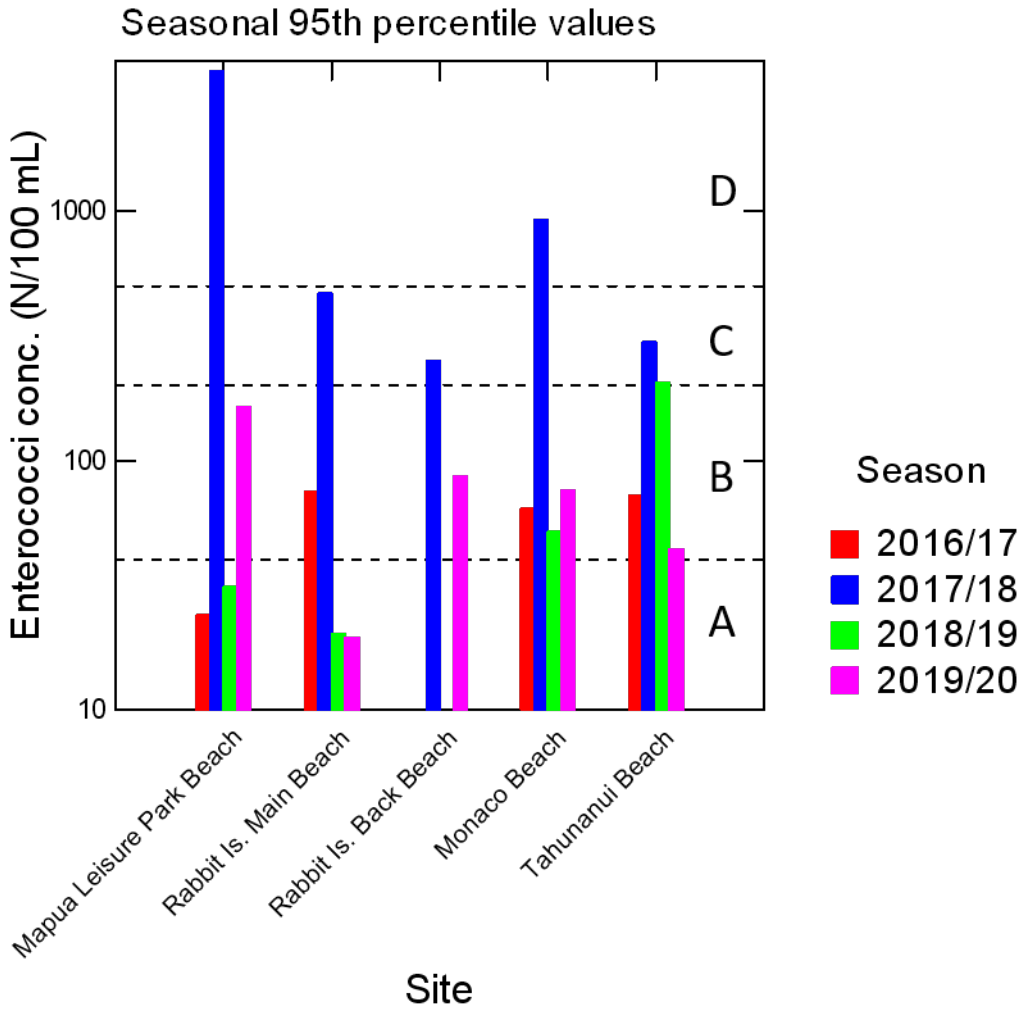

Figure 4-3: Seasonal ninety-fifth percentile enterococci concentrations for five recreational sites in the south Tasman Bay. The broken horizontal lines represent the 40 enterococci/100 mL, 200 enterococci/100 mL and 500 enterococci/100 mL concentration thresholds that define health risk categories A, B, C and D respectively (Table 4-1).

4.3 Measured sludge pathogen concentrations

The biosolids applied to land on Moturoa/Rabbit Island are subject to Autothermal Thermophilic Aerobic Digestion (ATAD). The process heats and maintains the sludge generated in the wastewater treatment process at the Bell Island WWTP at approximately 65 °C for a 14-day period; this does not constitute pasteurisation in the sense used in the NZ biosolids guideline (which specifies heating the sludge to a temperature of 70–80°C for approximately 30 minutes). As the scientific evidence presented below indicates, thermophilic treatment such as that achieved in the ATAD process is likely to have similar efficacy to pasteurisation of the biosolids. The stabilisation process also produces biosolids of a uniform nature.

The Moturoa/ Rabbit Island Consent Application - Biosolids Process Alternatives Assessment, prepared for the NRSBU by Beca Limited (Berry 2020), concludes that the biosolids treatment process achieves the requirement of Grade A stabilisation of biosolids as per the NZ biosolids guidelines (2003) and the heavy metal concentrations represent a grade B product.

Available microbial contaminant data are summarised as time-series plots in Figure 4-5 – Figure 4-6. Where possible, concentrations are compared to the relevant guideline value (Table 4.1, NZWWA 2003). The proportion of compliant samples is summarised in Table 4-2. Data are also provided for other pathogenic organisms not included in the NZ biosolids guidelines (2003)

Table 4-2: Compliance with microbial guideline values. (Table 4.1, NZWWA 2003). Rows shaded blue indicate additional pathogens for which guideline values do not exist. "N/S" indicates not sampled, "N/A" indicates not available. "Unknown" indicates compliance cannot be estimated because the analytical method is insufficiently sensitive.

Microbial contaminant	Guideline concentration	No. compliant samples	Proportion of compliant samples
E. coli	<100 MPN/g	20/22	91%
Campylobacter	<1/25 g (<0.04/g)	n/s	n/s
Salmonella	<1/25 g (<0.04/g)	0/22	Unknown
Enteric viruses	<1 pfu/4 g	22/22	100%
Helminth ova	<1/4 g	13/22	60%
Adeno viruses	N/A	–	–
Faecal coliforms	N/A	–	–
Total coliforms	N/A	–	–
Confirmed *Cryptosporidium*	N/A	–	–
Confirmed *Giardia*	N/A	–	–

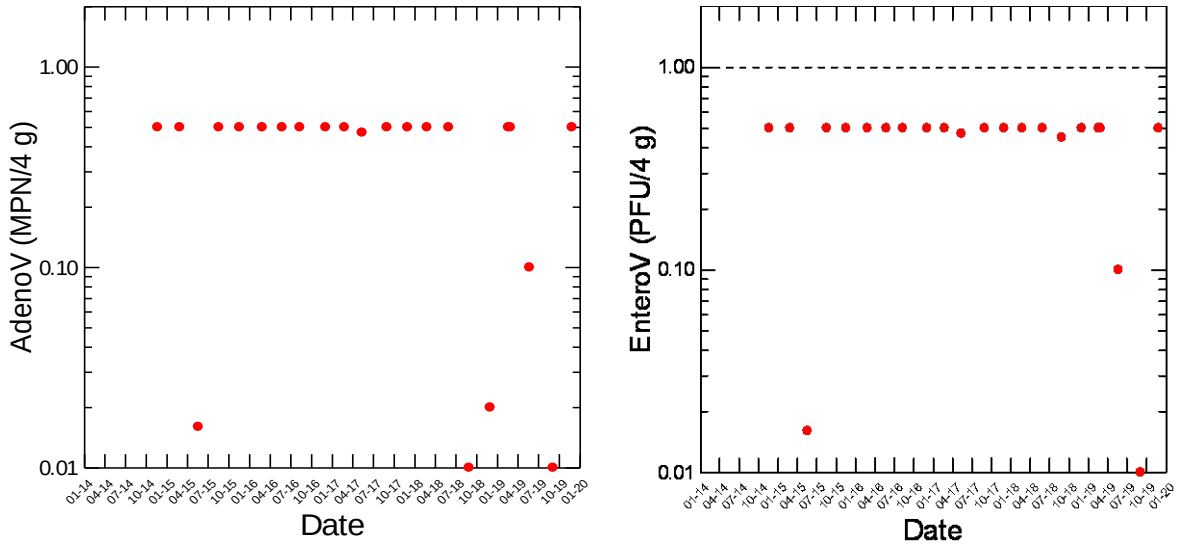

Figure 4-4: Concentrations of viral contaminants in processed biosolids. The horizontal dashed line indicates the guideline value for enteric viruses (1 pfu/4 g; pfu = plaque forming unit) (Table 6.2, NZWWA 2003).

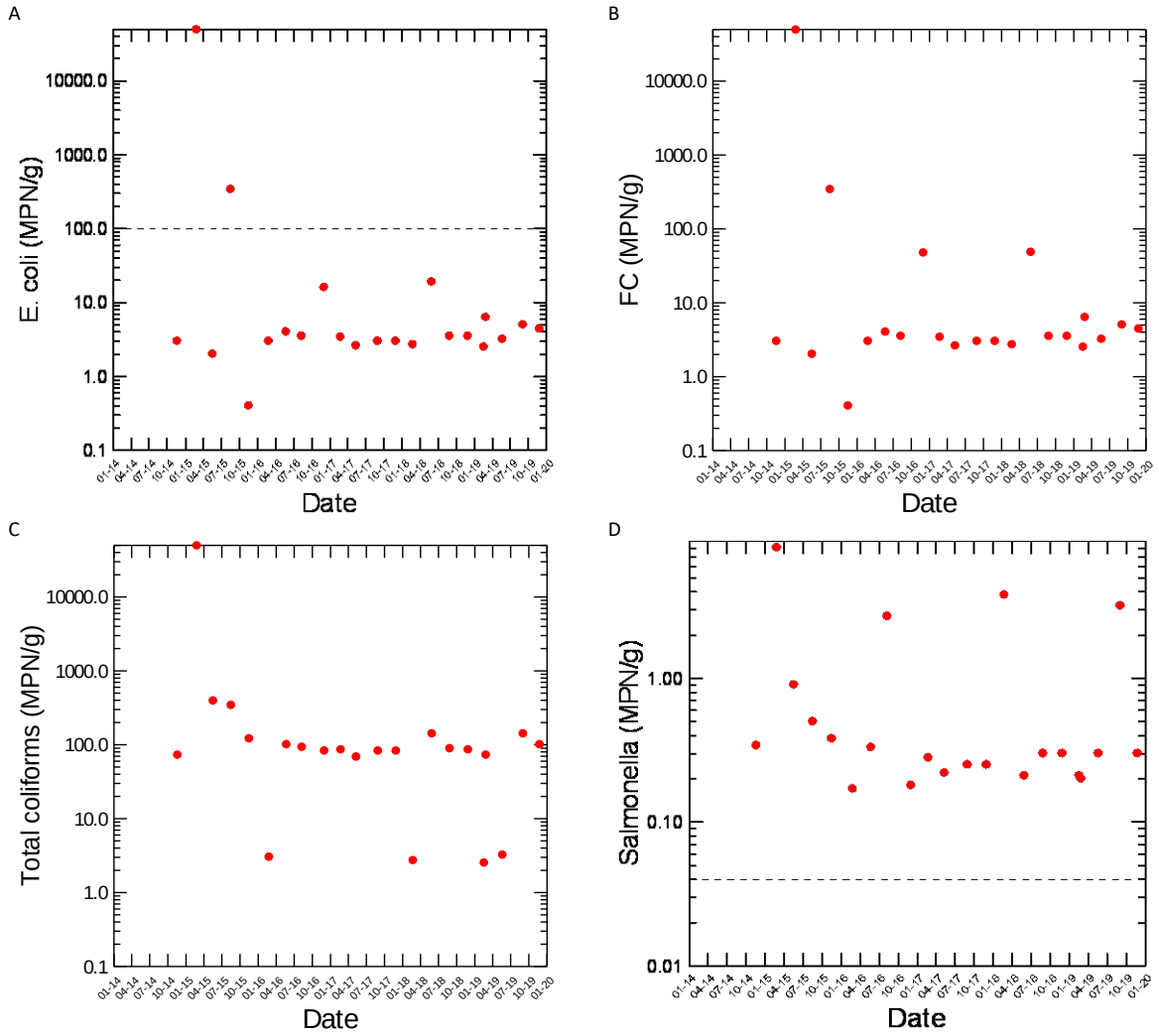

Figure 4-5: Concentrations of bacterial contaminants in processed biosolids. The horizontal dashed lines indicate relevant guideline value for *E. coli* (100/4 g) and salmonella (1/25 g) (Table 6.2, NZWWA 2003).

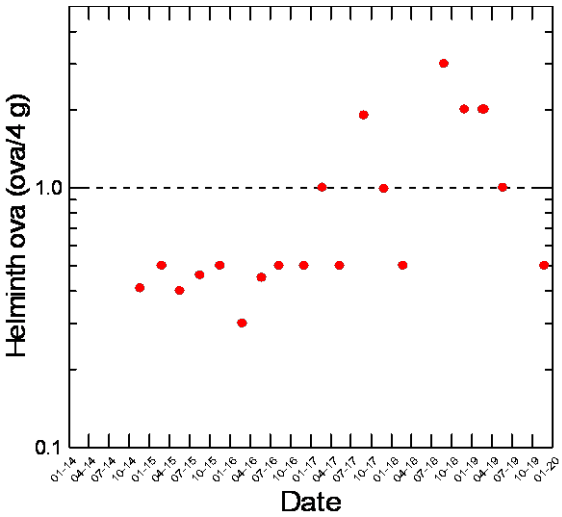

Figure 4-6: Results of analysis for helminth ova in processed biosolids. The horizontal dashed line indicates the guideline value for helminth ova (one per 4 g). (Table 6.2, NZWWA 2003).

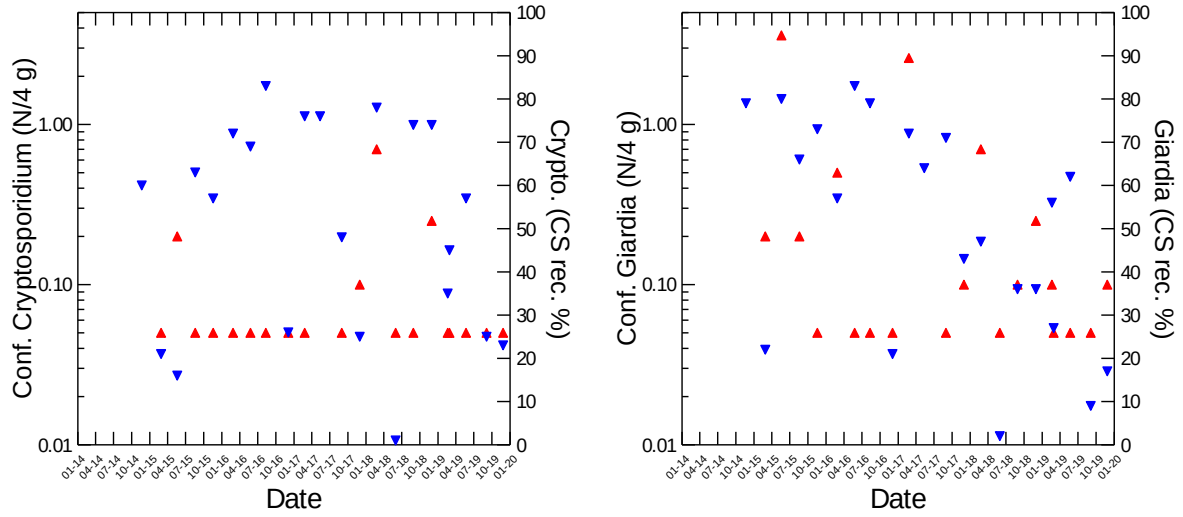

Figure 4-7: Results of analysis for protozoan contaminants in processed biosolids. The blue symbols indicate per cent recovery of a labelled inactivated organism (Color Seed®, CS), used for quality assurance purposes.

The results for Faecal Indicator Bacteria (FIB – *E. coli*, faecal coliforms, and total coliforms) indicate consistent concentrations over time. Generally low and reasonably consistent values suggest that the stabilisation process operates consistently over time. Lang and Smith (2008) had earlier demonstrated that *E. coli* in the supernatant derived from centrifuged sludge samples were largely inactivated at 55°C within 60 minutes in laboratory trials. More recently (De los Cobos-Vasconcelos et al. 2014) had demonstrated similar results, but also showed that reactivation of *E. coli* was possible after a one-hour treatment at 55°C. Although more variable results might be expected in samples derived from industrial treatment processes as a consequence of limitations in heat transfer, the extended period during which high-temperature conditions are maintained will offset these temperature variations in the ATAD process.

The stabilisation process reduces the concentrations of *Salmonella* consistently to quantifiable values ranging from approximately 0.4 to 10 organisms/g. These reported concentrations are inadequate to demonstrate compliance with the requirements of the guidelines, which define an acceptance threshold value of 1/25 g (=0.04/g). It should be noted however, that the analytical method in use is unable to provide the necessary sensitivity. Results are reported as <0.43 MPN/g, approximately 10× greater than the guideline value.[9] From the work of Lang and Smith (2008) it is likely that the actual sample concentrations are lower than the guideline concentration, but this cannot be demonstrated from the available data. Earlier investigations indicated that *Salmonella spp.* is more sensitive than *E. coli* to inactivation at thermophilic temperatures (55 °C) (Lang and Smith 2008). These organisms were effectively inactivated within 20-55 minutes at 55° in either of two culture matrices – an ideal growth medium, or a centrifuged sample derived from an approximately 3% (w/w) sewage sludge. The centrifuged samples had earlier been shown to represent sludge material adequately (Fenters et al. 1979). De los Cobos-Vasconcelos et al. (2014) demonstrated that reactivation of *Salmonella spp*

[9] The lower than required sensitivity of the test method is acknowledged by the laboratory (email from Ms Katherine Forward, Wednesday 22/07/2020 16:32). As discussed below, however, the environmental conditions achieved over an extended period in the ATAD mitigate the potential for risk arising from the relatively poor sensitivity of the analytical method.

was possible, and that exposure to temperatures up to 80°C for more than 90 minutes was required to achieve high inactivation. After reviewing the literature (Arthurson 2008) concluded that *Salmonella* was killed within 30 minutes in sludge heated to 70 °C. We conclude that prolonged heating achieved in the ATAD equipment (approximately 65 °C for up to 15 days) is likely to minimise the potential for survival and reactivation.

Concentrations of the key viral pathogens are low (below the limits of detection), confirming that the combined wastewater treatment process and ATAD process reduces the viral content of the sludge effectively.

The results for protozoan contaminants are less certain – the test for *Cryptosporidium* oocysts and *Giardia* cysts includes a recovery procedure. A known amount of labelled material is added to the sample and the recovery of this material is reported (per cent recovery). The acceptance criterion for recovery of labelled cryptosporidium is 14% – all but one sample exceeded that threshold. The recovery acceptance criterion for *Giardia* is 18% – all but two samples exceeded that threshold (EPA 2014). Four samples of 22 (18%) indicated the presence of *Cryptosporidium*, and 11 of 22 samples (50%) indicated *Giardia* to be present. However, the numbers of oocysts for either *Cryptosporidium* and *Giardia* in samples that returned positive results were very low, just above the analytical method limit of detection. These results are consistent with results in the literature, indicating that the ATAD process is likely to achieve the performance required to meet the NZ biosolids guidelines (Arthurson 2008; Lang and Smith 2008; Al-Gheethi et al. 2018).

The biosolids treatment process appears to reduce concentrations of six of the nine microbial test species sufficiently to meet the NZ guidelines. Even though the limit of quantification of the *Salmonella* test currently in use is inadequate to demonstrate compliance of this pathogen with the guideline value for Grade A biosolids, results for the other indicator organisms and pathogens suggest that compliance with the guideline is very likely.

4.4 Hydrogeological information

The hydrogeology of Moturoa/Rabbit Island was described by Tonkin & Taylor (2020). Using groundwater level data from monitoring wells and interpolation procedures, a groundwater gradient was defined that suggests that contaminants applied to the soil surface are likely to move in a northeast to southwest direction, should they enter the groundwater.

