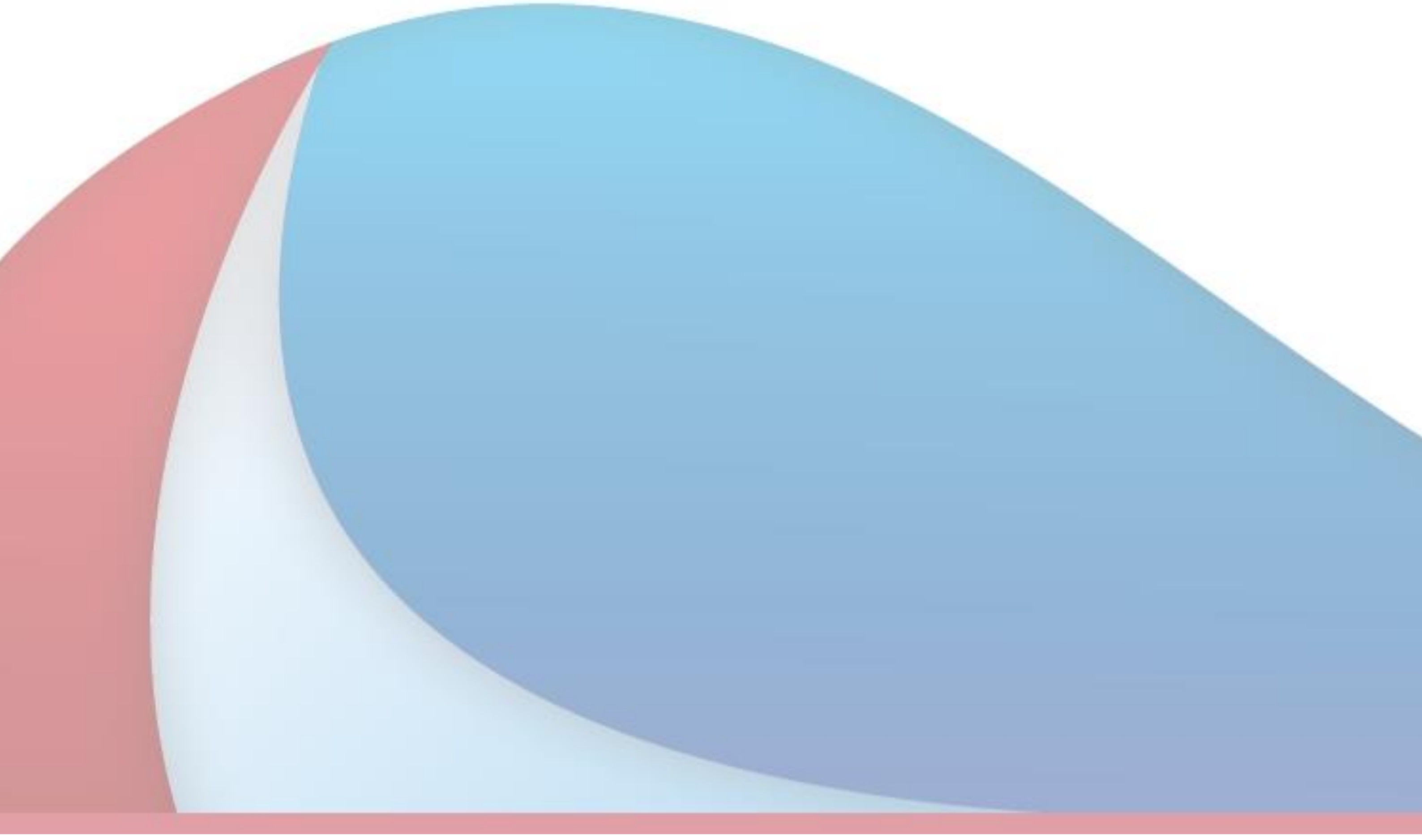
Wellington Water Consultancy Panel

Connect Water

Wellington Sludge Minimisation Facility

Process Basis of Design Report
May 2020



Contents

1 Executive Summary

At present, sludge from Wellington City's two Wastewater Treatment Plants (WWTPs), Moa Point and Karori WWTPs, is dewatered and disposed of at the Southern Landfill. The current sludge handling and disposal method is causing significant constraints on current landfill operation and longer-term aspirations for waste minimisation. Therefore, Wellington City Council (WCC) are proposing to establish a new Sludge Minimisation Facility to de-couple the disposal of sludge from landfill disposal and ultimately enable the future diversion of biosolids for beneficial re-use. The objectives of the project are:

1. The volume of sludge sent to landfill is substantially reduced;
2. The resilience of sludge management in Wellington is secured, because sludge disposal is de-coupled from the landfill, and the proposed sludge minimisation solution allows for growth in sludge over the next 50 years;
3. The sludge management system is safe to construct, operate and maintain;
4. The whole of life cost (TOTEX) of sludge management is minimised across the wastewater network.

To achieve these objectives, the current "Develop" stage of the project is considering process and site options for the new Sludge Minimisation Facility. To undertake process sizing and inform site selection, this report established a process basis of design. The key findings from this Basis of Design are:

Table 1: Key Findings from Basis of Design

Design Basis Parameter	Summary
Design Horizon:	The design horizon of the plant, in terms of plant capacity, is proposed to be 50 years. Therefore, assuming that the plant is commissioned in 2023, the design horizon is year 2073. Components of the new Sludge Minimisation Facility will have different design lives. The typical design life of a mechanically-intensive sludge processing plant is 20 to 25 years. Therefore, a design horizon of 50 years represents two to two and a half "life cycles" of the main process train of the new facility.
Design population:	Wellington City Council have published 30-year population projections from years 2013 – 2043, which have been used as a baseline population projection for the proposed Sludge Minimisation Facility. These projections have then been tested by considering low, high and very high projections around the baseline. It is proposed that the Sludge Minimisation Facility be sized to cater for a "high population growth" scenario, representing 20% growth above the baseline growth rate from WCC figures. This allows for some head room above baseline population growth and is thought to align with urban growth limitations in the Wellington City catchments. If population growth were to follow the "very high" scenario (which would create significant urban growth challenges), the capacity of the plant would be reduced to 33 years. However, this is still beyond the first lifecycle of a process/mechanical plant and would allow the capacity of the plant to be adjusted during a major upgrade in 20-25 years' time. Under the high scenario, the estimated population of the catchments serviced by Moa Point and Karori WWTPs is 248,548 persons. In the absence of specific trade waste growth predictions, it has been assumed that the trade waste contribution per head of population will stay the same as the population increases.
Sludge Flows:	An analysis of historical sludge flows over the last five years has been undertaken and then applied directly to the population projections. The historical sludge flow analysis has identified that sludge flows are reducing and it is uncertain whether these trends will continue. Therefore, to accommodate future sludge flow increases caused by changes in the

Design Basis Parameter	Summary
	WWTP operation, 2015 sludge flows have been used, which are higher than the most recent available dataset for 2019. Applying the "high" population projection, and assuming no significant change in the industrial / domestic mix of waste in the WWTP influent or significant changes to the WWWTP configurations, the estimated peak week sludge production in year 2073 is 147 Tonnes Dry Solids (DS) / week, or 17,544 m^3/week (as ~1% DS raw sludge). A peaking factor of 1.25 between average and peak weekly flows has been applied, based on analysis of rolling average weekly historical flows. A weekly sludge production figure has been used to accommodate daily variations in sludge production, which are expected to be accommodated by buffer storage.
Operating regime:	The above sludge flows assume continuous (24/7) operation of the Sludge Minimisation Facility without maintenance shutdowns. The actual operating regime of the plant will be dependent on the technology and should be considered when evaluating process options. The projected sludge flows above do not account for additional capacity required for maintenance and operational interruptions and will be taken into account when sizing specific process options. However, it assumed that the plant is to be able to run without personnel and with limited supervision.
Biosolids End Use Criteria:	The biosolids produced from the new Sludge Minimisation Facility will be subject to landfill disposal criteria (in the shorter term) and current and emerging biosolids guidelines for future re-use applications. For landfill disposal, the key criteria are that the biosolids are a minimum of 20% DS and are of a volume that enables the biosolids to be disposed of at 1 part biosolids to 4 parts other solid waste. This is currently achieved (albeit barely and with considerable constraints), and the new Sludge Minimisation Facility is expected to substantially improve this. In addition, odour management is a key driver for landfill disposal, so stabilising volatile organics which would otherwise generate odour is a key criterion for the new facility.In New Zealand, biosolids are graded for both "Stabilisation" (A or B) and "Contamination" (a or b) levels. The combination of these two grades (Aa, Ab, and so on) dictate what type of reuse pathways may be viable, subject to consenting. In order to allow future de-coupling of Wellington's sludge from discharge to Southern Landfill, a pragmatic approach would be to treat the sludge to at least a B stabilisation grade[1]. This would represent a reduction in water content and odour-causing compounds, making it more acceptable to the landfill in the short-term, and produce a biosolid which a land discharge consent could be obtained for in the future. It may be more cost effective to treat to a class A stabilisation grade, once handling and transportation costs are taken into account, but this will need to be determined as part of the options development and assessment process. There is very little information available on the contaminant concentrations in the Wellington sludges and so the likely contaminant grade of any biosolid produced cannot be assessed at this time. Sludge characterisation sampling is currently being undertaken by Veolia which will allow determination of the sludge's suitability for land application in particular. It is unlikely that the sludge will meet the current 'a' contaminant grade as municipal sludges are typically too high in copper and zinc to meet those concentration limits. It is worth noting that the current guidelines are under revision, with the future guidelines being more permissive with respect to heavy metal concentrations. However, the timeframe for adopting the new guidelines is uncertain. As such the current guidelines are considered to be the most relevant.

