

**Before Independent Hearing Commissioners
At Lower Hutt**

Under the Resource Management Act 1991 (the Act)

In the matter of a notice of requirement for a designation by Wellington Water Limited ('WWL') on behalf of Hutt City Council ('HCC'), in accordance with section 168A of the Act, for the construction, operation and maintenance of a water supply reservoir at Summit Road, Fairfield, Lower Hutt.

Statement of evidence of Laurence George Edwards for Wellington Water Limited (Project Strategy)

Dated 14 November 2024



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Contents

| | | |
|----|--|----|
| 1 | Introduction | 2 |
| 2 | Qualifications and experience | 2 |
| 3 | Code of Conduct | 3 |
| 4 | Scope of evidence | 3 |
| 5 | Executive Summary | 3 |
| 6 | Introduction to Wellington Water Limited | 4 |
| 7 | Lower Hutt Central and Taitā Water Storage Areas | 4 |
| 8 | Lower Hutt Central and Taitā Water Storage Areas Limitations | 6 |
| 9 | Project Objectives | 9 |
| 10 | Response to submissions | 12 |
| 11 | Conclusions | 13 |

Statement of Evidence of Laurence George Edwards

1 Introduction

- 1.1 My full name is Laurence George Edwards.
- 1.2 I am the Chief Advisor for Drinking Water at Wellington Water Limited ('**WWL**'). I have been in this position since 2019.
- 1.3 My role includes providing technical expertise and guidance to teams carrying out investigations and capital works, and planning for the drinking water supply network serving the Wellington metropolitan region and South Wairarapa, to develop programmes of work and projects that improve the water supply network.
- 1.4 I have 23 years of experience in the water industry. This has involved drinking water, wastewater and stormwater infrastructure projects from initial investigation to completion, mainly in the Wellington region, but also elsewhere in New Zealand, Australia and the United Kingdom. This includes various reservoir, pumping stations, and pipeline infrastructure projects.
- 1.5 This evidence relates to a notice of requirement ('**NOR**') for a designation issued by Hutt City Council ('**HCC**'), in accordance with section 168A of the Resource Management Act 1991 ('**RMA**'), for the construction, operation and maintenance of the proposed Eastern Hills reservoir adjacent to the existing Naenae Reservoir at Summit Road, Fairfield, Lower Hutt ('**Project**'). In particular, my evidence outlines the reasons for undertaking the Project, and what the Project is intended to achieve.
- 1.6 I am familiar with the area that the Project covers and have been involved with the Project in a technical overview and support role since 2020.
- 1.7 I am authorised to provide evidence on behalf of Wellington Water Limited.

2 Qualifications and experience

- 2.1 I hold a Bachelor of Science (Honours) in Civil Engineering from Napier University in Edinburgh, Scotland. I am a Chartered Professional Engineer, a member of Engineering New Zealand, and am also registered as an International Professional Engineer.

3 Code of Conduct

- 3.1 While the NOR is not before the Environment Court, I have read and am familiar with the Code of Conduct for Expert Witnesses in the current Environment Court Practice Note (2023).
- 3.2 As a Wellington Water employee, I acknowledge that I am not independent. However, I have sought to comply with the Code of Conduct in preparing my evidence (and will do so in giving evidence at the hearing). In particular, unless I state otherwise, this evidence is within my sphere of expertise and I have not omitted to consider material facts known to me that might alter or detract from the opinions I express.
- 3.3 The data, information, facts and assumptions I have considered in forming my opinions are set out in my evidence to follow. The reasons for the opinions expressed are also set out in my evidence to follow.

4 Scope of evidence

- 4.1 My evidence addresses the following:
- a Introduction to Wellington Water Limited;
 - b Lower Hutt Central and Taitā Water Storage Areas ('**WSA**');
 - c Lower Hutt Central and Taitā WSAs Limitations;
 - d Project Objectives; and
 - e Response submissions.

