15th March 2021

Submission's analysis team

Climate Change Commission

PO Box 24448

Wellington 6142

To the submissions analysis team Climate action for Aotearoa,

Introductory comments

1. Thank you for the opportunity to comment on He Pou a Rangi advice on Climate action for Aotearoa. This submission is made by Water New Zealand.

2. Water New Zealand is a national not-for-profit sector organisation comprising approximately 2400 corporate and individual members in New Zealand and overseas. Water New Zealand is the principal voice for the water sector, focusing on the sustainable management and promotion of the water environment and encompassing the three waters: drinking water, waste and storm waters.

3. We acknowledge the leadership of He Pou a Rangi's and support the vision of a climate-resilient and low emissions Aotearoa where our children thrive. This submission seeks to describe the role that our water systems would play in this future. There is a strong nexus between water use, energy and carbon. In the words of the Prime Minister's Science, Engineering and Innovation Council[1]:

   Energy, water and carbon form the cradle of life itself, and sustain us at every level from the cells of our bodies to ecosystems and economies. Together, energy, water and carbon provide the foundation for the evolutionary emergence of new forms from old ones, not only in living organisms but also in human societies and cultures.

   Accordingly, these intersections would suggest an expansion of the He Pou a Rangi vision of a country where people are not-only respected stewards of the land, but also of water.

4. The water sector is undergoing a period of radical change. A new drinking water regulator, Taumata Arowai is set to commence operation from 1st July 2020. Concurrently the Government has launched the Three Waters Reform Programme – a three-year programme to reform local government three waters service delivery arrangements[2]. The radical

[1] Prime Minister's Science, Engineering and Innovation Council, Canberra, Australia; Challenges at Energy-Water-Carbon Intersections
http://web.science.unsw.edu.au/~matthew/FINAL_EnergyWaterCarbon.pdf

[2] Department of Internal Affairs, Central/Local Government Three Waters Reform Programme
https://www.dia.govt.nz/Three-Waters-Reform-Programme

transformation of governance and aging infrastructure opens a "window of opportunity" for reassessing past practices and design philosophies to re-orientate the sector towards low carbon approaches.

5. The water sector is a willing and able partner to assist He Pou a Rangi work towards reducing New Zealand's water related emissions. Water New Zealand manages a Climate Change Special Interest group, with representatives from across the water sector, which is well placed to act as a focal point for He Pou a Rangi assistance. The mission of this group is to:

   We provide leadership across the New Zealand water sector to enable it to act to limit warming to 1.5 degrees. We actively work across all three waters to provide guidance to meet 'zero carbon' goals and adapt to the impacts and risks of a changing climate.

6. The carbon water nexus is a vast topic. We have chosen to focus on challenges and opportunities it presents (not currently addressed by the He Pou a Rangi's advice) rather than focusing on the individual consultation questions posed by the He Pou a Rangi. We begin by outlining where water related emissions arise. However there are a number of areas where water-energy-carbon intersections present challenges and opportunities that could be aligned with the He Pou a Rangi's advice. In line with the He Pou a Rangi's approach in providing advice to government we have attempted to sum up these opportunities by expanding on the "Neccessary actions" in the consultation package.

QUESTION: Is there anything specific about the eventual reductions Aotearoa might need to make to biogenic methane emissions that we would like to add?

Water and wastewater emissions

7. The contribution of the water sector to New Zealand emissions is not insignificant. Direct greenhouse gas emissions of methane and nitrous oxide from wastewater contribute an estimated 1.6% of total global emissions[3]. To this may be added the contribution from emissions associated with energy use, in excess of, 700 TJ/year for water supply and 1,000 TJ/year for wastewater[4].

8. Operational emissions associated with the sector, but reported elsewhere in the economy include fossil fuel use (e.g. vehicle use, standby power generation and heating), freight transport (including chemicals consumed in treatment processes or biosolids produced and removed from a wastewater treatment plants), materials production (including chemicals consumed during treatment processes) and waste (including transport and disposal of biosolids or other solid waste products generated during treatment processes).