Microbial contaminants are not measured in groundwater samples, and the hydrogeological assessment focuses on nitrate-N as a tracer of biosolids-derived contaminants. It is unlikely however that the groundwater is transporting measurable numbers of faecal contaminants toward the north coastline of Moturoa/Rabbit Island:

- Available biosolids data indicates consistently low concentrations of Faecal Indicator Bacteria in the material applied to land.
- Between the point of discharge, and the coastline, several attenuation processes are likely to occur:
  - Interception of material on vegetation and the land surface, followed by desiccation and possibly UV inactivation, if subject to sunlight.

- Microbial contaminants are likely to be adsorbed to organic materials on the soil surface and within the upper layers in the soil profile, as well as to minerals within the soil profile.
- The soils are sandy and the shallow groundwater system is described as unconfined – it is possible that aerobic decomposition processes occurring within the soil may also reduce microbial contaminants during transit.

As noted in sections 4.1 and 4.2, recreational water quality at the Moturoa/Rabbit Island Main Beach site is generally of the highest quality in the south Tasman Bay. This site is close to and downgradient from bore 11, one of the monitoring bores that indicated relatively elevated nitrate-N concentrations. There is no indication however of consistent or episodic input of FIBs from biosolids application to coastal waters causing measurable effects at the Main Beach site.

In similar manner, even though the Moturoa/Rabbit Island Back Beach site is not monitored every bathing season, the recreational water quality at this site is as good as other sites (e.g., Monaco Beach or Tahunanui Beach). The Back Beach site is likely to be impacted by other sources, particularly the inflow from the Waimea River. Once more, it is not possible to attribute any water quality impairment directly to the current or historical application of biosolids on Moturoa/Rabbit Island.

4.5 Health risks arising from airborne microbial contaminants

The biosolids applied to the forest have a low solids content (typically 4%), allowing the material to be discharged using relatively low pressure through coarse nozzles. Although the discharge process does not prevent the formation of aerosols, the droplet sizes tend to be larger rather than smaller, allowing the stream of biosolids to travel up to approximately 25 m.

The pasteurisation provided by the ATAD process, and relatively large droplet size combine to reduce the potential for inhalation of pathogens. Certainly, the digestion process effectively eliminates pathogens to the extent that they pose a risk to human health. The public is further protected from exposure to the land-applied material by use of buffer zones, physical barriers, exclusion zones and clear notification.

The existence of a forested area creates a porous physical barrier to air movement – trees are commonly used as windbreaks. Passage of air through the forested application area further reduces the potential for health risk. It is noted that odour impact may increase when the tree cover is removed (Heveldt 2020). In agricultural landscapes, trees and shelterbelts are used to reduce the effects of odour and dust arising from poultry houses, piggeries and feedlots (Bielefeld et al. 2015).[10] The mechanisms whereby shelterbelts or forests reduce odour will similarly reduce the ability for small particles (aerosols containing small numbers of residual viruses and other pathogens) to pass through the shelterbelt unhindered. These include:

- lower wind velocity (reducing both the momentum and distance these materials are likely to travel)
- tortuous airflow, with large surface areas with which particles may interact and to which particles may adsorb, and

[10] E.g., https://www.daf.qld.gov.au/business-priorities/agriculture/animals/pigs/piggery-management/housing/basic-housing

- volatile chemicals emitted from vegetation, which facilitate particle formation and adsorption of aerosols and other particles.

The risk to the public is reduced as a consequence of these factors. Residual risks are further reduced by following the recommendations in existing best management practices (Scion 2010):

- ensuring application is at a considerable distance from dwellings,
- ensuring the biosolids are adequately disinfected prior to land application,
- limiting public access to areas to which biosolids have been applied for an appropriate period of time,
- avoiding use of application equipment that generates aerosols,
- avoiding application during particularly windy periods,
- maintain a buffer around the application area to minimise the potential for overspray and limit public access to areas where biosolids have been applied,
- monitoring of buffer areas to ensure they are adequate to achieve the desired purposes.

Identifying and defining the application and buffer areas is also required to meet other environmental and management objectives. The management requirements identified in the guidelines and best management practices will ensure that land application of biosolids is adjusted in response to forest harvesting, contributing to ongoing public health protection.

As a consequence of the effective ATAD treatment process and careful management of land application of biosolids, we consider the risks to public health arising from inhalation of materials derived from the biosolids to be less than minor.

5 Synthesis

After considering the information from Section 4.1 and 4.2:

- Modelling predicts that microbial loads arising from streams draining into the Waimea Inlet are likely to be transported from the inlet to the east of south Tasman Bay, i.e., away from Moturoa/Rabbit Island.
- Although microbial concentrations in inflow streams are generally in a concentration range from tens to hundreds of *E. coli*/100 mL, they appear to have a moderate effect on the Monaco Beach recreation site (the site most likely to be impacted by microbial contaminants derived from freshwater inflows), which was graded "B" in three of the previous four seasons.
- Measured microbial water quality at both Moturoa/Rabbit Island sites is better on a season-by season basis that at the Mapua Leisure Park Beach site, and
- the Moturoa/Rabbit Island Main Beach site consistently has equally high-quality recreational water, if not the best quality, in the south Tasman Bay.
- Under these circumstances, health risks at the two recreational water quality sites on Moturoa/Rabbit Island are considered low.
- For the Main Beach site:
  - For two of the preceding four recreation seasons, the health risk at the Moturoa/Rabbit Island Main Beach was less than 1% in terms of gastrointestinal illness, and less than 0.3% in terms of acute febrile respiratory – these risks are considered below the observable adverse effects level.
  - In one of the other years, a 1–5% GI illness risk and 0.3–< 1.9% AFRI illness risk applied.
  - In the remaining season, the higher risk that applied (C grading) was the consequence of region-wide factors – illness risks were higher at all sites monitored and could not be attributed to biosolids application on Moturoa/Rabbit Island.
- For the Back Beach site:
  - A "C" grade applied in the one year when water quality at all sites were relatively degraded (2017/18), and
  - in the other year for which data are available, a "B" grade applied (1–5% GI illness risk, 0.3–< 1.9% AFRI illness risk).
  - Microbial water quality at the Back Beach site is likely to be influenced by the Waimea River – the north branch of the Waimea River discharges into the Waimea Inlet to the north of Best Island, and this channel is adjacent to the Back Beach site, and is likely to influence microbial water quality.

The biosolids monitoring data indicate that biosolids are consistently stabilised, and that concentrations of key viral pathogens are less than the analytical limit of detection. Recent *E. coli*

concentrations have consistently complied with the guideline value, and measurable effect on coastline water quality is very unlikely. *Salmonella* concentrations are consistent and low (all results <10 MPN/g, most reported as <0.43 MPN/g), but the analytical method is insufficiently sensitive to determine whether *Salmonella* concentrations comply with the guideline value (0.04 MPN/g). Protozoan concentrations (*giardia* and *cryptosporidium*) are very likely to be reduced through the stabilisation process, but there are no data for the before ATAD biosolids, and no guideline value against which to assess the results.

Consideration of the scientific literature suggests that the ATAD process is likely to reduce pathogen concentrations very substantially, and this is substantiated by the monitoring results. *Salmonella* concentrations are highly likely to be reduced as effectively as viruses and *E. coli*, particularly because temperatures in excess of 55°C are typically maintained for periods of 15 days.

The hydrogeological assessment suggests that the bulk of the groundwater moves from the north east to the southwest, discharging either into the west branch of the Waimea Inlet (which passes the Mapua settlement), or to the east branch of the Waimea Inlet to the north of Bell Island. The low concentration of most measured faecal contaminants in the stabilised biosolids indicates that a relatively small load of microbial contaminants are applied to the forests, and these contaminants are unlikely to have a measurable effect on coastal water quality. Existing recreational monitoring indicates that this is the case.

From the data and information available, we conclude that the application of stabilised biosolids to forests on Moturoa/Rabbit Island have not had a measurable effect on coastal microbial water quality and that this activity does not create a detectable risk to recreational water users in Waimea Inlet or southern Tasman Bay.

Several factors, including the very small concentrations of residual microbial contaminants in the heat-treated, well-stabilised biosolids, the use of relatively low-pressure spray systems, the presence of trees that operate as shelterbelts, the physical barriers and buffers and setback distances, coupled with active management of the disposal area (including use of signage to exclude and warn the public), combine to reduce public health risks to less than minor.

5.1 Monitoring

Currently no data exist for Faecal Indicator Bacteria or pathogens in the shallow groundwater on Moturoa/Rabbit Island. In view of the low frequency at which the stabilised biosolids are assessed, consideration could be given to quarterly assessment of the microbial quality of shallow groundwater. Monitoring of two of the existing wells would be adequate, and the selection would be guided by the outcomes of the hydrogeological assessment.

Consideration could also be given to undertaking more frequent monitoring of the stabilised biosolids derived from the ATAD process. The current quarterly monitoring frequency is inadequate to determine the consistency of the biosolids over timeframes shorter than is possible sampling once every three months. The Guidelines recommend that Grade A biosolids are assessed for *E. coli* at routine sampling frequencies greater than once/week (Table 7.1, NZWWA 2003).

Consideration could also be given to measuring concentrations of *Campylobacter*, which is identified as a pathogen of concern (and forms the basis for human health risk assessment in the recreational water quality guidelines (MfE/MoH 2003)), and for which a guideline value is defined.

For all variables for which a guideline value exists, consideration should be given to follow-up sampling when a non-compliant sample is obtained. This sampling would be intended to determine whether the non-compliant result was due to sampling error, rather than a process upset. If the process was found to be performing below standard, remedial action could be taken. I note that the applicant has volunteered a condition that addresses these matters – see Table 5-1, condition 17.

For protozoan contaminants, consideration could be given to assessing the concentrations of *Giardia* and *Cryptosporidium* cysts in the sewage sludge before digestion, as well as in the post-ATAD biosolids applied to land. This would provide some indication of the efficacy of the combined digestion–ATAD process, and whether there was requirement for process modification. Existing results indicate that a large proportion of results are reported as less than the analytical limit of detection, but these are also associated with low method recovery efficiency, which increases the uncertainty when quantifying low numbers of oocysts. This assessment could be done as a short duration survey, rather than as an ongoing consent monitoring requirement.

5.2 Comments on proposed consent conditions

Table 5-1: Comments on proposed consent conditions. Comments based on draft conditions provided by e-mail on Friday, 24/07/2020.

Condition	General requirement	Comment
9	Six-yearly monitoring and technology review	Support. This condition will provide an opportunity to consider revisions to guidelines, incorporate new technology as required, and recognise emerging risks – these actions are likely to reduce human health risk further.
15	Volume of biosolids measured	Support.
16	Temperature and time required for stabilisation	Support. The units of duration need to be identified (i.e., hours, days etc).
17	Routine sampling frequency and variables of concern	Support. The selection of variables and measurement frequency must be adequate to meet the requirements for Grade Ab biosolids; I understand that compliance with conditions 15 – 19 will ensure that this will be achieved.
28	Monitoring of groundwater for Faecal Indicator Bacteria	Support. Currently there is no assessment of groundwater faecal contamination. I recommend that inclusion of enterococci is considered as well (to provide indication of organisms arising from mammalian digestive tract, and to provide an indicator that correlates better with human health outcomes than other FIB, such as faecal coliforms or *E. coli.*)

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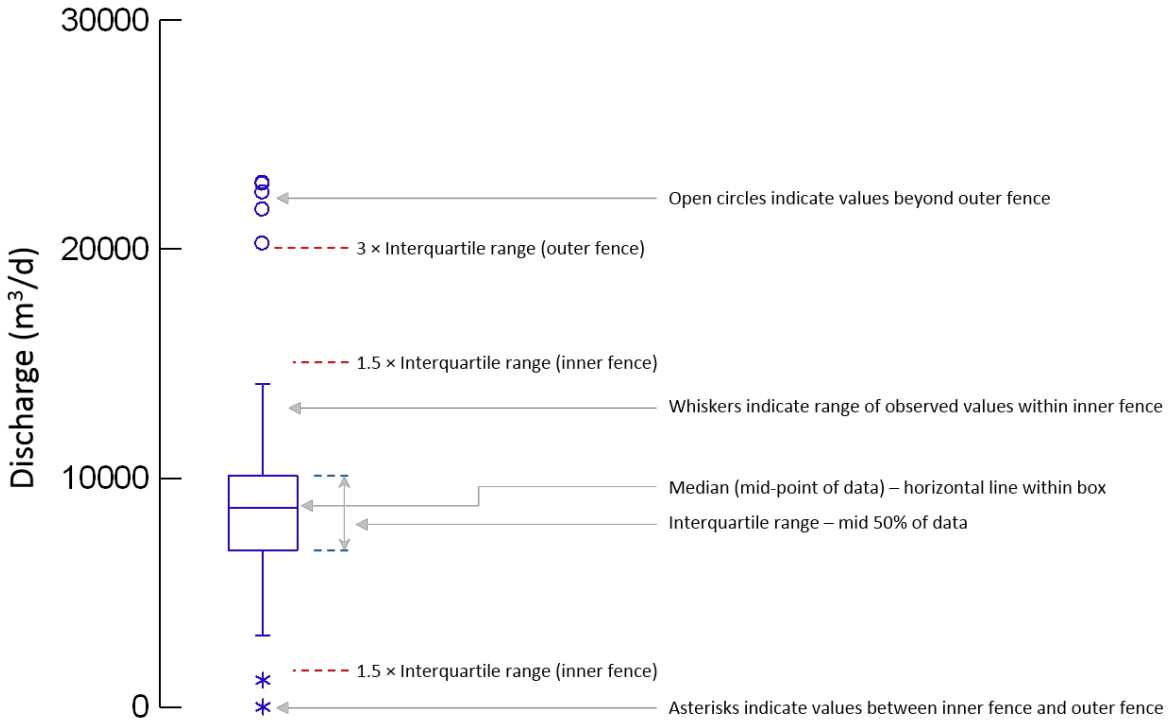
Appendix A Example Systat box and whisker plot



Appendix B Information to assist with the selection of viruses

Table B-1: Comparison of the merits and limitations of viruses for which dose-response information is available.

Virus	Advantages	Disadvantages
Gastrointestinal		
Enterovirus	Can induce more serious long-term effects compared to other viruses (Haas et al. 1999, DRG 2002, Simpson et al. 2003). Its inclusion is warranted given that it can cause more serious longer-term illnesses.[11]	Restricted to echovirus 12, the only enterovirus for which an infection dose-response relationship is available. Nevertheless, enterovirus by culture captures more than just echovirus, so, for example, would also capture Coxsackie virus. Meaning of "dose" not clear, giving rise to two quite different infection ID_{50} values (54 and 1052).[12]
Norovirus	Reported to be the most common aetiological agent in receiving waters (e.g., Sinclair et al. 2009). Infection ID_{50} is in the order of 20 virions (among susceptible people), but the dose-response curve rises steeply from the origin, such that ~20% of people may become infected after ingestion of just one virion, emphasising that a precautionary approach should be taken when modelling this virus.	Efficacy of wastewater treatment in removing infectious noroviruses is difficult to establish. Restricted to Norwalk virus—norovirus genotype I.1. But note that an outbreak study ((Thebault et al. 2013)) identified other genotypes to be, if anything, at least as virulent. In the absence of results to the contrary, and taking an appropriate precautionary approach, noroviruses in treated wastewater are assumed to be not aggregated - were they to be aggregated, health risks would be lessened. May require a conversion from the PCR method used in the clinical trial (Lindesmith et al. 2003; Teunis et al. 2008), as described in (McBride et al. 2013).
Rotavirus	Particularly affects children. The most infective virus for which published dose-response data is available. Has been used as a "model virus" in earlier QMRAs, for Warkworth (Stott & McBride 2009), Army Bay (Palliser 2011), Snell's Beach (Palliser & Pritchard 2012).	Not as prevalent in treated wastewater as noroviruses. Doses in the one available clinical trial (Ward et al. 1986) were measured in terms of "Focus Forming Units" (FFU), with the lowest "dose" set at 0.009 FFU. So FFU numbers need to be multiplied by an unknown factor to index doses of discrete virions (see the approach taken in a USA-wide study, (McBride et al. 2013).
Hepatitis A	A serious illness. Dose-response function indicates virulence (infection ID_{50} = <2).	Present in very low numbers in treated wastewater relative to noroviruses.
Coxsackie (an enterovirus)	May particularly affect children (Suptel 1963).	Studied by Couch et al. (Couch et al. 1965) for coxsackie A21 so restricted to respiratory illness response. Present in low numbers in treated wastewater. Dose-response function indicates moderate virulence (infection ID_{50} = 48).
Respiratory		
Adenovirus	Found routinely in treated wastewater (DRG 2002, Simpson et al. 2003, (Thompson et al. 2003), Hewitt et al. 2011).Very resistant to disinfection (is double-stranded DNA). A common cause of gastrointestinal illness (especially the 40/41 complex). Can be applied to respiratory infections, and therefore be relevant for surfers and/or water-skiers.	Dose-response only for adenovirus 4, a respiratory aetiological agent. Haas .. (1999) report fitting a single-parameter exponential model to data reported by Couch et al. (1966a) giving rise to an infection ID_{50} less than 2 virions. However, most adenoviruses are not respiratory agents. Applying the adenovirus 4 dose-response model to all adenoviruses for gastrointestinal illness appears to over-estimate the dose-response for that form of illness (we can expect more substantial response of the human body's defences to gastrointestinal infection compared to respiratory infection). Applying the model to only the respiratory portion of total adenoviruses requires assumptions about their proportional presence in treated wastewater (Kundu et al. 2013). The latter authors also considered other studies by (Couch et al. 1966a; Couch et al. 1966b; Couch et al. 1969).

[11] For example, coxsackievirus type B (an enterovirus) is now recognised as the most common viral aetiological agent associated with heart disease (Haas et al. 1999).

[12] Infection ID_{50} is a quantity derived from clinical trials of pathogen infectivity. It is the pathogen dose that would result in 50% of an exposed population becoming infected.

Adenoviruses

Respiratory viruses, particularly some adenoviruses, may also need to be considered within a QMRA. Respiratory symptoms (via inhalation of contaminated water when water skiing, or inhaling surf-generated aerosols) are sometimes associated with contact with wastewater-impacted coastal waters (WHO 2003). In particular, a New Zealand epidemiological study at seven coastal beaches found a respiratory effect associated with the faecal indicator bacterium enterococci (McBride et al. 1998). Respiratory-associated viruses are probably the commonest causes of acute respiratory infections, for example reportedly causing around 70% of acute sore throats (Mims et al. 2004). They can be particularly resistant to disinfection (Gerba et al. 2003; Thompson et al. 2003). However, while adenoviruses are commonly found in water (Horwitz 2001), including wastewater, many strains give rise to gastrointestinal illness (e.g., the 40/41 strain complex), with a rather smaller proportion associated with respiratory symptoms. So we should note that we have clinical trial information available only for the respiratory-illness-causing adenovirus 4 (Couch et al. 1966a; Couch et al. 1966b; Couch et al. 1969) for which a dose-response model has been developed (Haas et al. 1999). We can expect that people are more vulnerable to respiratory agents than to gastrointestinal agents, because the human body's defences to the latter are more formidable. Fong et al. ((Fong et al. 2010)) found only 3% of wastewater adenoviruses were type 4. So QMRA studies that apply the adenovirus 4 infection dose-response model to all adenoviruses (Gerba et al. 1996; Crabtree et al. 1997) have over-estimated health risk.

Other QMRA studies in New Zealand have predicted illness via ingestion among recreational water users near marine outfalls to be rather higher than illness-via-inhalation (Stott and McBride 2011). A recent study of wet weather bypass flows at Moa Point, Wellington, has included consideration of respiratory effects, using Fong's results (Crawford et al. 2014).

Enteroviruses

Enterovirus (EV) is a single-stranded member of the picornavirus family, containing over 70 serotypes.[13] It was originally classified into four groups, polioviruses, coxsackie A viruses, coxsackie B viruses, and echoviruses, but molecular characterisation has led to their reclassification into an enterovirus genus that includes 12 species: enterovirus A-H, J and Rhinovirus A-C. Human species of enterovirus are grouped into the four EV species A-D and the three Rhinovirus groups A-C.