5 Executive Summary

- 5.1 WWL manages drinking water, wastewater, and stormwater services on behalf of six councils in the region, including HCC.
- 5.2 WWL will be responsible for the construction, operation and maintenance of the Eastern Hills reservoir on behalf of HCC, and has been authorised to act as HCC's agent to support the project through the NOR process.¹
- 5.3 The storage reservoirs serving the Lower Hutt Central and Taitā WSA play a number of critical roles including providing direct water supply and setting

¹ See NOR lodgement letter from HCC dated 28 February 2024.

operating pressures within the zone, meeting peak water demand, providing storage for firefighting, providing buffer storage against operational disruptions, providing a sediment capture function, and retaining water following significant seismic events that damage supply and distribution pipelines.

- 5.4 The Lower Hutt Central and Taitā WSAs do not have sufficient capacity to meet the target level of service for current or future demand, nor do the existing reservoirs collectively have the required seismic resilience, though the Taitā reservoir was recently strengthened. As a result, the WSAs currently have weak operational resilience and are vulnerable to disruption following significant seismic events.
- 5.5 The proposed Eastern Hills reservoir will significantly expand local water supply storage serving the WSAs, support continued residential and business growth and community well-being, enhance the operational and disaster resilience of the WSAs, and enhance WWL's ability to undertake necessary network management and maintenance activities with minimal or no disruption to local water supply.

6 Introduction to Wellington Water Limited

- 6.1 WWL is a shared-service council-controlled organisation jointly owned by the Wellington, Hutt, Upper Hutt, and Porirua City Councils, South Wairarapa District Council, and the Greater Wellington Regional Council. WWL manages drinking water, wastewater, and stormwater services on behalf of these six councils.
- 6.2 WWL's purpose is 'Wellington Water exists so that people in the Wellington Region have safe, reliable, compliant, and affordable drinking water, stormwater, and wastewater services.'²
- 6.3 WWL will be responsible for the construction, operation and maintenance of the Eastern Hills Reservoir on behalf of HCC. Financial responsibility for the Project will remain with HCC, with funding provided through the Long Term Plan.

7 Lower Hutt Central and Taitā Water Storage Areas

- 7.1 The Project is located within the Lower Hutt Central WSA. The Lower Hutt Central WSA adjoins the Taitā WSA and serves as an interconnected system³. This network comprises a series of pipes and reservoirs that source their water from both the Waterloo Water Treatment Plant in Lower Hutt.

² Wellington Water Committee Paper – Organisational Capability Plan 2024-26, see https://huttcity.infocouncil.biz/RedirectToDoc.aspx?URL=Open/2024/09/WWC_27092024_AGN_3297_AT.PDF, page 190

³ Notice of Requirement, AEE, Section 2.2.1.

- 7.2 A WSA consists of a network of pipes and reservoirs that supply water to various users such as residents, businesses, and industries. Water Supply Areas (or zones) are typically separated based on operating heads (pressures). The difference between the elevation of the reservoir (and the water level within it) and the properties it serves determines the operating pressure within the WSA.
- 7.3 Potable water storage for the Lower Hutt Central WSA is currently provided by two reservoirs at Naenae (11.3 ML) and Gracefield (5.7 ML), giving a combined total of 17 ML. The Taitā WSA is serviced by a single 5.5 ML reservoir in Taitā which is fed from the Lower Hutt Central WSA. All these reservoirs operate with the same top water level (i.e. the reservoirs have the same maximum elevation of water that is contained within them]). The top water level sets the operating pressure as noted at 7.2 above.
- 7.4 Population projections show growth within the WSAs over time. Cumulatively, and according to available information, the combined Lower Hutt Central and Taitā WSAs had a population of 53,547 in 2021, and projections of 72,481 in 2051, 79,435 in 2071, and 83,007 in 2121.⁴
- 7.5 The WSA's storage reservoirs fulfil a number of critical roles, including:
- a Providing direct water supply and setting operating pressure within the downstream local water distribution network;
 - b Meeting the zone's peak water demand, as the bulk water supply (which includes the treatment plants and large diameter pipelines supplying reservoirs) cannot meet peak demand in the zone without supplementary supply from a local reservoir storage network;
 - c Providing sufficient storage for firefighting;
 - d Providing a storage buffer between the local water distribution network and zone's bulk water supply, thereby reducing the risk of disruption to the operation of treatment plants or pipelines causing loss of supply to customers, and reducing the risk of contaminated water reaching customers before it can be identified and dealt with;
 - e Providing a sedimentation function whereby fine sediments within the water can settle out, for periodic removal when maintenance is carried out on the reservoir; and

⁴ Lower Hutt Central and Taitā Storage Volume Assessment, Connect Water, October 2023, Section 4.1.