9. Capital delivery of water infrastructure can also be a significant contributor to greenhouse gas emissions. For example, Watercare conducted an analysis of carbon emissions associated with projects planned to be undertaken prior to 2029. They found that the projected carbon emissions was greater than operational emissions over the same period of time. Off the back

[3] IPCC, Climate Change 2014 – Mitigation of Climate Change. Working Group III Contribution to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. www.cambridge.org/9781107654815

[4] Water New Zealand, National Performance Review 2019-2020 www.waternz.org.nz/NationalPerformanceReview

of this analysis Watercare are targeting a 40% reduction in carbon emissions from construction by 2024[5].

QUESTION: Is there anything the climate commission could recommend in their advice to government to support the development of tools such as the Moata Carbon Portal?

Opportunities for the water cycle to a circular economy

10. The Water Environment Research Foundation estimate that the energy contained in wastewater and bio-solids exceeds the energy needed for its treatment 10-fold[6]. The Productivity Commission explored opportunities for energy capture from wastewater in its low emissions report[7]:

> *At present, 53% of the current effective New Zealand population is connected to 15 WWTPs that have anaerobic digesters to help provide onsite energy. Additional drivers, such as an increased emissions price, could lead to WWTPs with co-located anaerobic digesters covering an estimated 78% of New Zealand's population. This would help to divert solid waste away from landfill sites without effective gas recovery systems . Increasing the capacity of existing anaerobic digestion systems also appears to be a particularly suitable avenue to pursue. Recent research shows that processing residual industrial waste from WWTPs in anaerobic digestion plants could reduce emissions by up to 151 kt CO2e a year by 2050. This represents 150% of projected GHG emissions from industrial wastewater, suggesting that industrial wastewater treatment has the ability to become emissions neutral by 2030, and emissions negative by 2050.*

11. Colder climates can benefit from recapturing heat contained in waste-water, a practice employed internationally, most commonly in Scandinavia but has not been explored indepth in New Zealand. This has the opportunity to contribute to decarbonisation of low and medium temperature heat in industry and buildings, which Te Hou a Rangi has determined could be decarbonised by 2050.

12. Biosolids (the solid fraction of sewage) contain energy that can be recovered through a number of processes including; anaerobic digestion, co-digestion of bio-solids with other organic wastes, bio-solids incineration, or conversion of bio-solids to other fuels through processes such as gasification and pyrolysis.

13. Other renewable fuel sources from wastewater are in development. Ammonia extracted from wastewater can be burned directed in internal combustion engines or converted to fuel cells. Other organics present in wastewater are also being investigated for use in fuel cells that generate electricity. Recovery of phosphorus from wastewater is another recent international development but is energy intensive.

---

[5] Managing Infrastructure Carbon in New Zealand, H. Edmond (Mott MacDonald), C. Thurston (Watercare Services Limited), A. Mogridge (Watercare Services Limited), N. Dempsey (Mott MacDonald)

[6] Water Environment Federation, Energy Production and Efficiency Research - The Roadmap to Net-Zero Energy

[7] Productivity Commission, Low Emissions economy https://www.productivity.govt.nz/assets/Documents/lowemissions/4e01d69a83/Productivity-Commission_Low-emissions-economy_Final-Report_FINAL_2.pdf

Additional neccessary action 6: Scale up provision of low emissions energy sources.

Acknowledge the water sector can provide an important contribution to this work and as an important partner in its development.

There are opportunities to concurrently reduce water and energy use which could avoid emissions

14. Energy (and hence carbon) are inputs in the treatment and distribution of water. Further energy is consumed in the heating of water within homes and business, in water using appliances such as dishwashers, hot water heaters. At the other end of the pipe further energy is used to convey and treat wastewater. There is therefore an opportunity to reduce carbon by using more water efficiency. This can be achieved through financial mechanisms, such as charging for water, and non-financial mechanisms such as behaviour change campaigns and effective labelling.

15. Technical options also exist to reduce emissions through optimisation of pumps and treatment plant processes. Melbourne Water explored opportunities from wastewater treatment plant processes to reduce emissions through a public innovation challenge, that provided many examples of types of emissions reduction opportunities that are possible through process optimisation and technology development8.

An improved understanding of carbon-water is needed to avoid decisions that lock in high carbon trajectories

16. Water's availability, or lackthere of plays a key role in emissions trajectories. Where water supply is lpentiful it is an enabler for a range of land use options, and can be harnessed for use in hydro-electricity supplies or to cool power stations. Where there are constraints on water availability, this can force the use of emissions of intenstive water schemes such as desalination. Water reforms create an opportunity to embed drivers and incentives that prioritise effective stewardship of our water resource and encourage low emissions technologies.