Enteroviruses are often found in respiratory secretions (e.g., saliva, nasal mucus) and stools of infected persons. Poliovirus, coxsackie and echovirus can be spread through faecal-oral route. Infection can result in a wide variety of symptoms ranging from mild respiratory illness (common cold), hand, foot and mouth disease, acute haemorrhagic conjunctivitis, aseptic meningitis, myocarditis, severe neonatal sepsis-like disease, and acute flaccid paralysis. Enteroviruses are distributed worldwide and are influenced by season and climate. Infections can show a seasonal pattern with enterovirus prevalence peaking in summer and early fall in temperate areas, while tropical and semitropical areas showing no discernible seasonal trend.

A comparison with literature data found that E-30 (echovirus 30) was the most prevalent type detected internationally (Janes et al. 2014). Generally, enterovirus B viruses (in particular echoviruses) were the most frequently detected. Age distribution patterns were observed with 30–74% of all isolates detected in young children (< 5 years).

[13] http://www.picornastudygroup.com/types/enterovirus/enterovirus.htm

Surveillance and monitoring of enteroviruses has traditionally been based on culturing and serotyping. However, it is likely that concentrations may be under-reported due to differences in cell culture sensitivities (Schiff 1984; Schiff et al. 1984). Current advances in molecular techniques using RT-PCR for detection followed by sequencing of the capsid genes for typing is now the method typically used (Benschop et al. 2010).

Noroviruses

Noroviruses are a principal cause of viral gastroenteritis. They are single-stranded RNA viruses that have been classified into 5 genogroups (GI to GV). Strains I, II and IV can infect humans (particularly strain GII, see Matthews et al. 2012), while GIII infects bovine species and GV has recently been identified in mice. The GI viruses are highly infectious for a proportion of the population (Teunis et al. 2008) and spread easily by direct person-to-person or person-surface-person contact. By analogy, the GII genogroup exhibits the same behaviour. They also can be associated with waterborne gastroenteritis (Parshionikar et al. 2003) or shellfish-associated gastroenteritis (Lees et al. 1995; Thebault et al. 2013)[14] and are therefore a hazard to recreational water users (Gray et al. 1997). They have been detected in both raw and treated wastewaters (Nordgren et al. 2009), with strains of GI and GII predominating in human-derived wastewater that are typically very similar to human strains circulating in the population (van den Berg et al. 2005). Therefore, the public may be at appreciable risk whenever there is exposure to human wastes (animal viruses are generally thought to be not infectious to humans, and so other animal pathogens—bacteria and protozoa—come into play). For the purposes of the QMRA, noroviruses therefore represent the primary potential risk of infection from human-derived wastewaters via ingestion for primary contact users, such as swimmers, surfers and bodyboarders.

[14] These authors considered both infection and illness.

Appendix N:

Moturoa / Rabbit Island Biosolids Reconsenting – Objectives and Policies Assessment

The objectives and policies of the following statutory documents are reviewed in this appendix:

- New Zealand Coastal Policy Statement (**NZCPS**)
- National Policy Statement for Freshwater Management (**NPS-FM**)
- Tasman Regional Policy Statement (**TRPS**)
- Nelson Regional Policy Statement (**NRPS**)*
- Tasman Resource Management Plan (**TRMP**).

**Applying only to that part of the coastal waters of Waimea Inlet under Nelson City Council's jurisdiction.*

For assessment on other statutory matters and documents, including iwi management plans, please refer to Section 9 of the overarching AEE.

For the purposes of this assessment the relevant provisions have been grouped according to the following categories:

1. Resource use and waste management,
2. Effects on cultural values,
3. Effects on recreational values and public health,
4. Effects on soils, groundwater quality and coastal water quality,
5. Effects on ecology (terrestrial and coastal),
6. Effects on air quality,
7. Effects on natural character and landscape, and
8. Effects from natural hazards.

The Moturoa / Rabbit Island Reserve Management Plan is considered separately in Section 9 of this appendix.

1. Resource use and waste management

Reference	Objective/Policy	Assessment
NZCPS Objective 6	To enable people and communities to provide for their social, economic, and cultural wellbeing and their health and safety, through subdivision, use, and development, recognising that: • the protection of the values of the coastal environment does not preclude use and development in appropriate places and forms, and within appropriate limits; […]	Biosolids production at the WTTP, and subsequent application on Moturoa/Rabbit Island, allows for the Nelson Regional Sewerage Scheme to appropriately function and therefore provides for the social, economic and cultural wellbeing, and for the health and safety, of Tasman District and Nelson City residents. The various assessments in support of the AEE (in particular the forestry and soils assessment in Appendix G, the coastal assessment in Appendix I, and the public health assessment in Appendix M) demonstrate that Moturoa/Rabbit Island is an appropriate place for the application, subject to conditions including the ongoing use of exclusion zones and buffer areas.
NRPS Policy WM1.3.6	To work closely with adjoining territorial authorities in order to achieve integrated waste management in the Upper South Island.	The NRSBU, being a joint committee of the NCC and TDC, operates the WWTP and is responsible for the application of biosolids on Moturoa/Rabbit Island. Hence, this proposal achieves integrated waste management and is considered consistent with this policy.
NRPS Policy CO1.3.16	To recognise that some uses and developments dependent on the natural and physical resources in the coastal environment are important to the social, economic and cultural well-being of the people and the community, should be provided for within the coastal environment providing that the quality of the environment is maintained.	As explained above, the application of biosolids at Moturoa/Rabbit Island is an efficient and beneficial use of the existing wastewater treatment plant outputs (biosolids). It also provides important social and economic positive effects, as it provides the communities with an economically sustainable and affordable wastewater treatment system and ongoing use of existing wastewater infrastructure. The application of biosolids is a beneficial reuse of resources and enhances the commercial forestry.
TRPS General Objective 4	Efficient use and development of resources.	The application of the biosolids is essential in supporting the ongoing use of the WWTP, which is an efficient use of existing wastewater infrastructure. Application of biosolids is a beneficial reuse of resources and enhances the commercial forestry.
TRPS General Objective 5	Maintenance of economic and social opportunities to use and develop resources in a sustainable manner.	The proposal seeks to maintain an activity which has occurred for the last 24 years and achieves social and economic benefits for the users of the Nelson Regional Sewerage Scheme (see Section 8.2 of the AEE). The biosolids application also increases the economic return of the commercial forestry operation, which has flow-on social and economic opportunities for ratepayers in the Tasman region.

Reference	Objective/Policy	Assessment
TRPS Objective 6.1	Avoidance of the loss of the potential for land of productive value to meet the needs of future generations, particularly land with high productive value.	The proposed application of biosolids occurs to an existing area of high productive value in the form of a commercial forest. The application enhances the productive value through increasing growth rates.
TRPS Objective 10.4	Minimised risks of contamination on the environment arising from the storage, treatment or disposal of all forms of waste.	As discussed throughout Section 8 of the AEE, the application of biosolids is done in a way which minimises the risk of contamination on the environment. This includes through the production of Class Ab biosolids and limitations on nitrogen loading.
TRPS Policy 10.8	The Council will seek to minimise the generation of all forms of wastes, particularly hazardous wastes.	As discussed above, the continued provision of a biosolids application operation works to minimise the generation and need for disposal of waste. Biosolids is not hazardous waste.
TRMP Objective 6.3.2.1	Sustainable urban growth that is consistent with the capacity of services and has access to the necessary infrastructure such as water supply, roading, wastewater and stormwater systems.	This proposal ensures the continued production of biosolids from the operation of the WWTP, which is essential infrastructure required for sustainable urban growth.
TRMP Policy 6.3.3.1	To ensure that utilities and services are adequate to avoid, remedy, or mitigate adverse effects of urban development and population growth on both existing and future urban areas.	The application of biosolids on Moturoa/Rabbit Island will enable the ongoing operation of the WWTP. The WWTP provides a reticulated wastewater collection system which eliminates the need for individual onsite treatment where reticulation is available, hence avoiding adverse effects associated with urban development and population growth.

2. Effects on cultural values

Reference	Objective/Policy	Assessment
NZCPS Objective 3	To take account of the principles of the Treaty of Waitangi, recognise the role of tangata, whenua as kaitiaki and provide for tangata whenua involvement in management of the coastal environment by: • recognising the ongoing and enduring relationship of tangata whenua over the lands, rohe and resources: • promoting meaningful relationships and interactions between tangata whenua and persons exercising functions and powers under the Act; • incorporating matauranga Maori into sustainable management practices; and recognising and protecting characteristics of the coastal environment that are of special value to tangata whenua.	NRSBU recognises the status and importance of tangata whenua and the important value they bring to resource management processes. NRSBU also recognises the long history and special significance of Moturoa/Rabbit Island to iwi. NRSBU has consulted with Te Tau Ihu iwi prior to lodging these applications and throughout the prior Bell Island WWTP consenting process. This consultation and relationship will continue throughout the remainder of the consent process and into the future, including through NRSBU's offer to hold an annual hui. One of the purposes of this hui is to regularly seek input from iwi on whether the biosolids application is causing any issues or concerns with respect to cultural values and the coastal environment. With that feedback, any

Reference	Objective/Policy	Assessment
NZCPS Policy 2	The Treaty of Waitangi, tangata whenua and Maori heritage in taking account of the principles of the Treaty of Waitangi (Te Tiriti o Waitangi), and kaitiiakitanga, in relation to the coastal environment: […] f provide opportunities in appropriate circumstances for Maori involvement in decision making, for example when a consent application or notice of requirement is dealing with cultural localities or issues of cultural significance, and Maori experts, including pukenga, may have knowledge not otherwise available. [...]	potential mitigation or enhancement works can be developed. For the foregoing reasons, it is considered the proposed activities are consistent with this objective and policy.
NZCPS Policy 5	1 Consider effects on land or waters in the coastal environment held or managed under: a The Conservation Act 1987 and any Act listed in the 1st Schedule to that Act; or b other Acts for conservation or protection purposes; and having regard to the purpose for which the land or waters are held or managed; c Avoid adverse effects of activities that are significant in relation to those purposes; and d Other avoid, remedy or mitigate adverse effects of activities in relation to those purposes. 2 Have regard to publicly notified proposals for statutory protection of land or waters in the coastal environment and the adverse effects of activities on the purpose of that proposed statutory protection.	Under the Marine and Coastal Area (Takutai Moana) Act two applications for recognition of customary interests near Moturoa/Rabbit Island have been received from: • Ngāti Tama ki Te Tau Ihu; and • Te Atiawa o Te Waka-a-Maui Trust. Consultation with these iwi authorities is ongoing (outside the scope of the current applications).
TRPS Policy 4.1	The Council will pursue a process of consultation and participation in resource management between itself and the tāngata whenua of the District.	Whilst this policy is directed at Council, it is important to note that NRSBU has consulted with iwi throughout the preparation of this resource consent application. As noted above, NRSBU has consulted with Te Tau Ihu iwi prior to lodging these applications and throughout the prior Bell Island WWTP consenting process. This consultation and relationship will continue throughout the remainder of the consent process and into the future. The consultation strategy, outcomes, hui minutes, and ongoing communications are described in Section 10 of this AEE and provided in appendices O & P to

Reference	Objective/Policy	Assessment
		the AEE. Overall, it is considered that the project is consistent with this policy.
TRPS Objective 7	Recognition and protection of significant traditional interests of tangata whenua in relation to land, water, the coast and other taonga Maori.	As noted above, NRSBU recognises the ongoing and enduring relation of Te Tau Ihu iwi over their lands, rohe and resources. Consultation with iwi is ongoing.
TRMP Policy 8.2.3.21	To protect historic and cultural sites in riparian margins and the coastal environment.	As set out in Section 4.3.5 of the AEE, all currently known archaeological and cultural sites on Moturoa/Rabbit Island are excluded from biosolids application. Therefore, it is considered that there will be no impact on the protection of historic or cultural sites.
TRMP Objective 21.5.2	Maintenance of the cultural heritage values of items, sites or areas in the coastal marine area, including taonga of the tangata whenua.	As set out in Section 4.3.5 of the AEE, all currently known archaeological and cultural sites on Moturoa/Rabbit Island are excluded from biosolids application.
NRPS TW1.5.5	To ensure that tangata whenua views are sought and considered prior to Council consideration of any resource consent application which relates to matters which the tangata whenua themselves have indicated are of significance to them.	As discussed above, consultation with Te Tau Ihu iwi is ongoing. Te Tau Ihu have been invited to prepare a Cultural Impact Assessment provide for matters of significance to tangata whenua.
NRPS TW1.5.10	To recognise the tangata whenua are kaitiaki of the coastal environment.	In recognising the tangata whenua are kaitiaki of the coastal environment, Te Tau Ihu have been invited to prepare a Cultural Impact Assessment provide for matters of significance to tangata whenua.
NRPS TW1.5.11	To have regard to environmental plans prepared by iwi authorities.	Section 9.10 of the AEE provides an assessment of the proposed activities against the relevant iwi management plans.
NRPS Policy CO1.3.9	When managing the coastal environment, to recognise and provide for matters of special significance to tangata whenua identified and protected in accordance with tikanga maori.	As discussed above, consultation with Te Tau Ihu iwi is ongoing. Te Tau Ihu have been invited to prepare a Cultural Impact Assessment.
NRPS Policy WA1.3.7	To recognise and provide for the cultural and spiritual values of water to tāngata whenua.	

3. Effects on recreational values and public health

Reference	Objective/Policy	Assessment
NZCPS Objective 4	To maintain and enhance the public open space qualities and recreation opportunities of the coastal environment by: • Recognising that the coastal marine area is an extensive area of public space for the public to use and enjoy; […]	As discussed in Section 8.4 of the AEE, biosolids will not be applied in recreation areas nor affect public access to the coastal environment. Use of exclusion zones and buffer areas, carried over from the existing consents, will ensure that public open space qualities and recreation opportunities of the coastal environment are maintained. The coastal assessment and public health assessments (respectively in Appendices I and M of the AEE) conclude that the proposal does not result in any public health effects for users of the coastal marine area and that potential contamination as a result of the proposed works is low, with adverse effects on coastal water quality assessed as being less than minor or negligible.
NZCPS Policy 6 (2)	Additionally, in relation to the coastal marine area: […] a Recognise the need to maintain and enhance the public open space and recreation qualities and values of the coastal marine area. […]	
NZCPS Policy 18	Recognise the need for public open space within and adjacent to the coastal marine area, for public use and appreciation including active and passive recreation, and provide for such public open space, including by: a ensuring that the location and treatment of public open space is compatible with the natural character, natural features and landscapes, and amenity values of the coastal environment; b taking account of future need for public open space within and adjacent to the coastal marine area, including in and close to cities, towns and other settlements; c maintaining and enhancing walking access linkages between public open space areas in the coastal environment; d considering the likely impact of coastal processes and climate change so as not to compromise the ability of future generations to have access to public open space; and e recognising the important role that esplanade reserves and strips can have in contributing to meeting public open space needs.	

Reference	Objective/Policy	Assessment
TRMP Objective 21.7.2	Maintenance and enhancement of the amenity value derived from the natural character of the coastal marine area.	The proposed activities are not undertaken in the coastal marine area. Insofar as the coastal marine area is a potential receiving environment for contaminants from biosolids application, the assessment in Section 8 has demonstrated less than minor adverse effects on amenity values, or recreational use of the coastal marine area.
TRMP Policy 21.7.3	To avoid, remedy, or mitigate the adverse effects of activities in the coastal marine area, including structures for its use and enjoyment, on the amenity values of any part of the coastal marine area or coastal land, particularly on those values dependent on natural character, such as in areas adjacent to national parks, estuaries and open beaches, taking into account: a Location b Permanence c Size and number d Frequency and duration of use e Need to exclude activities or people.	
TRMP Objective 23.2.2	A coastal marine area in which public safety, people's property, and the environment, are free of adverse effects from hazardous substances.	The coastal assessment and public health assessments (respectively in Appendices I and M of the AEE) conclude that the proposal does not result in any public health effects for users of the coastal marine area.

4. Effects on soils, groundwater quality and coastal water quality

Reference	Objective/Policy	Assessment
NZCPS Objective 1	To safeguard the integrity, form, functioning and resilience of the coastal environment and sustain its ecosystems, including marine and intertidal areas, estuaries, dunes and land, by: […] • maintaining coastal water quality, and enhancing it where it has deteriorated from what would otherwise be its natural condition, with significant adverse effects on ecology and habitat, because of discharges associated with human activity.	The coastal assessment report (Appendix I) concludes that potential contamination as a result of the proposed works is low, with adverse effects on coastal water quality assessed as being less than minor or negligible. On this basis coastal water quality is maintained by the proposal.
NZCPS Policy 23	(1) In managing discharges to water in the coastal environment, have particular regard to: a The sensitivity of the receiving environment; […] (2) In managing discharge of human sewage, do not allow: […] a Discharge of human sewage directly to water in the coastal	The sensitivity of the receiving environment is considered in Section 6 of the AEE. The proposal involves the application of Class Ab biosolids to land and not the direct discharge of untreated human sewage to water. A consideration of alternative methods has been assessed in Appendices D and E. The proposal has also been assessed against the objectives and policies of the relevant iwi management plans (see Section 9.10 of the AEE) and hence has been informed by an

Reference	Objective/Policy	Assessment
	environment without treatment; and b The discharge of treated human sewage to water in the coastal environment, unless (i) there has been adequate consideration of alternative methods, sites and routes for undertaking the discharge; and (ii) informed by an understanding of tangata whenua values and the effects on them.	understanding of tangata whenua values. Consultation with iwi is ongoing. Overall, the proposal is considered consistent with Policy 23.
NPS-FM Objective A2	The overall quality of fresh water within a freshwater management unit is maintained or improved while: a Protecting the significant values of outstanding freshwater bodies; b Protecting the significant values of wetlands; and c Improving the quality of fresh water in water bodies that have been degraded by human activities to the point of being over-allocated.	As discussed in the groundwater assessment (Appendix H), groundwater effects are considered to be less than minor. Furthermore, groundwater is not used for any human activities on Moturoa/Rabbit Island.
NRPS Objective RM1.2.1	Sufficient monitoring to provide information on the state of the environment, to identify trends in it, to establish confidence in the outcome of resource management decisions.	Regular monitoring reports are proposed as part of the suite of volunteered consent conditions (Appendix Q). It is considered that the proposal is consistent with this objective.
TRPS Objective 7.4	Maintenance and enhancement of the quality of surface waters and groundwaters for all public uses and values.	As above, the groundwater assessment in Appendix H concludes that any adverse effects are less than minor. There are no public uses for groundwater on Moturoa/Rabbit Island.
TRMP Policy 23.2.3.4	To require contingency plans to be prepared and implemented for any accidental discharge of any hazardous substance into the coastal marine area arising from its storage, use or transport.	The Moturoa/Rabbit Island Biosolids Management Plan (the BMP) covers the ongoing operation and maintenance of the WWTP. The BMP sets out requirements about health and safety, staffing, and response to abnormal events (Appendix F). It is considered that the project is consistent with this policy.
TRMP Objective 33.1.2.1	The discharge of contaminants in such a way that avoids, remedies or mitigates adverse effects while: a Maintaining existing water quality; and	As discussed in the coastal assessment (Appendix I), effects on water quality as a result of the proposed biosolids application to land is considered less than minor and existing water quality is anticipated to be

Reference	Objective/Policy	Assessment
	b Enhancing water quality where existing quality is degraded for natural and human uses or values.	maintained. It is considered that this proposal is consistent with this objective.
TRMP Policy 33.1.3.2	To avoid, remedy or mitigate the adverse effects of discharges of contaminants so that both individually and cumulatively with the effects of other contaminant discharges, they enable the relevant water quality classification standards to be complied with.	Adverse effects associated with the input of contaminants discharging to the Waimea Inlet as a result of the proposed application of biosolids to land is considered low for both chronic and acute effects (see Appendix I). Consequently, all water quality classifications standards are expected to be complied with and this proposal is considered consistent with this policy.
TRMP Policy 33.1.3.6	To take in account the following factors in determining the significance of actual or likely adverse effects on the receiving water of or from contaminant discharges: a Any water classification given in any schedule to Chapter 36 or water conservation order. b Existing water quality of the receiving water. c The significance or sensitivity of the aquatic life or ecosystems. d The extent of the water body adversely affected. e The magnitude, time of year, frequency and duration of the adverse effect, including any cumulative effects as a result of the discharge. f The range and intensity of uses and values of the water body. g The conflicts between uses and values of the water body. h The nature of the risks of the adverse effect. i Any relevant national or international water quality guidelines or standards, or water conservation order.	The groundwater and coastal assessments (Appendices H and I respectively) take into account these factors in determining the actual and likely adverse effects on the receiving environment. As concluded by these assessments, the likelihood of contamination to groundwater and the coastal environment from biosolids application is assessed as being low.
TRMP Policy 33.1.3.7	To ensure the loss of nutrients and sediments to water is minimised through: a Working with industry and landowners to develop good industry practices that maximise nutrient use efficiently and minimise nutrient run-off and leaching; b Requiring through conditions on consent or plan rules that activities that discharge nutrients, or take and	The application of biosolids is proposed to be undertaken in accordance with best practice guidelines outlined in the NZ Biosolids Guidelines 2003. Limits imposed on the rate of biosolid application provided in the existing resource consent conditions and proposed for this application provides for the efficient use of nutrients whilst minimising nutrient run-off.