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[1] The B stabilisation grade represents the lowest acceptable reductions in pathogens and vector attraction under the Guidelines. Refer to Table 11 in the text for more detail.

2 Introduction

2.1 Background Information

The wider Wellington metropolitan region’s wastewater is currently managed through the operation of four Wastewater Treatment Plants (WWTPs), with disposal of the collected sludge into three landfills. All sludge from Wellington City’s Moa Point and Western (Karori) WWTPs is currently dewatered at the sludge dewatering facility (SDF) south of the Southern Landfill, known as Carey’s Gully SDF, and then disposed of in the Southern Landfill.

Wellington City Council (WCC) requires a fundamental change in the management of the sludge produced at its wastewater treatment plants. The change needs to enable the management of the sludge to be ‘de-coupled’ from the existing disposal to the Southern Landfill and enable WCC to pursue other options for disposing of, or otherwise utilising the sludge. The Southern Landfill is located in an urban context, with a sensitive and mobilised neighbouring community. WCC does not consider that landfilling at the site will remain viable in the longer term.

To achieve this, WCC wish to establish a new Sludge Minimisation Facility. The project is to be delivered in several stages, including Develop (Stage 1), Consenting (Stage 2), Detailed Design (Stage 3), Procurement (Stage 4) and Construction (Stage 5). The current Stage 1 – Develop – involves the identification and evaluation of options for the sludge minimisation process, and where it is to be located. Upon selection of a site and process, concept development for the preferred option will be undertaken.

2.2 Purpose of This Report

The purpose of this report is to present the key design criteria to enable the identification and selection of preferred site and process options. The key criteria that need to be considered when developing the options (and therefore covered in this report) are:

- Project objectives – to provide direction to the process and site selection.
- Design life – so that process (and site) sizing takes into account the design horizon of the plant.
- Population and sludge production projections – which are critical to plant sizing.
- Biosolids disposal criteria.

During concept design development for the preferred process and site options, this Basis of Design will be further developed to include all design disciplines, noting that they are dependent on the proposed site and process.

3 Project Objectives

Based on the strategic context provided in the project brief, the following project objectives have been established to provide direction to the selection and development of a preferred option for the new Sludge Minimisation Facility:

Table 2: Project Objectives

Objective	How will we know we have achieved the objective?	How Does this Impact Optioneering?
1. The volume of sludge sent to landfill is substantially reduced, so that: » **Operational constraints on the landfill from biosolids disposal are removed (short term); and** » **Wellington City Council can meaningfully pursue its solid waste minimisation objectives / aspirations (longer term).**	» Operational constraints have been identified at the landfill, which are caused by the volume of sludge relative to solid waste available for mixing. Through consultation with the landfill operators, we will confirm that the proposed volume reduction is substantial and of the right form to take away these constraints. » The volume of sludge to landfill is minimized to the extent that it does not provide a significant constraint on the Council's proposed solid waste minimization initiatives.	» Process options will be selected by initially applying a "fatal flaw" analysis which includes consideration of the degree to which sludge minimisation is achieved. » A wider range of criteria will then be assessed during a MCA that aligns to this objective.
2. The resilience of sludge management in Wellington is secured because: » **Sludge disposal is de-coupled from the landfill operation by removing the current landfill operational constraints imposed by biosolids disposal, and enabling future beneficial re-use;** » **Foreseeable growth in sludge production over the next 50 years is accounted for; and** » **System reliability is acceptable to Wellington Water based on the design, operating conditions and maintenance regime.**	» Social, environmental and cultural outcomes from future beneficial re-use are clearly defined. The technology selection can then be proven to have achieved these outcomes in previous projects. » The processing and disposal of sludge aligns to Tangata Whenua values. » Sludge growth projection are confirmed, and performance tests confirm that the plant can achieve this capacity (or has space to do so). » System reliability is tested through FMEA analysis.	» The design criteria needs to include consideration of current and future biosolids disposal criteria for beneficial re-use. Consider process options that allow for a range of disposal options. » Consider site and process options that enhance operational resilience. » Engage with iwi to establish Maori values and apply these to the selection of the process and site options (via a fatal flaw analysis and the MCA)
3. The sludge management system is safe to construct, operate and maintain.	» Tested through Safety in Design reviews to confirm that all parties are satisfied with the hazard controls proposed for construction and operation.	» When considering process options and sites, identify key health and safety exposure risks, and identify mitigation options. Where options present significant health and safety

Objective	How will we know we have achieved the objective?	How Does this Impact Optioneering?
	» Measurement of injuries and near miss reporting through the life cycle of the project and early operations period.	exposure risks that cannot be mitigated, they should be discounted.
4. The whole of life cost (TOTEX) of sludge management is minimised across the wastewater network.	» Key Wellington Water / WCC stakeholders understand and agree that the TOTEX of the solution has been minimised based on the detailed whole of life cost analysis presented, with robust comparison against alternatives.	» This will be considered during the MCA assessment.

4 Design Horizon and Population Projections

4.1 Design Horizon

Through an assessment of the design and actual life of assets from other sludge processing facilities and projects for process/mechanical plant operating under similar conditions, an indicative (target) design life for various types of plant and equipment has been established. This has been aligned to the population projection assessment presented later in this section.

The service life of individual components of a sludge processing facility may vary. The facility includes mechanical, electrical and control, building, and civil works, and associated services and ancillaries.

Expected service lives for specific asset categories are shown in Table 3 below. It should be noted that civil and building works will have a design life exceeding 20 years.

Table 3: Plant Service Life Schedule (Minimum Requirements)

Plant Category	Service life (Years)
Civil and Building works	60 +
Structures for mechanical plant	20
Biofilter media (if used)	5 – 10
Mechanical – main process train key components	20 – 30
Mechanical - pumps, compressors, fans, vessels, heat exchangers	20
Electrical - equipment power and instrument cabling	40
Electrical - motors and actuators	25
Electrical - motor starters, variable frequency drives, instruments	15
Electrical - process controllers	10

For the purposes of assessing the capacity of process plant, a design horizon of 50 years has been selected. This aligns to available population projections and identified limitations in growth projections for Wellington City, as described below. This equates to approximately two to two and a half life cycles of main process/mechanical plant and provides the flexibility to re-assess plant capacity at the end of the first plant lifecycle.

Therefore, on the basis that the plant is to be commissioned in 2023, the design horizon for process sizing is year 2073, with an interim horizon of 2048.

4.2 Design Population

To inform an analysis of sludge production rates (presented in Section 4), an assessment of population growth in the catchments serviced by the Moa Point and Karori WWTPs has been undertaken. This assumes that sludge production will increase linearly with population growth, which would require that there is no significant change to the mix of industrial / trade waste and domestic-borne wastewater in the WWTP influent to either plant, and that no significant change to the liquid treatment process are proposed. While detailed analysis of influent make-up has not been undertaken, we understand that there are no changes to industry within the catchment that would have a significant impact as far as can be practicably seen.

Population projections have been sourced from available published data from Wellington City Council for the period 2013 to 2043[2]. These estimates include Wellington's Northern suburb population whose wastewater is processed at Porirua WWTP. Therefore, the population estimates for the Northern suburbs of Wellington were retrieved from the Porirua Wastewater Network model and excluded from the WCC projections, as shown in Table 4.

Table 4: Baseline Population Adjustment.

