

Feedback form: New Zealand's draft National Infrastructure Plan

Your details

Name _____

Organisation (if applicable) _____

Position (if applicable) _____

Email _____

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About you

Please tell us which best describes you _____

☒ New Zealand citizen _____

☐ Industry professional (retired) _____

☐ Researcher _____

☐ Other (please specify):

Retired senior professional water engineer, having worked for GWRC and its predecessor organisations from 1975 to 2009. Intimately involved in the design and implementation of all the major water supply projects executed over that period.

Foundation member of the Wellington Lifelines Group. Fellow of Engineering New Zealand.

Sector or topic of interest

Please list or briefly describe the topics or sectors you are providing feedback on:

Project IPP0003141

Te Marua Water Treatment Plant Scheme Expansion Stage 1 (Pakuratahi Lakes)

My feedback on this project will be in 4 sections as follows:

SECTION 1

Comments on the proposal submitted by Wellington Water on behalf of GWRC.

SECTION 2

Comments on the assessment report prepared by the Infrastructure Commission.

SECTION 3

A brief overview of the vulnerabilities of the bulk water supply to the four cities of the region.

SECTION 4

An alternative proposal for a dam and water treatment plant on the Whakatikei River

Overall Summary.

The proposal to construct water storage lakes at Pakuratahi should not proceed.

The most vulnerable aspect of the water supply system of Wellington is the impact of a fault rupture following an earthquake generated on the Wellington Fault.

This proposal is extremely deficient in that it does not even mention this risk, and purely concentrates on security of supply in a drought event.

If this project is built, it will be extremely difficult to obtain funding in the future for another project to increase resilience.

The project has national significance in order to maintain Wellington as the seat of government after a major earthquake

SECTION 1

Comments on the proposal submitted by Wellington Water on behalf of GWRC.

I am extremely concerned to learn that the Pakuratahi Lakes storage proposal is being promoted as a means of increasing the resilience and water storage for the region.

This proposal does nothing at all to increase the resilience of the water supply system. In fact resilience is not even mentioned in the project description, only increased storage. Surely if such a huge sum of money is to be spent, that a resilience assessment would have been made, particularly in relation to a Wellington fault rupture scenario and climate change.

As you will be aware, in the Wellington fault movement scenario, the west side of the rupture moves north by up to 5 metres and the east side moves down by up to 1 metre.

The Wellington fault last ruptured between 300 and 500 years ago producing an earthquake of about magnitude 7.6

There is a 5% chance of the fault rupture occurring in the next 50 years.

A water supply network is similar to a living organism in that all the parts are interdependent and can not be assessed on a silo basis. This appears to be the case with the Pakuratahi Lakes proposal.

In section 3, I outline the vulnerabilities of the bulk water system, which appear to have been ignored in the analysis up to this point. These vulnerable points have been identified and well known since the first Lifelines Project in the early 1990's, and many subsequent investigations and reports.

The proposed Pakuratahi lakes are close to the Wellington fault, and water to and from these new lakes would have to cross the Wellington fault to connect back into the supply to Te Marua.