17. Other trade offs between water quality aspirations and greenhouse gas emissions emerge during the design and operation of wastewater treatment plants. For example, energy intensive process routes such as high rate or forced aeration systems use more electricity but produce a higher quality effluent and avoid methanogenic process routes. Low energy process methods such as passive pond systems use significantly less power but may produce lower quality effluent and use methanogenic process routes. It will be important for there to be strong engagement between water sector managers and Te Hou a Rangi as freshwater quality standards are developed.

Addition to necessary action 15: Integrate Government policy making across climate change and other domains

We suggest an addition point to "Ensure that emissions monitoring and targets are enshrined in the responsibilties and regulation of new water entities."

[8] Melbourne Water, Innovation's competition to reduce Scope 1 greenhouse gas emissions https://www.melbournewater.com.au/water-data-and-education/news/research-and-innovation/innovation-competition-reduce-scope-1

18. Correct determination of nitrogen emissions requires the various stages of the nitrogen cycle to be addressed. This is a complex process, which varies depending on the wastewater treatment plant configuration and effluent quality. Some of the shortfalls of New Zealand's current approach compared with the Australian (NGER Guideline approach) are summarised in a wastewater sector report[9].

> *The MfE 2019 MEG does not distinguish N2O that is potentially produced in the treatment process itself, but rather allocates all the N2O emissions to effluent discharged (i.e. using one emission factor, as a fraction of nitrogen discharged per capita via the wastewater to the WWTP). The NGER 2017- 18 Guidelines aim to distinguish N2O emissions associated with 'secondary treatment' in the WWTP from those associated with (treated) effluent discharge, using respectively different emission factors and taking into account the receiving water environment[66].*

19. Wastewater treatment emissions are poorly understood, with methods for GHG estimation from wastewater treatment not included in MfE's GHG reporting guidance. The water sector has raised internal funds and launched a project as a first step towards plugging this gap in understanding. The guideline intends to build on IPCC emissions factors, and prior work conducted in Australia and New Zealand to develop a set of standardised emissions factors for wastewater treatment plants in New Zealand.

20. The scope of work has been limited by available funding, however. Many questions regarding the true amount of wastewater emissions and opportunities to reduce these will remain unanswered. Research shows that nitrous oxide emissions vary widely depending on the type of wastewater treatment process and this variation will not be fully resolved within the scope of the current project. .

21. Improving the understanding of wastewater fugitive emissions in New Zealand is an important first step to managing this emissions source. At a central level updating the Ministry for Environments Greenhouse gas inventory and Voluntary Greenhouse Gas Reporting Guidance to reflect the standards under development would be an apporpriate starting point. Further understanding of wastewater emissions requires third party support, either from central government or academia.

Necessary action 18b. In addition to building a Māori emissions profile we suggest a separate programme to build a better sector profile for the water sector.

As well as better understanding the true quantum of emissions, this work could also quantify and prioritise emissions reductions opportunities from the sector.

[9] BECA, GHD, Boffa Miskell, The New Zealand Wastewater Sector: https://communications.ghd.com/pdf/Wastewater-Sector-Report-prepared-for-MfE.pdf

Water sensitive cities have a key role in mitigating against climate change

22. Integrated urban water management provides a unique opportunity for passive evaporative cooling of urban environments – purposely managed irrigation and increased vegetation has been shown to reduce air temperature in urban environments[10]. Whilst this mitigates against climate change impacts of increased temperatures will be important in northern towns of New Zealand. Water sensitive urban environments have the dual benefit of reducing energy and carbon needed for cooling, helping counter a trend of runaway energy use associated with increased cooling requirements in heat wave conditions.

Necessary action 15: Integrate Government policy making across climate change and other domains.

We suggest adding water supply, wastewater and stormwater service provision to the list of exploration for "investigating emissions reduction potentials and interdependencies amongst multisector activities, such as food production and distribution, tourism, construction and international education."

[10] CTC fir Water Sensitive Cities, Climate change mitigation
https://watersensitivecities.org.au/climate-change-mitigation/