Biosolids Management

Description

Wastewater is received at the inlet works, and then distributed to two anaerobic ponds, then four aerated ponds (Ponds A, B, C and D, shown in Figure 1). Ponds A, B, C and D have Aquamats installed. Sludge produced in the anaerobic and aerated ponds is currently stored in the ponds themselves. Historic sludge is also held on-site in the sludge storage pond (Figure 2). The term biosolids generally refers to sludge that has received some form of treatment/dewatering.

The sludge is removed from the ponds every 10 – 20 years. The next removal will be required approximately 5 – 10 years from now, if current operation were to continue. As of a survey undertaken in 2013, Ponds A, B, C and D were only at 5 – 11% of their capacity, while the sludge pond was at 75% capacity.

Figure 1: Raglan WWTP overview

Figure 2: Raglan WWTP sludge storage lagoon

The existing sludge onsite (in the ponds) must be managed/removed if the ponds are to be converted into an alternate treatment process. This involves dredging of the ponds, for which the aquamats must be temporarily removed.

Management options for dealing with any biosolids generated by the new treatment process must also be assessed.

Implementing a new treatment system could produce a large volume of biosolids for disposal relative to the option of retaining the ponds. While the ponds have intermittent removal of sludge (every 10-20 years), the other treatment options produce biosolids for daily/weekly disposal. However, the sludge from the ponds is more difficult to reuse, and hence are more likely to go to landfill. This is due to quality control, as the sludge from the ponds often contains rags and plastics. The other treatment options propose more opportunities for biosolids reuse.

Beneficial reuse of biosolids is the preferential management option for existing biosolids and biosolids produced from the new treatment process. An example of beneficial reuse is the application of biosolids to land, providing nutrients to support plant growth.

Management Option	Description	Image
Existing biosolids		
Removal and dewatering of biosolids onsite – geotextile bags	Removal of biosolids (via dredging of the ponds) on site, followed by storage in geotextile bags, if the site has sufficient area. The biosolids will then be removed to landfill or beneficially reused if possible. The geotextile bags (pictured) are constructed from high strength, permeable geotextiles, thus retaining the biosolids as water is decanted.	
Removal and dewatering of biosolids onsite – mobile dewatering equipment	Removal of biosolids (via dredging of the ponds) onsite, followed by dewatering of biosolids using conventional mobile dewatering equipment. The dewatered biosolids will then be removed to landfill or beneficially reused if possible. Conventional mobile dewatering is a containerised system (pictured), which has a filter insert.	
Removal and dewatering of biosolids onsite – rotary drum vacuum filter	Removal of biosolids (via dredging of the ponds) onsite, followed by dewatering of biosolids using a rotary vacuum drum filter (RVDF). The dewatered biosolids will then be removed to landfill or beneficially reused if possible. The Alar Engineering Corporation RVDF is pictured.	
Treatment		
Anaerobic digestion	Anaerobic digestion of the sludge produces biogas which is combusted to generate energy/heat. This option is only economic if there is a use for the heat produced.	
Addition of primary treatment post screening	Capture primary biosolids and mix with secondary biosolids from the new process. This will reduce the volume of biosolids produced and produce heat/energy. However, this option has a high cost associated with it.	
Produced biosolids from new treatment process		

Management Option	Description	Image
Disposal in ponds	Return biosolids produced in the new treatment processes to the ponds. Limited by capacity, additional nutrient load.	
Dewatering	Dewatering of the biosolids as part of the new process, followed by removal to landfill or beneficial reuse if possible.	
Reuse opportunities		
Monofill of existing ponds	Filling of the ponds with the dewatered biosolids, thus using the biosolids as a fill material for landscape restoration.	
Composting	Co-compost the biosolids with food waste and green waste at Xtreme Zero Waste in Raglan, in the horizontal composting unit. This could only be completed with biosolids produced from new treatment processes only. However, there may be potential to mix in pond biosolids as a filler.	
Vermi-composting	Transport of biosolids to MyNoke vermi-composting facility in Tokoroa. A source of wood waste would be required for this option.	
Land disposal	Disposal of dewatered biosolids on nearby forested land.	

