REGIONAL BIOSOLIDS STRATEGY
LOWER NORTH ISLAND

Report 3: Identifying Opportunities for Councils to Work Together for Sludge Management.

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Regional Biosolids Strategy – Lower North Island

Report 3: Identifying Opportunities for Councils to Work Together for Sludge Management.

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LOWER NORTH ISLAND

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1 EXECUTIVE SUMMARY

1.1 Background

Ten lower North Island councils are working in partnership to develop a biosolids strategy that includes a potential collective approach for sludge management and beneficial use programmes. The strategy is led and co-ordinated by Lowe Environmental Impact (LEI) and The Institute of Environmental Science and Research Ltd (ESR).

A stock-take and gaps analysis were undertaken to determine the scale of the current sludge problem for each district. Using the findings from this analysis the project partners aim to work together to determine potential collective solutions including processing, end-uses, consenting and stakeholder engagement processes. Some of the potential solutions will be trialled (e.g. biosolids composting field trials). The final project outcome will be a 'tool box' of different scenarios that provide a model of operation that can be applied in other regions around New Zealand.

1.2 Scope

The purpose of this report is to summarise the findings of the Stage 1 Gaps analysis (Stage 1 Gap analysis, Task 1a Desk top study, June 2017 and Task 1b Site visits and field investigation, October 2017) and use this information to identify common problem areas faced by councils with regards to biosolids management, and investigate potential solutions. This report addresses Stage 2: Opportunities to Work Together, Task 2a by identifying areas where Councils could work together, sharing costs, existing infrastructure and providing contingency scenarios. A draft MoU has been prepared to enable Partner Councils to signal a willingness to further explore opportunities to work together, including potential for joint research projects, joint field trials, sharing of and enhancing of intellectual property and sharing resources and infrastructure.

1.3 Key Findings

Results from the initial gaps analysis surveys indicated that information held by the councils in the Lower North Island regarding sludge volumes and quality in oxidation pond systems was limited, as was information on quality and quantity of stockpiled sludge (Stage 1 Gap analysis, Task 1a Desk top study, June 2017 and Task 1b Site visits and field investigation, October 2017). However, a number of common problem areas and potential collective solutions were identified. The main findings of this report were as follows:

- Few Councils have investigated alternative end-use options for sludge, most dispose to landfill, monofill or stockpile sludge.
- Common problem areas for sludge management are:
    - Urgency.
    - Unknown quality and volume of sludge,
    - No identified end-use,
    - A lack of community engagement and/or appropriate community engagement framework,

  - Physical, infrastructural and financial restrictions to de-sludging, dewatering, transport and processing of sludge,
  - Regulation,
  - High financial burden of sludge management, and
  - No contingency plans in place
- The result of these common problems is large quantities of sludge remaining in oxidation ponds, stockpiled or sent to landfill.
- Many opportunities exist for Councils to work collaboratively to achieve a collective biosolids strategy that would benefit all parties, including:
  - Sharing sludge processing infrastructure (either location or equipment)
  - The development of a Global Regulatory Framework
  - Sharing knowledge and maintaining collaboration to establish effective contingency plans, and learn from past inefficiencies.
  - Shared Community Engagement Framework and sharing knowledge around community engagement processes
  - The development of standards for all WWTP to reduce inconsistencies in describing quantity and quality of sludge (i.e. wet weight vs dry weight) and variability of material.
- The findings proved a good starting point for discussions that will be built upon through Stage 4 (Scenario evaluation: T4a Development of 'straw men' scenarios) and Stage 5 (Draft strategy: T5b Draft strategy) of this project.

2 VISION AND GOALS

2.1 Vision

A co-ordinated approach is adopted by all Partner Councils within the Manawatu-Wanganui Region for the beneficial and productive use of sludge from each urban municipal wastewater treatment plant.

2.2 Goals

The Partner Councils will work together, sharing costs and equipment in areas where scalability is most appropriate. The use of existing infrastructure will be essential, as will the ability to provide contingency scenarios. The ability to work together and share resources will ensure that the biosolids produced by each community's wastewater treatment plant (WWTP) is:

- Minimised as part of the national waste minimisation strategies;
- Stabilised in order to meet Grade B biosolids standards so that they are no longer classed as hazardous wastes;
- Managed in a regionally consistent and cost-effective manner;
- Managed through shared expertise and resources for the benefit of all parties;
- Extracted and processed through regional processing facilities when appropriate;
- Processed in an economically viable and sustainable manner;
- Processed and discharged under authorisation of 'global' resource consents and/or as permitted activities; and
- Beneficially used and no longer discharged to landfill except when required for the safe control of potentially hazardous wastes or substances.

3 INTRODUCTION

The lower North Island has 46 WWTP. Within these are approximately 36 municipal wastewater treatment oxidation pond systems containing over 46,000 m^3 (dry, approx.) of sludge. This oxidation pond sludge requires removal every 30-50 years, as well as sludge from 4 small and 5 high rate treatment plants which require more regular removal (daily or weekly). Most of this sludge ends up in landfills which is not a sustainable long-term management option and runs contrary to government waste minimisation goals (e.g. New Zealand Waste Strategy, 2010 to support the Waste Minimisation Act, 2008).

Finding alternatives to landfilling and management of biosolids is especially difficult for smaller communities where limitations due to lesser economies of scale can stifle the development of workable solutions. Often the solution chosen is one of convenience rather than what is best for the community and environment, or bigger picture sustainable strategies. All territorial authorities are facing the same problem – what to do with their biosolids.

Re-use of biosolids is often hindered by 'unknowns', high-costs and lack of infrastructure which limit potential re-use options. In addition, community perception (lack of effective community engagement) and existing regulations may present road-blocks to re-use. Most Councils are amenable to developing strategies for biosolids re-use, but many do not have the infrastructure/knowledge to implement them at present.

The purpose of the Regional Biosolids Strategy- Lower North Island is to develop a collective biosolids strategy that will provide economies of scale and alternatives for discharge and beneficial use of biosolids in the lower North Island. The strategy aims to provide affordable, sustainable and targeted solutions that are consistent with national waste minimisation strategies.

A collective of 10 councils in the lower North Island are working together in a partnership to develop this collaborative biosolids strategy.

3.1 Purpose

A 'gaps analysis' has been undertaken to determine the scale of the sludge issue within each District. This information has been compiled into two reports (Stage 1 Gap analysis, Task 1a Desk top study, June 2017 and Task 1b Site visits and field investigation, October 2017, summarised in Appendix A). The main findings of these investigations were:

- The study region (lower North Island) covers 9 districts and 46 WWTP; 36 oxidation pond systems, 4 small treatment plants, 5 high rate (complex) treatment plants and 1 wet well system
- Information held by the councils regarding sludge volumes and quality of both stockpiled sludge and sludge in oxidation ponds is limited
- Approximately 11 oxidation ponds in the region require management in the next five years, and at least two of these have significant trade waste inputs.
- 11 WWTP's have stockpiled sludge of unknown volume and quality.
- Five WWTP's (high rate) have an ongoing requirement for sludge management
- Few Councils have investigated alternative end-use options for sludge, most dispose to landfill, monofill or stockpile sludge.