Reference	Objective/Policy	Assessment
	use water for irrigation, or are land disturbances, are carried out with good industry practice.	
TRMP Policy 33.1.3.10	In establishing water quality limits to safeguard the critical values and achieve the management objectives set out in Schedule 30B, to consider for future inclusion in the Plan in accordance with Policy 33.1.3.8(d) the following parameters (together with any additional parameters agreed between the Waimea Plains Freshwater and Land Advisory Group and Tasman District Council): a Ammonia b Cyanobacteria (Phormidium) c Deposited sediment d Dissolved inorganic nitrogen e Dissolved oxygen f Dissolved reactive phosphorus g Macro-invertebrates h Macrophyte coverage i Microbial levels j Nitrogen toxicity k Periphyton coverage and biomass l pH m Suspended sediment n Temperature o Nitrate-nitrogen and phosphorus.	A full set of monitoring requirements are provided for in the existing resource consents and are proposed for this application (see Section 11 and Appendix Q of the AEE). This includes the requirement for topsoil, subsoil and groundwater sampling for pH, organic matter, total nitrogen, available phosphorous, potassium, calcium, magnesium, sodium, arsenic, cadmium. chromium, copper, lead, mercury, nickel, zinc and aluminium.
TRMP Policy 33.1.3.13	To promote and encourage discharges of wastes to land or constructed wetlands in preference to discharges to water where: a Discharge to land or constructed wetlands has less actual or potential adverse environmental effects than discharge to water; b Land disposal system design and operation is such that adverse effects on the environment, including soil and surface and groundwater quality are avoided, remedied or mitigated; and c The discharge to land is the best practicable option.	As discussed above and in the appended technical assessments, adverse effects on the receiving environment, including soil and surface and groundwater quality, is considered to be less than minor. This is supported by groundwater and soil monitoring, which shows that there have been no observable adverse effects associated with the application of biosolids to land over the last 24 years. Applying biosolids in this manner is considered to be an efficient method in which to dispose of class Ab biosolids which are a product of the wastewater treatment process.
TRMP Policy 33.1.3.16 (1)	When considering any application for a discharge, the consent authority must have regard to the following matters:	Various limits on the application, including nitrogen loading, are provided for in the existing resource consent conditions and are also proposed for this application (see Section

Reference	Objective/Policy	Assessment
	a the extent to which the discharge would avoid contamination that will have an adverse effect on the life-supporting capacity of fresh water including on any ecosystem associated with fresh water and b the extent to which it is feasible and dependable that any more than minor adverse effect on fresh water, and on any ecosystem associated with fresh water, resulting from the discharge would be avoided.	11 of the AEE). Based on these rates (and supporting assessment), the application of biosolids to land is assessed as being a low-risk activity. Overall, any adverse effects associated with contamination are considered to be less than minor.
TRMP Policy 33.1.3.16 (2)	When considering any application for a discharge, the consent authority must have regards to the following matters: a The extent to which the discharge would avoid contamination that will have an adverse effect on the health of people and communities as affected by their contact with fresh water; and b The extent to which it is feasible and dependable that any more than minor adverse effect on the health of people and communities as affected by their contact with fresh water resulting from the discharge would be avoided.	Any adverse effects resulting from the proposed application of biosolids to land has been considered less than minor. There is no freshwater abstraction on Moturoa/Rabbit Island, with potable water reliant on the municipal water supply. Hence, adverse effects on public health is considered to be less than minor and this proposal is considered consistent with this policy.
TRMP Objective 33.2.3	The avoidance, remediation or mitigation of the adverse effects resulting from emergency discharges or accidental spills.	The Moturoa/Rabbit Island Biosolids Management Plan (the BMP) covers the ongoing operation and maintenance of the WWTP. The BMP sets out requirements about health and safety, staffing, and response to abnormal events (Appendix F). It is considered that the project is consistent with this policy.
TRMP Policy 33.2.3.1	To promote and advocate development of site contingency plans to avoid, remedy or mitigate the likely adverse effects of any emergency discharges or other accidental spills.	As above for TRMP objective 33.2.3 it is considered that the project is consistent with these policies.
TRMP Policy 33.2.3.2	To ensure that land use and discharge activities are carried out, having regard to contingency planning measures appropriate to the nature and scale of any discharge and risk to the environment for any accidental discharge of any contaminant that may result in connection with the activity.	

5. Effects on ecology (terrestrial and coastal)

Reference	Objective/Policy	Assessment
NZCPS Objective 1	To safeguard the integrity, form, functioning and resilience of the coastal environment and sustain its ecosystems, including marine and intertidal areas, estuaries, dunes and land, by: • Maintaining or enhancing natural biological and physical processes in the coastal environment and recognising their dynamic, complex and interdependent nature; • Protecting representative or significant ecosystem and sites of biological importance and maintaining the diversity of New Zealand's indigenous coastal flora and fauna; and	Protection is afforded to all Significant Native Habitats on Moturoa/Rabbit Island, and in the coastal marine area, by ensuring these areas are excluded from biosolid application. This will ensure the natural and biological processes in those areas will be maintained.
NZCPS Policy 1	1) Recognise that the extent and characteristics of the coastal environment vary from region to region and locality to locality; and the issues that arise may have different effects in different localities. 2) Recognise that the coastal environment includes: a the coastal marine area; b islands within the coastal marine area; c areas where coastal processes, influences or qualities are significant, including coastal lakes, lagoons, tidal estuaries, saltmarshes, coastal wetlands, and the margins of these; d areas at risk from coastal hazards; e coastal vegetation and the habitat of indigenous coastal species including migratory birds;	This proposal is informed by a comprehensive package of specialist reports, in particular the coastal assessment at Appendix I, that have considered the extent and special characteristics of the coastal environment in the proximity of the proposal site and its surrounds. The application is informed by the specific coastal environment qualities in the area.
NZCPS Policy 11	To protect indigenous biological diversity in the coastal environment: a Avoid adverse effects of activities on: […] v Areas containing nationally significant examples of indigenous community type.	Waimea Inlet is listed in Schedule 25D of the TRMP as an area with nationally significant ecosystem values. The Inlet is one of only two sites where the endangered peppercress plant has been recorded and the endangered grey saltbush is also present. The Inlet is also considered to be of outstanding importance to waders, and is used by white heron, royal

Reference	Objective/Policy	Assessment
	b Avoid significant adverse effects and avoid, remedy or mitigate other adverse effects of activities on: […] iii Indigenous ecosystems and habitats that are only found in the coastal environment and are particularly vulnerable to modification, including estuaries, lagoons, coastal wetlands. Dunelands, intertidal zones, rocky reef systems, eelgrass and saltmarsh.	spoonbill Australasian bittern and banded rail. As discussed in the coastal assessment report in Appendix I, adverse effects on indigenous biological diversity within the Waimea Inlet as a result of the proposed activities is considered to be less than minor, when taking into account the rate in which biosolids will be applied and the proposed buffer areas and exclusion zones.
NRPS Objective WA1.2.2	The maintenance and enhancement of coastal water quality to protect fishery, fish spawning and aquatic ecosystems and, in specific areas, to protect shellfish gathering, contact recreation, and cultural and spiritual values.	As discussed in Section 8.7 of the AEE and the coastal assessment report (Appendix I), effects on coastal water quality and coastal marine life is considered to be less than minor, with the risk of contamination assessed as being low. This will ensure coastal water quality is maintained.
TRPS Objective 2	Maintenance of the biological diversity and healthy functioning of land, freshwater, coastal and marine ecosystems.	The proposed application of biosolids to land is considered to be have negligible ecological effect (see Sections 8.7 and 8.10 of the AEE), with biological diversity and the healthy functioning of the Waimea Inlet maintained.
TRPS Objective 6.2	Maintenance and enhancement of significant areas of indigenous vegetation, significant riparian lands, significant habitats of indigenous fauna and significant natural, landscape and historic features of lands.	As discussed in Section 8.10.1 of the AEE, all Significant Native Habitats on Moturoa/Rabbit Island are excluded from the biosolids application area under the existing consents and will remain so under the proposed consent conditions. It is considered that this project is consistent with this objective.
TRPS Policy 10.9	The Council will ensure that environmental contamination from the storage, treatment or disposal of wastes, particularly hazardous wastes, is avoided, remedied or mitigated	It is not proposed to dispose of hazardous wastes as part of this application. The proposed application of biosolids to land is considered to be have negligible ecological effect (see Sections 8.7 and 8.10 of the AEE). It is considered that the project is consistent with this policy
TRMP Policy 10.1.3.2	To safeguard the life-supporting capacity of the District's indigenous ecosystems, including significant natural areas, from the adverse effects of subdivision, use and development of land.	As discussed above, and within Appendix I, adverse effects on indigenous biological diversity within the Waimea Inlet as a result of the proposed activities are considered to be less than minor. Section 8.10.1 of the AEE, also provides that all Significant Native Habitats on Moturoa/Rabbit Island are excluded from the biosolids application area. It is considered that the project is consistent with this policy

6. Effects on air quality

Reference	Objective/Policy	Assessment
NRPS Objective DA1.2.1	Improvement in Nelson's ambient air quality.	Section 8.8 of the AEE, and the report in Appendix L, sets out mitigation measures which will effectively address odour emissions in order to maintain air quality. Inclusion of a condition requiring no offensive or objectionable odour effects beyond the boundary of the site (i.e. in the coastal marine area) will ensure consistency with these provisions.
NRPS Policy DA1.3.3	To control and/or reduce the volume or concentration of point source discharges so that the adverse effects on people or ecosystems at ground level are avoided or mitigated.	
NRPS Policy DA1.3.4	To ensure industrial, commercial, rural and domestic discharges avoid significant adverse effect on the environment, including people, plants or animals.	
TRPS Policy 9.6	The Council will preserve the natural character of the coastal environment by protecting: […] Water and air quality.	
TRPS Policy 9.7	The Council will avoid, remedy or where appropriate, mitigate adverse effects of the subdivision, use or development of coastal land on: […] Water and air quality.	
TRPS Policy 10.3	The Council will seek to avoid, remedy or mitigate adverse effects of the discharge of contaminants to air	
TRMP Objective 34.1.2	The discharge of contaminants to air in such a way that avoids, remedies or mitigates adverse effects while: a Maintaining existing air quality; and b Enhancing air quality where existing quality is degraded for natural or human uses or values	Adverse effects on air quality will be managed as set out in Section 8.8 of the AEE in a such a manner that ensure existing air quality is maintained.
TRMP Policy 34.1.3.1	To ensure that any discharges of contaminants to air are undertaken in a way that avoids, remedies or mitigates any adverse effects on the receiving environment or surrounding activities.	As set out in Section 8.8 of the AEE, adverse effects associated with odour discharges are considered to be less than minor. The discharge of contaminants to air will be undertaken in accordance with the proposed mitigation measures to ensure effects on the receiving and surrounding environment are avoided, remedied or mitigated where possible.
TRMP Policy 34.1.3.2	To allow or regulate contaminant discharges to air in relation to their actual or potential contamination effects, including: a Adverse effects on human health; b Adverse effects on amenity values; c Contamination of adjacent sites; d Degradation of water quality;	

Reference	Objective/Policy	Assessment
	e The production of objectionable, noxious or offensive odours.	
TRMP Policy 34.1.3.4	To provide for management of some actual and potential adverse effects of discharge to air – particularly odour and dust effects – as ancillary to land use activities, and to take them into account when resource consent applications are being considered.	Section 8.8 and 11 of the AEE sets out the mitigation measures which will effectively address potential odour emissions.

7. Effects on natural character and landscape

Reference	Objective/Policy	Assessment
NZCPS Objective 2	To preserve the natural character of the coastal environment and protect natural features and landscape values through: • Recognising the characteristics and qualities that contribute to natural character, natural features and landscape and their locations and distribution. • Identifying those areas where various forms of subdivision, use, and development would be inappropriate and protecting them from such activities; […]	As set out in Section 8.11 of the AEE, existing natural character values associated with the coastal marine environment are considered to be maintained as effects of the proposed activities are already established under the existing resource consents. The assessments undertaken in support of the current applications indicate the continuation of the activity will not impinge on the preservation of the coastal environment.
NRPS Objective CO1.2.1	Achievement of the social, economic and cultural needs of the community within the coastal environment, while ensuring a high level of protection is afforded to the natural character and to natural and physical resources associated with the coast.	As explained above, the application of biosolids at Moturoa/Rabbit Island is an efficient and beneficial use of the existing wastewater treatment plant outputs (biosolids), and provides important social and economic positive effect, as it provides the communities with an economically sustainable and affordable wastewater treatment system process output. As also explained above, and in section 8.11 of the AEE, it is considered that given the current consents, the existing natural character values associated with the coastal marine environment are maintained.
TRPS General Objective 1	Maintenance and enhancement of the quality of the Tasman District environment.	The proposal maintains and enhances the environment of the Tasman District as the application of Class Ab biosolids to land provides a safe and efficient means in which to dispose of wastewater by-products.
TRPS General Objective 6	Protection and enhancement of significant natural, heritage and cultural values of resources	As discussed in Section 8.11, the application of biosolids is not considered to compromise natural character values and natural and physical resources associated with the coastal marine area.

Reference	Objective/Policy	Assessment
TRMP Objective 8.2.2	Maintenance and enhancement of the natural character of the margins of lakes, rivers, wetland and the coast, and the protection of that character from adverse effects of the subdivision, use, development or maintenance of land or other resources, including effects on landform, vegetation, habitats, ecosystems and natural processes.	As discussed in relation to Objective 2 and Policy 14 of the NZCPS, the application of biosolids is considered to have less than minor adverse effects on natural character values and existing natural character values will be preserved.
TRMP Objective 21.1.2	Preservation of the natural character of the coastal marine area, particularly its margins, and including the maintenance of all values that contribute to natural character, and its protection from the adverse effects of use or development.	
TRMP Objective 21.3.2	Maintenance of the natural character and landscape of the coastal marine area.	
NZCPS Objective 2	To preserve the natural character of the coastal environment and protect natural features and landscape values through: • Recognising the characteristics and qualities that contribute to natural character, natural features and landscape and their locations and distribution. • Identifying those areas where various forms of subdivision , use, and development would be inappropriate and protecting them from such activities; […]	
TRMP Objective 8.1.2	The maintenance and enhancement of public access to and along the margins of lakes, rivers, wetlands and the coast, which are of recreational value to the public.	The application of biosolids does not limit public access to the coastal marine area. This is discussed further in Section 8.4 of the AEE.
TRMP Policy 8.1.3.3	To avoid, remedy, or mitigate the adverse effects on public access caused by structures, buildings, and activities in or adjoining water bodies or the coastal marine area.	

8. Effects from natural hazards

Reference	Objective/Policy	Assessment
NZCPS Objective 5	To ensure that coastal hazard risks taking account of climate change, are managed by: • Locating new development away from areas prone to such risks;	Sea level rise as a result of climate change and potential risks of inundation has been considered as part of this application (see Section 8.12 of the AEE). Moturoa/Rabbit Island has sufficient land area for biosolids

	• Considering responses, including managed retreat, for existing development in this situation; and • Protecting or restoring natural defences to coastal hazards.	application throughout the consent term based on current modelled scenarios. A 6-yearly monitoring and technology review condition is proposed to assess any amendments required to the activities in the event of any changes to the modelled scenarios.
NZCPS Policy 4	Provide for the integrated management of natural and physical resources in the coastal environment, and activities that affect the coastal environment. This requires: […] c Particular consideration of situations where: Development or land management practices may be affected by physical changes to the coastal environment or potential inundation from coastal hazards, including as a result of climate change.	
NZCPS Policy 25	In areas potentially affected by coastal hazards over at least 100 years: a Avoid increasing the risk of social, environment and economic harm from coastal hazards.	
TRPS Objective 11.1	Reduced risks arising from flooding, erosion, inundation and instability and earthquake hazards.	
TRMP Objective 23.1.2	Subdivision, use or development of coastal land that avoids the need for protection works against hazards from natural coastal processes.	

9. Moturoa / Rabbit Island Reserve Management Plan (Section 4.2 Biosolids)

Reference	Objective / Policy	Assessment
Objective 1	To limit the application of biosolids on the Islands to Moturoa/Moturoa / Rabbit Island only (i.e. keep Rough and Bird Islands free of biosolids).	The application of biosolids is proposed only on Moturoa/Rabbit Island.
Objective 2	To ensure appropriate best management practice is used in all aspects of the application of biosolids to forest plantation areas on Moturoa/Moturoa / Rabbit Island.	As outlined in Section 3 of the AEE, the application of biosolids will be undertaken in accordance with best practice measures. This includes adherence to the NZ Biosolids Guidelines 2003.
Objective 3	To recognise the benefits of applying biosolids to forest plantation areas on Moturoa/Moturoa / Rabbit Island as a fertiliser, while balancing this with the need to protect cultural and ecological values and avoid conflicts with people undertaking recreational activities on the Island (particularly in areas classified as Recreation Reserve).	The application of biosolids is a beneficial means in which to dispose of waste material. This activity benefits forestry activity, by providing a source of nitrogen fertiliser as well as supporting the ongoing use of wastewater infrastructure in the Tasman district.
Objective 4	To balance the most effective and efficient means for disposal of biosolids.	The application of biosolids is an effective and efficient method of disposing of a waste material.
Policy 1	All activities associated with the application of biosolids to forested areas on Moturoa / Rabbit Island should be undertaken in accordance with the relevant best practice guidelines. As at 2016, these included: • Best Management Practices for Applying Biosolids to Forest Plantations in New Zealand (New Zealand Forest Research Institute Ltd, 2010); • Guidelines for the Safe Application of Biosolids to Land in New Zealand (NZWWA, 2003); and • New Zealand Environmental Code of Practice for Plantation Forestry (NZFOA, 2007).	As discussed in Section 3.5, the application of biosolids will be undertaken in accordance with relevant best practice guidelines, specifically the New Zealand Biosolid Guidelines 2003.
Policy 2	The NRSBU is encouraged to engage and meet with iwi before submitting any applications for new or varied resource consents associated with the application of biosolids to Moturoa/Moturoa / Rabbit Island. Note: Iwi are particularly interested in exploring various ways environmental effects can be mitigated, whether the total amount of biosolids applied can be reduced, and other alternatives available for treating and disposing of sludge from	As discussed in Section 10 of the AEE, consultation with iwi is ongoing. A comprehensive assessment of alternative options has been undertaken as discussed in Section 5 of the AEE.