Year	Wellington City Baseline Population Estimates	Wellington Northern Suburbs Population Estimates	Baseline Population Estimate for Moa Point and Karori WWTP Catchments
2013	197,500	24,700	172,800
2018	211,142	27,400	183,742
2023	221,421	30,100	191,321
2028	229,303	32,800	196,503
2033	234,286	35,500	198,786
2038	240,915	38,200	202,715
2043	248,953	40,900	208,053
2048	257,052	43,600	212,915
2053	265,151	46,300	217,777
2058	273,250	49,000	222,640
2063	281,349	51,700	227,502
2068	289,448	54,400	232,364
2073	297,547	57,100	237,226

From the baseline population estimates, low, high and extremely high projections have then been developed to test the sensitivity of process sizing to changes in population growth. The rationale for the low, high and extremely high projections is as follows:

- **Low Projection** – This projection assumes growth occurs at 20% below anticipated growth rate from period to period. This was an arbitrary factor chosen by Connect Water as 20% less growth than anticipated would cause a significant drop in population compared to the baseline population estimates.
- **High Projection** – This projection assumes growth occurs at 20% above anticipated growth rate. This was an arbitrary factor chosen by Connect Water as 20% more growth than anticipated would cause a significant increase in population compared to baseline population estimates.
- **Extremely High Projection** – This projection assumes growth occurs at 55% above the anticipated baseline growth rate. Previous estimates from Wellington Water (and others) show that population is expected to grow by 50,000 to 80,000 over the next 30 years[3]. The baseline data provided shows an increase of 50,000 people in 25 years. In order for the population to reach an additional 80,000, a growth rate of 55% would be required above the baseline expected growth rate.

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[2] Wellington City Council Population Forecast, prepared by .id, November 2019. Refer https://forecast.idnz.co.nz/wellington/population-households-dwellings

[3] Wellington City Council. Wellington Urban Growth Plan. 2015, https://wellington.govt.nz/~/media/your-council/plans-policies-and-bylaws/plans-and-policies/a-to-z/wgtn-urban-growth/wgtn-urban-growth-plan2015.pdf. Accessed 9 Apr 2020.

To adjust the population estimates to the proposed design horizon of 50 years, each scenario estimate was linearly extrapolated from 2043 to 2073s. This resulted in an increase of 972, 770, 1178 and 1553 people per year for baseline, low, high and extremely high scenarios respectively. Assuming sludge production is proportional to population growth, the per capita production rate was used at a reference year to estimate both the DS sludge and volumetric raw sludge production. Figure 1 and

Table 5 and provide a summary of the population analysis.

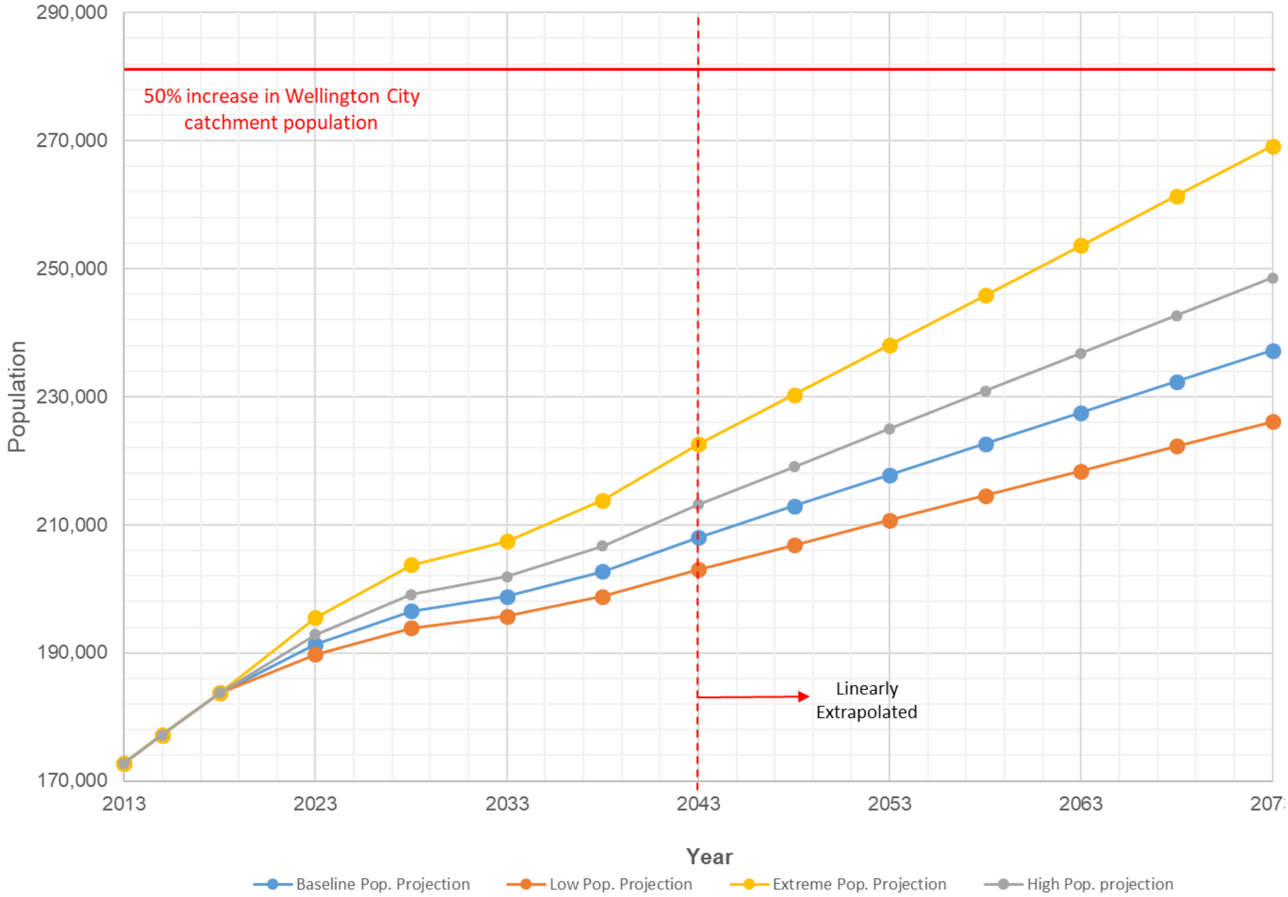

Figure 1: Projected Catchment Population for Moa Point and Karori WWTP Catchments, 2013 – 2073.

Table 5: Estimated Sludge Minimisation Facility Catchment Population 2015 - 2043

Year	2015*[1]	2018	2023	2028	2033	2038	2043	2048	2053	2058	2063	2068	2073
Baseline Pop. Projection	177,177	183,742	191,321	196,503	198,786	202,715	208,053	212,915	217,777	222,640	227,502	232,364	237,226
Low Pop. Projection	177,177	183,742	189,805	193,918	195,720	198,815	203,003	206,856	210,708	214,560	218,412	222,265	226,117
High Pop. Projection	177,177	183,742	192,837	199,104	201,880	206,669	213,199	219,090	224,982	230,873	236,765	242,656	248,548
Extremely High Pop. projection	177,177	183,742	195,526	203,760	207,441	213,816	222,570	230,335	238,101	245,866	253,632	261,398	269,163

Notes:

1. 2015 population was linearly interpolated from Figure 1 for the basis of this analysis.

5 Plant Capacity

5.1 Sludge Volume and Solids Production

5.1.1 Background Information

This section presents an analysis of sludge production projections for the period 2023 – 2073 by considering historical sludge production trends and applying the population projection analysis from Section 3. In undertaking the analysis, several factors relating to sludge production from the Wellington city WWTPs need to be considered:

- The sludge coming from Karori WWTP is a small portion of the total sludge production, historically amounting to 4.1% of the total sludge production from the Wellington city WWTPs. We are not aware of any plans to undertake significant capacity upgrades, relative to the Moa Point WWTP, which would change this proportion. Therefore, it is assumed that growth in the Karori catchment will be proportional to the total growth figure. Allowing for minor change, we have applied a 4.5% increase to the Moa Point WWTP sludge production (for which a more detailed data set is available) to arrive at total sludge production data for the purposes of Sludge Minimisation Facility sizing.
- Sludge from Karori WWTP is currently delivered to Southern Landfill as a dewatered cake. The design of the new Sludge Minimisation Facility will need to allow for this to be blended back into the more dilute Moa Pt sludge (e.g. for digestion) or introduced at an appropriate stage of the process (e.g. prior to thermal drying).
- Moa Point WWTP sludge is produced as a ~1% dry solids (DS) concentrated slurry of mixed primary and secondary (waste activated) sludge, however the percentage DS in the slurry varies considerably. The hydraulic loading design for the proposed new Sludge Minimisation Facility will need to take this into account at detailed design and may change if sludge thickening or blending processes are used in the new plant. For the purposes of concept design, it is more meaningful to express the sludge production basis in terms of tonnes dry solids per unit of time.
- Sludge production / transfer varies daily through the week. For example, due to operation and maintenance constraints, more sludge is transferred to the existing Carey's Gully during the week than during the weekend. To account for this and potentially differing operating regimes between the process options, for the purposes of the concept design, sludge production figures have been expressed on a weekly basis. Once the preferred process technology is known, the operating regime can be revisited. For the historical sludge analysis presented in this section, a weekly rolling average has been used to manage "noise" in the data set.
- Moa Point WWTP sludge production is measured at two points:
    - **Point 1:** The 1% slurry called "**Transfer Sludge**" is grab sampled on a periodic basis. Between 2015 and 2020, 733 grab samples were collected and analysed for Total Suspended Solids. There is considerable variability in the data series (the standard deviation is 15% of the average). Flow rate is measured and totalised on a daily basis.
    - **Point 2:** The ~28% DS "**Wet Cake**" produced at the existing Carey's Gully Sludge Dewatering Plant goes over the weighbridge of the Southern Landfill. The wet cake is sampled more often for TSS than the Transfer Sludge – it has been sampled and analysed 1236 times over the same period. It can be regarded as a more o composite sample because the wet cake is the result of significant back mixing of sludge before it is dewatered, so the sample is more homogenous. The variability in the data series is lower, with the standard deviation is 9.5% of the average.