This report summarises the findings from Stage 1 Gap analysis (Task 1a and 1b, Appendix A) and outlines the scope and potential for the 10 Partner Councils to work together, with a focus on common 'problem areas' such as:

- De-sludging;
- Dewatering;
- Transport;
- Sludge processing;
- Application;
- Regulatory approval;
- Consultation;
- Cost savings; and
- Contingency.

Regional capacity will be identified and areas where Councils could work together, sharing costs, existing infrastructure and providing contingency scenarios. The ability to work together and share resources will be identified though the establishment of a matrix where the various contributions can be shown from each Partner. A draft MoU will be prepared and circulated with this report to the partners that identifies opportunities and scenarios whereby they can work together (Appendix B).

4 PARTICIPANTS AND RELATIONSHIPS

4.1 Partner Councils

The Partner Councils are:

- Horizons Regional Council
- Ruapehu District Council
- Wanganui District Council
- Rangitikei District Council
- Manawatu District Council
- Tararua District Council
- Masterton District Council
- Palmerston North City Council
- Horowhenua District Council
- Kapiti Coast District Council

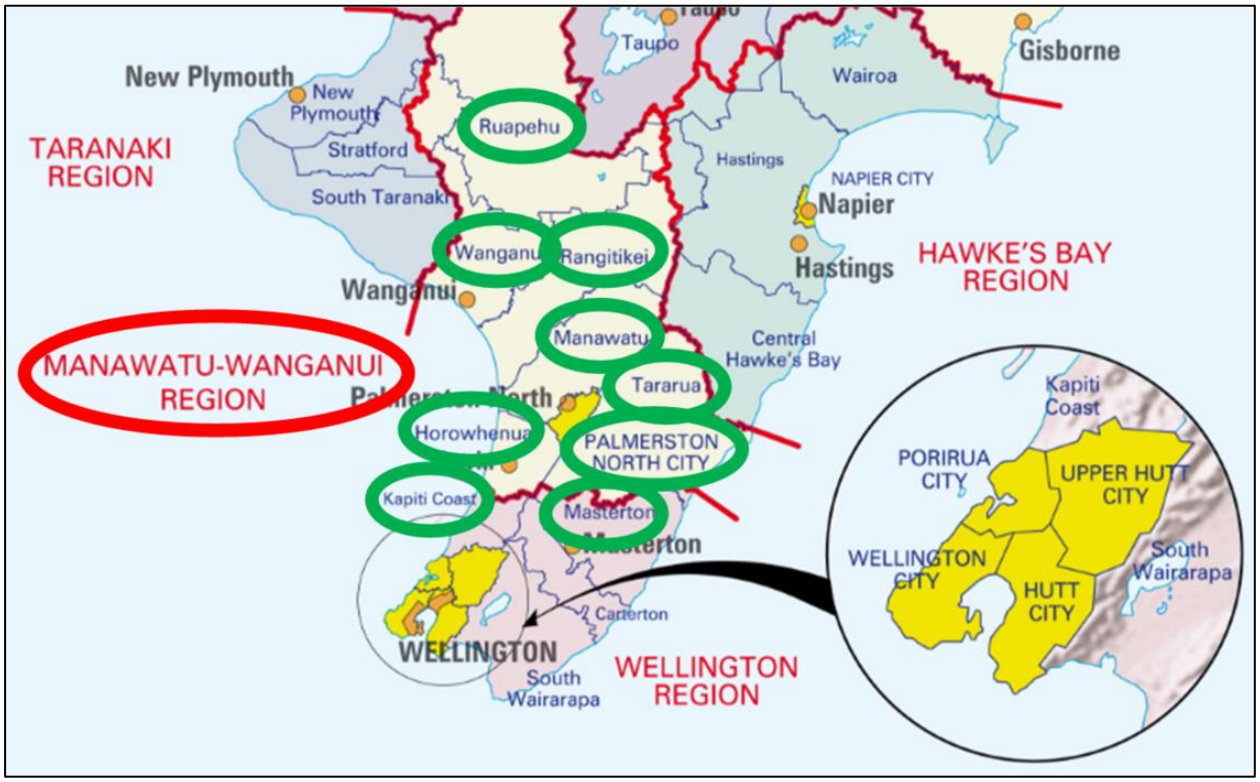

Figure 4.1: Partner Council Locations

Other councils from neighbouring regions may join in future, and some industrial businesses (such as food processing plants) within the boundaries of the Partner Councils may also join, provided that their biosolids are of acceptable quality for incorporation into the regional land application processes.

4.2 Wastewater Treatment Plant Facilities in the study region

Each Partner Council operates municipal WWTP's for the urban areas listed below.

Table 4.2.1: Council Partners and the WWTP Operated Within their District.

Council	Urban Area
Horowhenua District Council	Tokomaru Shannon Foxton Beach Foxton Waitarere Beach Levin Mangaore
Manawatu District Council	Rongotea Kimbolton Cheltenham Awahuri Sanson Fielding Ohakea Halcombe
Rangitikei District Council	Lake Duddings Bulls Marton Koitiata Mangaweka Hunterville Ratana Taihape
Tararua District Council	Dannevirke Pahiatua Woodville Norsewood Ormondville Eketahuna Pongaroa
Palmerston North City Council	Totara Road
Masterton District Council	Homebush Riversdale Castlepoint Tinui
Whanganui District Council	Airport Road
Ruapehu District Council	National Park Ohakune Pipiriki Raetihi Rangataua Taumarunui Waiouru Whakapapa
Kapiti Coast District Council	Paraparaumu Ōtaki

Initial stages of the collective biosolids strategy (Stage 1: gaps analysis) identified that within these 9 districts there are 46 WWTP; 36 municipal wastewater treatment oxidation pond systems (red), 4 small treatment plants (blue), 5 high rate (complex) treatment plants (green) and 1 wet well system (orange),

4.3 Relationships

Horizons Regional Council are the main regulator for issuing and monitoring discharge resource consents. Currently Councils work independently with regards to their biosolids management, but those involved in the project have indicated an ability/desire to work together to achieve a collective strategy. For a collective strategy to be successful the Partner Councils will need to work collaboratively but some will take lead roles while others will be more supportive or solely participate as providers of biosolids. Expertise will be provided by the most appropriate organisation. Other resources will be provided as required in the most efficient manner amongst the parties.

A technical group was formulated in initial stages of the project with representatives from the 10 Partner Councils, these representatives will continue to meet and discuss ongoing progress and have input into strategy development. The potential contribution for each Council and how a collective strategy may look moving forward is discussed in section 6. Gaps analysis – summary.

A 'gaps analysis' was undertaken to determine the scale of the sludge issue within the region. This information has been compiled into two reports (Stage 1 Gap analysis, Task 1a Desk top study, June 2017 and Task 1b Site visits and field investigation, October 2017). A large amount of information was provided by Partner Councils and is summarised in Appendix A.

5 SLUDGE MANAGEMENT: ISSUES, CHALLENGES AND SOLUTIONS

5.1 Overview: The Sludge Management Process

Sludge management involves a series of steps to enable disposal/beneficial use of the sludge. Such steps may include processes to reduce weight and volume (e.g. dewatering) to reduce disposal costs, and processes to reduce potential health and environmental risks of the sludge. At each step there are various options that can be considered. Figure 6.1 is a flow chart outlining some of the process involved to manage the sludge.