Reference	Objective / Policy	Assessment
	the Bell Island Wastewater Treatment Plant.	
Policy 3	Exclusion areas, where no application of biosolids is permitted, should include: a) Rough Island, Bird Island and all areas classified as Recreation Reserve on Moturoa/Moturoa / Rabbit Island; b) The harakeke/flax swamp near the northern coast of Moturoa/Moturoa / Rabbit Island; c) Mahinga kai areas; d) Sites of archaeological significance (i.e. areas of land where recorded archaeological sites, wāhi tapu, koiwi or other taonga are located); e) Areas identified as significant native habitats; f) The eastern tip of Moturoa/Moturoa / Rabbit Island (area east of Corder Road); g) The coastal margin and waterways; h) Land subject to tidal inundation (taking sea level rise into account); i) Any areas where heavy metal concentrations exceed acceptable standards; and j) Any other areas identified by resource consent conditions.	The proposed exclusion zones are in accordance with the RMP. As discussed in Section 4.3.5 of the AEE, exclusion areas include: • The majority of the area held for Recreation Reserve, including the entire strip along the northern extent of the island; • Significant native habitats; and • Archaeological and cultural sites.
Policy 4	Buffer zones should provide an adequate setback from sensitive cultural and ecological sites, the coastline and waterways (including the Traverse, tributaries and estuarine areas) and recreational activities that take place on the islands.	As set out in Section 4.3.5 of the AEE and in the existing resource consent conditions, buffer area are required 50m from Mean High Water Springs in order to limit any adverse effects on the coastal marine area and recreational areas.
Policy 5	During the time period between Labour Weekend and Easter each year, biosolid application activities should be scheduled to avoid (or be well set back from) areas where recreational activities take place on the Islands. The latter includes all areas of Recreation Reserve and roads and tracks available for specific recreation activities (e.g. Monaco Road, Boat Ramp Road, Tasman's Great Taste Trail and the western half of Moturoa/Moturoa / Rabbit Island).	The buffer areas required in the existing resource consents and proposed in the application ensure biosolid application activities are sufficiently setback from recreational areas. This includes an increased buffer area from the Domain area during November to April when there is increased recreational use.
Policy 6	The NRSBU is encouraged to investigate ways of preventing or minimising odour from crossing the boundaries of the areas being sprayed (e.g. factor wind direction	Section 8.8 of the AEE, and the report in Appendix L, discuss methods in which adverse

Reference	Objective / Policy	Assessment
	and strength into the spraying schedule, if practicable).	odour effects are proposed to be avoided or minimised where possible.
Policy 7	Options for minimising odour issues resulting from biosolid application activities should be explored as part of any future resource consent application.	
Policy 8	Forestry blocks scheduled for biosolid application should be adequately identified on the ground (e.g. by taping them off) and have signage in place, notifying the public of the stand down period that applies to that block, at least one month in advance of spraying.	As set out in the Biosolids Management Plan (Appendix F of the AEE), forestry blocks are appropriately taped off prior to the application of biosolids, with signage put in place.

Attachment O

Duncan Cotterill

ENGAGEMENT STRATEGY

Moturoa/ Rabbit Island Biosolids Resource Consent Project

Prepared for the Nelson Regional Sewerage Business Unit
April 2020

Duncan Cotterill

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1 INTRODUCTION

1.1 This Engagement Strategy sets out the purpose and statutory obligations for the engagement process, establishes the objectives for the engagement, identifies key stakeholders, potentially affected parties, and other interested groups (e.g. community groups) that will need to be engaged with.

1.2 This Engagement Strategy sets out the approach to the engagement process (including best practice tools) and identifies the expected outcomes of these engagement activities that are to be part of the resource consent process.

1.3 This Engagement Strategy has been developed to ensure that engagement is carried out effectively, in accordance with all statutory requirements, and to ensure that all persons potentially affected by, or interested in, the renewal consents have an opportunity to become actively and effectively involved in the process.

1.4 This document is a living document and is intended to evolve through the engagement process.

2 BACKGROUND

2.1 The Nelson Regional Sewerage Business Unit (**NRSBU**) operates the Bell Island Wastewater Treatment Plant (WWTP) which receives and treats wastewater from Tahunanui, Stoke, Richmond, Brightwater, Wakefield, and Mapua. The suite of consents authorising the ongoing operation of the WWTP and associated discharges to the Waimea Inlet, to land via irrigation and to air (odour) have recently been renewed for a term of 20 years.

2.2 Ancillary to the operation of the WWTP the NRSBU holds three resource consents which together authorise the biosolids operation at Moturoa/ Rabbit Island.

- Discharge permit authorising the discharge biosolids to land (forestry blocks)
- Land use consent authorising the use of Rabbit Island for the discharge of biosolids and associated buildings and structures
- Coastal permit authorising the construction and occupation of an underground pipeline from Bells Island to Rabbit Island

2.3 The biosolids discharge permit is due to expire on 8 November 2020 and the NRSBU is in the process of renewing this and associated consents, including a new discharge permit to authorise the discharge of odour to air. The application will be supported by an Assessment of Environmental Effects (**AEE**).

3 PURPOSE

3.1 The purpose of this Engagement Strategy is to provide a clear framework to guide the engagement process associated with the renewal application (**the project**). The aim of this Consultation Strategy is to provide a pathway for the NRSBU and project team to:

3.1.1 Inform stakeholders, Te Tau Ihu iwi, potentially affected parties, and other interested parties of the project including environmental investigations, findings, and environmental effects.

3.1.2 Encourage stakeholders, Te Tau Ihu iwi, potentially affected parties, and other interested parties to be involved in the pre-consenting engagement stage of the project.

3.1.3 Actively engage with stakeholders, Te Tau Ihu iwi, potentially affected parties and other interested parties so that they meaningfully engage in the process and convey in sufficient detail any issues and concerns that they may have.

3.1.4 Respond to feedback received from stakeholders, Te Tau Ihu iwi, potentially affected parties, and interested parties and convey how their issues and concerns have been considered by the NRSBU.

3.1.5 Provide a reference point for all members of the project team to ensure that everyone is working towards the same common goal. It is critical to the success of the project that all members of the project team follow the agreed processes and techniques outlined in this document.

3.1.6 Develop an internal "engagement record" to provide an accurate record of the engagement undertaken for the project.

3.1.7 Provide for internal cross-check monitoring between members of the project team. This is important to ensure engagement is undertaken in the manner agreed to by various parties including the NRSBU and Te Tau Ihu iwi.

3.1.8 Ensure compliance with the statutory and legal requirements and best practice guidelines that govern the engagement process.

4 OUTCOMES SOUGHT

4.1 The desired outcomes in respect of this Engagement Strategy are as follows:

4.1.1 An opportunity to participate in the engagement process is provided for all people and organisations interested in or affected by the project and that useful feedback is received to assist NRSBU decision making;

4.1.2 Te Tau Ihu iwi are engaged in accordance with the status afforded to them by way of the Ngāti Apa ki te Rā Tō, Ngāti Kuia, and Rangitāne o Wairau Claims Settlement Act 2014, the Ngāti Kōata, Ngāti Rārua, Ngāti Tama ki Te Tau Ihu, and Te Ātiawa o Te Waka-a-Māui Claims Settlement Act 2014, and the Ngati Toa Rangatira Claims Settlement Act 2014, rather than just as the general public, and in a manner that meets their cultural or organisational needs;

4.1.3 NRSBU provides quality information, delivered in simple language, to allow participants to understand the particulars of the project;

4.1.4 Reliable, useful, and informed responses to engagement are received;

4.1.5 All participants are satisfied that the engagement process has been conducted in a genuine and open-minded manner;

4.1.6 All participants are satisfied that their responses have been considered and understand how their responses have been addressed;

4.1.7 The NRSBU has a full record and an audit trail of a comprehensive engagement process to support any future actions;

4.1.8 The engagement process promotes open lines of communication between NRSBU and stakeholders, Te Tau Ihu iwi, potentially affected parties and interested parties past lodgement of the application and into the future;

4.1.9 Compliance with the NRSBU strategic goals; and

4.1.10 The Tasman District Council is satisfied that appropriate and effective consultation has been undertaken in accordance with Resource Management Act 1991 (RMA) best practice.

5 GUIDELINES TO ENGAGEMENT

5.1 The framework for this Engagement Strategy is derived from the guidance and requirements set out in the RMA, Local Government Act 2002 (**LGA**), and planning documents that were formed under these legislative frameworks. Guidance is also drawn from other directive sources such as policy documents and case law.

5.2 The relevant legislative provisions, planning documents, and specific policy documents/strategies informing this Engagement Strategy are:

- The Resource Management Act 1991 (the **RMA**);
- Local Government Act 2002;
- Te Tau Ihu iwi Deed of Settlement Acts;
- Te Tau Ihu iwi Statutory Acknowledgements;
- The Waimea Inlet Strategy;
- Tasman Regional Policy Statement;
- Nelson Regional Policy Statement;
- Draft Nelson Regional Policy Statement;
- Tasman Resource Management Plan;
- Nelson Resource Management Plan;
- Iwi Management Plans
- Tasman District Significance and Engagement Policy;
- Nelson City Council Significance and Engagement Policy 2014 (amended 2016); and
- Statement of Consultation Principles – developed in the Environment Court.

5.3 Some key understandings drawn from the above are summarised below to provide guidance and context to the NRSBU and the project team.

5.3.1 Section 36A of the RMA provides that there is no duty for applicants (and councils) to undertake consultation/ engagement for resource consent applications. Whether to undertake consultation/ engagement, and the extent and nature of that, is up to the applicant, however, is considered best practice by the Courts. The Environment Court made a clear statement in the case of *Watercare Services Ltd v Auckland Council*[1]:

"*consultation is best practice and it is foolish for a party not to consult with those with a known interest in a proposal. Consultation is actively encouraged (if not directed) by the Court*".

5.3.2 Early engagement with Māori is best practice for resource consent applicants in order to establish a working relationship with mana whenua, demonstrate compliance with the relevant provisions in Part 2 of the Resource Management Act, and to reduce the likelihood of future difficulties arising, including litigation.[2]

5.3.3 Engagement is often required to identify the full extent of environmental effects i.e. to provide a full AEE. Schedule 4 of the RMA requires that an AEE should

[1] [2011] NZEnvC 155, (2011)

[2] *Te Kura Pukeroa Maori Inc v Thames-Coromandel District Council* (NZEnvC W069/07, 5 September (2007)

include an identification of the persons affected by the proposal, the engagement undertaken, and any response received.

5.3.4 Both Council's Significance and Engagement Policies require that the extent and significance of engagement is to be determined on a case by case basis, and that consultation should occur at a similar scale to the effects expected to be generated by the project.

5.3.5 The primary objective of engagement is a genuine exchange of information and points of view between applicants and people affected or interested in a proposal.

5.3.6 Engagement is a two-way process and an open mind is important to allow both parties to put forward their points of view, and to listen to and consider other perspectives.

5.3.7 Agreement does not need to be reached but it is expected that all parties will make a genuine effort. Narrowing the areas of disagreement is beneficial to the applicant.

6 GROUPS TO BE ENGAGED WITH

6.1 Stakeholders, Te Tau Ihu iwi, potentially affected and interested parties for this project have been identified and are listed below. As signalled in the introduction section this list is not exhaustive and the expectation is that it will be updated (both insertions and deletions) as the project progresses.

6.2 It is important to acknowledge the distinction between "affected persons" and "interested parties". Affected persons are identified by Council as experiencing an adverse effect from the project that is minor or more than minor. "Interested parties" refers to a broader group and includes everyone who has an interest in an application, geographic area or issue.

Stakeholders - Statutory bodies

- Nelson City Council
- Tasman District Council
- Department of Conservation
- Nelson Marlborough Conservation Board
- Nelson/Marlborough Fish and Game Council
- Nelson/Marlborough District Health Board (Public Health Department)
- Ministry for Primary Industries

Stakeholders - Environmental groups

- Friends of Nelson Haven and Tasman Bay
- Forest and Bird Protection Society
- Waimea Inlet Forum

Stakeholders – Significant Industry

- Nelson Pine
- Turners and Growers Global Limited
- Cedenco Foods New Zealand Limited
- Alliance

Te Tau Ihu Iwi

- Ngāti Koata
- Ngāti Kuia
- Ngāti Tama ki te Waipounamu
- Ngāti Apa ki te Rā Tō
- Te Rūnanaga o Ngāti Rārua
- Ngāti Toa
- Te Ātiawa o te Waka a Māui
- Te Rūnanga a Rangitane ki Wairau

Potentially affected landowners and occupiers (in proximity)

- Mapua and Districts Community Association
- Best Island Residents
- Mapua Leisure Park
- Mapua Wharf commercial centre – including bike hire
- Greenacres golf club
- PF Olsen Limited

Other interested parties

- Mapua Ferry operator
- Mapua Boat Club
- Monaco Boat Club
- Vortex Wind Karting
- Rough Island Equestrian Park
- Nelson mountain bike club
- Nelson Orienteering Club
- Athletics Nelson

7 ENGAGEMENT TECHINQUES AND METHODS

7.1 Engagement should be targeted to the specific audience - a one size fits all approach is not appropriate.

7.2 Some groups may be able to identify their preferred forms of engagement. It is expected that NRSBU and the project team will use reasonable endeavours to engage with parties in the manner identified. This will assist to develop long-term relationships and shows a willingness to operate in good faith and with an open mind.

COVID - 19

7.3 Normal practice is for an Engagement Strategy to identify a variety of different engagement methods, however, given the current situation (alert level 3 pandemic lockdown) some engagement methods are not realistic or appropriate for NRSBU to undertake at this time. In light of these restrictions this Engagement Strategy presents are truncated list of options that are suitable for NRSBU to pursue in the current circumstances.

7.4 Government direction indicates that at alert level 3 it will not be possible for people to congregate in groups. As such, usual engagement methods such as meetings, Hui, workshops, public display boards and site visits will not be possible. The NRSBU will facilitate alternate ways for those engaged with to provide feedback in a meaningful way.

7.5 The NRSBU will adopt the following engagement methods:

7.5.1 **Email**

NRSBU will use email as the main form of communication. Initial engagement contact, provision of information, responses/ feedback, follow up and ongoing updates will be via email in the first instance.

NB If any party engaged with elects phone correspondence then this will be adopted in lieu of the above.

7.5.2 **Phone**

Follow up to feedback/ responses will be made by phone call where contact numbers are provided. Verbal communication is considered to better establish long-term relationships and is preferred for short communications where possible.

7.5.3 **Virtual meetings**

If interest is shown from those parties engaged with, meetings/ hui will be held online utilising Skype, Zoom, Microsoft Teams services.

7.5.4 **Virtual Rabbit Island tour**

In lieu of site visits the NRSBU will offer a virtual Top of the Souths Map tour to interested parties. This will need to be conducted in small groups.

7.5.5 **Website**

The NRSBU will establish a project page on the NRSBU website and will provide a mechanism for people to request further information on the project.

7.5.6 **Consistent point of contact**

The NRSBU will ensure that there is a single point of contact for all engagement related queries to ensure that all contacts are responded to in a consistent and timely manner. With the exception of engagement with Te Tau Ihu Iwi where Aneika Young will assume a liaison role on behalf of the NRSBU.

7.5.7 **Media Releases**

Will serve as an update on project development and will capture a wider audience that is not limited to the project area. These would generally be timed to publicise key milestones in the project.

7.5.8 **Newspaper**

Public notices and articles in the ‘Nelson Mail’ and the ‘Waimea Weekly’ will be used where appropriate.

7.5.9 Register of Interest

A list of persons who have a general interest in the project and have requested updates and information on key milestones and events. A page on the NRSBU's website will be established to enable people to register their interest.

7.5.10 Register of Stakeholders

A list of persons who actively want to take part in the engagement process and who wish to be members of stakeholder groups. The register shall be contained in the engagement database.

7.5.11 Engagement Database

An engagement database will be kept for recording all parties contact details; all correspondence with and documentation sent out (including feedback that is provided to those who have participated in the engagement process with respect to how their concerns / issues have been addressed and / or why their issues and concerns have not been addressed); attendees at meetings and all engagement documents.

8 ENGAGEMENT WITH TE TAU IHU IWI

8.1 The NRSBU have engaged Aneika Young to guide the overall approach to engagement with Te Tai Ihu iwi. The NRSBU rely on Ms Young to convey the particulars of the project in a format and manner that is appropriate to Māori, to facilitate communication/ hui and to record the responses received for the NRSBU.

8.2 Ms Young will prepare an Engagement Agreement (or similar) to document the particulars of the engagement that will take place with Te Tau Ihu Iwi. Te Tau Ihu iwi will decide on an appropriate response to the project however the expectation is that this may be in the form of a Cultural Impact Assessment or an iwi position statement.

8.3 Provided a schedule of fees/ disbursements is provided, the NRSBU will cover the costs associated with the preparation of any Cultural Impact Assessment and/ or establish terms of reference before any work is done.

8.4 Where further information is required by Te Tau Ihu Iwi from the NRSBU, Ms Young will request this from the consents manager in a timely manner to ensure potential delays are managed.

8.5 Ms Young will facilitate the feedback/ response exchange between Te Tau Ihu Iwi and the NRSBU and where appropriate will provide reasons for the NRSBU decision making.

8.6 The NRSBU acknowledges that Te Tau Ihu iwi may wish to provide sensitive information during the course of the engagement process. Information which discloses the location of wāhi tapu for example, or would otherwise represent a serious offence to tikanga Māori if made public, can be withheld from disclosure to third parties under section 7(2)(ba) of the Local Government Official Information and Meetings Act 1987 (LGOIMA) and, once an application for resource consent is lodged, be the subject of orders under section 42 of the Resource Management Act 1991.

8.7 The NRSBU will reply on Ms Young to provide further specifics about the key protocols with iwi engagement as the project processes.

9 RISKS

9.1 The following risks are identified so that the NRSBU and the project team are aware of the potential challenges involved in the engagement process.

9.1.1 Timing

(a) The timeframe to lodgement of the resource consent application is tight and there is insufficient time for engagement to occur in a meaningful way. A key risk is that engagement efforts will be regarded as ingenuine and a "box ticking exercise" rather than meaningful engagement.

(b) Due to COVID-19 the NRSBU is unable to undertake some forms of engagement that would otherwise have been pursued.

(c) The NRSBU must ensure that it is flexible and capable of adapting to the current circumstances whilst staying true to the project outcomes sought and adhering to the guiding principles of this Engagement Strategy.

9.1.2 Lack of engagement

(a) Some people and organisations may be preoccupied with business contingency planning due to COVID-19 and unable to participate in the project engagement process. Those parties who are not considered an essential service may not be open or online and may fail to receive, respond, or engage with the NRSBU's efforts to engage.

(b) Few responses may mean that the NRSBU fails to obtain valuable input and subsequently fails to take into account important considerations. This may have a flow on effect with respect to compiling a full and complete AEE.

(c) The NRSBU acknowledges the extraordinary post settlement demands on Te Tai Ihu iwi both with respect to resources and time. There is a risk that these pressures may result in Te Tau Ihu iwi being unable to participate fully in the engagement process.

9.1.3 Failure to identify key stakeholders

(a) Failure to engage with any stakeholder, affected person or interested party may result in a critical issue/ environmental effect arising post lodgement of the application that the NRSBU is not alive to or able to avoid, remedy or mitigate within the scope of the application.

9.1.4 Differing values and concerns

(a) Information needs to be carefully packaged and different engagement approaches must be adapted for different groups that are targeted to address key matters of concern and/or value. and approached differently with certain groups.

(b) The NRSBU need to engage in good faith and with an open mind which may be challenging due to project delivery timing constraints.

10 NEXT STEPS

10.1 This Engagement Strategy will be developed following input from the NRSBU and the consent authority (TDC) following an informal pre-application meeting.

10.2 As the COVID-19 situation evolves there may become opportunities for alternate methods of engagement to occur provided parties are willing.

10.3 Inputs from affected and interested parties will be gathered through the following mechanisms:

- Electronic records of all communications (phone, email, and written);
- Records of virtual meetings (with agreed minutes where appropriate);
- Feedback forms and registrations of interest via the website

10.4 The consent manager will be responsible for ensuring that the engagement database is kept up to date at all times.

Application of biosolids to forestry blocks at Moturoa/ Rabbit Island

The Nelson Regional Sewerage Business Unit is in the process of renewing resource consents to authorise the application of biosolids to land (forestry blocks) at Moturoa/ Rabbit Island. Biosolids have been applied to land at Moturoa/ Rabbit Island since 1996. The NRSBU will also be applying for a resource consent to discharge odour generated by the biosolids operation to air.

The application for resource consent will be supported by an assessment of environmental effects and will be lodged with the Tasman District Council (the consent authority) by 7 August 2020. The NRSBU is engaging with Te Tau Ihu Iwi and key stakeholders including the District Health Board, Environmental interest groups, recreational users of Moturoa/ Rabbit Island and the neighbouring Best Island and Mapua communities.

