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When the first barrier fails: Strengthening protection for drinking water sources

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Summary

Safe, good quality drinking water is a foundation of public health. The first, and most significant, barrier against drinking water contamination and illness is the protection of source water. Source water refers to the bodies of water (groundwater, rivers, lakes, springs, reservoirs) from which we take our drinking water.

However, as a Canterbury community found last year when they were notified that their drinking water source breached the health standard for nitrate, the protection of communities' source waters has been neglected and its importance too frequently downplayed by those in charge of land and water use.

In the wake of the Havelock North outbreak, new valuable legislative and policy

reforms were made but the Waimate breach reveals there are still weaknesses in responsibility and accountability for the protection of water sources.

This Briefing describes how Waimate's water came to be contaminated; identifies that the regional council was aware of the risk but didn't take adequate action to prevent it; and makes recommendations for how the government can strengthen responsibility and accountability in Aotearoa's drinking water supply system to ensure community health is prioritised and future contamination events prevented.

"I'm two days off having a baby. So, I've been drinking this water my entire pregnancy until we were notified."

On 6 August 2022, residents of a small town in Waimate in the Canterbury region were informed that their drinking water supply had breached the national drinking water standard for nitrate. The breach revealed a failure to protect the community's source water from contamination, despite the protection of source water being the "first, and most significant, barrier against drinking water contamination and illness".[1] The case of the Waimate breach exposes weaknesses in responsibility and accountability of public agencies to protect sources of drinking water, which continues to leave source water and public health vulnerable.

Nitrate contamination of water has become a significant public health concern in Aotearoa in recent decades, as the predicted consequences of intensified land use come to pass, and evidence emerges of broader human health implications from exposure to nitrates. Nitrate loss to water has increased substantially, mainly due to an increase in dairy cattle (from 3.8 million animals in 1994 to 6.5 million in 2017) [2] and supported by increases in the use of fertiliser, irrigation and imported feed.[3-5]

New Zealand's current drinking water standards set a Maximum Acceptable Value (MAV) for nitrate based on the World Health Organization guideline at 11.3mg/L nitrate-nitrogen (sometimes referred to as 50mg/L nitrate, which means the same) designed to prevent death from methaemoglobinemia in infants. This condition is commonly known as 'blue baby syndrome' as it interferes with oxygen in blood and may be indicated by a change in babies' skin colour. The Waimate community's drinking water breached this MAV.

At a public meeting called to discuss the exceedance in September 2022 [6], a pregnant resident questioned authorities,

> *You've got a level of 50 milligrams currently, but we've obviously been exposed to this getting towards 50. What's the risk of having had an entire pregnancy, potentially sitting around 48, 49?"*
>
> *"I'm two days off having a baby. So, I've been drinking this water my entire pregnancy until we were notified.*

More recently, experimental, genetic and epidemiological evidence has suggested nitrate in drinking water could increase the risk of bowel cancer [7] and preterm birth [8 9] at levels far below the current MAV. For example, in 2018, a large Danish cohort study observed an

increased risk of bowel cancer at levels 13 times lower than the MAV.[10] In 2022, the Office of the Prime Minister's Chief Science Advisor provided a short review of the potential risk nitrate in drinking water poses to human health, which suggested the evidence was inconclusive with regards to nitrates carcinogenic effects.[11] In June 2022, the French Agency for Food, Environmental and Occupational Health & Safety (ANSES) review [12, p.1] concluded that:

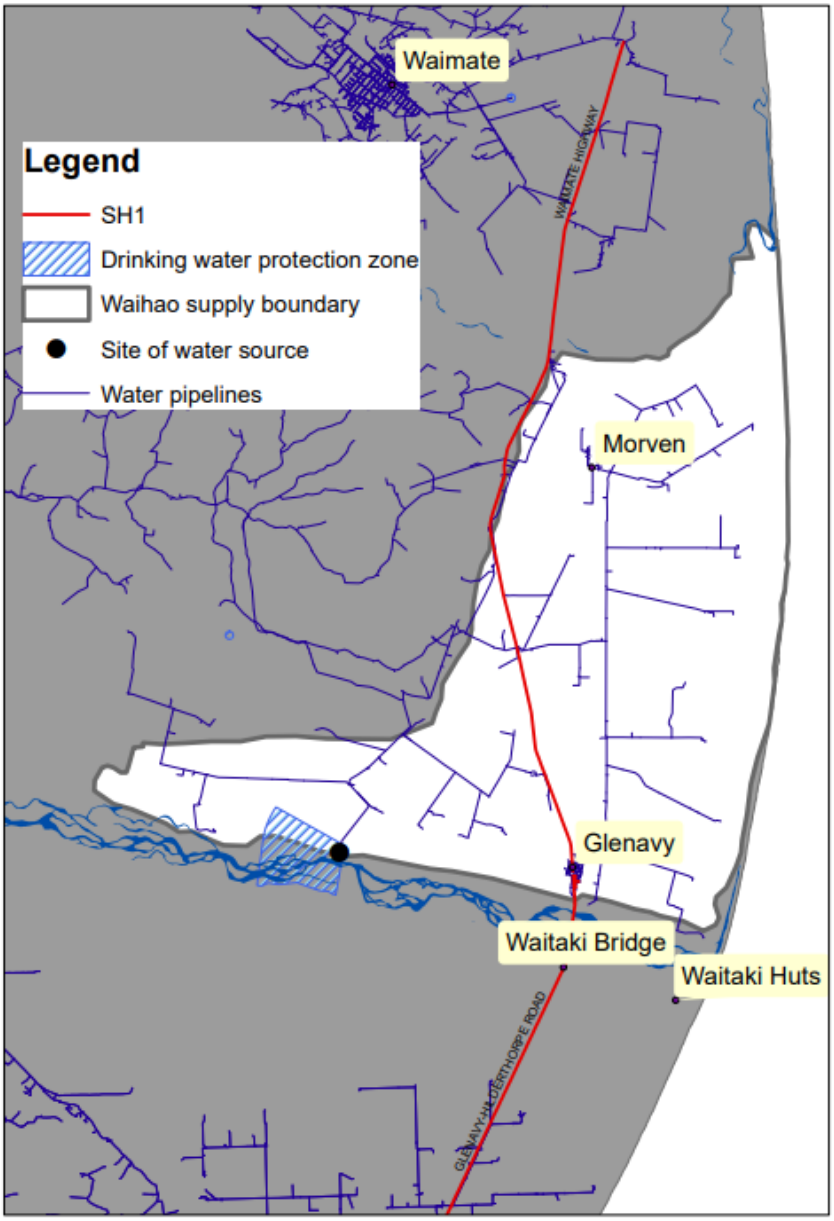
> *[T]here is an association between the risk of colorectal cancer and exposure to nitrites and/or nitrates, whether they are ingested via the consumption of processed meat or drinking water. The higher the exposure to these compounds, the greater the risk of colorectal cancer [bowel cancer] in the population.*

With emerging evidence and questions still to be answered about the risks to human health, public health logic would demand a precautionary approach to nitrate contamination. Best practice drinking water protection the world over has stressed the first barrier for safe, good quality drinking water is protection of its source.

However, this protection is inadequate in Aotearoa currently.

How did the Waimate community's source water become contaminated?

The contamination of Waimate's drinking water didn't happen overnight. Years earlier the regional council, Environment Canterbury (ECan), made land use decisions that would significantly increase nitrate contamination of the district's fresh water and set the community's Lower Waihao water supply on the path to the breach.



Map showing the affected Waihao supply (white area on map). Source: ECan.

A 2015 report, prepared for ECan, on land use and farming practice change in the Waimate area investigated the likely impact of proposed conversions from border dyke irrigation to spray irrigation in an area called the “Northern Fan”.[13] The Northern Fan includes the Lower Waihao groundwater source. The report estimated that in 2014 land use generated an average concentration of 2.5 mg/L, with approximately 33% of the 180 wells in the area potentially exceeding the MAV. The report warned that, with proposed conversion from border dyke irrigation to spray irrigation conversion, the average nitrate concentration was likely to increase to 3.9 mg/L, with 59% of all wells breaching the MAV. [13]

Despite the report's warning, ECan did not step in to restrict or avoid these conversions. By 2017, only about 5% of the Northern Fan land was still using border dyke irrigation (a decrease from 30% in 2014), while spray irrigation covered approximately 84% of the land. Reviewing legislation and policy that was in effect at the time, it appears that ECan had options under the Resource Management Act that it could have used to avoid the large increases in nitrate predicted by the report.