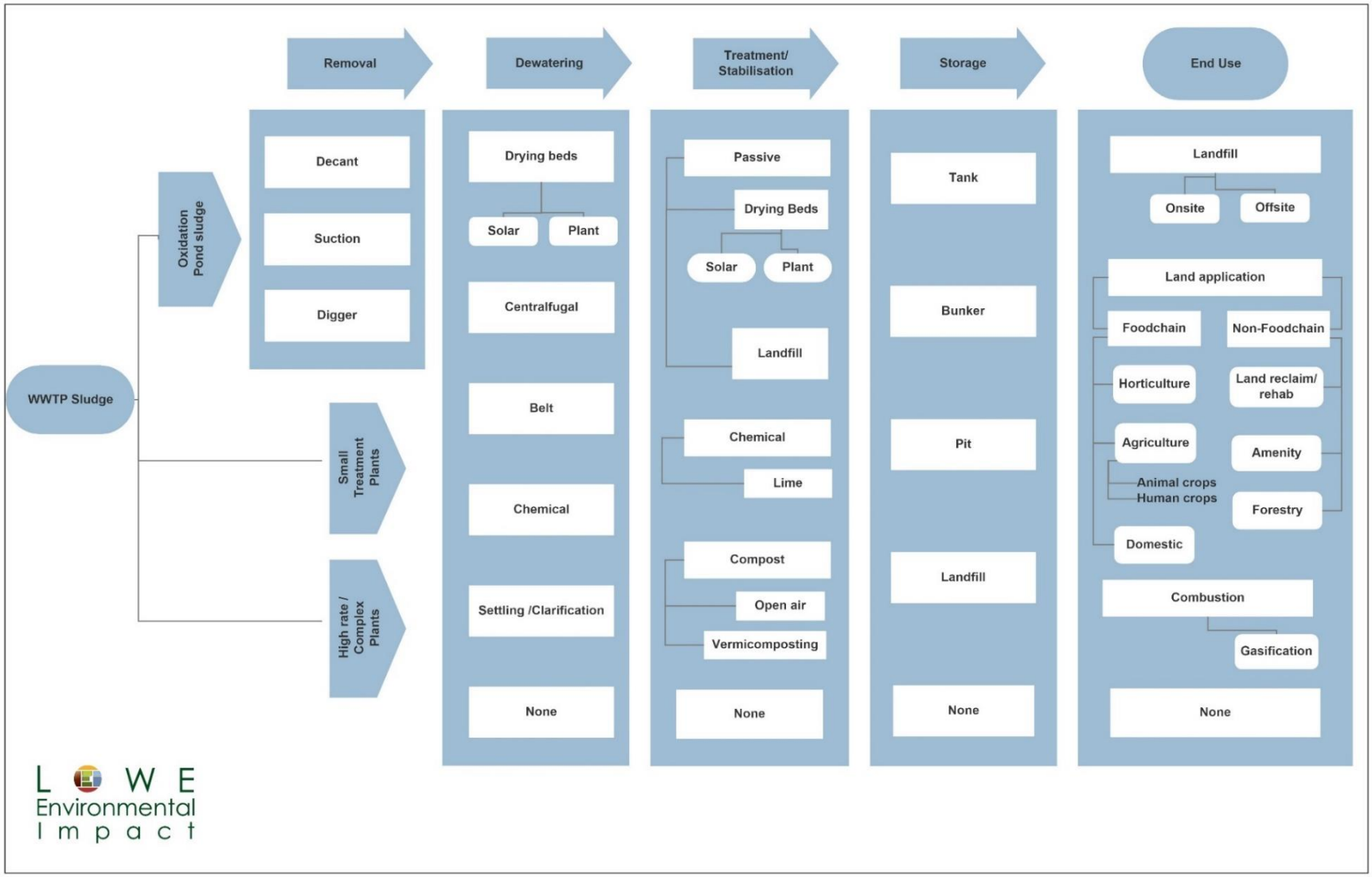

Figure 6.1. Flow chart of the sludge management processes

5.2 Common problems

The most common problems faced by councils relate to cost. In most cases there is either a need to reduce the cost of sludge management (landfill) or to develop an end-use that is economically feasible, with many current options prohibitive due to associated costs. Regulations and 'unknowns' are also huge barriers, such as unknown end-use, likely associated costs, quantities and qualities of sludge.

In the sections and tables below, we have outlined in more detail some of the common problem areas for each stage of the sludge management process. We have also outlined opportunities where councils could work together, sharing costs and infrastructure resulting in a reduction in the quantity of biosolids sent to landfill.

5.2.1 Urgency – Sludge Availability and Timing

Many WWTPs require ongoing sludge management or de-sludging within 5 years whilst others will require management over longer time periods (5-20 years) (Appendix A).

There are 11 ponds in the region that are likely to require de-sludging within the next five years (e.g. Foxton and Marton), in addition, 11 WWTP sites have stockpiled sludge and five have an ongoing requirement for sludge removal (Levin, Ohakea, Totara road, Paraparaumu, Ōtaki) (Appendix A).

Current Issues	Impact	Opportunities to Work Together	Requirements to Achieve Working Together
Many oxidation ponds are full or nearing maximum capacity. i.e. Foxton WWTP Many WWTP have a lack of on-site storage space or storage space is running out. i.e. Airport Road WWTP storage space will be full within 3 years. Cost of landfill is prohibitive and/or landfills are nearing maximum capacity. i.e. Paraparaumu WWTP can no longer dispose of sludge to Otaihanga landfill as it is now at capacity. Modification or upgrades to WWTP required de-sludging or maintaining the quality of effluent may require removal of sludge. Timing of resource consents – sludge management coordinated with consent renewals. More urgent for some councils than others.	Pressure on oxidation ponds (not running efficiently), WWTP and treatment systems. Low quality effluent. High cost of transport and landfill disposal. No identified end-use.	Share resources and information, for example shared dewatering equipment, transport and re-use location. Those with requirements within 5-10 or 10+ year timeframes can use the developed model to share resources.	Identify the timing of each WWTP requiring de-sludging Communication and sharing of knowledge between Partner Councils.

5.2.2 Quality of Sludge

Sludge quality is influenced by factors such as trade waste input, age of pond, whether the pond has previously been desludged and where the pond sits within the treatment system i.e. first pond vs last pond in treatment train**.**

Current Issues	Impact	Opportunities to Work Together	Requirements to Achieve Working Together
Mostly unknown sludge quality. Some WWTP have high trade waste contribution and likely elevated contaminants. i.e. Marton and Airport Road WWTP Significant variability is likely within oxidation ponds in a treatment system. i.e. Foxton WWTP. Smaller communities likely meet Grade B biosolids guidelines criteria already (NZWWA, 2003).	High cost of sludge analysis to determine quality. Low quality sludge reduces end-use options, may require blending or further stabilisation before re-use; increase cost. Sludge is stockpiled or left in-situ.	Blending with better quality sludge, compost or green waste will dilute contaminants in low quality sludges; potential to mix sludge from different WWTPs to produce better quality product. Blending or mixing removes requirement for individual sludge analysis; reduced costs to individual councils.	Sludge quality may be identified from information in the Stage 1 Gaps analysis, assumptions can be made based on trade waste information. Sludge quality may need to be determined in some cases through analysis. A range of quality sludges and/or green waste is required for blending sludges as an end-use option.

5.2.3 Volumes of sludge

The volume of sludge to be managed varies greatly between WWTPs. Many smaller communities have minimal sludge to manage whilst larger WWTPs have large quantities requiring ongoing management, in general most Councils do not accurately know the volumes of sludge requiring management.