When using the "Wet Cake" data source, consideration must be given to:

- Centrifuge solids capture rate – an aspect of the current sludge dewatering plant is that between the 1% Transfer Sludge and the Wet Cake sampling points, 5% of mass is "lost" to centrate. This reflects the so-called capture rate of the centrifuges which averages 95%.

  This centrate gets biologically treated at a moving bed bioreactor (MBBR) type WWTP at the Carey's Gully SDP, known as the "Black Boxes". In treating the solids-bearing centrate, the MBBR process produces sludge itself which is not accurately measured. This MBBR sludge is injected into the main sludge feed line into the SDP and blends in with the Moa Point Transfer Sludge. An MBBR process typically generates much less sludge (expressed as solids) than what it is fed as TSS. We can therefore assume that the correction for capture rate ("lost mass" cannot be fully negated by this unknown contribution of MBBR sludge.

- Dehydration – the wet cake sometimes sits in the well-ventilated SDP building for several days before it is transported to the landfill. It is suspected that the wet cake loses some moisture during this period. The mass balance between Transfer Sludge and wet cake shows a discrepancy that cannot be explained through capture rate alone. Refer to Table 6 below.

5.1.2 Historical Sludge Production

For the purpose of this analysis a "year" is defined as the beginning of March to end of February to allow for a 5-year data evaluation, while also including the most recent available data.

The sludge produced from Moa Point WWTP is transferred to the Carey's Gully SDP, where it is then centrifuged at a certain target capture rate. As the Total Suspended Solids (TSS) of sludge in Point 1 (Transfer Sludge) is not measured every day, values have been interpolated for the missing days. The dry solids (DS) calculated from Point 2 was compared to the DS calculated from Point 1 to evaluate whether a consistent ratio between the two occurs. Table 6 provides this comparison.

Table 6: Comparison of DS sludge calculated from Point 1 and Point 2

	Point 2		Point 1		
Year	Weigh Bridge DS (Tonnes)	Capture rate	Centrifuge feed DS (Tonnes)	Transferred DS (Tonnes)	Ratio
2015	3883	0.96	4050	4149	0.98
2016	3642	0.95	3831	4311	0.89
2017	3653	0.96	3810	4127	0.92
2018	3897	0.96	4070	4505	0.90
2019	3639	0.95	3839	4355	0.88
Average Capture Rate		**0.95**	**Average Ratio**		**0.91**

As shown in Table 6, the ratio is seen to fluctuate significantly over the past five years. We attribute this to the TSS at Point 1 being measured using grab samples, where there is potential for operators to apply judgement and undertake additional sampling if they are not satisfied with the initial sample (and other such operational factors). Therefore, the data set produced from Point 2 was used to determine current DS sludge production. By picking a safe peak factor we can negate any underestimation that is made due to evaporation of moisture between wet cake production and the weighbridge.

To accommodate for the fact that dry solids are also present in the centrate after the centrifuge process (as previously noted), the DS sludge measured from the weighbridge was divided by the average capture rate of 95%. The results of this analysis are shown in Table 7.

Table 7: Historical Dry Solids Production from Carey's Gully Sludge Dewatering Plant.

DS sludge rolling analysis (Tonnes/week)					
Year	Weigh Bridge DS Data		DS with applied Capture Rate		Peak factor
	Average Weekly Production	Peak Weekly Production	Average Weekly Production	Peak Weekly Production	
2015	76.26	90.26	80.28	95.01	1.18
2016	71.93	89.40	75.72	94.11	1.24
2017	71.25	85.33	75.00	89.82	1.20
2018	76.24	89.74	80.25	94.47	1.18
2019	70.92	85.27	74.65	89.76	1.20
Average Peak Factor:					**1.20**

The volumetric raw sludge data has been obtained from Point 1 as this is a reliable data set and is the best representation of the volumes that will feed into the new Sludge Minimisation Facility. Table 8 presents the historical average weekly production, peak weekly production and the resulting peak factor for volumetric raw sludge production.

Table 8: Historical Volumetric Raw Sludge Production from Moa Point WWTP.

Volumetric Raw Sludge Rolling Analysis (m3/week)			
Year	Average Weekly Production	Peak Weekly Production	Peaking Factor[1]
2015	9988	11581	1.16
2016	9905	11333	1.14
2017	8380	10232	1.22
2018	8276	9321	1.13
2019	7663	8723	1.14
		Average Peak Factor	**1.16**

Notes:

1. Peaking Factor has been developed based on an analysis of average and peak weekly sludge production as follows:

- The Average Weekly Production (AWP) for current production was determined from measured data by taking the mean of a seven day rolling average of available data. The projected AWP was then evaluated using population projections provided by Wellington City Council's urban growth team with an adjustment using Porirua WWTP catchment estimates.
- The Peak Weekly Production (PWP) is represented by the 95th percentile production of DS sludge and volumetric raw sludge. This assumes that any peaks above this can be accommodated by buffer storage rather than providing capacity in the process train itself.
- The peak factor is expressed as the ratio of PWP divided by AWP. This peak factor, in conjunction with the future population projections, has been used to determine the projected PWP of the plant.

The peaking factors presented in Table 7 for the last five years of production vary between 1.14 and 1.22. An analysis has also been undertaken of peaking factor in the Transfer Sludge flow data, which results in slightly lower peaks. In order to cater for reasonable peak production as well as a safety margin because of mass balance discrepancies it is proposed that a peaking factor of 1.25 is applied, such that:

- Peak Weekly Production = 1.25 x Average Weekly Production.

5.1.3 Sludge Production Basis for Projections

Initially the intention was to linearly extrapolate the historical sludge production to determine future sludge production. However, as seen in Figure 2, the sludge production is decreasing over the years, possibly due to process optimisation both at Moa Point WWTP and Carey's Gully Sludge Dewatering Plant. Further investigation would be required to confirm this.

The projected population of Wellington City presented in Figure 1 shows all population scenarios increasing over time, which would typically correlate to an increase in sludge production. As the source of the decrease has not been confirmed the likelihood of this continuing cannot be predicted. Extrapolating in line with this trend would risk undersizing the new Sludge Minimisation Facility. Therefore, the trend produced by the projected population was used to forecast sludge production.

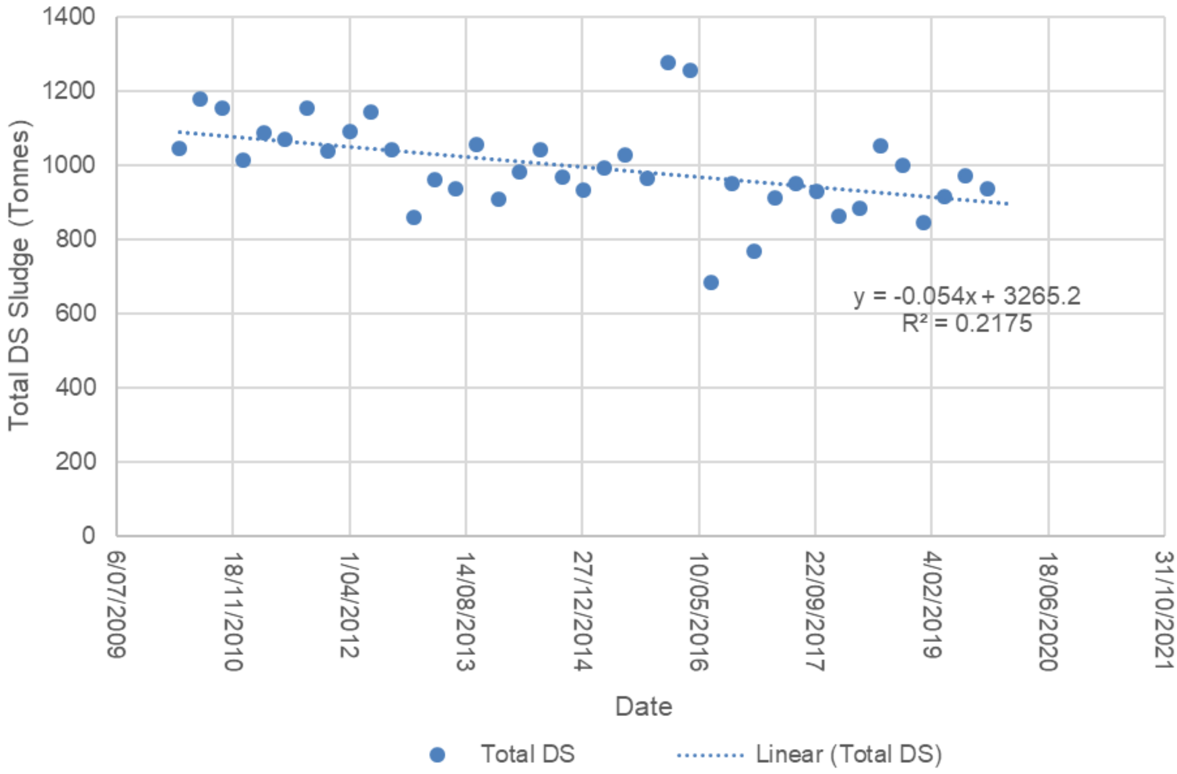

Figure 2: Moa Point WWTP Sludge DS Production, 2009 – 2020.