- f Retaining water following significant seismic events for emergency supply, through appropriate design and construction of reservoir pipework (inlet, outlet, scour and overflow), and automatic operation of isolation valves (auto-shutoff valves) triggered by ground accelerometers and flowmeters.
- 7.6 Combined, the Lower Hutt Central and Taitā WSAs (and their storage reservoirs) service a large portion of the Hutt Valley, including key critical customers including hospitals, civil defence centres, medical centres and aged care facilities. This makes it essential that the WSAs can cope with business, residential and critical user demand, is reliable, and is resilient or can be repaired quickly following natural disasters.

8 Lower Hutt Central and Taitā WSAs Limitations

- 8.1 Current water storage within the WSAs is well below what is needed to support the efficient and effective operation of the network, and to address the network operational and disaster resilience needs. This results in a number of constraints and limitations. This section of my evidence describes the relevant water storage constraints that affect the zone.

Network operation constraints

- 8.2 Previous investigations found that the total storage capacity of the Naenae and Gracefield reservoirs (Lower Hutt Central WSA) does not meet WWL current level of service requirements, with an existing shortfall of approximately 12 ML⁵. Future population growth⁶ will exacerbate this.
- 8.3 From time-to-time WWL will need to undertake maintenance activities on the existing reservoirs that require them to be isolated from the supply, and during those times there is an elevated risk of loss of supply to customers if there is a disruption to supply to the WSAs from the treatment plants. Taking any of the three reservoirs that serve the WSAs offline currently significantly increases the risk to supply to residents, businesses, and critical community facilities due to the limited operational flexibility provided by current storage levels.
- 8.4 Sufficient water retention times are also important for the reliable provision of safe and healthy drinking water to the community. With the existing reservoirs, the retention times are such that there is an elevated risk that any possible contamination within the bulk supply would not be able to be identified, isolated, and managed before the water reaches consumers. The risk arises due to the

⁵ Notice of Requirement, AEE, page 9.

⁶ Assuming 50th percentile growth based on data from Sense Partners

lag time between when water enters the Bulk Supply and identification of potential contamination. For example, the main indicator test for faecal contamination (*E.coli*) requires around 24 hours for a result to be returned from when a sample is taken.

- 8.5 Nationally and internationally, water design guidelines recommend designing reservoirs on a zone-to-zone basis with future growth considerations. Both nationally and internationally, water quality is an important consideration in reservoir design. Recommended turnover rates generally specify a maximum detention time of 2 days. A shorter turnover time increases the risk that system contamination cannot be contained within the reservoir for appropriate actions to be taken prior to public consumption, as explained in section 8.4. Conversely, a longer turnover time increases the risk in water quality deterioration within the reservoir (stagnation) requiring additional treatment prior to consumption. In my experience, an allowance of around 48 hours at average daily demand is appropriate for new reservoirs.

Operational resilience

- 8.6 Operational resilience is a key requirement for a reliable water supply network. Operational resilience refers to the network's ability to continue operating following a reasonably predictable disruption event. This may be a supply pipe burst, third party damage, contamination event, or mechanical failure at a water treatment plant, for example. During such events, consumers of water within the WSA should not generally notice any interruption to their service.
- 8.7 The existing WSAs have weak operational resilience. The 22.5 million litre storage available in the WSAs currently provides for around 29 hours of water supply following an operational event, at average day demand. This only equates to 17 hours of supply during peak ('**maximum day**') demand times. However, WWL's Target Level of Service ('**TLoS**') is for 48 hours of in-zone storage at average daily demand for operational purposes. As a result, there is currently a significant shortfall between the WSA's existing water storage capacity and the TLoS to support operational resilience. This current shortfall will be exacerbated further by population growth in the zone.

Disaster resilience

- 8.8 Supply into the WSAs is vulnerable to significant disruption due to natural disasters, in particular, significant seismic events. Lower Hutt lies above Pacific and Australian tectonic plate subduction zone interface. The zone is therefore

highly susceptible to seismic events. This risk is exacerbated by sections of the local water supply network being located in areas prone to liquefaction and ground shaking amplification. Consequently, there is a significant risk that seismic activity events will, over time, act to disrupt the supply to consumers, including critical customers. Disaster resilience is therefore a key consideration for the WSAs.