The suite of consents authorising the ongoing operation of the WWTP and associated discharges to the Waimea Inlet, to land via irrigation and to air (odour) have recently been renewed for a term of 20 years.

If you want to find out more and receive updates on the project as it progresses, please email your details to the consent manager Katherine Forward Katherine.forward@duncancotterill.com

Posted 58 days ago by Duncan Heal Less than a minute to read

Nelson Regional Sewerage Business Unit

7 May 2020

[Recipient]

Via email:

Tēnā rā koe

Kei te mihi ahau e te rangatira me te kaitiaki hoki o te rohe nei, tēnā rā koe.

Resource Consent Renewal - Moturoa/ Rabbit Island Biosolids Application to Land

BACKGROUND

1 The Nelson Regional Sewerage Business Unit (NRSBU) operates the Bell Island Wastewater Treatment Plant (WWTP) which receives and treats wastewater from Tahunanui, Stoke, Richmond, Brightwater, Wakefield, and Mapua. The consents for the WWTP and discharge to the Waimea Inlet have recently been renewed for a term of 20 years.

2 The NRSBU also holds resource consents for the application of biosolids at Moturoa/ Rabbit Island:

- Discharge permit authorising the discharge biosolids to land (forestry blocks)
- Land use consent authorising the use of Rabbit Island for the discharge of biosolids and associated buildings and structures
- Coastal permit authorising the construction and occupation of an underground pipeline from Bell Island to Rabbit Island

3 The biosolids discharge permit is due to expire and the NRSBU is in the process of renewing this and associated consents, including a new discharge permit to authorise the discharge of odour to air. An application will be lodged with the Tasman District Council (the consent authority) by **7 August 2020** and will be supported by an Assessment of Environmental Effects (AEE).

ENGAGEMENT

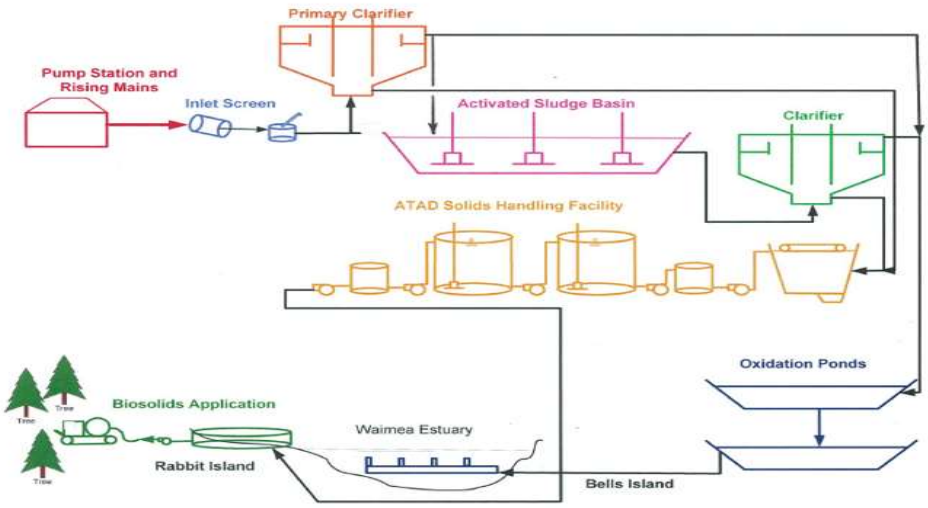
4 The NRSBU recognises that engagement is a key component of the resource management process and acknowledges that engagement with [iwi entity] is critical to inform the resource consent application and AEE.

5 The NRSBU has engaged Aneika Young as a cultural environmental consultant to assist in facilitating the engagement between NRSBU and iwi entities in Te Tau Ihu. Ms Young will be working to ensure appropriate meaningful engagement takes place, sharing of relevant

information, and supporting a response from iwi. Please also refer to the Engagement Strategy document for more information on how NRSBU will engage with Te Tau Ihu iwi.

WHAT ARE BIOSOLIDS?

6 A secondary biproduct of the wastewater treatment process is the production of sludge. The sludge is treated through Autothermal Thermophilic Aerobic Digestion (ATAD) which heats the sludge to high temperatures for a prolonged period. This digestion process converts sludge to class A biosolids which are suitable for application to land. The biosolids are well pasteurised and the ATAD treatment process eliminates pathogens to the extent that they are not considered to pose a risk to human health. The treatment process is illustrated below.



THE CURRENT APPROACH

7 The existing discharge permit authorises the NRSBU to apply biosolids to forestry blocks subject to appropriate conditions. The conditions require the NRSBU to undertake regular monitoring of biosolids quality, soil, groundwater and the coastal marine environment.

8 Consent conditions prescribe that no biosolids are to be applied to identified archaeological sites, culturally significant sites and ecologically significant areas (exclusion zones). A buffer zone from the mean high-water springs line minimises potential effects of the biosolids operation on recreational use of Moturoa/ Rabbit Island and takes into account potential sea level rise/ storm surge events.

WHY APPLY BIOSOLIDS ON MOTUROA/ RABBIT ISLAND?

9 Forestry has been the predominant land use at Moturoa/ Rabbit Island since the 1920's and NRSBU has been applying biosolids to forestry blocks at Moturoa/ Rabbit Island for the last 24 years. The biosolids provide nutrients which supplement the nutrient poor soils found at Moturoa/ Rabbit Island and increase tree growth. These nutrients replace conventional fertilisers. The NRSBU's goal is to maintain 100% beneficial reuse of biosolids into the future.

THE APPLICATION METHOD

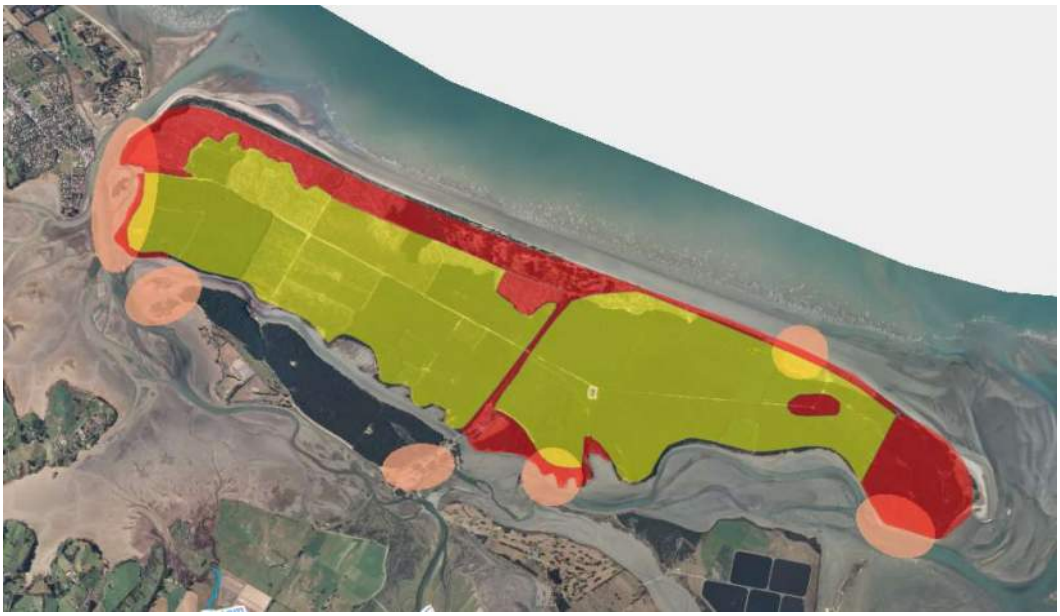
10 Biosolids are currently applied via a heavy-duty travelling irrigator that tracks into forestry rows and sprays liquid biosolids on its return trip. Biosolids are applied at varying application rates dependant on tree age. The consent conditions require the NRSBU to adhere to a maximum average rate of nitrogen per hectare per year.

11 A biosolids management plan details operational procedures including monitoring and record keeping, block selection and spray schedule, pre and post spray checks, signage, health and safety requirements and emergency/ contingency planning.

12 The current application method is a proven cost efficient and environmentally sustainable way of beneficially utilising the biosolids.

EXCLUSION ZONES

13 The existing exclusion zones include culturally significant sites, archaeological sites, recreation reserve areas and ecologically significant areas. The NRSBU acknowledges that there may be additional sites that need to be considered as future exclusion zones and seeks your advice to identify these locations. The plan identifies the biosolids application area (yellow), the exclusions zones as per existing conditions of consent (red) and known archaeological sites (peach circles).



ASSESSMENT OF EFFECTS ON THE ENVIRONMENT

14 The NRSBU has commissioned NIWA to undertake a public health risk assessment and the AEE will consider existing monitoring data and results related to groundwater, soil, estuarine health, and odour complaints. It will also consider alternative options for biosolids disposal as required under the Resource Management Act.

15 The NRSBU is engaging with all Te Tau Ihu iwi and is consulting with key stakeholders including the District Health Board, environmental interest groups, recreational users of Moturoa/ Rabbit Island and the neighbouring Best Island and Mapua communities.

16 The NRSBU is committed to continuous improvement of the existing operation taking into account best practice requirements, relevant guidelines and regulations and where possible to respond to concerns raised in engagement.

CULTURAL IMPACT ASSESSMENT

17 As part of the resource consent process there is scope to develop a Cultural Impact Assessment (CIA), which will be included in the resource consent application when this is lodged with the Tasman District Council. The NRSBU would be grateful if you would please indicate whether you are interested in preparing a CIA in collaboration with other Te Tau Ihu iwi groups or whether your preference is to prepare an individual CIA. The NRSBU recognises the resourcing,

capability and capacity issues that iwi entities face, and appropriate reimbursement will be provided to cover costs for any CIA that iwi provide.

HUI

18 The NRSBU would like to organise a hui to provide an opportunity for you to hear from the project team and experts on the application and ask any questions that you may have. A placeholder has been tentatively set for the week 18 – 22 May 2020 and the NRSBU would appreciate you advising any availability constraints within this period.

HOW DO YOU PROVIDE FEEDBACK?

19 Aneika Young has been engaged by the NRSBU to facilitate iwi engagement and together with the consent manager, Katherine Forward, will both be available to discuss the application and provide any further information you require. If you prefer, please contact me personally.

20 The NRSBU asks that you provide initial feedback in relation to the following matters by **15 May 2020**.

- What is your role/ organisation?
- How would you like the NRSBU to engage with your organisation moving forward - email or phone?
- Do you have a key person from your organisation that you can appoint for future correspondence and communications?
- Are you interested in preparing a CIA?
- Are you interested in attending a hui during the week of 18 – 22 May?

21 Please address all feedback to Aneika Young via email aneika.young@cawthron.org.nz and copy to Katherine Forward katherine.forward@duncancotterill.com

Hei kōnei rā,

Nathan Clarke

General Manager
Nelson Regional Sewerage Business Unit (NRSBU)

Telephone: 022 013 4808
Email: nathan.clarke@ncc.govt.nz

Nelson Regional Sewerage Business Unit

8 May 2020

[Recipient]

Via email: [email address of contact]

Attention: **[name of contact]**

Dear [Sir/Madam]

Resource Consent Renewal - Moturoa/ Rabbit Island Biosolids Application to Land

BACKGROUND

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2.3 Coastal permit authorising the construction and occupation of an underground pipeline from Bell Island to Rabbit Island

3 The biosolids discharge permit is due to expire and the NRSBU is in the process of renewing this and associated consents, including a new discharge permit to authorise the discharge of odour to air. An application will be lodged with the Tasman District Council (the consent authority) by **7 August 2020** and will be supported by an Assessment of Environmental Effects (AEE).

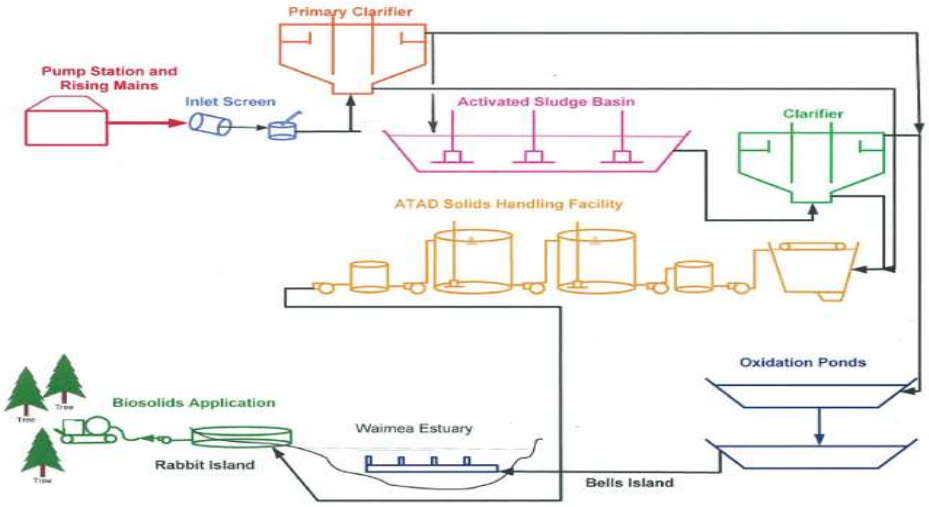
ENGAGEMENT

4 The NRSBU recognises that engagement is a key component of the resource management process and has identified you as a key stakeholder in the biosolids operation. The NRSBU would welcome your feedback in the pre-consenting process.

5 Given the implications of COVID-19, the NRSBU asks that you provide feedback by **Friday 15 May 2020**. If required, the NRSBU will follow up by phone and/ or virtual meeting - Skype or similar. Contact details for the NRSBU's consent manager are located at the end of this letter.

WHAT ARE BIOSOLIDS?

6 A secondary biproduct of the wastewater treatment process is the production of sludge. The sludge is treated through Autothermal Thermophilic Aerobic Digestion (ATAD) which heats the sludge to high temperatures for a prolonged period. This digestion process converts sludge to class A biosolids which are suitable for application to land. The biosolids are well pasteurised and the treatment process eliminates pathogens to the extent that they are not considered to pose a risk to human health. The treatment process is illustrated below.



THE CURRENT APPROACH

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8 Consent conditions prescribe that no biosolids are to be applied to identified archaeological sites, culturally significant sites, and ecologically significant areas (exclusions zones). A buffer zone from the mean high-water springs line minimises potential effects of the biosolids operation on recreational use of Moturoa/ Rabbit Island and takes into account potential sea level rise/ storm surge events.

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THE APPLICATION METHOD

10 Biosolids are currently applied via a heavy-duty travelling irrigator that tracks into forestry rows and sprays liquid biosolids on its return trip. Biosolids are applied at varying application rates dependant on tree age. The consent conditions require the NRSBU to adhere to a maximum average rate of nitrogen per hectare per year.

11 A biosolids management plan details operational procedures including monitoring and record keeping, block selection and spray schedule, pre and post spray checks, signage, health and safety requirements and emergency/ contingency planning.

12 The current application method is a proven cost efficient and environmentally sustainable way of beneficially utilising the biosolids.

ASSESSMENT OF EFFECTS ON THE ENVIRONMENT

13 The NRSBU has commissioned NIWA to undertake a public health risk assessment and the AEE will consider existing monitoring data and results related to groundwater, soil, estuarine health, and odour complaints. It will also consider alternative options for biosolids disposal as required under the Resource Management Act.

14 The NRSBU is engaging with Te Tau Ihu iwi and is consulting with key stakeholders including the District Health Board, environmental interest groups, recreational users of Moturoa/ Rabbit Island and the neighbouring Best Island and Mapua communities.

15 The NRSBU is committed to continuous improvement of the existing operation taking into account best practice requirements, relevant guidelines and regulations and where possible to respond to concerns raised in engagement.

HOW DO YOU PROVIDE FEEDBACK?

16 Katherine Forward a resource management lawyer at Duncan Cotterill has been appointed consent manager and is available to discuss the application and provide any further information you require. If you prefer, please contact me personally.

17 Please address all feedback to Katherine via email katherine.forward@duncancotterill.com by **15 May 2020**.

18 The following questions may assist to guide your feedback; however the NRSBU encourages you to address any matter that you consider is relevant to the application.

18.1 What is your role/ organisation?
18.2 Do you have a key person from your organisation that you can appoint for future correspondence and communications?
18.3 What do you see as the positives of the application of biosolids at Moturoa/ Rabbit Island?
18.4 Are you aware of any negatives of the application of biosolids at Moturoa/ Rabbit Island?
18.5 In considering the current approach what matters do you think the NRSBU should take into account?
18.6 If the NRSBU is to continue to apply biosolids at Moturoa/ Rabbit Island are there specific conditions that it should comply with?
18.7 What do you consider is an appropriate term of consent?
NB - the existing consent was granted for 25 years
18.8 How would you like the NRSBU to engage with you – email or phone?

Yours sincerely

Nathan Clarke

General Manager
Nelson Regional Sewerage Business Unit (NRSBU)

Telephone: 022 013 4808

Email: nathan.clarke@ncc.govt.nz

NRSBU MOTUROA/ RABBIT ISLAND BIOSOLIDS RESOURCE CONSENT PROJECT

HUI ('ZUI') 4 JUNE 2020

1.30PM – 3.30PM

Attendance

NRSBU project team: Daniel Murray (**Tonkin Taylor**), Katherine Forward (**Duncan Cotterill**), Jessica Ottowa (**Duncan Cotterill**), Don Morrisey (**Cawthron – marine environment**), Chris Purchas (**Tonkin Taylor – biosolids alternatives assessment**)

Aneika Young (**iwi liaison engaged by the NRSBU**)

Nathan Clarke (**NRSBU)**

Kit Maling (**NRSBU Board chair and TDC**)

Te Waari Carkeek (**TDC**)

Kura Stafford (**Ngāti Tama**)

Sylvie Heard and Darren Horne (**Te Ātiawa**)

Darren Horne present for Q&A session only

Apologies

Frank Hippolite (**NRSBU**)

Julia Easson (**Ngāti Kuia**)

Justin Carter (**Ngāti Koata**)

Nick Chin (**Rangitāne**)

Alice?

1 **Karakia Whakatimatanga** - by Te Waari Careek

2 **Introductions** - mihimihi around the NRSBU project team, TDC and iwi representatives.