Since sludge production has decreased over the years, the reference point was taken as 2015 as opposed to 2019, as this is the earliest year that a full, reliable dataset is available. Prior years were ignored. The population for 2015 was estimated by linearly interpolating the baseline population from 2013 to 2018, resulting in a population of 177,177.

To account for sludge produced at Karori WWTP a 4.5% increase was applied to the DS sludge produced at Moa point[4]. The same increase cannot be applied to the volumetric raw sludge as the new Sludge Minimisation Facility will receive dewatered sludge from Karori WWTP. Currently the sludge produced at Karori WWTP is dewatered to 22% DS and amounts to ~200 tonnes DS per annum[5]. Therefore, an increase of 17.5 m^3/week volumetric raw sludge can be applied to the Moa Point WWTP calculations to account for volumetric raw sludge produced at Karori WWTP. Accordingly, the basis of forecast sludge production is summarised in Table 9.

Table 9: Sludge Production Basis

Parameter	Value
Year	2015
Population	177,177
Total Volumetric Raw Sludge AWP (m^3/week)	10,005
Volumetric Raw Sludge AWP (m^3/week) per capita	0.056
Total DS Sludge AWP (Tonnes/week)	84
Total DS Sludge AWP (Tonnes/week) per capita	0.00047
Peak Factor	1.25

5.1.4 Sludge Growth Rate and Plant Capacity Recommendation

Assuming sludge production is proportional to population, the forecast sludge production was determined using the sludge basis and the population growth rates described above. The results for average weekly production and peak weekly production for both dry solids sludge and volumetric raw sludge for each population growth scenario are provided in Figure 3 and Figure 4 respectively.

As shown in the figures, the target capacity for the proposed new Sludge Minimisation Facility has been set as the year 2073 projected sludge production rate for the high population growth scenario. Based on the assessment of sludge growth projections, it has been assessed that this will provide a reasonable level of capacity above the baseline projection. Should the very high population scenario occur, the plant is expected to reach capacity in 2057, 16 years ahead of the 50-year design horizon. However, recent urban growth studies have highlighted that, under different urban growth scenarios, land use limitations will likely not enable this level of growth to occur. Furthermore, if it did, the capacity of the plant would be reached well outside the first lifecycle of the main process plant and would enable a re-assessment of capacity to be undertaken at that time and accounted for in any upgrades.

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[4] de Haan, Nanne. *Wellington Sludge Investigation Report*. Veolia Water Service (ANZ), 2018, p. 8.

[5] Tonkin & Taylor Ltd, 2015. *Wellington Regional Biosolids Strategy*. Tonkin & Taylor, p.7.

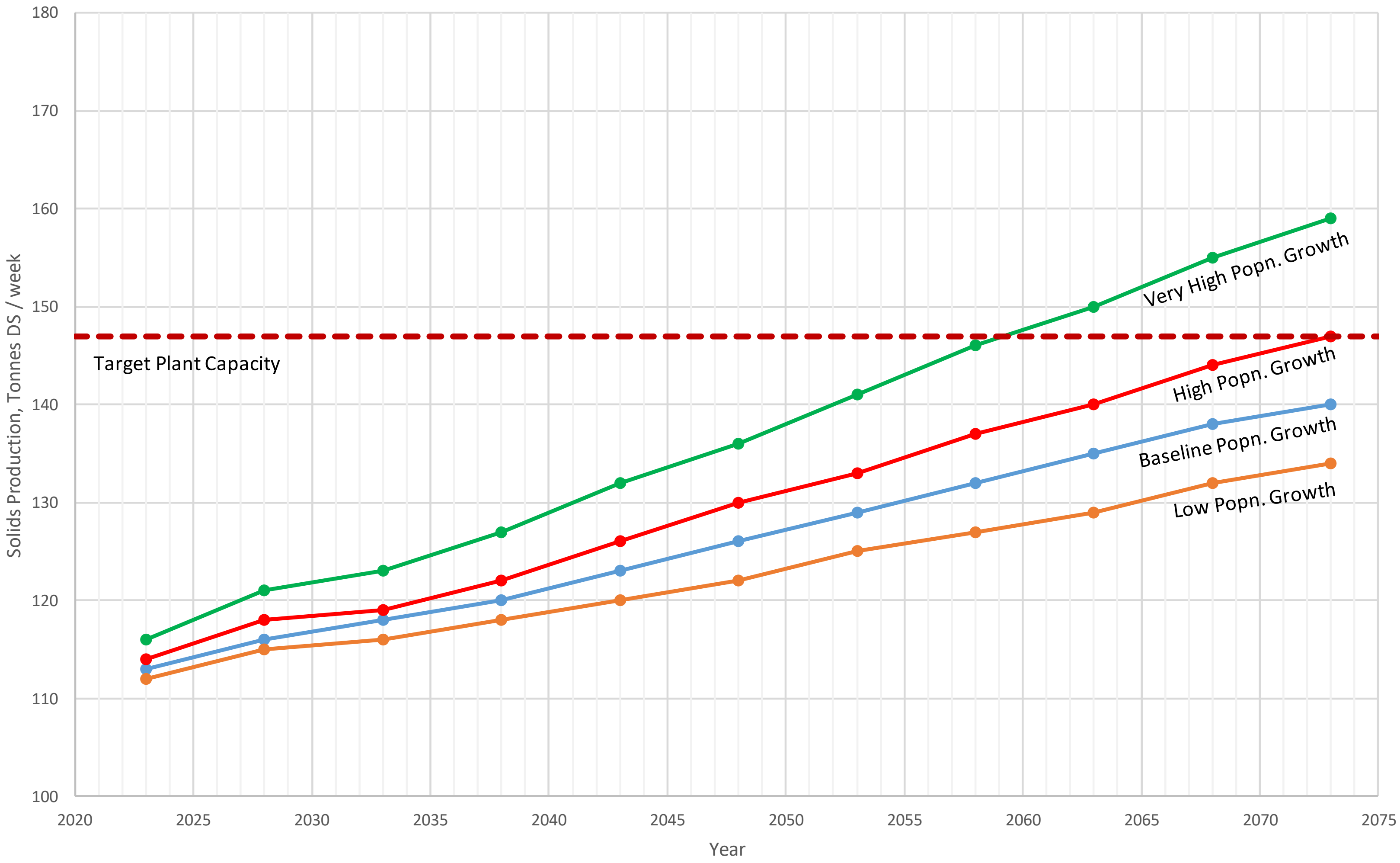

Figure 3: Wellington City Sludge Production Projections, Peak Week Dry Solids, 2023 – 2073.

Figure 4: Wellington City Sludge Production Projections, Peak Week Raw Sludge, 2023 – 2073.

On the basis of this assessment the proposed plant capacity for the new Sludge Minimisation Facility is provided below.

Table 10: Sludge Production Basis

Parameter	Value
Year	2073
Population Served	248,548
Population Projection Scenario Applied	High (20% above WCC baseline population projections)
Plant Volumetric Raw Sludge Capacity (at 1% DS, m^3/week)	17,544[1]
Plant Dry Solids Capacity (Tonnes/week)	150[1]
Assumed Peak Factor	1.25

Notes:

1. Assumes continuous operation and excludes capacity for maintenance outages. Refer to Section 5.2 for further details.

5.2 Operating Regime

The operating regime of the proposed Sludge Minimisation Facility will be very dependent on the technology employed. Many biological and complex thermal processes require continuous operation to maintain stable operation with periodic maintenance periods. During engagement with plant vendors for process sizing during this Develop stage, additional plant capacity and storage requirements will need to be taken into account over and above the capacity recommended in Section 5.1.4.

For the purposes of concept control systems design, it is assumed that the plant will operate unmanned with limited supervision, where feasible. Specific operational considerations, and operational complexity, are to be taken into account in the multi-criteria assessment of options.