Current Issues	Impact	Opportunities to Work Together	Requirements to Achieve Working Together
Volumes are generally unknown. High rate plants generate sludge on a regular basis. i.e. Paraparaumu and Levin WWTP. Many WWTPs have large quantities of sludge stockpiled on site and/or in oxidation ponds i.e. Shannon and Tokomaru geobags. Inaccuracy in measurements of sludge volumes, and inconsistency in how volumes are reported and discussed cause confusion and inefficiencies.	Unknowns lead to inaction – further stockpiling. Cost of removal, transport, treatment and/or disposal is dependent on volume to be managed.	Shared infrastructure such as transport. Development of a centralised processing facility - Reduce cost for individual councils. - Will require ongoing commitment and constant availability of sludge Communication between councils – consistent terminology and measurements used for reporting and discussing volumes (i.e. wet weight vs dry weight)	Identify timing and requirements for each WWTP de-sludging. Volumes at high rate plants need to be accurately measured and consistently reported. Councils need to use consistent terminology and measurements/technique. Will require sludge surveys at some WWTPs with full oxidation ponds or stockpiled sludge.

5.2.4 No identified end use programme

Most Partner Councils have no end-use identified for their sludges. Some are investigating composting and land application however most either landfill or stockpile on-site.

Current Issues	Impact	Opportunities to Work Together	Requirements to Achieve Working Together
Many councils have not identified end-use for sludge due to: - No prior need for disposal. - Sludge quality issues. - Required Community/iwi engagement. - A need for detailed cost analysis.	Large quantities of sludge have been stockpiled or landfilled. Cost of landfill disposal is high. No re-use of sludge. Double handling of sludge.	Working together can reduce costs to individual councils. - Global resource consents. - Possible development of a centralised end-use/land application site. Potential to establish a centralised processing facility producing a high-quality end-product that could be re-used by all councils (e.g. compost). Shared information (i.e. cost analysis and technical information) would prevent repetition; reduced costs.	Requires community, iwi and council support. Requires the development of an end-use strategy, community engagement framework and cost analysis - memorandum of understanding and agreement for Council Partners to work together to allow for the development of a strategy. Requires effective communication between Partner Councils.

5.2.5 Community engagement

Community engagement is often required when developing sludge management programmes. Community engagement with iwi and the wider public around biosolids end-use/re-use is variable between councils. A well thought out community engagement strategy is necessary for any end-use strategy to work.

Current Issues	Impact	Opportunities to Work Together	Requirements to Achieve Working Together
Community likely have interest in end-use options. Communities can be reluctant for sludge re-use in some cases. RMA and regulatory considerations. Frameworks for consultation not developed. - Most Councils have no community engagement process established.	Sludge is stockpiled or sent to landfill, increasing costs and lack of space available. Movement of sludge between rohe may limit ability to dispose/re-use	Development of a global framework that can be utilised by all councils. Well engaged community will be more likely to be receptive and positive to ideas.	Requirement for Council Partners, iwi and community to engage. Requirement for a reliable and flexible framework to aid engagement. Sharing of knowledge between Councils on community engagement processes and outcomes i.e. KCDC have already made good progress in this area and gained insight will be valuable to all Partner Councils.

5.2.6 De-sludging

WWTPs with oxidation ponds that are full or near capacity require de-sludging. De-sludging is a difficult and costly exercise that requires the appropriate planning and equipment as well as knowledge of the consistency and volumes of sludge to be moved.

Current Issues	Impact	Opportunities to Work Together	Requirements to Achieve Working Together
Many oxidation ponds require de-sludging within a short time frame (5 years), e.g. Foxton, Marton and Taihape WWTPs Fill oxidation ponds do not work efficiently.	Pond systems that are over capacity put pressure on infrastructure, resources and do not produce high quality effluent. High costs associated with de-sludging.	Sharing resources and infrastructure may reduce costs and time. A common contractor with experience and knowledge will reduce error.	Identify timing of each WWTP de-sludging requirements and resourcing needs. Sharing information between councils; who is planning to de-sludge ponds, when and how this will be carried out.

5.2.7 De-watering

Depending on end-use, oxidation pond sludge usually requires de-watering.

Current Issues	Impact	Opportunities to Work Together	Requirements to Achieve Working Together
High rate plants require de-watering on a regular basis, e.g. Levin, Totara Road and Paraparaumu WWTP. Oxidation pond sludge can be between 3-8% solids depending on position of pond in the treatment train, age of pond and pond base material. The required water content of sludge depends on the desired end-use. De-watering requires space on site and infrastructure.	Wet sludge increases weight and volume, therefore costs more to transport and process. Wet sludge is more odorous and has higher vector attraction. De-watering is costly and requires space on site.	A common end-use would mean the ability to share resources and infrastructure, reducing costs. Potential to have a centralised de-watering facility, or use an established de-watering facility at an existing WWTP. Alternative to have a portable de-watering system that can be moved around sites depending on requirements – shared cost.	Sludge end-use needs to be identified in order to determine the de-watering requirements. De-watering facilities need to be available, and accessible.

5.2.8 Transport

All councils that require sludge management will potentially have to consider transport requirements.

Current Issues	Impact	Opportunities to Work Together	Requirements to Achieve Working Together
Sludge may need to be moved from WWTP for off-site treatment, landfill or other location (depending on end-use). May be considered a hazardous waste – depends on sludge quality. Need to consider cultural views on movement between different rohe. The cost of moving large quantities of sludge are prohibitive.	High costs associated with transport – number of truck loads (influenced by volume and water content). Compliance costs and issues around transport of hazardous waste.	A common end-use would mean the ability to share resources and infrastructure, reducing costs.	Need to identify an end-use program (location). Determine timing and distance requirements.

5.2.9 Sludge processing

After removal from the oxidation pond or WWTP, further sludge processing may be required, depending on end-use.

Current Issues	Impact	Opportunities to Work Together	Requirements to Achieve Working Together
End-use and sludge quality will determine sludge processing requirements. If Grade B under the NZ biosolids guidelines (NZWWA, 2003), then further processing may not be required for certain types of application to land (e.g. forestry, Resource Consent still required). If sludge does not meet Grade B requirements, then further processing (stabilisation) is required such as blending or composting. Infrastructure is required to process sludge. Inconsistency in describing quantity and quality of sludge as well as variability of material complicates processing.	Requires consenting. High costs. Time required. Requirement for facilities and infrastructure	A common end-use would mean the ability to share resources and infrastructure, reducing costs.	Identifying end-use would determine processing requirements.

5.2.10 Application to land

Application of sludge to land as a fertiliser or soil conditioner can be a viable means of re-use.

Current Issues	Impact	Opportunities to Work Together	Requirements to Achieve Working Together
No resource consent if the sludge meet Grade A requirements of the current NZ biosolids guidelines (NZWWA 2003), but requires a resource consent if Grade B. Variability in product quality and timing of production. Levels of contaminants may prohibit land application. Suitability of material for crops must be considered. Most councils have not considered land application a viable option but it is a possible end-use alternative for many.	May require transport, sludge processing, sludge analysis, resource consents, community engagement and associated infrastructure. Associated costs can be high; sludge is stockpiled or sent to landfill.	Shared land application site would allow for centralised consents (global consents) and a reduction in associated costs.	Identify - Timing of required de-sludging - Volumes of sludge - Quality of sludge Location of application i.e. to crops or other.