Waimate District Council (WDC) was meeting its responsibilities as a supplier. After detecting nitrate above half of the MAV (5.65mg/L), it followed its legal requirement to implement further monitoring. A real time monitor was introduced, which was useful but could not prevent the breach that had already been set in motion years earlier. By August 2022, nitrate levels had breached the MAV and the council issued a do-not-drink notice, providing the community with a temporary alternative drinking water supply in tanks at three locations.

Taumata Arowai, the new national drinking water regulator, established in the wake of the contamination of Havelock North's drinking water in 2016, was notified of the breach. Beyond this, it is unclear what role Taumata Arowai took or is taking. To date, the only public statement [14] made on the breach was that their role is to:

> *ensure drinking water supplied to residents was safe but it was not involved in establishing causes of contamination. It was comfortable with the council's handling of the issue…*
>
> *"If drinking water quality was impacted by a consent issued by a regional council a review of the conditions of a consent could be requested[…] There could also*

> *be other actions possible under the Resource Management Act to address adverse environmental effects*

However, it doesn't appear to be investigating the contamination further, or seeking a review of consents. Neither the drinking water regulator nor ECan appears to be taking adequate action to address the cause of the contamination, leaving the supply vulnerable to future breaches.

ECan emphasised in its public statements that heavy rain drove the exceedance. While they did identify intensive farming as a contributor, their wording stressed a steady increase in nitrate in groundwater over decades rather than the reasonably dramatic increase in the case of the Lower Waihao scheme documented from 2015 to the time of the exceedance.[15] To our knowledge, they have not acknowledged that they predicted this outcome.

WDC lifted the do-not-drink notice in December 2022, reporting that the nitrate level had reduced to 38mg/L (8.6mg/L nitrate nitrogen) and stating [16],

> following months of observation, monitoring and ongoing tests, recent results have now shown the water to be consistently within the acceptable MAV limits, meeting the drinking water standards and proving safe to consume/

WDC has committed to installing a denitrification unit for the Lower Waihao scheme, the final cost of which is yet to be determined. In one report, the council suggests it may cost up to $750,000 to install, plus operational costs.[14] However, a scoping report produced for another Canterbury district found that construction of a small denitrification plant could be almost eight times higher, in the region of $6 million, and cost a further $360,000 per year to run. For the 600 people on the Lower Waihao scheme, this means at minimum set up costs could be $1250 per resident but could be up to $10,000 per resident, plus ongoing operational costs.[17] ECan has said they will not contribute to any costs associated with denitrification as they are not responsible for the treatment of water.[14]

These costs, and the potential health risks, will be passed on to communities from private interests because of a failure of regulators to prioritise the safety of source water.

Why is the first barrier failing?

Source water protection is our first and most significant barrier against drinking water contamination and illness. With regards to nitrate contamination, it is failing.

Recently published research found that close to 10% of 435 groundwater sites sampled nationally had nitrate levels exceeding the MAV and 33% of just over 1,000 surface and groundwater sites sampled were found to have levels above half the MAV.[18]

Not all regional councils appear to fully understand their responsibilities for source water quality. The government inquiry into the 2016 Havelock North outbreak reported that Hawkes Bay Regional Council initially gave evidence that claimed they did not have any responsibility for the safety or quality of drinking water. The inquiry explained, "the Regional Council's resistance to any acceptance of responsibility for drinking water (until

late in the Inquiry process) has shown that this goal [to overcome the “no responsibility” mindset of regional councils through policy was not achieved in its case.”[19]

The inquiry identified six fundamental principles for drinking water safety. Their second principle states that: “Protection of the source of drinking water provides the first, and most significant, barrier against drinking water contamination and illness”.[1] The fifth principle is that: “Suppliers must own the safety of drinking water.”