6 Biosolids End Use Criteria

This section discusses the sludge specification requirements for both landfill acceptance and for potential future sludge discharge pathways, which need to be considered to meet the core objectives of the approach. It summarises the potential pathways available and the relevant classification and regulatory frameworks that influence the requirements for sludge production and disposal.

6.1 Sludge Discharge Options

6.1.1 Sludge Management in New Zealand

There is currently no standard approach to management of WWTP sludge in New Zealand. Geographic location, site space, sludge quality, and environmental, cultural and economic considerations are all factors which influence the available options for sludge treatment and disposal. Typically, the starting point is to identify the most feasible local discharge route and develop the treatment process to meet the criteria required for this use, based on the considerations listed above. The most commonly used sludge discharge routes in New Zealand are summarised below:

- **Landfill disposal:** Assumes a suitable landfill location is available. Most common discharge pathway in New Zealand. There is usually no resource consent application required for the WWTP operator. High greenhouse gas profile associated with transportation, and contrary to NZ waste strategy objectives.
- **Mine or landfill rehabilitation:** Improves infertile and degraded soils in certain mine and landfill sites by providing beneficial nutrients. This will require identification of a suitable location, a discharge consent and transportation to site.
- **Agriculture, cropping and horticulture:** Provides nutrients to soils, low transportation cost assuming a short distance from site. This can have a negative public perception, and requires a discharge consent, depending on biosolids grade.
- **Forestry:** Provides nutrients to soils, less negative public perception, but requires a discharge consent and transportation to site, depending on biosolids grade.
- **Vermiculture:** Utilisation of worms to convert biodegradable material into soil conditioner. This does not require a consent application, and positive public perception. Limited number of processing facilities in NZ, and so carries a market risk.
- **Combustion:** Direct combustion of biosolids to generate heat for plant processes, such as biosolids drying. This will result in the emission of fine ash particulate matter, carbon monoxide, nitrogen oxides, sulphur dioxide and other air pollutants.

A summary of biosolids end uses in New Zealand is shown in Figure 5 further below. The end use of biosolids for some other local authorities in New Zealand is noted below:

- Hutt Valley: Solids are dried in the thermal dryer and sent to Silverstream landfill. Previously had been used as a soil conditioner on farms in the Tangimoana area in Manawatu. The biosolids were supplied at no cost and the user paid for the transport. There were strict quality control requirements and the biosolids were required to be stockpiled for two weeks until the results of the chemical analysis were available.
- New Plymouth: Solids are dried in a thermal dryer and used to produce a fertiliser called Bioboost®. Biosolids fertiliser is expensive to produce and must compete with other cheaper compost products. The composting and landscaping supplies market is a well-established and there are a number of manufacturers of compost in the lower North Island. New Plymouth District Council has also had to obtain discharge consents in three regions in order to allow the product to be applied to land by the end users.
- Kapiti Coast: WAS from the Paraparaumu WWTP is dried in an indirect drier to 75% DS. Currently biosolids are disposed of to the Otaihanga Landfill. The dryer heat is supplied by a wood fuelled boiler. KCDC propose to evaluate emerging technologies which will provide resources such as chemicals, fertilisers and electricity.

- Christchurch City Council – WAS and primary sludge is digested then dried in an indirect drier to ~90% DS. Dried biosolids are used for mine rehabilitation.
- Selwyn District: Solar dried sludge from the Pines WWTP in Rolleston is also used for land rehabilitation at Stockton Mine.
- Watercare: Sludge from Mangere WWTP is digested, then dewatered and used for quarry rehabilitation on Puketutu Island
- Hamilton City: Sludge from Pukete WWTP is digested then dewatered and vermi-composted.
- Dunedin City: Digested sludge from Green Island WWTP is incinerated.

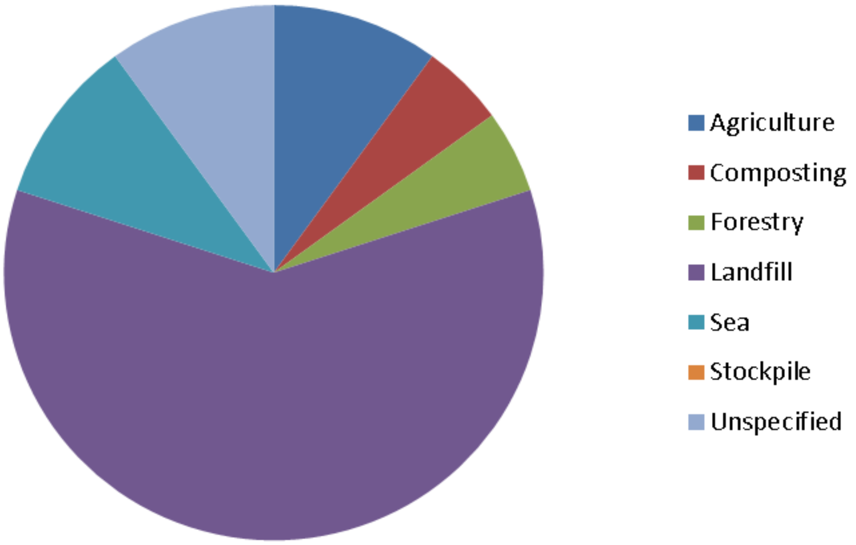

Figure 5: Biosolids End-Use in New Zealand (CH2M Hill 2015)

6.1.2 Wellington Sludge Management

For the proposed Wellington Sludge Minimisation Project, the drive to de-couple wastewater sludge management from the landfill operation has been influenced by other factors, and so the sludge management process will be selected without a preferred disposal route selected. In the short-term, it has been agreed that the sludge from the new facility will continue to be discharged to landfill while other disposal pathways are identified.

This means that the treated sludge specification will need to be set at a level which is either suitable for a range of options or can be upgraded in the future to meet any specific requirements. To allow short-term and longer-term discharge routes, the relevant criteria for the treated sludge specification are:

- Southern Landfill's sludge acceptance criteria
- Land application guidelines

These are discussed further below.

6.2 Discharge Criteria

6.2.1 Landfills

6.2.1.1 **Southern Landfill**

Southern Landfill is a Class A[6] classified landfill, which is owned and operated by Wellington City Council. Under MfE's Landfill Waste Criteria[7], as a Class A landfill Southern Landfill can accept municipal waste and non-liquid, non-municipal wastes that are not classified as hazardous. Sludge from urban wastewater treatment is classified as non-hazardous by the NZ Waste List[8] (waste code 19 08 05), and hence Southern Landfill can accept the waste without detailed quality specifications. However Southern Landfill's operational staff have noted that there are other parameters which need to be controlled for the sludge to continue to be accepted at the Landfill, including:

- **Total Sludge Volume, and Dry Solids Content.** Sludge from the Carey's Gully dewatering facility is currently sent to the landfill at approximately 25% dry solids. At this concentration the sludge must be blended with general waste in a volumetric ratio of at least 4 parts general waste to one-part sludge for waste cohesion and compaction. This 4:1 blending ratio limit's Council's ability to implement waste minimisation and/or diversion. Increasing the dry solids concentration of the sludge would address both these issues as the blending ratio could be reduced, and the total volume of sludge to be blended would also drop.
- **Odour.** Currently the landfill 'buries' the sludge in the base of the day's cell as an odour management precaution. This also influences the operation of the dewatering plant as the landfill stops accepting sludge at midday. Stabilising volatile organics which generate odour would allow both operations more flexibility.

6.2.1.2 Other Landfills

The current stage of the Southern landfill is expected to be full by 2025. The next stage of expansion is under development, subject to receiving resource consent. Though it is considered an unlikely scenario, if the landfill does not receive consent for the planned expansion WCC may need to consider other short-term disposal routes for the sludge.

If the sludge goes to another Class A landfill, the acceptance criteria are likely to be similar to that at Southern Landfill, but the cost of transportation (likely to be at least 36 km) will be a further driver to reduce the mass of sludge.

If the sludge is sent to a Class B landfill, more stringent acceptance criteria may also be required to prevent contaminants leaching into soils or groundwater.

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[6] Centre for Advanced Engineering, Landfill Guidelines (2000)

[7] https://www.mfe.govt.nz/publications/waste/module-2-%E2%80%93-hazardous-waste-guidelines-landfill-waste-acceptance-criteria-and-5 accessed 13/03/20

[8] https://www.mfe.govt.nz/waste/guidance-and-resources/waste-list, accessed 13/03/20

6.2.2 Land Discharge Criteria

6.2.2.1 Biosolids Guidelines

Overview

Best practice for safe disposal of sludge onto land in New Zealand is currently set out in the *NZWWA/MfE Guidelines for the Safe Application of Biosolids to Land in New Zealand*, published in August 2003 (the Guidelines). The Guidelines apply international and national scientific evidence through standardised practices to allow this disposal route to be managed in a safe and sustainable manner. The Guidelines also provide guidance to regional authorities on suitable activity statuses for applications of biosolids to land, although not all authorities have adopted them.