5.2.11 Regulation

Current regulations must be considered when determining biosolids re-use options.

Current Issues	Impact	Opportunities to Work Together	Requirements to Achieve Working Together
Regulations in place such as Resource Management Act (RMA) and Regional and District Plans. - Application of Grade B biosolids to land requires consent. - Separate consents are required for each end-use. - High level of detail required to satisfy section 88 of the RMA. - Some council consents are coming up for renewal and will require investment of time and money for the reconsenting process.	High cost, time resource and information requirement of individual and repeated consents are prohibitive.	Blend or process (shared facilities) sludge to meet Grade A biosolids requirements - no consent is needed under some Regional plans, or grade B – consents required. Establishment of a single regulatory body for the region - potential for global consents to reduce associated costs.	All territorial authorities require resource consents to discharge biosolids to land if biosolids meet Grade B, but not if grade A. All partner councils would require the same regulatory body to be able to work together (e.g. Horizons). Unknowns need to be clarified (sludge quality, quantity, end-use)

5.2.12 Economics

The cost vs benefit of sludge management options directly impacts viability of end-use options.

Current Issues	Impact	Opportunities to Work Together	Requirements to Achieve Working Together
Lots of unknowns, require detailed cost analysis. End-use must be economically feasible to councils. Landfilling is becoming more expensive – how does this compare to alternatives? Scale of the sludge issue is large.	Sludge is stockpiled or sent to landfill.	Sharing infrastructure and resources reduces costs for individual councils. Working together allows for more end-use options.	Memorandum of understanding and agreement for Council Partners to work together to allow for the development of a strategy. Strategy available for use.

5.2.13 Contingencies

Most Councils have little or no contingency plans in place. A back up plan to guard against a potential failure in the functioning of WWTP facilities or other unforeseen event that prevents the usual wastewater/sludge management is essential.

Current Issues	Impact	Opportunities to Work Together	Requirements to Achieve Working Together
Most councils do not have current back-up plans for failure in WWTP sludge treatment, full oxidation ponds or landfills over capacity. There is a current lack of equipment, space and knowledge to share when required.	Stockpiling, full oxidation ponds and sludge going to landfill.	Shared facilities and infrastructure or available space (capacity) at larger WWTPs. Clear contingency plans put in place and information shared between WWTPs.	Effective communication and maintaining relationships between Councils. Memorandum of understanding and agreement for Council Partners to work together to allow for the development of a strategy. Strategy available for use.

6 POTENTIAL SCENARIOS – WORKING TOGETHER

6.1 Opportunities Working Together Matrix

In this section a 'shared opportunities' matrix is presented (Table 7.1). This matrix briefly outlines the potential for working together as identified from sections 5 and 6 above. In addition, Table 6.2 highlights potential 'key contributions' for each Partner Council as a thought piece for subsequent stages of the project. These tables are intended as a starting point for discussions and will be built upon through collaboration between Partner Councils and the Project Team. This process will identify regional capacity and areas where Councils could work together, sharing costs, equipment and identify areas where scalability is most appropriate. This information will directly relate to Stage 4: Scenario Evaluation, T4a Development of 'straw men' scenarios and Stage 5: Draft Strategy of the project.

Table 6.1 Opportunities for Working Together Matrix

	Horowhenua DC	Manawatu DC	Rangitikei DC	Tararua DC	Palmerston North C(	Masterton DC	Whanganui DC	Ruapehu DC	Kapiti Coast DC
Urgency	●	●	●	●	●	●	●	●	●
Quality of sludge	● ● ●	● ● ●	● ● ●	● ● ●	● ● ●	● ● ●	● ● ●	● ● ●	● ● ●
Volumes of sludge	● ● ●	● ● ●	● ● ●	● ● ●	● ● ●	● ● ●	● ● ●	● ● ●	● ● ●
No identified end-use	● ● ● ●	● ● ● ●	● ● ● ●	● ● ● ●	● ● ● ●	● ● ● ●	● ● ● ●	● ● ● ●	● ● ● ●
Community engagement	● ● ●	● ● ●	● ● ●	● ● ●	● ● ●	● ● ●	● ● ●	● ● ●	● ● ●
De-sludging	● ● ●	● ● ●	● ● ●	●	●	● ● ●	●	●	●
De-watering	● ● ●	● ● ●	● ● ●	●	● ● ●	● ● ●	● ● ●	●	● ● ●
Transport	● ● ● ●	● ● ● ●	● ● ● ●	● ● ● ●	● ● ● ●	● ● ● ●	● ● ● ●	● ● ● ●	● ● ● ●
Sludge processing	● ● ● ●	● ● ● ●	● ● ● ●	● ● ● ●	● ● ● ●	● ● ● ●	● ● ● ●	● ● ● ●	● ● ● ●
Application to land	● ● ● ●	● ● ● ●	● ● ● ●	● ● ● ●	● ● ● ●	● ● ● ●	● ● ● ●	● ● ● ●	● ● ● ●
Regulation	● ● ●	● ● ●	● ● ●	● ● ●	● ● ●	● ● ●	● ● ●	● ● ●	● ● ●
Economics	● ● ● ●	● ● ● ●	● ● ● ●	● ● ● ●	● ● ● ●	● ● ● ●	● ● ● ●	● ● ● ●	● ● ● ●
Contingencies	● ●	● ●	● ●	● ●	● ●	● ●	● ●	● ●	● ●

Contribution key

- Shared knowledge/information
- Shared infrastructure/equipment
- Shared costs
- Shared regulatory framework

Table 6.2 Key contributions

	Horowhenua DC	Manawatu DC	Rangitikei DC	Tararua DC	Palmerston North C(	Masterton DC	Whanganui DC	Ruapehu DC	Kapiti Coast DC
Key Notes	Foxton oxidation ponds require de-sludging. Tokomaru, Shannon have stockpiled sludge ready for re-use. Levin has on-going sludge production.	Sanson requires de-sludging. Fielding stockpiled sludge requires management.	Marton, Ratana and Taihape oxidation ponds require de-sludging.	No urgent requirement for sludge management.	Ongoing sludge production.	Homebush decommissioned ponds - wet sludge requireing magement and sludge in on-site monofils.	Onsite storage at Whanganui is running out.	Stockpiled sludge at Waiouru requires management.	Paraparaumu produces sludge continuously.
Potential Contributions	Ongoing sludge contribution. Oxidation pond sludge and mature/stabilised sludge from geobags.	Onsite composting facilities available at Fieding WWTP. Composting knowledged.	Oxidation pond sludge contribution	On-site monofils at Dannevirke, Pahaitua and Woodville may provide source of mature sludge.	Ongoing sludge contribution. On-site de-watering facilities. Composting knowledge/infrastructure	On-site monofils may provide source of mature sludge.	On-site de-watering and thermal drying facilities.	Sludge stored in geobags at Waiouru may provide mature sludge contribution.	De-watering facilities available. Kapiti DC have already established community engagement processes - shared knowledge.

7 MEMORANDUM OF UNDERSTANDING

A draft Memorandum of Understanding (MOU) is in Appendix A. The objective of the MoU is to obtain agreement from Partner Councils of their willingness to work towards the potential shared opportunities outlined in this report. Signing of the MoU will signal a desire by Councils to achieve shared goals and for the further development of a 'collective biosolids strategy'.