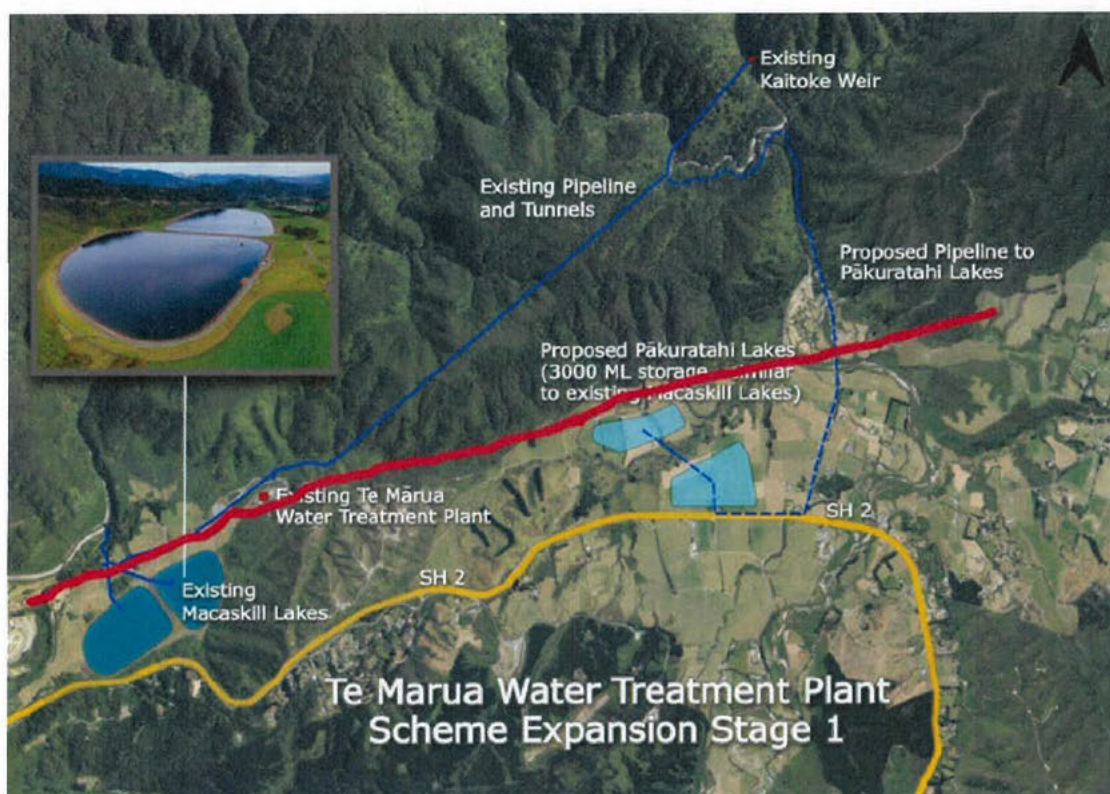
The Te Marua Water Treatment Plant and the Macaskill Lakes are also located very close to the fault, which also runs close to, and between, some parts at the treatment plant, and also between the lakes and the pumping station, crossing 4 large diameter pipeline connections to the lakes.

With our current knowledge and experience of ground deformations arising from fault rupture, it is my view that the Te Marua project may not have been built in its current form as the location is not sufficiently secure. Yet the current proposal is adding a new facility upstream of Te Marua. Because of this linear and interdependent proposal, a major disruption at Te Marua would mean that the Pakuratahi lakes would be probably **of no use at all**. One of the principles to be taken account of when promoting a new facility is that it must be able to operate **independently** of other parts of the system, and is not dependent on the survival of another facility. This fundamental principal appears to have been totally ignored or not understood.

On the Wellington Water image below which I think formed part of the application, I have marked the approximate location of the Wellington fault. Note that it passes close to the Macaskill lakes, crossing the large diameter pipelines between the lakes and treatment plant, and also close to the proposed Pakuratahi lakes.

The second image below GW plan no A1-10185-03-BS shows in more detail the location of the fault and the existing facilities at Te Marua.

What a rupture of the fault will do to the integrity of the lakes and treatment plant is indeterminable, but certainly the large pipes (which are up to 1000mm diameter) will be ruptured over significant lengths. Reconnecting these pipes will be no easy task.



Location of Wellington Fault relative to the existing facilities at Te Marua and proposed at Pakuratahi



This image GW plan A1-10185-03-BS shows the Wellington fault location in relation to the Te Marua facilities

After leaving Te Marua the water must pass through numerous other areas of high risk to the integrity of the distribution system. These are outlined in Section 3

Having been involved in the concept preparation, detailed design and construction of the Te Marua project, it is my opinion that following NZ recent experience, and having now a better understanding of ground rupture from earthquakes, **that the Te Marua project would not be built now.**

And yet the Pakuratahi Lakes proposal will put even more eggs into a very fragile basket, and increases the vulnerability of the water supply system.

I feel that it is my professional duty to bring to your attention the inappropriateness of proceeding with this Pakuratahi Lakes proposal. If a vast amount of money is to be spent to increase the availability of water for the Wellington, seismic resilience must be the major consideration.

SECTION 2

Comments on the assessment report prepared by the Infrastructure Commission.

The comments numbered sequentially and follow the sequence of the assessment document:

1 Indicative Description

Insufficient supply is the only stated objective of this project.

No mention of climate change including sea level rise, or the security of supply following a fault rupture earthquake.

2 Amber rating for Value for Money (para 3)

Water metering and pricing could have an impact on demand. However in a really severe drought metering alone will not be adequate and actual policing and enforcement of consumption will be required.

If the supply has been compromised by a seismic disruption, meters are of no use at all if there is no water to measure. This is a point that generally does not appear to be well understood at a variety of levels.