3 **NRSBU presentation** – as per power point slides

- Slides 1 – 10 presented by Nathan Clarke, NRSBU General Manager
- Intent for the biosolids operation is to retain 100% beneficial reuse of biosolids product
- NRSBU committed to consulting with the community and avoiding adverse environmental effects. This is consistent with the NRSBU strategic goals and the project objectives
- Current biosolids option is the best practicable option – the application will seek to maintain this practice
- Scientific evidence shows little to no adverse effects on the receiving environment
- Very important to obtain feedback from iwi as cultural values are not reflected in the science
- Term of consent must be long enough to provide for commitment of both Councils to fund the infrastructure (security if investment)
- Need for recognition that biosolids are not the same waste product that enters the WWTP

- Biosolids are subject to a digestion process that produces a product that is suitable for application to land and pose no risk to human health
- Biosolids act as a substitute for fertiliser
- Class A standards are consistently met. Biosolids are tested frequently

- Slides 11 – 23 and 25 – 29 presented by Daniel Murray
- Overview of existing biosolids application area, exclusion zones, buffer areas and known culturally significant sites as per the Moturoa/ Rabbit Island Reserve Management Plan (2016)
- A key purpose of engagement is to understand whether all sites of cultural significance have been captured
- NRSBU will continue to exclude all existing areas for any renewed term of consent
- Extensive monitoring required by existing consent conditions and data available
- Biosolids application method is flexible and not prescribed by the consent conditions – intent of the NRSBU is to maintain flexibility to adapt application method to allow for both technical and best practice advancements
- Block selection and application method is subject to maximum nitrogen application rates, wind direction and predicted rainfall
- Biosolids Management Plan controls biosolids operation – checks and balance process and details responsibilities/ obligations on NRSBU, TDC, PF Olsen, Nelmac and NM Waste
- Independent expert reports currently in draft form – to be finalised following the outcomes of engagement
- Ministry for Environment guidance provides that should allow for 30cm sea level rise by 2060

- Slide 24 presented by Don Morrisey from Cawthron
  Key issues and concerns for the coastal environment are potential for penetration of trace metals and contaminants
- Current consent requires survey of application area sites as well as some reference sites every 6 years – visual and transect surveys – large quantity of data to inform assessment
- Monitoring shows there has been no influence of organic enrichment as a result of biosolids application
- Trace metals concentrations found at reference sites and application area sites are the same – suggests no impact from biosolids application
- Estuarine animals live at both reference sites and application sites – suggests no impact from biosolids application
- Biosolids application a very small contribution to the nitrogen load to the Waimea Inlet
- Waimea Inlet is 95% tidal so water is flushed out to wider Tasman Bay quickly – high dilution

- Slides 29 and 30 presented by Chris Purchas
- Discussed how biosolids is disposed of in other NZ centres

- Evaluation criteria are balanced against each other to assess a range of alternate options – all important considerations that form part of the assessment matrix
- Alternatives assessment concludes that the current operation is the best option

4 **Q&A session**

Q **Darren Horne**

- Do NRSBU hold past records of recommendations/ comments from Iwi?
- Significance of Moturoa is very high
- Archaeological mapping does not reflect the full significance of the island
- Concern that there are other large areas of significance that have not been identified (burial grounds)

A **Daniel Murray**

- Existing recorded significant sites are excluded from application areas

Katherine Forward

- 1995 application engagement process identified sites of cultural significance which were directly transposed to the existing exclusion zone plan
- Copy of John Mitchell report (1994) can be made available along with a 2015 CIA prepared for PF Olsen harvest

Q **Kura Stafford**

- What was the historic state of the Waimea Inlet pre 1983 i.e. pre industry discharge?
- Aim should be to get the condition of the Waimea Inlet back to pre-industry contaminant level

A **Nathan Clarke**

- Freezing works and apple processing facility discharged direct into the Inlet
- WWTP was constructed to improve the health of the Waimea Inlet

Don Morrisey

- Very limited (if any) data available

Q **Kura Stafford**

- Interest in capability of the WWTP and NRSBU network to accommodate demand/ population growth

A **Nathan Clarke**

- NRSBU can accommodate additional contamination load (ponds can buffer flows coming in and accommodate a lot of rainfall) more difficult to accommodate demand for increased discharge – constrained by conditions on resource consents – daily limit and can only discharge for 3 hours on the outgoing tide
- Space available at the WWTP to construct additional infrastructure if required

Q **Kura Stafford**

- No cultural lens has been applied to the NRSBU operation – common themes with other CIAs

- Cultural knowledge needs to sit beside the science to help inform
- Iwi view the Waimea Inlet as a whole and do not isolate biosolids discharge from the WWTP discharge
- Coastal environment is the iwi food basket and WWTP should be removed and discharge applied elsewhere
- Aspiration to remove infrastructure from these areas
- Acknowledgement of the beneficial reuse but to the detriment of iwi being able to harvest kai

Q **Kura Stafford**

- Is there a restriction on applying biosolids to food producing land?
- What other alternative land/ methods can be explored?

A **Nathan Clarke**

- Fonterra do not accept milk from land where treated wastewater/ biosolids applied
- Perception driven
- Only 18% of Biosolids are beneficially reused in New Zealand. Not yet “taken off”
- NRSBU do not wish to send biosolids to landfill

Q **Kura Stafford**

- Has the NRSBU/ TDC received any funding from the Government shovel read projects?

A **Nathan Clarke**

- Yes, to construct an additional cycle way across the Island. This will assist where NRSBU need to exclude public due to biosolids operation – alternate route available

Note: This project has now been turned down by TDC parks and reserves and money will be refunded to Central government. TDC do not wish to have recreational uses in the forested areas of Rabbit island - only on the designated routes on the outside of the island (as per the Moturoa/ Rabbit Island Reserve Management Plan 2016)

Q **Sylvie Heard**

- Acknowledgement of early engagement
- Need to think about maintaining access for tāngata whenua
- Would like to see WWTP consent condition (annual hui) offered as a condition of consent

A **Nathan Clarke**

- NRSBU see benefit in annual hui covering both Moturoa and Bell Island aspects of the operation – best approach is to encompass all NRSBU activities in the discussion

Q **Sylvie Heard**

- What is consent term being sought?

A **Nathan Clarke**

- NRSBU intend to seek a 35-year term

Kit Maling

- 35-year term sought due to the capital investment required
- NRSBU has taken possession of land at Best Island (60ha) $3M and feasibility to confirm suitability for discharge of treated wastewater – reduce load going to the Waimea Inlet
- Pilot scheme also underway to reuse wastewater for wastewater treatment processing
- Desire to assist improvement of Waimea Inlet to enable kai to be gathered in the future

Nathan Clarke

- Plan to sequentially move away from discharging to the Waimea Inlet
- Work on a 50-year master plan is underway – engagement will be part of the iterative process

Q **Kura Stafford**

- Why 6-year monitoring of the coastal environment?

Don Morrisey

- Unknown but suspect due to contaminant loads being so low that adequate time is necessary to allow any adverse effects to be identified – time between surveys to monitor any trends

Q **Darren Horne**

- Is there any soil monitoring data available?
- Cultural map is not the full scope – it identifies archaeological sites only
- MPI have concerns about biosolids being mixed with food industries - this is a food producing area for Maori
- Burial sites need to be secured

A **Katherine Forward**

- NRSBU have engaged with MPI (Tracey Kingi). MPI have requested copies of various expert reports to inform their feedback
- Identification of sites of cultural significance are critical part of this engagement process

Daniel Murray

- Soil sampling is a regular activity and is an existing condition of consent

Q **Kura Stafford**

- What other industries are discharging to the Waimea Inlet?
- Are there any other contaminants discharged to Moturoa?

A **Nathan Clarke**

- Other discharges include Sealord (Boulder Bank), Talley's (Motueka), Nelson North WWTP (Tasman Bay)
- No other contaminant discharges at Moturoa

Q **Kura Stafford**

- Other infrastructure projects happening around the district – iwi resources are stretched

A **Daniel Murray**

- Application lodgement deadline is 7 August, but this is not an endpoint. We hope to have CIA by then but will continue working together beyond lodgement

Q **Darren Young and Kura Stafford**

- Moturoa is highly significant to iwi

A **Te Waari Careek**

- Engagement process is important step to facilitate relationship between iwi and NRSBU

Q **Kura Stafford**

- Minimum x3 CIA - one for each waka
- Good to have a go at a collaborative CIA

A **Nathan Clarke**

- Funding provided from NRSBU for CIA development

5 **Karakia Whakamūtunga** – by Darren Horne

ACTION POINTS

Iwi representatives – to advise how many CIA will be developed (collaborative, independent or mix)

NRSBU project team – to provide iwi representatives:

- soil sampling results/ report when available
- previous iwi engagement specific to Moturoa
- historic monitoring data for the Waimea Inlet (prior to industry discharge) if available

Aneika - circulate presentation and meeting minutes

Attachment P

Moturoa/ Rabbit Island Biosolids Resource Consent Renewal Summary of Consultation

76 parties were consulted with via email and letter drop (including 38 Best Island residents and Te Tau Ihu Iwi). Physical letter drops to all Best Island residential properties. 14 parties have provided feedback. Copies of all communication are available for review on request.

Name of Consultee	Consent term preference
1. **Tasman District Council**	-
2. **Nelson City Council**	-
3. **Department of Conservation**	-
4. **Ministry for Primary Industries**	-
5. **Friends of Nelson Haven & Tasman Bay Incorporated**	10 Years
6. **Waimea Inlet Forum**	No support or objection to a particular term
7. **PF Olsen**	-
8. **Nelson Pine**	35 Years
9. **Mapua Boat Club**	-
10. **Mapua Ferry**	1 year unless spraying on western end ceases
11. **Kiwi Journeys**	1 year unless spraying on western end ceases
12. **Mark & Lisa Quinn**	10 years
13. **Justine Summers**	-
14. **Trevor Sellors & Jocelyn Winters**	-

Consultee	Summary of Feedback	Requested Conditions
Key Stakeholders- Statutory Bodies		
Tasman District Council *Anna Gerraty*	• The Moturoa/ Rabbit Island Reserve Management Plan (RMP) needs to be complied with • No disposal on Rough Island as per public feedback on the RMP • Maps in the RMP differ to the application area currently consented i.e. no biosolids applied to recreation reserve areas	None
Nelson City Council *Clare Barton*	• Supports a regional approach for the efficient management of waste • Application outcomes should not be inconsistent with the goals set out within the Waimea Inlet Charter and associated Waimea Inlet Strategy • Operation cannot impinge on the recreational values of Moturoa/Rabbit Island • Application needs to consider climate change and sea level rises may impact the disposal	None

	locations and methods in the short and long term	
Department of Conservation *Lionel Solly*	• Provided the activity is carried out in accordance with the provisions of the RMP and with the following caveats the adverse effects on the environment should be minimal: - Areas subject to ponding after heavy rainfall events, need to be avoided (as required by the RMP) - Compliance with the Waimea Inlet Action Plan and any Work Plans specific to the RMP.	Compliance with the RMP No biosolids to be applied to land subject to tidal inundation or areas where ponding occurs after heavy rainfall
Ministry for Primary Industries *Brigid Preston, Tracey Kingi*	• Concerns about human health and the effects on water quality and marine and aquatic environments. • Concerns about the ability for tangata whenua to carry out traditional and customary practices to harvest mahinga kai	None
Key Stakeholders- Environmental Groups		
Friends of Nelson Haven & Tasman Bay Inc. *Helen Campbell*	• Beneficial reuse acknowledged although "increased productivity does have a negative effect on wood quality" • Concerns regarding restrictions on public access and "offensive odour/ greenhouse gas emissions in recreational areas" • Activity is offensive to Maori cultural values; and destruction/contamination of cultural heritage sites • Increased nitrogen, Phosphorus and BOD loading and consequential run-off contamination • Lack of data/research into the adverse effects and all data needs to be up to date and available • Recommendation that NSBRU, both Councils, Iwi, and DOC work collaboratively with the community to identify adverse effects of all contaminants to the Waimea Inlet • Concerns about the impacts of climate change particularly the groundwater levels and significant aquifers and in relation to increased rainfall/storm surges, sea level rise and higher temperatures (land and sea) • The Waimea Inlet is "a sensitive receiving environment ….and a Site of International Importance for Shorebirds" • The benefits of convenience and cost may be outweighed by public and cultural opinion. Need to consider alternative methods as well as alternative land-based disposal sites • Support Council progressively reducing the areas available for biosolids application so that Moturoa/ Rabbit Island can be returned to Reserve status	"limiting the terms of these proposed consents to "(say) 10 years so that the hard data can be transposed into any future consents proposals" "Buffers to the areas of wetlands and Waimea Inlet must be at least **50 metres**: wider obviously in the proximity of Tasman Bay and potentially extending to a preferable 200m from MHWS of natural vegetation buffer around all of the islands" Incorporate trigger points for extension in areas of significance or where restoration/enhancement has been established.

		Ecologically important/ significant areas are to be identified by appropriate experts, and sludge dispersal prohibited in these areas.
Waimea Inlet Forum *David Sissons*	• Beneficial reuse acknowledged - "Biosolids have resulted in faster growth of the pines, increases in the rate of carbon sequestration, and increases in the rate of return on the timber; thus a boost in funds available for other management actions on the reserve and for general Council operations". • Compliance with the RMP • Alignment with the TDC Coastal Management Strategy – to address climate change of Council assets • Concern for potential effects on groundwater, soil, estuarine health, and odour complaints • Concern for recreational use of Moturoa/ Rabbit Island and ecological values of the reserve and its surrounds • Two pressures that are progressively reducing the land areas available for the application of biosolids – increased area managed for ecological values rather than pine plantation and inroads of saltwater • Request that expert reports cover EOCs • Concern that groundwater levels rise close to ground level and above during periods of wet weather • Anticipate that consent will be transitional – bridging the gap from end of the current consent to such tie as the TDC Coastal Management Strategy is adopted	Adaptive approach to address climate change which includes trigger points to predict when and where application should cease. Current 50m setback from MHWS updated to respond to vertical heights and setback measured from the appropriate contour.
Key Stakeholders- Significant Industry		
PF Olsen *Sam Nuske*	• Beneficial reuse acknowledged - biosolids application provides "impressive and economically significant, 20% increase in growth rates for the trees" • "Commercial and environmental value-add that the region is very fortunate to have". • No negative impacts on the normal forestry operations • The NRSBU and NM waste work proactively around recreational users of Moturoa/ Rabbit Island and impacts on stakeholders are considered • Confidence that NM Waste understands and is serious about the environmental aspects such as adhering to spraying setbacks from the estuary, cultural sites and public accessways • Negatives (costs of road maintenance and tree pruning) outweighed by the positives	None

Nelson Pine *Phillip Wilson*	• Biosolids application reduces cost of treatment for industry and rate payers • Solid background of research showing predominantly beneficial outcomes - "This is one of the few golden examples of beneficial use of biosolids in NZ". • Improved growth rate of trees and soil structure • Cost effective use of biosolids due to savings from the alternative use of manufactured fertilisers. • Difficulty with controlling odour • Negative public perception of the activity.	Care should be taken not to allow onerous conditions which result in this great example of beneficial use being constrained
Other Interested Parties		
Mapua Boat Club *Tim Robinson*	• Concern about increased nitrogen discharges to groundwater/ tidal waters especially when considering sea level rise/ storm surges • Application needs to consider whether the conditions are sufficient to protect the estuary and monitor the substances • Varied discharge necessary to take into account different times of the year and tree nutrient uptake • Consideration is needed to address demand/ urban expansion. • Expectation that those who discharge to the environment "need to up their game" and adopt current best practice and meet community expectations • Attention needed to ensure that the application considers the long-term options for sewerage disposal in the event of sea level rise • When determining the term of the consent, it would be appropriate to "consider whether there will be sufficient opportunity to review the consent, should the sea level rise and become a sufficient risk that the continued disposal of biosolids is no longer appropriate"	Conditions that allow for the consent to be 'called in' if the sea levels rise to a point that make the discharge inappropriate.
Mapua Ferry Operator *Andrew Schwass*	• Beneficial reuse acknowledged - benefits to the growth rate of the trees and island is near to Bell Island (ease of transport i.e. getting the biosolids to the Island). • "Our opinion is that spraying bio-solids (human waste) and mixing this with recreation/tourism, just doesn't mix and quite honestly, [it is] wrong" • The Island is frequently used by domestic/ international tourists and families. • Many complaints from visitors (passing spraying while biking) who are "appalled by the odour" • "The odour lasts for several days and reports of the foul odours in these sprayed areas are ongoing and consistent" • "We have made several complaints and phone calls to the Council over the years as the spraying that is taken place in winter (at the Mapua end) has the odour drifting over to the Mapua Wharf due to the calm winter days"	"Don't spray the western half of Rabbit Island full stop" "Spray where the public do not have access to, (Richmond end) or find a more suitable forestry block to spray the waste".

	• The sight of "a person in a white, fully protected suit with a mask on doesn't send the right message" • Consent term – if no spray at the Western end of Moturoa/ Rabbit Island then no issue with length of consent. If not then should be on a yearly basis "we would like to be fully engaged in this consent as this is the time where we would like to be heard (finally) about the impacts this spraying has when you mix it with recreation and tourism.	
Best Island Residents		
154 Best Island *Mark Quinn*	• Odour issues mean there is concern for the quality of life on Best Island • "Odours have been getting worse over the last few years maybe because of larger amounts of biosolids being applied, to trees the harvesting of trees that had previously provided screening from the smell" • At the whim of the winds. If the wind is blowing from the north we get it • Current approach has proven not to work • Area [presumably area serviced by the WWTP] is growing and "I can only imagine this getting worse without some sort of major change in process" • Consent term – 10 years until there is a proven compliance process established • Disappointed with consultation timeframe for response	Robust compliance monitoring of the odour discharge conditions.
132 Barnett Avenue *Justine Summers*	• Odour issues giving rise to concern for the quality of life on Best Island • "When the wind is blowing north Best Island takes a direct hit" • "The smell is so horrific and can actually make you gag and at times you cannot even go outside" • "Cannot even consider a consent term. Do not want the NRSBU to apply biosolids at all onto Moturoa"	None
131 Barnett Avenue *Trevor Sellars, Jocelyn Winters*	• Notes economic gain for the Council from the trees when harvested and trees are sold • No odour controls so oppose the renewal • Complaints about odour have increased markedly over the last few years. Concern that the NRSBU "care little for our situation and are not prepared to change what they do to make a positive difference" • "The method of application needs to be changed if we are to begin to consider supporting this application". • Disappointed with consultation timeframe for response	Need odour controls. Cover the waste – "unless it is covered, there will always be an odour issue".

Attachment Q

Moturoa / Rabbit Island Biosolids Reconsenting – Volunteered Draft Consent Conditions

Note: Yellow highlighted cells indicate information or cross-referencing which needs to be updated once confirmed.

Consent Holder - Nelson Regional Sewerage Business Unit
Consent Authority (Council) – Tasman District Council

RMxxxxxx	Discharge permit	To discharge biosolids to land on Moturoa / Rabbit Island
RMxxxxxx	Discharge permit	To discharge odour to air as a result of the discharge of biosolids to land and the operation of the Biosolids Application Facility (**BAF**) on Moturoa / Rabbit Island
RMxxxxxx	Land use consent	To operate and maintain the Biosolids Application Facility and all other land use activities associated with the discharge of biosolids to land on Moturoa / Rabbit Island
RMxxxxxx	Discharge permit	To discharge stormwater and washdown water to land at the Biosolids Application Facility on Moturoa / Rabbit Island.