8 CONCLUSIONS

This report identifies some of the common problem areas related to biosolids management faced by councils in the study area (lower North Island) and investigates how the councils could work together sharing knowledge, capability, capacity and infrastructure to find cost effective solutions.

A summary of the ways councils could collaborate include:

- At least 11 WWTP oxidation ponds require de-sluding in the next 5 years. Those councils can work to share costs, equipment and infrastructure related to de-sludging; dewatering and sludge processing.
- Sharing sludge processing infrastructure (either location or equipment) is a real possibility, leading to shared and reduced costs and the provision of contingency and back up options.
- Resource consents are generally required for sludge processing and beneficial re-use such as land application (if the resulting product is Grade B as described in the NZ biosolids guidelines). A Global Regulatory Framework would alleviate the costs and time associated with individual and repeated consents for similar activities.
- Sharing knowledge and maintaining collaboration helps to establish effective contingency plans, and avoided repeating past mistakes/learning from past inefficiencies.
- Shared Community Engagement Framework and sharing knowledge between Councils on community engagement processes and outcomes will enable a well engaged community and faster and more robust decision making. Development of an engagement framework to engage with both Tangata Whenua and the wider community is essential.
- There is an opportunity to develop standards for all WWTP so that inconsistencies in describing quantity and quality of sludge (i.e. wet weight vs dry weight) as well as variability of material can be reduced, thereby allowing for easier/more streamlined sharing of knowledge and processing of materials.

To be able to progress this project further an MOU is required between partners signalling their willingness to further explore opportunities to work together, including potential for joint research projects, joint field trials, sharing of and enhancing of intellectual property and sharing resources and infrastructure.

9 APPENDICES

Appendix A: Summary of information on sludge/biosolids in the Lower North Island study area
Appendix B: Memorandum of Understanding

APPENDIX A

Summary of information on sludge/biosolids in the Lower North Island study area

WWTP	Type and Details	Sludge on Site (Current)	Accumulation m^3/yr (dry)	Removal - Historic	Removal - Future	Sludge Quality	Population
Horowhenua District Council							
Tokomaru	Oxidation pond	Approximately 700m^3 (at 40% DM) stored in geobags on site. Minimal in ponds.	Unknown	De-sludged in 2016, stored in geobags on site	Stored sludge requires management	Mature/stabilized sludge, below heavy metal and *E. coli* limits for grade b biosolids. Approximately 40% dry matter.	552
Shannon	Oxidation pond	Approximately 1,820 m^3 (at 17.5%) stored in geobags on site. Minimal in ponds.	Unknown	De-sludged in 2015, stored in geobags on site	Stored sludge requires management	Mature/stabilized sludge, below heavy metal and *E. coli* limits for grade b biosolids. Approximately 17% dry matter.	1,500
Foxton Beach	Oxidation pond	None	Unknown	De-sludged 2013	Not until 2028	Unknown	1,641
Foxton	Three oxidation pond system	25,696 m^3 at approximately 8% DM	2,580 m^3 (approximate, HDC)	Never	Requires de-sludging. Programmed to occur within 2 years	Trade waste includes meat works and poultry. Some sections of the oxidation ponds are above *E. coli*, Cu, Cd and Zn levels for grade B biosolids.	2,500

WWTP	Type and Details	Sludge on Site (Current)	Accumulation m^3/yr (dry)	Removal - Historic	Removal - Future	Sludge Quality	Population
						If all sections are combined/blemded sludge would be below grade B limits.	
Waitarere Beach	Two oxidation ponds and an aerobic pond	Minimal		De-sludged 2013/14	Does not require desludging	Unknown	585 (seasonal)
Levin	Complex WWTP. Produces anaerobically pressed sludge daily.	n/a	700 m^3 per year (approx.)	Sludge is removed weekly to landfill	Ongoing removal to landfill	Significant trade waste contribution. High Zn but other contaminants unknown, likely high.	20,600
Mangaore	No treatment, wet wells connect into Shannon system	n/a	n/a	n/a	n/a	n/a	
Manawatu District Council							
Rongotea	Two stage pond system and wetland	Unknown	Approximately 15 m^3	Emptied 2015	Unlikely within 5 years	Unknown, no trade waste.	600
Kimbolton	Single oxidation pond	Minimal	n/a	Never	Unlikely within 5 years	Unknown, no trade waste	200
Cheltenham	Single oxidation pond	Minimal	n/a	Never	Unlikely within 5 years	Unknown, no trade waste	90
Awahuri	Single oxidation pond	Minimal	n/a	Never	Unlikely within 5 years	Unknown, no trade waste	35

WWTP	Type and Details	Sludge on Site (Current)	Accumulation m^3/yr (dry)	Removal - Historic	Removal - Future	Sludge Quality	Population
Sanson	Two oxidation pond in series	60 m^3 in ponds		Never	Requires desludging. Current plan to transport to Fielding WWTP.	Unknown, no trade waste	540
Fielding	Complex plant. Clarifiers and oxidation pond system	Stockpiled 25,000 m^3 (30% DS) aged digester sludge in storage ponds and 25,000 m^3 (3% DS) in an anaerobic lagoon, composted over time.	1,460 m^3 alum sludge, 730 m^3 digester sludge 90 m^3 anaerobic lagoon.	n/a	Stockpiled sludge requires management, currently stockpiled and composted over time	Significant trade waste so likely to contain contaminants.	16,250
Ohakea	Oxidation pond system (Pasveer ditch), clarifier and drying beds.	Minimal	91 m^3 per year	Removed on regular basis to landfill	Ongoing	Unknown, no trade waste	249 residents and up to 950 non- residents
Halcombe	Oxidation ponds	Estimate 3 m^3 in pond	1.5 m^3 per year	De-sludged 2015	Unlikely within 5 years	Unknown, no trade waste	534
Rangitikei District Council							
Lake Duddings	Single oxidation pond	Minimal	Minimal	Never	Unlikely within 5 years	Unknown but no permanent population. Likely minimal contamination.	No permanent population
Bulls	Screen, 2 oxidation ponds in series	3,000 m^3 (3 % DS) estimated in	Unknown	Desludged 2016	Unlikely within 5 years	Unknown, some trade waste	1,500

WWTP	Type and Details	Sludge on Site (Current)	Accumulation m^3/yr (dry)	Removal - Historic	Removal - Future	Sludge Quality	Population
		pond 1, pond 2 unknown				contribution likely	
Marton	Oxidation ponds, three ponds in sequence.	Estimate 47,550 m^3 at approximately 8 % DM in ponds	Unknown	Never	Requires desludging	High trade waste input including landfill leachate. Sludge contains elevated As and Zn, above Grade B biosolids limits. Not suitable for re-use in present form, requires blending with green waste or sludge from another WWTP to bring below grade B limits.	4,000
Koitiata	Oxidation pond	Unknown but likely minimal	Unknown	Never	Unlikely within 5 years. Planned to mix and pump to sand dunes	Unknown	105
Mangaweka	Small treatment plant. Modular treatment system.	Minimal	Unknown	Unknown, likely taken to Marton WWTP	Unlikely within 5 years	Unknown	147