While no specific disposal pathway has been identified yet, from a practical perspective it is likely that beneficial use would occur on land in either the Greater Wellington or Manawatu-Whanganui (Horizons) Regions, as transporting sludge further north is unlikely to be feasible. An initial review of Greater Wellington and Horizons Regional council rules show that:

» **GWRC's** Proposed Natural Resources plan[9] includes conditions for discharging biosolids to land. Under Rule R77 application of Aa biosolids to land is a permitted activity and under Rule R78 application of Ab, Ba or Bb biosolids to land is a restricted discretionary activity. This plan is still in the Appeal process, and so is not operative as of the time of writing.

» **Horizons Regional Council's** One Plan includes conditions for discharging unrestricted (grade Aa) and restricted use biosolids are outlined in Rule 14-7 and Rule 14-8 respectively[10].

» The rules in both plans are consistent with the current Biosolids Guidelines.

Therefore, compliance with the Guidelines will be required for any land application of the treated biosolids.

A new document (*Guidelines for Beneficial Use of Organic Materials on Productive Land*), developed by four key Waste Sectors, intends to provide an update to the existing guidelines once it is published. However, it will not replace the current Guidelines until it has been adopted by Regional Councils as the basis for the relevant discharge rules. This document was issued as draft for public consultation in December 2017 and the final version is expected in 2021.

The sludge specifications and intended applications for both guidelines are summarised in this section.

Current Guidelines

The Guidelines for the Safe Application of Biosolids to Land in New Zealand (NZWWA, 2003) specifies a basis for grading biosolids, the levels of treatment required to achieve the specified grades and management procedures for applying the biosolids for different land uses. The biosolids are graded against two factors, the level of stabilisation achieved (Grade A or B) and the level of chemical contaminants (Grade a or b). The stabilisation and contaminant grades are combined to give four possible grades of biosolids, Aa, Ab, Ba and Bb. Grade Aa products can be applied to land as a permitted activity with no requirement for a resource consent. All other biosolids grades require a resource consent to be applied to land (see Figure 6)

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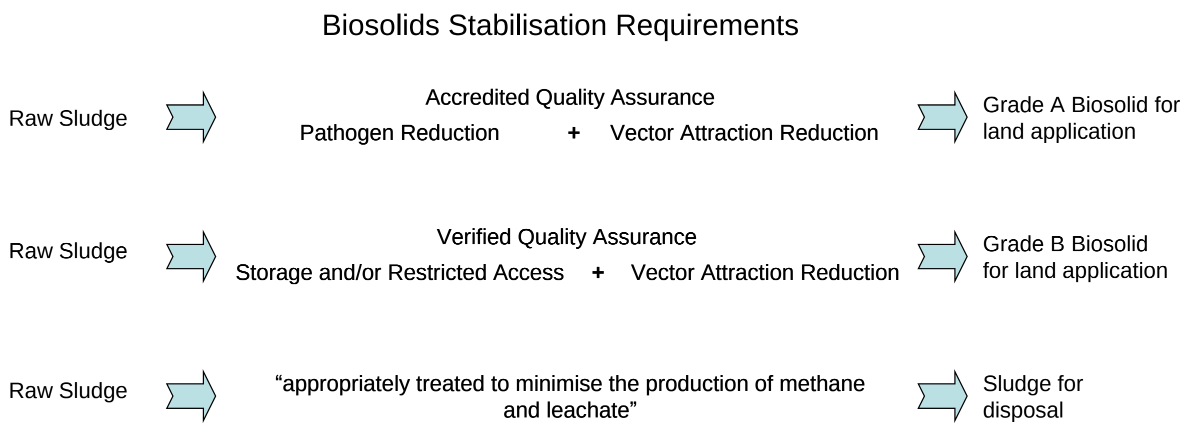
[9] *Chapter 5 Rules, Proposed Natural Resources Plan for the Wellington Region (31.07.2015)* (GWRC, 2015)

[10] *Chapter 14, One Plan Part II* (Horizons Regional Council, 2014)



Note: Grade A and Grade B requirements are defined in NZWWA Guidelines. Any sludge not treated to achieve Grade A or B is classed as a sludge and not a biosolid. The treatment requirements are taken from the New Zealand Waste Strategy.

Figure 6: Treatment Requirements for Different Stabilisation Grades of Biosolids.

The stabilisation grade is defined by a combination of pathogen reduction and vector attraction reduction (VAR). These requirements are summarised in Table 11.

Table 11: NZWWA/MfE Guidelines – Biosolids Stabilisation Requirements

	Acceptable pathogen reduction processes	Acceptable vector attraction reduction methods	Product
Grade A	Accredited quality assurance ***Plus*** One pathogen reduction process from the 3 options below: **1. Time temperature process** a) ≥7% DS Within the relationship $$t = \frac{131700000}{10^{0.14T}}$$ (t=days, T=°C) T≥50°C and t≥15 seconds b) <7% DS Within the relationship $$t = \frac{50070000}{10^{0.14T}}$$	Accredited quality assurance ***Plus*** At least one vector attraction reduction/ odour method from the list below: **1.** Mass of volatile solids in biosolids shall be reduced by a minimum of 38%; or **2.** Biosolids ≥90% DS if heat dried at T>80°C; or **3.** T≥40°C for ≥14 days and T_{ave} ≥45°C; or **4.** SOUR @ 20°C≤ 1.5g/m^3 for liquid sludges from aerobic processes; or **5.** pH ≥ 12 @ 25°C for at least 2 hours and pH≥11.5 for 22 more hours; or **6.** Soil incorporation	Accredited quality assurance ***Plus both:*** **1. Verification sampling** showing that: - *E. Coli* < 100 MPN/g - *Campylobacter* <1/25g - *Salmonella* < 1/25g - Enteric viruses <1 PFU/4g - Helminth ova < 1/4g And **2. Routine sampling** showing that: *E. Coli* < 100 MPN/g

	Acceptable pathogen reduction processes	Acceptable vector attraction reduction methods	Product
	(t=days, T=°C) T≥50°C and t≥30 minutes c) Composting - In-vessel: T≥55°C for ≥3 days, or - Windrow: T≥55°C for ≥15 days with a minimum of 5 turnings during this period **2. High pH – high temperature process** pH>12 (measured at 25°C) for ≥72 hours and maintain T>52°C for 12 consecutive hours within the 72 hours, all from the same chemical application, and drying to >50% DS afterwards. **3. Other processes** Demonstration by agreed comprehensive process and product monitoring that the Grade A pathogen levels can be consistently met.		
Grade B	Verified quality assurance ***Plus*** Storage/exclusion period, depending on end use	Verified quality assurance ***Plus*** One of the vector reduction attraction methods from Grade A.	Not applicable

To apply a Grade B biosolid to land, management processes need to be put in place which are specific to the land use and which may make it impractical as a solution in some cases. These are discussed in more detail below.

Contaminant grades are assigned based on concentration of metals and organochlorine compounds in the biosolids. If the concentrations of *all* the contaminants in the biosolids are at, or below the specified limits, it is classified as grade ‘a’, otherwise it is classed as grade ‘b’. These contaminant limits are tabulated below (Table 12). Note that grade ‘a’ biosolid concentrations are equivalent to the soil limit concentration.

Sludge treatment does not typically provide any reduction in the contaminant concentration of the sludge, with the exception of composting, which ‘dilutes’ the concentrations through blending with other substances to meet grade ‘a’ requirements. The alternative is managing the composition of influent which enters the WWTP (i.e. limiting industrial wastewater discharges), as 70-90% of metal contaminants from influent end up in sludge.

Table 12: NZWWA/MfE Guidelines - Biosolids Contaminant Requirements[11]

	Grade a maximum concentration (mg/kg dry weight)	Grade b maximum concentration (mg/kg dry weight)
Metals		
Arsenic	20	30
Cadmium	1	10
Chromium	600	1500
Copper	100	1250
Lead	300	300
Mercury	1	7.5
Nickel	60	135
Zinc	300	1500
Organics		
DDT/DDD/DDE	0.5	0.5
Aldrin	0.02	0.2
Dieldrin	0.02	0.2
Chlordane	0.02	0.2
Heptachlor & Heptachlor epoxide	0.02	0.2
Hexachlorobenzene (HCB)	0.02	0.2
Hexachlorocyclohexane (Lindane)	0.02	0.2
Benzene hexachoride (BHC)	0.02	0.2
Total polychlorinated biphenyls (PCBs)	0.2	0.2
Total dioxin TEQ	0.00003	0.00005

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[11] Reproduced from “Guidelines for the safe application of biosolids to land New Zealand” *(MfE/NZWWA, August 2003)*

Draft WaterNZ Guidelines

The *Guidelines for Beneficial Use of Organic Materials on Productive Land* are the updated version of the existing NZWWA/MfE Biosolids Guidelines. The scope of this document has been extended to include all wastes of animal origin, whether human or otherwise, as they contain similar levels of pathogens, trace elements and organic contaminants, meaning risks should be managed in a similar manner. When finalised, it is expected that this document will replace the

A fundamental premise of these new guidelines is that a wide range of organic materials can be beneficially recycled to land, provided that they undergo sufficient treatment, appropriate land management controls are in place, and the agronomic nitrogen requirements of the land are not being exceeded. Organic materials can be use beneficially as a soil replacement or for land rehabilitation.