3 Overall assessment results (para 2)

The security of water supply to Wellington is of national significance because of Wellington being the seat of government. The disruption that would arise from having to relocate Government away from Wellington would be immense. No mention is made of this aspect.

4 3 Assessment of Strategic Alignment Stage 1 (para 4)

Although the risk from an increased residual flow requirement is mentioned again there is no mention of the risk arising from climate change or seismic effects.

In addition there is no mention of the vulnerability of other components of the water supply system. The project has been described in a silo with no comment at all on connecting infrastructure. (this comment applies to all the projects in the 100 long list)

A water supply network is almost like a living organism in which each part depends on the others for its operation and security. Network infrastructure proposals must always been considered in this light.

5 (para 8)

The objectives statement does mention “strengthening resilience to shocks and stresses” but I think that this is one of the few places that resilience is mentioned, but not developed any further.

6 (para 10)

Drought appears to be the ONLY factor where resilience has been considered. This is only a very narrow assessment.

7 (para 12.)

The proposal is of National significance with Wellington being the seat of Government.

8 Rating

Once again the report indicates that the only risk is a shortfall in supply, and possible reduction in source water availability.

9 4 Assessment of Value for Money Stage 1 (para 3)

The long list included a range of options, including such improbable solutions as towing icebergs from Antarctica and a dam in the Makara Valley. None of the options appeared to have considered how they would integrate operationally with the rest of the system and the connection costs involved. In assessing value for money these costs could be substantial. In addition no assessment has been made to determine if any other enhancements would be required to the system to enable this water to be used.

Two other significant possible water sources were not considered, both of which had been included in earlier GW investigations of future sources. These are the Otaki River and the Maungakotukutuku valley dam proposal inland from Paraparaumu.

I received a copy of the Applicant’s submission following an OIA request, but the 5 options in the short list were not shown.

10 Rating (para 3)

Once again the fallacy that water metering and its influence on demand is stated. The highest risk to the supply of water to Wellington is the disruption that would be caused by a fault rupture, but once again no mention has been made.

11.5 Assessment of Deliverability Stage 1 (para 6)

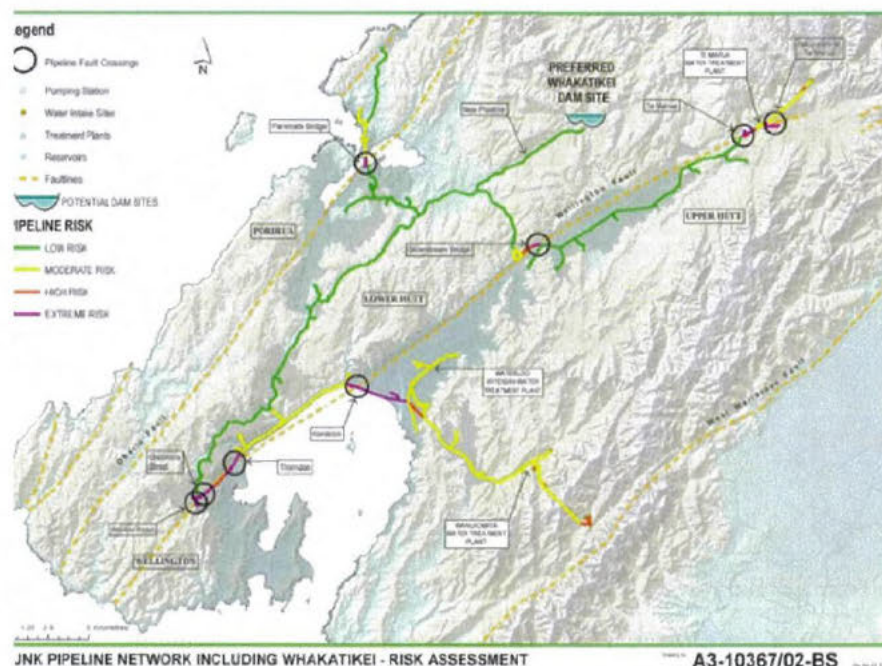
An Audit Office Report was prepared towards the completion of the Te Marua project. This report was one of a suite of reports on a variety of major projects carried out at that time by the Audit Office. This report gives some understanding of the complexity of building a multi-year project over a time of extreme (over 10%pa) inflation.

The statement that expanding an existing scheme reduces risk is a fallacy. It may make integration easier but it makes both projects vulnerable to the **same event**. One of the principles that must be followed is to avoid interdependence when seeking to increase overall resilience to natural hazards.