WWTP	Type and Details	Sludge on Site (Current)	Accumulation m^3/yr (dry)	Removal - Historic	Removal - Future	Sludge Quality	Population
Hunterville	Front end treatment system and 2 oxidation ponds.	Unknown	Estimated 4.5 m^3 per year	2015	Unlikely within 5 years	Unknown	450
Ratana	2 oxidation ponds	Unknown	Unknown	Never	Likely require desludging within 5 years. Current plan to transport to Fielding WWTP.	Unknown	327
Taihape	Oxidation pond	Unknown	Unknown	Never	Likely require desludging within 5 years Current plan to transport to Fielding WWTP.	Unknown	1,670
Tararua District Council							
Dannevirke	Six oxidation ponds.	Unknown quantity stored in onsite monofils. Minimal sludge in ponds	Unknown	2014, 2015, 2016, 2017 to onsite monofil	Does not require desludging. Onsite monofils may require management within 5 years. Current plan to grass cells once full and leave for 12 months	Unknown	5,043
Pahiatua	Three oxidation ponds	Unknown	Unknown	2002-2003 to onsite monofil	Does not require desludging within 5 years. Onsite monofils	Unknown	2,500

WWTP	Type and Details	Sludge on Site (Current)	Accumulation m^3/yr (dry)	Removal - Historic	Removal - Future	Sludge Quality	Population
					may require management within 5 years. Current plan to grass cells once full and leave for 12 months		
Woodville	Two oxidation pond system with two maturation cells.	Oxidation pond 2 estimated to contain 20 m^3 (DS) Total sludge on site has been estimated to be 1,925 m^3 (at 3% solids)	Unknown	Pond 1 desludged and placed in maturation cells on site in 2008/2009	Does not require desludging within 5 years. Onsite monofils may require management within 5 years. Current plan to grass cells once full and leave for 12 months	Unknown	1,401
Norsewood	Two oxidation ponds	Minimal. Ponds receive overflow of septic tank effluent only	Minimal	n/a	Unlikely within 5 years	Unknown	330
Ormondville	Two oxidation ponds	Minimal. Ponds receive overflow of septic tank effluent only	Minimal	n/a	Unlikely within 5 years	Unknown	422
Eketahuna	Two oxidation ponds	Unknown quantity stored in biotubes onsite	Minimal	Desludged in 2016, stored in biotubes onsite to dewater	Possible removal of stored sludge within five years. Current plan transfer to	Unknown	441

WWTP	Type and Details	Sludge on Site (Current)	Accumulation m^3/yr (dry)	Removal - Historic	Removal - Future	Sludge Quality	Population
					Dannevirke sludge cells.		
Pongaroa	Two oxidation ponds	Minimal. Ponds receive overflow of septic tank effluent only	Minimal	n/a	Unlikely within 5 years	Unknown	300
Palmerston North City Council							
Totara Road	High rate, complex plant. Screening, primary sedimentation, anaerobic digestion, aeration lagoons, clarifier, UV, wetlands, discharge to river.	n/a	2,312 m^3 per year	Ongoing Sludge from primary sedimentation is digested, dewatered and co-composted with sludge from clarifier. Alum sludge is also composted.	Continuation of current regime	30% industry contribution so likely contaminants. Primary digested sludge measured high levels of *E. coli* and other pathogens but low Cu and Zn.	74,945
Masterton District Council							
Homebush	High rate WWTP. Oxidation ponds	35,000 m^3 of sludge (@ 40%, approx. 21,000 m^3 dry) stored in onsite monofil. 15,000 m^3 in decommissioned ponds (wet volume). Unknown	Unknown	Never de-sludged	Newer ponds (2013), likely do not require de-sludging within 5 years (estimated 15-20 years)	Reported to receive urban WW only. In-situ sludge has variable characteristics; elevated Cu, Zn and *E. coli* (35,000 cfu/g), however, still meets grade B criteria.	25,000

WWTP	Type and Details	Sludge on Site (Current)	Accumulation m^3/yr (dry)	Removal - Historic	Removal - Future	Sludge Quality	Population
		volume in active oxidation ponds					
Riversdale	Oxidation pond	Unknown	Unknown	Never de-sludged	Unlikely within 5 years, young ponds with small population	Unknown	Seasonal
Castlepoint	Oxidation pond	Unknown	Unknown	Never de-sludged	Unlikely within 5 years, young ponds with small population	Unknown	197 (seasonal)
Tinui	Oxidation pond	Unknown	Unknown	Never de-sludged	Unlikely within 5 years, young ponds with small population	Unknown	150
Whanganui District Council							
Airport Road	High rate WWTP. Activated sludge. Contact stabilization, dewatering and thermal drying	Onsite storage, unknown volume.	22,200 m^3 per year (at 20% DS. 4,440 m^3 dry)	Primary and waste activated sludge dried and stored on-site.	On-site storage full within 3 years. Needs sludge management within 5 years	High trade waste (meat works, tannery and dairy).	42,150
Ruapehu District Council							
National Park	Two oxidation pond system	Minimal	Unknown	Sludge removed at clarification and sent to landfil	Minimal sludge accumulation, unlikely to require de-sludging within 5 years	Unknown. Minimal trade waste so likely low contaminants	240
Ohakune	Two stage oxidation pond system.	Unknown quantity of sludge	Unknown	Never	Unlikely de-sludging within 5 years.	Unknown. Minimal trade waste so likely	1,500

WWTP	Type and Details	Sludge on Site (Current)	Accumulation m^3/yr (dry)	Removal - Historic	Removal - Future	Sludge Quality	Population
		accumulation in ponds				low contaminants	
Pipiriki	Small treatment plant. Septic tank system	Minimal	Unknown	Sludge removed at septic tank stage	Minimal sludge accumulation, unlikely to require de-sludging within 5 years	Unknown. Minimal trade waste so likely low contaminants	20
Raetihi	Three oxidation pond system	Minimal in accumulated in ponds.	Unknown	Never	Unlikely within 5 years	Unknown. Minimal trade waste so likely low contaminants	749
Rangataua	Oxidation pond system	Minimal	Unknown	Never	Unlikely within 5 years	Unknown. Minimal trade waste so likely low contaminants	1,344
Taumarunui	Two oxidation pond system	Minimal	Unknown	Sludge from primary and secondary ponds removed and sprayed onto land.	Continuation of existing scheme likely.	Trace elements lower than guideline limits for grade B.	4,870
Waiouru	Small treatment plant. MBR Plant	Minimal in ponds. Unknown quantity of sludge stored in geotubes onsite.	Unknown	Never	Stockpiled sludge requires management.	Unknown. Minimal trade waste so likely low contaminants	890
Whakapapa	Small treatment plant.	Minimal	Unknown	Never	Unlikely within 5 years.	Unknown. Minimal trade waste so likely	200

WWTP	Type and Details	Sludge on Site (Current)	Accumulation m^3/yr (dry)	Removal - Historic	Removal - Future	Sludge Quality	Population
						low contaminants	
Kapiti Coast District Council							
Paraparaumu	High rate, complex plant.	Historical storage of sludge in six ponds. Ponds contain approx. 7,300 m^3 (wet) sludge in need of disposal	930 m^3/yr (after centrifuge drying)	Sludge transported to landfill	Stockpiled sludge requires management (landfill?). Continuous sludge production will be transported to landfill.	Quality of stockpiled sludge tested. Determined to be mature/stable and below guideline limits for heavy metals.	49,000
Ōtaki	Complex plant. Aerated lagoon, clarifier, oxidation ponds, anaerobic digester	Unknown	Unknown	2014 to landfill	Sludge removed at clarifier and centrifuged before transporting to Paraparaumu WWTP.	n/a	6,000