The grading convention of biosolids for stabilisation and contaminants is modified, so contaminant grades are given a '1' or '2' for compliance and non-compliance respectively. The 'A' and 'B' grading for stabilisation requirements remains the same.

The acceptable pathogen and vector attraction reduction processes remain the same as the 2003 Biosolids Guidelines (see Table 11). The pathogen requirements under verification sampling and routine sampling also remain unchanged.

For contaminant requirements, metal concentration limits are set at the current Guidelines 'b' limit, and new limits have been set for emerging organic contaminants (see Table 13**Error! Reference source not found.**).

Table 13: WaterNZ Guidelines – Contaminant Requirements for Grade 1 Biosolids[12]

Parameter	Concentration limit (mg/kg dry weight)
Metals:	
See Error! Reference source not found. 'b'	
Emerging Organic Contaminants (EOCs):	
Nonyl phenol and ethoxylates (NP/NPE)	50
Phthalate (DEHP)	100
Linear alkydbenzene sulphonates (LAS)	2600
Musks – Tonalide	15
Musks – Galaxolid	50

6.2.2.2 Applications

Grade Aa/A1 Biosolids

Grade Aa (or A1) biosolids are considered to be unrestricted use biosolids. This means they are of sufficiently high quality that they can be safely handled by the public and applied to land without risk of significant adverse effects, and so their use is recommended as a permitted activity. These biosolids must carry a registered Biosolids Quality Mark (BQM) to provide independent confirmation that they meet grade

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[12] Reproduced from "Guidelines for Beneficial Use of Organic Materials on Productive Land" *(WaterNZ, December 2017)*

Aa requirements. The only limits placed on the use of Grade Aa/A1 biosolids are from regional plan rules, if these do not allow discharge as a permitted activity.

Other Grades

Grade Ab, Ba and Bb biosolids discharges are restricted use, and will require a resource consent to be discharged to land. In practice this means that appropriate discharge rates and methods will need to be established which do not present a risk to public health or the environment. This may involve a soil characterisation study, identification of groundwater, surface water or other ‘sensitive’ areas, social considerations, restrictions on nitrogen loading rates, and monitoring requirements.

Grade B biosolids (Ba, Bb) potentially contain pathogens at levels which pose a risk to human health, and so require special controls to manage this risk, depending on the end use (Table 14 -). These controls combine vector attraction reduction (VAR) and management protocols to manage public health risk.

Table 14 - NZWWA/MfE Guidelines - Recommended Controls for Grade B Biosolids, depending on end use[13]

Land use	VAR requirement	Recommended controls
Salad crops, fruit, other crops for human consumption that may be eaten unpeeled or uncooked	1. Mass of volatile solids in biosolids shall be reduced by a minimum of 38%; or 2. SOUR @ 20°C≤ 1.5g/m3 for liquid sludges from aerobic processes; or 3. pH ≥ 12 @ 25°C for at least 2 hours and pH≥11.5 for 22 more hours;	May be applied immediately ***Plus*** Soil incorporation. ***Plus*** A further waiting period of at least 1 year before crops are sown (the land may be used for other purposes in the meantime).
	Storage/ exclusion period	Store or lagoon for at least 1 year prior to application. ***Plus*** Soil incorporation. ***Plus*** A further waiting period of at least 1 year before crops are sown (the land may be used for other purposes in the meantime).
Public amenities, sport fields, public parks, golf courses, playgrounds, land reclamation	1. Mass of volatile solids in biosolids shall be reduced by a minimum of 38%; or 2. SOUR @ 20°C≤ 1.5g/m^3 for liquid sludges from aerobic processes; or 3. pH ≥ 12 @ 25°C for at least 2 hours and pH≥11.5 for 22 more hours;	Store or lagoon for at least 6 months prior to application. ***Plus*** Soil incorporation. ***Plus*** Restriction on public access for period of time necessary to establish a full vegetation cover on the land.
	Storage/ exclusion period	Store or lagoon for at least 1 year prior to application. ***Plus*** Soil incorporation. ***Plus*** Restriction on public access for period of time necessary to establish a full vegetation cover on the land.

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[13] Reproduced from “Guidelines for the safe application of biosolids to land New Zealand” *(MfE/NZWWA, August 2003)*

Land use	VAR requirement	Recommended controls
Fodder crops and pasture, orchards where dropped fruit is not harvested, turf farming, industrial or non-edible crops, crops that will be peeled or cooked before eating	1. Mass of volatile solids in biosolids shall be reduced by a minimum of 38%; or 2. SOUR @ 20°C≤ 1.5g/m^3 for liquid sludges from aerobic processes; or 3. pH ≥ 12 @ 25°C for at least 2 hours and pH≥11.5 for 22 more hours;	May be applied immediately. **Plus** Soil incorporation. **Plus** Fruit and turf should not be harvested or pastures grazed for at least 6 months after applications. **Plus** Crops that will be peeled or cooked should not be harvested for at least 6 months after application.
	Storage/ exclusion period	Store or lagoon for at least 1 year prior to application ***Plus*** Soil incorporation ***Plus*** Fruit and turf should not be harvested, or pastures grazed for at least 6 months after applications. ***Plus:*** Crops that will be peeled or cooked should not be harvested for at least 6 months after application.
Forest, trees or bush scrubland	1. Mass of volatile solids in biosolids shall be reduced by a minimum of 38%; or 2. SOUR @ 20°C≤ 1.5g/m3 for liquid sludges from aerobic processes; or 3. pH ≥ 12 @ 25°C for at least 2 hours and pH≥11.5 for 22 more hours;	May be applied immediately. ***Plus*** Public access restricted for 6 months. ***Plus*** Buffer zones should be fenced and signposted.
	Storage/ exclusion period	Store or lagoon for at least 1 year prior to application. ***Plus*** Public access restricted for 6 months. ***Plus*** Buffer zones should be fenced and signposted.

Biosolids with a ‘b’ grade for contaminants should be characterised for the contaminant content (metals and organic chemicals) to validate that they do not contain abnormal contaminant concentrations. This will inform the application rate, based on an understanding of the background soil concentrations and the soil concentration limit.

As nitrogen is relatively mobile in soils, the potential for leaching of nitrogen from biosolids (of all grades) into groundwater is an issue which must be taken into considering for land application. Ideally, the N content in the biosolids and in the receiving soil should be assessed to establish a nitrogen mass balance and determine an application rate. The general approach to this issue is to ensure that the agronomic nitrogen needs of crops is being met. As agronomic rates can vary widely depending on site conditions, a default value of 200 kg total N/ha/year is often adopted for New Zealand pastures.

Under the new Draft Guidelines, the default value for nitrogen loading rates for continual application of biosolids to productive land shall not exceed an average of 200 kg N/ha/year over a maximum of two years, based on evidence that the organic nitrogen present in the product is eventually mineralised. For rebuilding of degraded soil or refurbishment of contaminated land, the one-off biosolids application volume should not result in a nitrogen concentration exceeding 150 kg mineral N/ha. With the exception of the nitrogen loading rates, the conditions and recommended controls for land application of unrestricted or unrestricted use organic materials remains unchanged from the 2003 Biosolids Guidelines.

6.3 Conclusions

In order to allow future de-coupling of Wellington's sludge from discharge to Southern Landfill, a pragmatic approach would be to treat the sludge to at least a B stabilisation grade. This would represent a reduction in water content and odour-causing compounds, making it more acceptable to the landfill in the short-term, and produce a biosolid which a land discharge consent could be obtained for in the future. It may be more cost effective to treat to a class A stabilisation grade, once handling and transportation costs are taken into account, but this will need to be determined as part of the options development and assessment process.

There is very little information available on the contaminant concentrations in the Wellington sludges and so the likely contaminant grade of any biosolid produced cannot be assessed at this time. Sludge characterisation sampling is currently being undertaken by Veolia which will allow determination of the sludge's suitability for land application in particular. It is unlikely that the sludge will meet the current 'a' contaminant grade as municipal sludges are typically too high in copper and zinc to meet those concentration limits. However, it is more likely that the sludge will meet future contaminant limits which are likely to be more permissive.

Connect Water (WSP New Zealand & CH2M Beca)
c/- CH2M Beca Ltd
L6, Aorangi House, 85 Molesworth St
PO Box 3942, Wellington 6140
New Zealand

t: +64 4 473 7551
f: +0800 578 967

w: www.beca.co.nz