Options Assessment Criteria

Criteria	Issue/Topic	Description/Explanation
Public Health	Microbiological quality of treated wastewater	Risk of public exposure to waterborne pathogens through:
		- Direct contact with the conveyance or treatment process
		- Direct contact with the receiving environment, for example through contact recreation
		- Indirect exposure, through food gathering (such as shellfish, fish, watercress, etc) and groundwater use.
	Health effects from irrigation	Risk of public exposure to pathogens from irrigation.
	Treated wastewater re-use	Risk of contamination from treated water for non-potable re-use.
Environment	Water quality	Potential effects on freshwater (surface and ground) and coastal/marine receiving environments
	Aquatic ecology	Potential effects on aquatic ecosystems
	Terrestrial ecology	Potential effects on terrestrial ecosystems and soils
	Coastal environment and resources	Potential effects on significant coastal and marine areas, existing harbour and coastal processes, and physical footprint within the harbour and coastal marine area.
Cultural	Mauri	Potential effects on mauri of land, water and air
	Kai moana	Potential effects on kai moana and the kaitiaki management of customary fishing
	Cultural values	Potential effects on the relationship of Maori and their culture and traditions with their ancestral lands, water, sites, waahi tapu and other taonga
	Health and Wellbeing	Potential effects on the ability of the land, sea and air to support wairua in order to maintain health and wellbeing for Maori
Social and community	Amenity value and aesthetics	Potential effects on the natural and built environment (e.g. visual, odour, noise)
	Urban development	Extent to which the option enables residential and commercial development within the projected timeframe
	Recreation	Extent to which the project enhances or detracts from local recreational activities and opportunities
	Food gathering	Extent to which the project enhances or detracts from people’s ability to collect food within the area
	Access to the coast	Extent to which an option effects access to the coastal marine area.
	Re-use potential of option	Extent that treatment by-products can be utilised beneficially now and into the future (i.e. irrigation/nutrients for food production)
Sustainability	Carbon footprint	Potential embodied and operational carbon footprint
Constructability	Geology, soil, groundwater conditions	Option suited to local environmental conditions
	Land availability, accessibility	Adequate and secure land must be available for the required infrastructure, timescales that fit within project timing
	Existing infrastructure	Potential to maximise use of existing infrastructure that has a valuable remaining economic life, e.g. power supply, treatment plants, pumps, conveyance pipes and existing sites.
Technology	Reliable, proven and robust technology	To be sustainable, an option should be based on proven technology and have adequate redundancy (spare operational capacity to provide back-up in case of failure)
	Adaptable and flexible	Due to the uncertainty associated with future growth, a feasible option must be able to adapt to changing conditions such as increased flows and loads, discharge quality requirements, input requirements, and energy availability.
	Able to be staged	The extent to which an option could be staged (e.g. through modularised components).
	Operational and engineering resilience	The option must be sufficiently resilient to natural hazards and operational failure.
Financial Implications	Capital cost	Is the cost of the project appropriate for the project area and the population served?
	Operating and maintenance cost	Can the capital infrastructure be maintained and operated in a cost-effective manner?
	Whole of life cost	How do the whole of life costs pf the various options compare?
	Financial risk	Is the option affordable even if growth does not occur as predicted?
Opportunities and Benefits	Opportunity for resource recovery	The provision of beneficial reuse of treated wastewater. (i.e. with emphasis on food production)
		The potential for beneficial reuse of biosolids. (i.e. with emphasis on food production)
Statutory Considerations	Consistency of the option with National Policy Statements (NPS)	Includes consistency with the New Zealand National Coastal Policy Statement (NZCPS), National Policy Statement for Freshwater Management (NPS-FM) and any other relevant NPS
	Consistency of the option with any other relevant legislation outside of the Resource Management Act	Includes consistency with the Reserves Act, and any other relevant Act

Options Assessment

Biosolids management options are assessed based on the above criteria in the following table.

