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Let's not waste our wastewater, or our water!

By Garrett Hall, Technical Director Environments; Garry Macdonald, Water Market Segment Director and Chris French, Business Director Water and Wastewater.



The commitment by central government and regional councils to improve water quality throughout New Zealand is driving a step change in municipal wastewater treatment plants (WWTP) with significantly improved environmental performance.

Major reform in the three waters sector, together with resource management and other legislative reform, and population growth pressures, will only accelerate this change. The focus will be on both point (e.g. direct discharge) and non-point or diffuse (e.g. agriculture) sources of contamination of our fresh and marine waters.

At the same time, water takes from freshwater sources will also come under scrutiny because of over-allocation in some regions and the challenges of maintaining low flows in dry seasons or years. This requirement to reduce water takes for municipal supply will likely lead to us to consider non-potable use of highly treated wastewater – as has happened in many other countries.

The drive towards advanced wastewater treatment such as at Pukekohe WWTP (Auckland) and Kinloch WWTP (Taupo) for environmental reasons will – providentially – take us further along the road to “water reuse”.

Both the impetus to improve water quality at source, as well as the growing need to reuse wastewater, will see the broader adoption of increasingly advanced wastewater treatment processes across New Zealand.

However, with that comes more intensive use of energy and consumables, and more demanding biosolids management, across the operation of our plants. In fact, the pursuit of greater environmental performance through these plants sets us on a potential course to conflict with another important environmental consideration – carbon emissions.

Accounting for carbon emissions can also inform decisions on the way we treat our wastewater and presents the opportunity to adopt innovative yet practical approaches. In this complex and dynamic environment of change, we need an approach that takes an holistic view of wastewater management, one that balances improved water quality with environmental performance, financial cost, and the potential for increased greenhouse gas emissions.

The challenges posed by climate change, such as more frequent extreme events – wet and dry – and sea level rises will increase this need to find robust and resilient solutions for water and wastewater management.

This article examines the drivers for more advanced treatment in the context of significant sector and legislative disruption. It also provides real world examples and innovative solutions for wastewater treatment to manage the conflict between improved treatment standards and increasing carbon emissions.

Legislative drivers to better wastewater management

Wastewater management in New Zealand is already subject to a hierarchy of laws, regulations, regional policies and localised planning rules, and recent legislation.

In recent years, we have seen various reviews and proposed, or actual new legislation intended to address and improve water quality, such as the National Environmental Standard for Freshwater, National Policy Statement (NPS) for Freshwater 2020 incorporating Te Mana o te Wai, plus the Three Waters Reform which is currently underway.

The impact of this legislation on wastewater treatment will likely require a shift away from passive natural treatment systems (such as oxidation ponds) towards more advanced processes requiring nutrient removal and disinfection.

Not only do these advanced treatment processes require large investments in physical structures, but operational costs, energy and chemical consumption also increase alongside more demanding biosolids management as more biosolids are produced – all with increased associated greenhouse gas emissions.

Considering Māori cultural values

Importantly, Māori cultural values have an increased focus and are becoming more integral to the decision-making process on wastewater solutions.

Whilst each iwi and/or hapū has distinctive and specific experiences, there are some common, shared, and similar values and perspectives to consider.

In particular, a strong disapproval of wastewater discharge to water, freshwater, recreation areas, marine environments, and food crops. Conversely, there is generally higher approval for waste being used to generate electricity, applied to forestry and used on non-food crops – all forms of beneficial reuse.

A key requirement of the Freshwater NPS 2020 includes a requirement to manage freshwater in a way that ‘gives effect’ to Te Mana o te Wai through (amongst other matters), working with tāngata whenua and communities to set out long-term visions for freshwater management and prioritising the health and wellbeing of water bodies.

Furthermore, the Water Services Bill requires those exercising functions, powers and duties to give effect to Te Mana o te Wai. Therefore, the concept of Te Mana o te Wai is now engrained further into our decision making about how we manage wastewater.



Mangere WWTP Biological Nutrient Removal Facility. CREDIT: Watercare

Commitment to reduced emissions

While these drivers are set to improve the environmental performance of our wastewater management systems, the likely increase in greenhouse gas emissions will do little to meet our requirements of the Zero Carbon Act and New Zealand’s international commitment to reducing carbon emissions.