Section 3 Wellington Water Supply System vulnerability

The proposal under consideration indicated that the only vulnerability to Wellington's water supply is a shortage of source water arising from a drought or changed consent conditions for water takes. This is far from the actual situation.

The GW plan A3-10367/02BS below shows an assessment of the relative vulnerability of the bulk water supply system. Note that the possible Whakatikei intake and connecting pipeline to Judgeford are also shown for comparison.

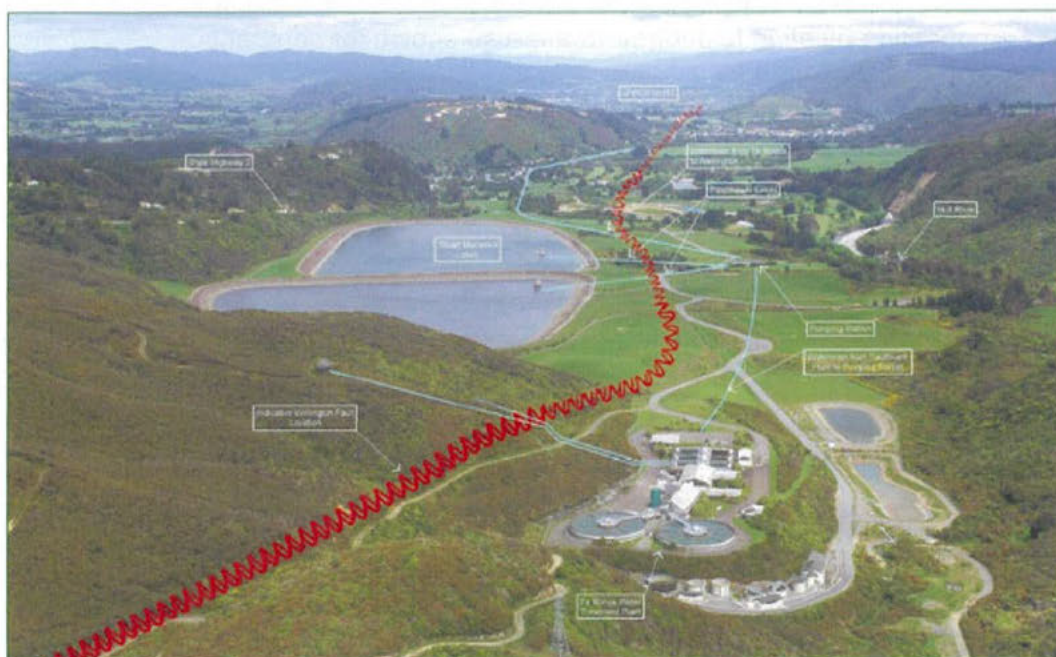


Outlined below are the main vulnerabilities of the treatment plants and pipelines, arising from climate change or fault rupture affecting the bulk water system.

1 Kaitoke-Te Marua to Karori system.

- Rockfall dams in Hutt River steep valley upstream of the Kaitoke intake

- Kaitoke intake structure and weir. Constructed in 1940s. No diversion tunnel. Major work required to replace at some point.
- Toxic algae blooms more likely because of climate change.
- Bridge between No 1 tunnel and strainer house now replaced, probably OK.
- No 2 tunnel long length from Kaitoke to Te Marua. Rockfalls in tunnel as it is only partially lined with concrete.
- Water treatment plant pipelines to process and wash water tanks on the hill crossing the fault.
- Macaskill lakes very close to the fault. With the lakes having a large extent, uneven settlement following fault rupture could cause overtopping, as well as failure of the earth embankments.
- Pipes connecting the lakes to the pumping station being 4 at 900mm diameter and also large drainage pipes cross the fault.
- Crossing of fault by the main delivery pipeline south of the lakes. Some mitigation installed at this point to enable a limited connection.



GW plan A1-10185-03BS This image shows the approximate position of the Wellington Fault in relation to the Te Marua facilities, including the lakes, pumping station and pipelines.

- Crossing of the fault and Hutt River at Silverstream. New bridge installed probably OK, but depends on any change of course of Hutt River along the fault line
- Fault crossings at entrance to Karori facilities.