Ref	Condition	Reference in AEE for further info	Equivalent in other relevant consents
General			
(1)	The Consent Holder shall ensure that the activities authorised by these consents are undertaken in general accordance with the information provided with the application entitled "Moturoa / Rabbit Island Biosolids Reconsenting" prepared by Tonkin + Taylor dated August 2020. In the event there is any conflict between this application and any conditions of these consents, the conditions shall prevail.	n/a	Adapted from Bell Island WTTP consents
(2)	The Consent Holder shall ensure all persons with responsibilities under these resource consents are provided a copy of the resource consents, and the Biosolids Management Plan in condition 11, and made aware of their responsibilities under these documents. For the avoidance of doubt those persons shall include the Moturoa / Rabbit Island forestry operator and the biosolids application contractor and the Operations and Maintenance contractor for the Bell Island Wastewater Treatment Plant.	n/a	n/a - new condition
(3)	The term of Resource Consents RMXXXXX, RMXXXXX and RMXXXXX [all resource consents other than BAF stormwater/washdown] is 35 years.	Section 1.5	14.0 in NN940379V3
(4)	The term of Resource Consent RMXXXXX [BAF stormwater/washdown] is 5 years.	Section 1.5	14.0 in NN940379V3
(5)	The Council may, in accordance with section 128 of the Resource Management Act 1991, serve notice on the Consent Holder of its intention to review the conditions of these consents annually between 1 November and 1 December for either of the following purposes:	n/a	Adapted from Bell Island WTTP consents; 3.1 in NN940379V3

Ref	Condition	Reference in AEE for further info	Equivalent in other relevant consents
	(a) To deal with any adverse effect on the environment arising from the exercise of these consents which was not foreseen at the time the application was considered and which is appropriate to deal with at the time of review; or (b) To require the Consent Holder to adopt the best practicable option to remove or reduce any adverse effect on the environment resulting from the exercise of these consents. *Advice note: The Council may, in accordance with section 128 of the Resource Management Act 1991, serve notice on the Consent Holder of its intention to review the conditions of these consents:* *(a) To enable standards set by a new rule(s) in any regional plan that has been made operative since the granting of these consents to be met;* *(b) When relevant national environmental standards have been made; or* *(c) If the information made available to the consent authority by the Consent Holder for the purposes of the application contained inaccuracies which materially influenced the decision on the application and the effects of the exercise of the consent(s) are such that it is necessary to apply more appropriate conditions.*		
(6)	In the conditions of these consents, "Biosolids Guidelines" means the *Guidelines For The Safe Application Of Biosolids To Land In New Zealand (August 2003)*, published by the New Zealand Water & Wastes Association.	Section 3.5	n/a - new condition
Annual Hui			
(7)	During the month of November each year, the Consent Holder shall arrange a hui for Te Tau Ihu iwi. For the avoidance of doubt this hui may be combined with any hui required under the resource consents for the Bell Island Wastewater Treatment Plant. Notification of the hui shall be via the Consent Holder's website and by email or mailed notice to each iwi representative at least four weeks before the hui. Minutes of the annual hui will be distributed to all parties within four weeks of the date of the hui. The purpose of the hui shall include but is not limited to the following: (a) The Consent Holder recognising the role of tangata whenua as kaitiaki and seeking to understand ongoing cultural considerations in relation to the activities subject to these consents; (b) The Consent Holder providing an opportunity for Te Tau Ihu iwi to view the activities subject to these consents including an opportunity to assess sites of cultural significance and confirm that identified archaeological sites are adequately protected; (c) The Consent Holder seeking input from Te Tau Ihu iwi into potential works or measures that could be undertaken on Moturoa / Rabbit Island to maintain the natural character and ecological values of Moturoa / Rabbit Island and protect the Mauri of the Waimea Inlet insofar as it relates to the activities subject to these consents. *Advice note: The notification requirements in this condition will be complied with if the Consent Holder gives four weeks of notice to* each *iwi representative in accordance with contact details maintained by Tasman District Council.*	Section 10.3.3	Adapted from Bell Island WTTP consents

Ref	Condition	Reference in AEE for further info	Equivalent in other relevant consents
Annual Report			
(8)	The Consent Holder shall submit an Annual Report and provide it to the Council's Team Leader Monitoring and Enforcement by 31 October of each year. The Report shall cover the period from 1 July to 30 June and include, but not necessarily be limited to, the following: (a) Collation, analysis, and interpretation of the monitoring results required by the conditions of these consents. This assessment shall include an analysis of the past five years' monitoring data and identification of any trends in the results; (b) Summary of any non-compliances with the conditions of these consents and any the adequacy and scope of such monitoring and any actions arising; (c) A summary of complaints, if any, received by the Consent Holder and any measures taken in response to those complaints; (d) Details of the date of the hui as required by Condition 5 above, numbers in attendance, and a summary of matters discussed and any actions arising; and (e) The record of results from all odour monitoring patrols undertaken in accordance with Condition 26 over the previous year.	Section 11	Adapted from Bell Island WTTP consents
6-Yearly Monitoring and Technology Review Report			
(9)	The Consent Holder shall submit a Monitoring and Technology Review Report to the Council's Team Leader Monitoring and Enforcement by 1 March 2026 and thereafter at six-yearly intervals throughout the term of these consents. For the avoidance of doubt this report may be combined with the Monitoring and Technology Review Report required under the resource consents for the Bell Island Wastewater Treatment Plant. The Monitoring and Technology Review Report shall be prepared by a suitably qualified and experienced person(s) and shall include the following: (a) Forecast of biosolids quality and quantity throughout the remainder of the consent term as a result of potential future changes to wastewater inputs and/or the wastewater treatment process at the Bell Island Wastewater Treatment Plant; (b) An assessment of the implications of climate change (reasonably foreseeable within the term of these consents) on the application of biosolids at Moturoa / Rabbit Island; (c) An assessment of the ability of the activities subject to these consents to continue complying with the conditions of these consents for the remainder of the consent term, particularly in relation to: (i) The assessment in (a) and (b) above; (ii) Monitoring or other relevant data gathered under these resource consents; (ii) Any reported non-compliance with consent conditions in the prior reporting period; (d) An assessment against the Biosolids Guidelines including any subsequent update; (e) A summary of significant technological changes and advances in relation to biosolids production, treatment, application and end use that could be of relevance to the activities authorised by these consents; and	Section 11	Adapted from Bell Island WTTP consents

Ref	Condition	Reference in AEE for further info	Equivalent in other relevant consents
	(f) A general assessment of whether any newly available technology option(s) or combination of options identified through (e) above is likely to represent the Best Practicable Option (BPO) to minimise the potential and actual adverse effects of biosolids application on Moturoa / Rabbit Island. *Advice note: The reporting dates in this condition align with the conditions imposed on the Bell Island Wastewater Treatment Plant resource consents and the three-yearly Long-Term Plan cycle and will be carried out under the consultative procedures of, and approved budgets under the Local Government Act 2002.*		
(10)	The Consent Holder shall consider the assessment completed in Condition 9(f) and advise the Consent Authority whether it intends to adopt any option(s) or incorporate such technologies as BPO.		
Biosolids Management Plan			
(11)	A Biosolids Management Plan shall be maintained and reviewed annually and include details of: (a) Roles and responsibilities of organisations and staff responsible for the activities subject to these consents, including the chain of command; (b) Procedures to be followed to ensure all relevant conditions under these consents are fully complied with, including independent sections to address: (i) Biosolids application limits; (ii) Exclusion zones and buffer areas; (iii) Odour management and minimisation, including: 1. A detailed description of the activities that may give rise to odour emissions, including discussion of the individual processes, equipment or plant elements and their function; 2. On-site odour monitoring requirements; and 3. Contingency measures to deal with plant malfunctions and maintenance requirements. (iv) Health and safety of the biosolids application contractor and the general public accessing Moturoa / Rabbit Island; (v) Monitoring required under these resource consents; and (vi) Complaints. (c) How records will be kept including time of application, weather conditions, quantities applied, location of application, any other operational parameters; (d) Areas to be used for biosolids application in the following year; (e) Incident and accident response procedures, including in relation to equipment failures and accidental spillage of biosolids; and (f) Methodology for annual review of the plan.	Section 4.3.6	9.0 in NN940379V3 (previously Contingency and Management Plan)
(12)	A copy of the Biosolids Management Plan in Condition 11 shall be made available to the Council's Team Leader Monitoring and Enforcement upon request.		

Ref	Condition	Reference in AEE for further info	Equivalent in other relevant consents
Complaints and Notifications			
(13)	The Consent Holder shall maintain a Complaints Register for the purpose of recording and dealing with any complaints that are received by the consent holder in relation to the exercise of these resource consents. All complaints received by the Consent Holder in relation to the activities authorised by these consents shall be logged immediately in the Complaints Register. The Complaints Register shall record: (a) The date, time, location, duration, and nature of the alleged event/incident; (b) Name, phone number and address of the complainant unless the complainant wishes to remain anonymous; (c) Any remedial action taken by the Consent Holder in response to the complaint and when it was undertaken; (d) The possible cause of the relevant event/ incident that led to the complaint; (e) The weather conditions at the time of the relevant event/ incident including estimates of wind direction, wind strength, temperature and cloud cover; and (f) The date and name of the person making the entry.	Section 11	Adapted from Bell Island WTTP consents; 3.0 in NN940379V3
(14)	Details of any complaints received that may indicate non-compliance with the conditions of these consents shall be provided to the Council's Team Leader Monitoring and Enforcement within 48 hours of receipt of the complaint.		Adapted from Bell Island WTTP consents; 11.0 in NN940379V3
Biosolids Volume and Quality			
(15)	The daily volume of biosolids transferred between the Bell Island Wastewater Treatment Plant and Moturoa / Rabbit Island shall be recorded. For this purpose a flowmeter of an accuracy to within ±5% shall be maintained between the pumps at the Bell Island Wastewater Treatment Plant and the Biosolids Application Facility on Moturoa / Rabbit Island.	n/a	1.2 in NN940379V3
(16)	(a) Material being processed to biosolids shall be held at 50°C or higher for a minimum duration as determined by the following equation: Minimum duration = 50,070,000 / 10^(0.14t) where t is temperature in °C and is greater than 50°C; and (b) A continuous record of the temperature of material being processed to biosolids shall be made and recorded for the duration of the consent and plotted on a continuous record to enable compliance to be readily visible.	Appendix D	7.1 in NN940379V3
(17)	(a) At no less than weekly intervals a grab sample of biosolids shall be analysed for E. coli and volatile solids reduction; (b) If a sample in clause (a) fails to meet the Biosolids Guidelines requirements for E. coli and volatile solids reduction, the Consent Holder shall increase sampling to no less than 7 samples per month over a three-month period and samples shall be analysed for E. coli, Campylobacter, Salmonella, enteric viruses and helminth ova; and	Appendix D	7.1 in NN940379V3

Ref	Condition	Reference in AEE for further info	Equivalent in other relevant consents
	(c) If clause (b) applies, once there are less than three non-compliances in any three-month period against the limits specified in the Biosolids Guidelines, sampling may return to that specified under clause (a).		
(18)	(a) At three-monthly intervals the biosolids shall be measured, on a mg/kg dry weight basis, for the following metals/metalloids: arsenic, cadmium, chromium, copper, lead, mercury, nickel, and zinc. (b) If the concentrations exceed the grade b maximum concentration limits in the Biosolids Guidelines, weekly sampling should be implemented to demonstrate that the biosolids contaminant grade is appropriate for application to land. (c) If clause (b) applies, once there are four consecutive samples below the grade b maximum concentration limits in the Biosolids Guidelines, sampling may return to that specified under clause (a).	Appendix D	7.1 in NN940379V3
(19)	Each year, a composite sample shall be monitored for the following organic compounds: Total polychlorinated biphenyls (PCBs); nonyl phenol and ethoxylates (NP/NPE); phthalate (DEHP); linear alkydbenzene sulphonates (LAS); Tonalide and Galaxolid.	Appendix D	7.1 in NN940379V3
Biosolids Application Limits			
(20)	Biosolids shall be applied at an average depth of no greater than 40mm per application.	Section 4.3.4	4.1 in NN940379V3
(21)	Biosolids shall not be applied: (a) Within 24 hrs of a 10 mm rainfall event occurring in a 24 hr period; or (b) If a rainfall event of more than 50mm is forecast within 24 hrs by a recognised meteorological forecasting service.	Section 4.3.4	4.2 in NN940379V3
(22)	Biosolids application to any given forestry block shall be limited to the following: (a) During the time period from the last prior-to-harvest biosolid application to 12 years after replanting, biosolids shall be discharged at an average rate of no more than 150 kilograms of nitrogen per hectare per year, calculated using a three year rolling average, and no single discharge shall exceed 450 kilograms nitrogen per hectare per application year. (b) During the time period from 12 years following replanting to the last prior-to-harvest biosolid application, biosolids shall be discharged at an average rate of no more than 100 kilograms of nitrogen per hectare per year, calculated using a three year rolling average, and no single discharge shall exceed 300 kilograms nitrogen per hectare per application year. (c) No more than one application of biosolids shall occur to any given forestry block during the period following harvest and prior to replanting.	Section 4.3.4	4.6 in NN940379V3
Exclusion Zones and Buffer Areas			
(23)	No biosolids shall be applied at any time in the exclusion zones shown in Plan XXXX attached to and forming part of these consents.	Section 4.3.5; Appendix C	5.1 in NN940379V3
(24)	No biosolids shall be applied in the following buffer areas:	Section 4.3.5	6.1 in NN940379V3

Ref	Condition	Reference in AEE for further info	Equivalent in other relevant consents
	(a) Around the entire coastal edge of Moturoa / Rabbit Island a buffer area of 50 metres from Mean High Water Springs; (b) From the edge of the plantation forest a buffer area of 15 metres; (c) Around the perimeter of the Moturoa / Rabbit Island Domain a buffer area of: (i) 30 metres during the months of April to October inclusive; and (ii) 100 metres in the months of November to March inclusive.		
Odour			
(25)	There shall be no discharges to air from the biosolids application activity or the BAF that results in an adverse effect that is offensive or objectionable beyond the line of Mean High Water Springs around the perimeter of Moturoa / Rabbit Island.	Section 8.8	New condition
(26)	The Consent Holder shall appoint a suitable independent person to the role of odour patroller and shall comply with the following odour patrol protocol: (a) The odour patroller shall visit Moturoa / Rabbit Island at least once per month and record observations of odour at specified locations around the perimeter of the Island and on the shoreline of Best Island facing Moturoa / Rabbit Island and at any other position(s) that may be impacted by odour that could have an adverse effect beyond the line of Mean High Water Springs around the perimeter of Moturoa / Rabbit Island; (b) The odour patroller shall also undertake a visit to Moturoa / Rabbit Island in response to any odour complaint in circumstances where the initial investigation by the consent holder indicates that the reported odour event may have been caused by the biosolids application activity on Moturoa / Rabbit Island; (c) Odour patrols shall include the specified locations at which odour observations are made and the numerical scale of the offensive or objectionable nature of the odour which the odour patroller adopts to record the observations; (d) The Consent Holder shall inform the biosolids application contractor of the outcomes of the odour patrol and any necessary interventions or inputs shall be made to the application location or method to mitigate the odours observed; (e) In addition to the monthly odour patrols, the odour patroller may, at their discretion, visit Moturoa / Rabbit Island at any time to make observations of odour; this may, but will not necessarily be, in response to complaints received. (f) The Consent Holder shall provide the contact details of the odour patroller to Council's Team Leader Monitoring and Enforcement. If this odour patroller changes the contact details shall be updated with Council's Team Leader Monitoring and Enforcement. (g) The record of results from all odour monitoring patrols shall be retained and provided to the Council on request.		Adapted from Bell Island WTTP consents

Ref	Condition	Reference in AEE for further info	Equivalent in other relevant consents
Groundwater			
(27)	The eleven existing shallow piezometers on Moturoa / Rabbit Island, as shown on Plan XXXX attached to and forming part of these consents, shall be maintained and monitored as follows: (a) At three-month intervals groundwater levels shall be measured and recorded at all eleven piezometers. (b) At three-month intervals representative samples shall be taken from all eleven piezometers for pH, conductivity, nitrate-nitrogen, ammonium-nitrogen, phosphorus and chloride. (c) At three-month intervals representative samples shall be taken from at least two piezometers for faecal indicator bacteria. (c) Each year a representative sample shall be taken from all eleven piezometers, filtered and analysed for the following heavy metals/metalloids; arsenic, cadmium, chromium, copper, lead, mercury, nickel, zinc, aluminium.	Appendix H	7.2 in NN940379V3
Soil			
(28)	(a) At a minimum of three-yearly intervals, two soil samples shall be undertaken within the topsoil (0 to 20 cm) and subsoil (20 to 40 cm) layers every 10 ha in areas where biosolids have been applied. Samples from each soil layer shall be combined to form a composite sample. At each sample location, the GPS coordinates shall be recorded. (b) Each composite sample shall be measured for pH, organic matter, total nitrogen, available phosphorous, potassium, calcium, magnesium, sodium and the following metals/metalloids: arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc; (c) Each composite sample shall not exceed the heavy metal maximum soil concentration limits recommended in the Biosolids Guidelines; (d) If a composite soil sample undertaken in accordance with the above subclauses exceeds the heavy metal maximum soil concentration limits recommended in the Biosolids Guidelines, then the Consent Holder shall: (i) prepare a report to investigate whether the exceedance(s) was as a result of natural influences, one off event, or in whole or part associated with the activities authorised by these consents; and (ii) comment on whether the exceedance measured is likely to continue; and (iii) recommend whether any further action needs to be taken by the Consent Holder. A copy of this report shall be provided to the Council's Team Leader Monitoring and Enforcement. *Advice note: For each 10ha area there shall be two composite samples. One composite sample for each of the topsoil and subsoil layers.*	Appendix G	7.3 in N940379V3
Coastal			
(29)	Every six years transect surveys along the foreshore shall be undertaken. The survey is to include sediment profile descriptions, sediment nutrient assessment, habitat classification, and benthic micro and macro algal cover. The transect locations shall be the same as those established under resource consent NN940379V3.	Appendix I	7.6 in NN940379V3

Ref	Condition	Reference in AEE for further info	Equivalent in other relevant consents
(30)	(a) Visual checks along the Moturoa / Rabbit Island foreshore within Waimea Inlet shall be undertaken by a suitably qualified person at three-yearly intervals for the duration of this consent. Photographic records shall be taken at each inspection. (b) Should this visual inspection indicate any adverse effects on the foreshore, further analysis and tests are to be undertaken at the discretion of the Council's Team Leader Monitoring and Enforcement.	Appendix I	7.7 in NN940379V3
Biosolids Application Facility			
(31)	Within 5 years of commencement of these consents, all stormwater and washdown water at the Biosolids Application Facility shall be captured and discharged to the BAF holding tanks.	Section 4.2	New condition

Conditions from NN940379V3 no longer considered needed

Ref	Condition	Reasons no longer needed
1.1	The Permit Holder shall keep such records as may be reasonably required by Council and shall, if so requested, supply this information to the Council. If it is necessary to install measuring devices to enable satisfactory records to be kept, the Permit Holder shall, at his or her own expense, install, operate and maintain suitable devices.	No longer necessary. Records supplied via strengthened annual and 6-yearly reporting conditions.
2.0	Access by Council staff or its officers or agents to the land subject to this discharge permit is reserved pursuant to Section 332 of the Resource Management Act.	RMA already covers this.
4.4	If even application of biosolids is not possible due to wind, then application shall cease in the area affected.	No longer necessary. Covered by strengthened odour conditions.
4.5	Soil pH shall be maintained at pH 5 or greater at all times during biosolid application.	No longer necessary. Covered by strengthened monitoring conditions.
5.2	An archaeological survey is to be undertaken in construction areas before works begin. Any archaeological sites in addition to those already excluded that are discovered during this survey or during subsequent biosolids operations are to be brought to the immediate attention of a representative nominated by tangata whenua and the Historic Places Trust for assessment and advice. Council shall also be notified. Works in the immediate vicinity of any such site are to cease until advice is offered. Such sites may be excluded from the biosolids operation.	Recorded sites already in exclusion zones. Recently confirmed via RMP process (September 2016).
5.3	Council may exclude such further areas from the biosolids consent area as are considered necessary should further areas of ecological significance be subsequently identified. Operations in such areas shall cease upon Council's request to allow for further assessment and shall not continue without Council's agreement.	All significant ecological areas already identified. Recently confirmed via RMP process (September 2016).
5.4 8.1 8.2 8.3	As part of the preparation work for biosolids disposal on each new area, identified areas of gravel are to be recorded and mapped on a plan of the Island by a suitably qualified person. For gravel lenses which are greater than one hectare in extent a short borehole (or similar) shall be installed and supervised permeability testing shall be performed. Biosolids application rates to the gravel lens shall be reduced as follows, depending on the measured horizontal permeability (K): K < 10 -4 m/s 7.8 tonnes of dry solids per hectare every three years. 10 -4 < K < 10 -2 m/s The three-yearly application rate shall be reduced proportionally from 7.8 to 0 tonnes of dry solids per hectare. K > 10 -2 m/s No biosolids shall be applied. All gravel lenses which are to receive no biosolids at all or biosolids at a reduced application rate shall be clearly marked and identified to the operator applying the biosolids.	Completed and no longer necessary.

Ref	Condition	Reasons no longer needed
6.2	If biosolids do not meet Class A standards then the buffer zones given in Condition 6.1(a), (b), (c) and (d) shall be increased to 400 metres in from the edge of the forest canopy and public access shall be restricted for a period of one year after application.	Presumption that Class A always met.
7.4	Prior to commencement of disposal operations, and after a period of rain, the Consent Holder shall map groundwater seepage areas along the Waimea Inlet estuarine perimeter of Rabbit Island.	Completed.
7.5	A survey of benthic micro and macro algal cover shall be undertaken prior to disposal, as agreed with Council's District Resource Analyst or his agent, to provide baseline data. This survey shall be repeated every six years.	Completed.
10.1	The applicant will be required to meet Council's actual and reasonable charges incurred as a result of monitoring compliance within the terms of this consent.	RMA already covers this.
13.0	Council's District Resource Analyst or his/her agent may require remedial works to be implemented if monitoring shows unacceptable environmental impacts; such works may include application of biosolids at reduced loading rates, or the addition of lime if soil pH at any soil sampling site falls below 5.0.	No longer necessary. Covered by strengthened conditions regarding reporting, complaints register, etc.