	Key: Red – Largely fails to meet the criteria, Amber - Marginally meets the criteria, Green - Meets criteria well											
Management Option	Public Health	Environment	Cultural	Social & Community	Sustainability	Constructability	Technology	Financial Implications	Opportunities and Benefits	Statutory Considerations	Comments	Carry forward to short list?
	Existing Biosolids											
Removal and dewatering of biosolids onsite – geotextile bags	N/A – no discharge to environment[1]	N/A – no discharge to environment	Hapū have reiterated opposition to marine options and support for re-use options. Avoidance of adverse public health and environmental effects obviously aligns with hapū ethics. Any option with elevated risk wouldn't be supported.	Unlikely to have adverse amenity and aesthetic effects	Low energy option	Further work required to determine whether geotextile bags can be accommodated on-site.	Reliable and proven technology.	Low cost dewatering option. Majority of cost associated with disposal to a licensed disposal facility.	Low quality biosolids anticipated. Likely to be required to go to a licensed disposal facility.	N/A – no discharge to environment	Potential to be used on-site dependent on land areas available.	**YES**
Removal and dewatering of biosolids onsite – mobile dewatering equipment	N/A – no discharge to environment	N/A – no discharge to environment	Hapū have reiterated opposition to marine options and support for re-use options. Avoidance of adverse public health and environmental effects obviously aligns with	Unlikely to have adverse amenity and aesthetic effects	Moderate energy option	Mobile dewatering equipment likely to be accommodated on-site.	Reliable and proven technology.	Moderate cost dewatering option. Majority of cost associated with disposal to a licensed disposal facility.	Low quality biosolids anticipated. Likely to be required to go to a licensed disposal facility.	N/A – no discharge to environment	Well proven technology employed around NZ.	**YES**

[1] This assessment does not cover off-site discharges related to third party facilities e.g. licensed landfills or composting facilities.

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			hapū ethics. Any option with elevated risk wouldn't be supported.									
Removal and dewatering of biosolids onsite – rotary drum vacuum filter	N/A – no discharge to environment	N/A – no discharge to environment	Hapū have reiterated opposition to marine options and support for re-use options. Avoidance of adverse public health and environmental effects obviously aligns with hapū ethics. Any option with elevated risk wouldn't be supported.	Unlikely to have adverse amenity and aesthetic effects	Moderate energy option	Rotary drum filter equipment likely to be accommodated on-site.	Technology trialled by Watercare – full time operator input required.	Moderate cost dewatering option. Majority of cost associated with disposal to a licensed disposal facility.	Low quality biosolids anticipated. Likely to be required to go to a licensed disposal facility.	N/A – no discharge to environment	Technology requires full time operator input on ongoing basis.	No
	Treatment											
Anaerobic digestion	N/A – no discharge to environment	N/A – no discharge to environment	Hapū have reiterated opposition to marine options and support for re-use options. Avoidance of adverse public health and environmental effects obviously aligns with hapū ethics.	Potential for adverse odour effects from the process – requires further assessment.	Anaerobic digestion of the sludge produces biogas which is combusted to generate energy/heat. This option is only economic if there is a use for the heat produced.	Needs to accompany a sludge producing liquid stream treatment process. Further site investigations required.	Reliable and proven technology.	High CAPEX option compared to other options.	Biosolids likely to be suitable for beneficial reuse.	N/A – no discharge to environment	Scale of Raglan WWTP too small for economic gains to be made from energy/heat.	No

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Management Option	Public Health	Environment	Cultural	Social & Community	Sustainability	Constructability	Technology	Financial Implications	Opportunities and Benefits	Statutory Considerations	Comments	Carry forward to short list?
			Any option with elevated risk wouldn't be supported.									
Addition of primary treatment post screening	N/A – no discharge to environment	N/A – no discharge to environment	Hapū have reiterated opposition to marine options and support for re-use options. Avoidance of adverse public health and environmental effects obviously aligns with hapū ethics. Any option with elevated risk wouldn't be supported.	Potential for adverse odour effects from the process – requires further assessment.	Capture primary biosolids and mix with secondary biosolids from the new process. This will reduce the volume of biosolids produced and produce heat/energy.	Needs to accompany a sludge producing liquid stream treatment process. Further site investigations required.	Reliable and proven technology.	High CAPEX option compared to other options.	Biosolids likely to be suitable for beneficial reuse.	N/A – no discharge to environment	Scale of Raglan WWTP likely to be too small for this technology.	No
	Produced biosolids from new treatment process											
Disposal in ponds	N/A – no discharge to environment	N/A – no discharge to environment	Hapū have reiterated opposition to marine options and support for re-use options. Avoidance of adverse public health and environmental effects obviously aligns with hapū ethics. Any option	Unlikely to have adverse effects.	Low energy option, however, biosolids will accumulate in ponds and require subsequent removal.	No new infrastructure required.	Reliable and proven technology.	Low CAPEX cost option, however OPEX cost is deferred to later date.	Low quality biosolids anticipated (as new biosolids will mix with old sludge in the pond). Likely to be required to go to a licensed disposal facility.	N/A – no discharge to environment	All options could form part of the long-term sludge/biosolids management options for the site.	**YES**