Taumata Arowai appears to have been largely focused on this fifth principle. The regulator is working to establish a register of suppliers and to assess their drinking water safety plans, which must include source water risk management plans. This is important and Taumata Arowai has inherited alarmingly little useful information on this from the Ministry of Health when it took over this role.[20]

However, as the Waimate breach shows, suppliers do not have the power to restrict land use or activities in a way that protects their source water. So, while the plans may identify land use risks, they can’t act to address them. Valuable changes were made to the Resource Management Act in 2021 that make it more explicit that regional councils must take source water protection into account when issuing consents. And the new National Policy Statement for Freshwater Management 2020 sets out the Te Mana o Te Wai framework, which states that councils must provide for the health of the environment and drinking water before considering commercial interests.

However, without more systematic processes of holding regional councils to account, suppliers and the public lack the resources to challenge decisions that threaten their source water. Even where larger suppliers do have resources and take an active role in regional planning to further protect source water, appeals for more stringent targets are outweighed by commercial interests. For example, Christchurch City Council proposed a target of 1mg/L nitrate-nitrogen for the aquifers that provide water for Christchurch City as part of ECan Regional Plan 7. The commissioners concluded [21 (p.66)]:

> [W]e are not satisfied that the additional constraint on dairy farming in the Waimakariri catchment that would be necessary to attain the more stringent standard sought by the City Council would be justified by the evidence tending to show risk of cancer

If suppliers cannot restrict land use and activities to protect source water, and there is a hands-off approach to ensuring regional councils meet their public health responsibilities, then our first barrier is failing. We need to strengthen responsibility and accountability in the system.

Recommendations to strengthen public agencies’ responsibility and accountability for protecting water sources

As the Waimate exceedance illustrates, cracks remain in our system that leaves source water and public health vulnerable. Additionally, public health is underrepresented in regional planning and is often not prioritised. To strengthen responsibility and accountability to protect our communities’ drinking water, we recommend the following actions.

- **National water regulator Taumata Arowai should:**
  - Be given a drinking water advocacy function for source water protection (like the Department of Conservation has for conservation), via the Water Services Act.
  - Be required to engage in all regional plan making (where Te Mana o Te Wai, the framework established in the NPS-FM and Water Services Act, is given effect).
  - Be adequately funded to take proceedings against councils where regional plans or consenting means source water protection is inadequate.
  - Commit to incident reports for serious contamination events to inform future water safety plans.
  - Revise its monitoring approach so that it can identify early and intervene where more pervasive contaminants like nitrate may be increasing.
  - Revise its nitrate MAV based on the precautionary principle, acknowledging the growing body of evidence of human health risks below 11.3mg/L.
- **National Environmental Standards for Sources of Human Drinking water should be revised to:**
  - Require regional councils to identify all upstream influences on source water as the drinking water protection zone, not only a small area around the abstraction point, as has been proposed.
  - Apply to all potential drinking water supplies, including private supplies, in the catchment, not only those the supplies required to register with Taumata Arowai.
  - Provide input (eg irrigation, stocking rates) control rules that can been applied immediately where nitrate (or other) contamination has exceeded the MAV.
- **Medical Officers of Health should be required to engage regional planning processes to advocate for their region's public health needs.**
- **Ministry for the Environment should be given the resources to take proceedings against councils where regional planning is inconsistent with the law.**

What is new in this Briefing:

- A case study illustrates the impacts of nitrate contamination on a community water supply.
- A review of legislation and policy, and actions taken by agencies, reveals weaknesses in responsibility and accountability for protecting drinking water sources.
- We make recommendations to strengthen the protection of drinking water sources by strengthening responsibility and accountability.

Implications for public health:

- Preventative and enforced protection of drinking water sources is needed to prioritise public health over short-term economic decisions.
- The precautionary approach is essential for protecting drinking water sources, especially where contamination of the source may take a long time to rectify (as with nitrate).
- Treatment of nitrate-contaminated drinking water is prohibitively expensive for drinking water suppliers (eg district councils or individuals) and passes the costs of private interests on to the community.
- Public health needs to be strongly represented in regional planning for

fundamental health determinants like safe drinking water.

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This article is part of the Public Health Priorities Series, coinciding with the launch of the Public Health Communication Centre. These articles highlight some of Aotearoa's most pressing issues and policy solutions to be considered in light of the upcoming general election. You can read more articles from the series as they are published here.

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