APPENDIX B

Memorandum of Understanding

NOVEMBER 2017

AGREEMENT BETWEEN

LOWE ENVIRONMENTAL IMPACT (LEI)

AND

HORIZONS REGIONAL COUNCIL
RUAPEHU DISTRICT COUNCIL
WANGANUI DISTRICT COUNCIL
RANGITIKEI DISTRICT COUNCIL
MANAWATU DISTRICT COUNCIL
TARARUA DISTRICT COUNCIL
MASTERTON DISTRICT COUNCIL
PALMERSTON NORTH CITY COUNCIL
HOROWHENUA DISTRICT COUNCIL
KAPITI COAST DISTRICT COUNCIL

IN RESPECT OF:

Collective Biosolids Strategy, Stage 3: Opportunities to Work Together

MADE ON THE DAY OF 2017

PARTIES

(1) Lowe Environmental Impact Limited of 411 Church Street, Palmerston North.
(2) Horizons Regional Council of 11 Victoria Avenue, Palmerston North 4410.
(3) Ruapehu District Council of 59 Huia Street, Taumarunui 3920.
(4) Wanganui District Council of 101 Guyton Street, Whanganui 4500
(5) Rangitikei District Council of 46 High Street, Marton 4741.
(6) Manawatu District Council of 135 Manchester Street, Feilding 4743.
(7) Tararua District Council of 26 Gordon Street, Dannevirke 4942.
(8) Masterton District Council of 64 Chapel Street, Masterton 5810.
(9) Palmerston North City Council of 32 The Square, Palmerston North City 4410.
(10) Horowhenua District Council of 126 Oxford Street, Levin 5510.
(11) Kapiti Coast District Council of 175 Rimu Road, Paraparaumu 5254.

BACKGROUND

A. Lowe Environmental Impact Ltd (LEI) was established by Director, Hamish Lowe in 2010 and is a consultancy specialising in the provision of high quality professional services in the fields of Land Treatment, Agricultural Science and Engineering, and Community Wastewater.

B. LEI, ESR and 10 Councils in the lower North Island have been working together under a Ministry for the Environment (MfE) funded Waste Minimisation Project, to develop a biosolids strategy that includes a potential collective approach for sludge management and beneficial use programmes.

C. The particular focus of this agreement is the Stage 2: Opportunities to Work Together, Task 2a of the MfE funded project 'Regional Biosolids Strategy: Lower North Island'. Specifically, the parties are agreeing to continue to work together to establish a collaborative biosolids strategy for the lower North Island.

NOW IT IS AGREED AND DECLARED BETWEEN THE PARTIES AS FOLLOWS:

1. The Parties wish to explore opportunities to work together, in a collaborative manner, to determine potential collective solutions for their biosolids management including processing, end-uses, consenting and stakeholder engagement processes.

2. The parties agree to co-fund the MfE Project to the sums outlined in the Waste Minimisation Fund Application (Waste Minimisation Fund Application - Business case Small Community Collective Biosolids Strategy – Rural Lower North Island, 2016).

3. Without limiting the extent of collaboration and, for the purpose of this Memorandum, referred to as "Projects" the Parties could consider:
(a) joint research projects;
(b) joint field trials;
(c) sharing of and enhancing of intellectual property; and
(d) sharing resources and infrastructure.

4. In the event the Parties decide to collaborate on any Project, they will then record such decision in writing on such terms and conditions as may be agreed between them.

5. No Party will publicise the fact, or any content of this Memorandum or the Project, without first obtaining the prior written consent of the other Party, which will not be unreasonably withheld or delayed.

6. This Memorandum shall take effect as from the date of execution and will continue for a period of two years until the MfE Waste Minimisation research project terminates and at which time the Parties will discuss the merits or otherwise of extending the term or varying the terms and conditions of this Memorandum.

7. The Parties agree that any discussions between them in respect of this Memorandum or any Project shall be undertaken in good faith.

8. Each Party recognises the potential cost to a Party if any information is circulated or disclosed without permission of the other Party. The details of this Memorandum or any Project are also confidential between the Parties.

9. It is agreed that each Party will at all times keep confidential, treat as privileged, and not directly or indirectly make or allow any disclosure of, and use of, any information relating to this Memorandum or any Project, except to the extent:

- Required by law
- Necessary to carry out its obligations under this Memorandum
- That the information is already within the public domain, otherwise than by a breach of this Memorandum.

The confidentiality provisions of this clause 8 will survive termination of this Memorandum.

10. This Memorandum may be altered or varied at any time by written agreement and signed by duly authorised representatives of each Party.

11. This Memorandum shall be governed in accordance with the laws of New Zealand and the New Zealand Courts shall have exclusive jurisdiction to determine any matter or issue arising under this Memorandum.

Signature for and on behalf of

LOWE ENVIRONMENTAL IMPACT

_____

Name:

Signature for and on behalf of

HORIZONS REGIONAL COUNCIL

_____

Name:

Signature for and on behalf of

RUAPEHU DISTRICT COUNCIL

_____

Name:

Signature for and on behalf of

WANGANUI DISTRICT COUNCIL

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Name:

Signature for and on behalf of

RANGITIKEI DISTRICT COUNCIL

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Name:

Signature for and on behalf of

MANAWATU DISTRICT COUNCIL

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Name:

Signature for and on behalf of

TARARUA DISTRICT COUNCIL

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Name:

Signature for and on behalf of

MASTERTON DISTRICT COUNCIL

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Name:

Signature for and on behalf of

PALMERSTON NORTH CITY COUNCIL

_____

Name:

Signature for and on behalf of

HOROWHENUA DISTRICT COUNCIL

_____

Name:

Signature for and on behalf of

KAPITI COAST DISTRICT COUNCIL

_____

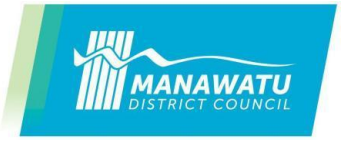
Name:


Ministry for the
Environment
Manatū Mō Te Taiao


L W E
Environmental
I m p a c t

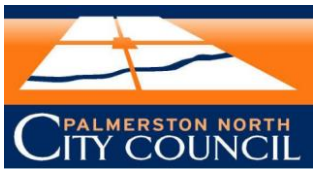

E/S/R
Science for Communities


Kāpiti Coast
DISTRICT COUNCIL
Me Huri Whakamuri, Ka Titiro Whakamua


MANAWATU
DISTRICT COUNCIL


WHANGANUI
DISTRICT COUNCIL
Te Kaunihera a Rohe o Whanganui


horizons
regional council


PALMERSTON NORTH
CITY COUNCIL


TARARUA
DISTRICT COUNCIL


RUAPEHU
DISTRICT COUNCIL


MASTERTON
DISTRICT COUNCIL
TE KAUNIHERA Ā-ROHE O WHAKAORIORI


RANGITĪKEI
DISTRICT COUNCIL
Making this place home.


Centre for Integrated Biowaste Research


MASSEY
UNIVERSITY
TE KUNENGA KI PŪREHUROA
UNIVERSITY OF NEW ZEALAND


Horowhenua
DISTRICT COUNCIL