Some Local Government Authorities are now looking at roadmaps for decarbonisation as part of their journey to plan and budget for reducing their carbon footprint to meet the Zero Carbon Act target of net-zero greenhouse gas emissions by 2050. Beca has been working with WWTP owners across New Zealand to undertake baseline assessments of wastewater treatment operation, including Puketū WWTP (Hamilton) and Project Shotover WWTP (Queenstown Lakes). These baselines are the foundation for a carbon roadmap, where the carbon and cost impact of different options can be realised to help prioritise projects and programmes, and make informed decisions when planning upgrades and new wastewater treatment facilities.

Adopting a lower carbon wastewater management future

Many energy efficient wastewater treatment technologies are emerging which can support reduced carbon emissions. For example, Membrane Aerated Biofilm Reactor (MABR) technology is being trialled at some New Zealand sites. MABR technology, or ‘bubbleless’ aeration, utilises gas permeable membranes to provide the oxygen required for aerobic biological treatment.

We might also see a national trend back towards natural treatment such as enhanced constructed wetlands, as trialed at Māori values with systems that emit lower levels of carbon emissions.

However, a commonly identified barrier to the adoption of emerging technologies is New Zealand’s remoteness from the core markets of potential technology suppliers, such as Europe and North America. Overcoming these barriers requires a willingness of our key decision-makers to support innovative solutions, backed by procurement strategies that appropriately and collaboratively share risk and enable new technology establishment at a more rapid rate than has been experienced in the past.

Resource recovery – the value of wastewater

Traditionally the focus of wastewater management has been on minimising the impacts of wastewater on both public health and the environment. More recently the potential for wastewater as a valuable resource for both water supply and energy has become more prevalent in councils’ considerations.

Embracing wastewater recovery can become a positive response to climate change. Wastewater as a resource plays a significant role in reducing carbon emissions, primarily by offsetting the use of other carbon intensive materials in the economy, such as artificial fertilisers. Active and successful examples of nutrient recovery from wastewater in New Zealand exist already, including:

- Vermiculture composting. Worm farms have successfully been implemented to beneficially reuse biosolids at several sites throughout New Zealand.
- Rehabilitation of Puketū Island using digested, dewatered biosolids from the Mangere WWTP in Auckland.
- Production and sale of Bioboost® - thermally dried biosolids produced by New Plymouth District Council’s WWTP and used as an agricultural and domestic fertilizer since September 2002.
- Transportation of dried biosolids from the Christchurch WWTP to active open-cast mines on the West Coast to rehabilitate through revegetation of the mined areas.
- Capture of biogas from the digestion of sludge in wastewater treatment plants, for heat and electricity generation. Many of our large WWTPs have been using biogas to generate onsite power for more than 50 years, which reduces their need to import power from the main grid. There is potential to exploit this further where practically and economically feasible, as a transport and pipeline gas fuel (for heating in buildings).
- Thermal hydrolysis (THP) upgrades which offer potential to significantly increase biogas production, as well as produce more stable biosolids for offsite disposal.



Otago Valley, South Island. CREDIT: Getty Images

Noting, these types of resource recovery solutions are much more easily achieved at scale. For example, Watercare seeks to achieve energy neutrality at its Mangere WWTP and potentially others by 2025.

Responding to the challenge will be more difficult for smaller WWTPs, who may find that consolidating larger municipal facilities would be a better option.

Conclusion

Central and local government drivers to achieve greater outcomes for our water bodies are becoming clear, supported by significant legislative reform.

This is set to have a significant impact on our approaches to wastewater management, with the more universal adoption of wastewater treatment systems that deliver greater standards of effluent quality.

While this has the potential to create even greater carbon emissions – through the adoption of more advanced and intensive technologies – it also presents significant opportunity to create a lower carbon future.

Our best ability to harness this opportunity is to consider our options in early decision making and planning.

Making the most of this opportunity requires joined-up thinking and alternative views - which can be achieved through our water sector reform and increasing application of Māori cultural values to our wastewater management approaches.



Garrett Hall – Garrett brings more than 20 years' experience across stormwater, water supply, wastewater and transportation infrastructure. He has wide-ranging skills and expertise in long-term resource consenting projects, and has developed strong relationships over the years with local and regional New Zealand councils and agencies.

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in many engineering industry organisations, including the Boards of Water Environment Federation (WEF), Water NZ and IPENZ/Engineering NZ, as well as being immediate past Co-Chair of Oxfam Aotearoa/NZ. He is a Distinguished Fellow of Engineering NZ and the only NZer to be appointed as a WEF Fellow.

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