2 Orongorongo/Wainuiomata to Wellington system

- Scree slopes above Orongorongo intake could be mobilised, causing the intake to be buried.
- Rockfalls in the 3.2km long partially lined tunnel carrying the water pipe from the Orongorongo intakes to Wainuiomata WTP
- Loss of pipeline from Wainuiomata river intake to WTP from scouring in flood event.
- Subsidence due to poor ground conditions across Wainuiomata valley floor.
- Poor ground conditions in Gracefield.
- Across Petone foreshore subsidence following fault rupture, sea level rise due to climate change, liquefaction during seismic event.
- Pipelines crossing the fault at Korokoro
- Rockfalls onto pipelines Korokoro to Ngauranga (Hutt Road)
- Liquefaction Ngauranga to Thorndon
- Pipelines crossing the fault in the very constricted busy area on Thorndon Quay just south of Tinakori Road. Note that there are many other lifelines in this location.
- For the WCC pipeline from Thorndon to Macalister Park Reservoir, sea level rise, liquefaction and lateral spreading, along Customhouse and Jervois Quays

3 Waterloo to Naenae and Gracefield System

- West side of the aquifer ruptured by movement on the fault. Subsequent performance of aquifer unknowable.
- General possibility of liquefaction affecting pipelines on valley floor

Not all of these impacts will necessarily occur, but sufficient will occur so as to severely compromise the delivery of water to the cities of the region.

Together these represent a far greater risk to the continuing supply of water than a shortage of source water, and mitigating these impacts must be given the highest priority.

Section 4

Alternative proposal for dam and water treatment at the Whakatikei River

About 100 years ago land was purchased for water supply purposes in the Whakatikei catchment by the Wellington City and Suburban Water Supply Board, and is still held by GWRC. The decision was subsequently made to take water from further up the main valley, enabling the Kaitoke source to also supply Upper Hutt.

Back in 2007, as a part of a comprehensive assessment of possible future sources, for both increased storage and to increase resilience, consultants prepared a very full investigation of all aspects of designing, consenting and constructing a new source in the Whakatikei catchment. The project would consist of a dam, water treatment plant, pumping station and connecting outlet pipeline which would join the Kaitoke to Karori pipeline at Judgeford.

Alternative proposals were prepared for a dam in the Wainuiomata catchment (Skull Gully) and a Pakuratahi Dam

Following a multi-criteria analysis the Whakatikei Dam option was shown to be the clearly preferred option over the other two sites.

The proposal was reported to the 4 cities with the recommendation that if a dam should be required in the future it would be constructed at the Whakatikei site.

Report No 2 to the WCC Strategy and Policy Committee meeting 7 August 2008 noted the advantage of the site being on the western side of the fault and close to the northern suburbs growth areas. This report also detailed the vulnerability of water supply to Wellington City in the event of a major earthquake.

The estimated cost in 2008 of the Whakatikei dam proposal was \$142M for storage of 8,400 ML (million litres)

A full analysis of costs and benefits was carried out by BERL Consultants. Their conclusion was that the project was justified on an economic basis.

The location of the proposed dam, water treatment plant and connecting pipeline to Judgeford is shown on GW plan A3-10367/02BS reproduced in Section 3 above.

The major advantage of using the Whakatikei River as a source is that the intake and outlet pipeline are in stable country being well away from the Wellington Fault. By connecting to the Kaitoke to Karori pipeline at Judgeford, supply could be made to the western areas of the region without the pipeline having to cross the fault. This includes all of Porirua City, Tawa, Churton Park, Johnsonville and Newlands, Khandallah and Ngaio (via a small interconnection pumping station), Wilton and Wadestown and Karori. The total population being supplied would be about 130,000. Continuous supply could well be available after the fault rupture event, or restored very quickly. Water from the western areas could also be fed down into the Wellington CBD when broken connections were repaired.

One of the major factors in selecting a water source is separation from other sources and location as close as possible to the end delivery point

For the long-term resilience of water supply to the 4 metropolitan cities it is vital that a new source must be in a **secure location** with **secure links** to population areas.

Building a facility at Whakatikei meets these fundamental requirements.

The Pakuratahi proposal should be eliminated from all future planning in that it does not provide for any security of supply following a seismic event.

Prepared 3 August 2025

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Date

03/08/25

Your feedback

- *When providing your feedback, please let us know which chapter/recommendation/topic you are responding to.*
- *Alternatively, you may indicate that you are addressing challenges, gaps or opportunities not covered by the draft National Infrastructure Plan.*
- *Please explain, and if possible, provide examples or evidence.*
- *Please also include any proposed change or improvements that would address your feedback.*