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Management Option	Public Health	Environment	Cultural	Social & Community	Sustainability	Constructability	Technology	Financial Implications	Opportunities and Benefits	Statutory Considerations	Comments	Carry forward to short list?
			with elevated risk wouldn't be supported.									
Dewatering	N/A – no discharge to environment	N/A – no discharge to environment	Hapū have reiterated opposition to marine options and support for re-use options. Avoidance of adverse public health and environmental effects obviously aligns with hapū ethics. Any option with elevated risk wouldn't be supported.	Unlikely to have adverse effects.	Moderate embodied and operational carbon.	Dewatering equipment likely to be accommodated on-site. Further site investigations required.	Reliable and proven technology (depending on technology chosen).	Moderate OPEX cost option.	Biosolids likely to be suitable for beneficial reuse.	N/A – no discharge to environment		**YES**
	Reuse opportunities											
Monofill of existing ponds	N/A – no discharge to environment	N/A – no discharge to environment	Hapū have reiterated opposition to marine options and support for re-use options. Avoidance of adverse public health and environmental effects obviously aligns with hapū ethics. Any option with elevated	Potential for adverse odour effects from the process – requires further assessment.	Low embodied and operational carbon.	Option only possible if existing ponds are not required as part of a wider option. Further work required to determine this.	Reliable and proven technology.	Relatively low CAPEX and OPEX option.	Biosolids will not be available for beneficial reuse unless removed from monofill at a later date.	N/A – no discharge to environment	All options could form part of the long-term sludge/biosolids management options for the site.	**YES**

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Management Option	Public Health	Environment	Cultural	Social & Community	Sustainability	Constructability	Technology	Financial Implications	Opportunities and Benefits	Statutory Considerations	Comments	Carry forward to short list?
			risk wouldn't be supported.									
Composting	N/A – no discharge to environment	N/A – no discharge to environment	Hapū have reiterated opposition to marine options and support for re-use options. Avoidance of adverse public health and environmental effects obviously aligns with hapū ethics. Any option with elevated risk wouldn't be supported.	Potential for adverse odour effects from the process – requires further assessment.	Low embodied and operational carbon.	N/A – off-site facility required.	Largely unproven in New Zealand. Some historic facilities that have now closed (e.g. Rotorua).	Relatively low CAPEX and OPEX option.	Results in the beneficial reuse of biosolids.	N/A – no discharge to environment		**YES**
Vermi-composting	N/A – no discharge to environment	N/A – no discharge to environment	Hapū have reiterated opposition to marine options and support for re-use options. Avoidance of adverse public health and environmental effects obviously aligns with hapū ethics. Any option with elevated risk wouldn't be supported.	Potential for adverse odour effects from the process – requires further assessment.	Low embodied and operational carbon.	N/A – off-site facility required.	Reliable and proven technology. Sites located in the North Island.	Relatively low CAPEX and OPEX option.	Results in the beneficial reuse of biosolids.	N/A – no discharge to environment		**YES**

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Management Option	Public Health	Environment	Cultural	Social & Community	Sustainability	Constructability	Technology	Financial Implications	Opportunities and Benefits	Statutory Considerations	Comments	Carry forward to short list?
Land disposal	N/A – no discharge to environment	N/A – no discharge to environment	Hapū have reiterated opposition to marine options and support for re-use options. Avoidance of adverse public health and environmental effects obviously aligns with hapū ethics. Any option with elevated risk wouldn't be supported.	Potential for adverse odour effects from the process – requires further assessment.	Low embodied and operational carbon.	N/A – off-site facility required.	Not widely adopted in New Zealand, relatively unproven because of this.	Relatively low CAPEX and OPEX option.	Results in the beneficial reuse of biosolids.	N/A – no discharge to environment		**YES**