8.9 Reservoir storage is key in this context as it provides secure water storage available for local supply/distribution while damage to the supply and distribution mains is being repaired. Sufficient storage is also needed to support critical customers (i.e. hospitals and emergency operation centres) and their ability to continue operating (subject to reinstatement of local water supply lines) immediately following an event, right through to the restoration and reinstatement of the Bulk Water supply into the local storage network. Reservoir storage is also critical for servicing and supporting people with enough water for survival, and to assist local communities and support services with post-event recovery following a disaster event.

8.10 The amount of water required for disaster resilience is reflected in WWL’s TLoS following a significant and disruptive seismic event. This TLoS is summarised in **Figure 1** below.

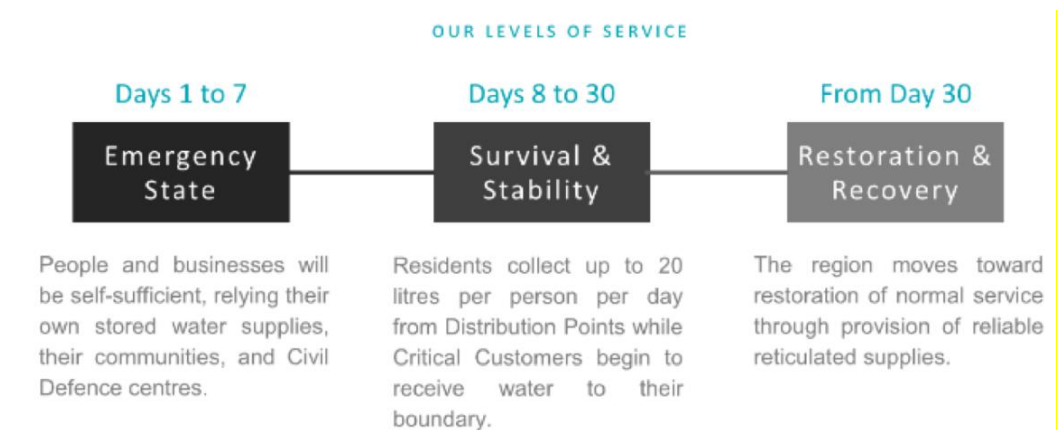


Figure 1: Wellington Water targeted level of service post-earthquake.

8.11 Between days 8 and 30, the TLoS provides:

- a 20 L of water per person per day to residents (via distribution points) from Day 8;
- b Basic water supply to major hospitals and civil defence centres from Day 8;
- c Basic water supply to aged care and medical services from Day 14; and

- d Basic water supply to educational facilities from Day 21.
- 8.12 The TLoS for the Wellington Region, following a significant seismic event, is to provide 80% of users with at least 80% of their water needs within 30 days of a 7.5 magnitude earthquake. For the Lower Hutt Central and Taitā WSAs, the proximity of the Waterloo treatment plant means that this could potentially be reduced to about 15 days⁷.
- 8.13 The combined Lower Hutt Central and Taitā WSAs do not meet this requirement to enable supply of 20 L/person/day to residents from day 8 to at least day 15 after an earthquake, and to reconnect supply to critical users such as hospitals and rest homes.
- 8.14 Recent investigations show that the Gracefield reservoir has structural and condition issues, which means that it has limited remaining useful life⁸. As a consequence, Gracefield reservoir is expected to need replacement within the next 10 years. This will impact the total storage volume in the Lower Hutt Central WSA as 5.7 ML would not be available during construction of the replacement reservoir. Provision of additional storage by the proposed Eastern Hills reservoir is therefore critical to allowing this work to proceed without compromising supply.

9 Project Objectives

- 9.1 Growth projections together with the resilience shortfalls (both operational and disaster hazard related) within the WSAs and the current LOS have driven the Project objectives underpinning the Eastern Hills reservoir project.
- 9.2 This section of my evidence outlines how the project objectives have responded to the current limitations and constraints described in Section 8 of this evidence, and how these have in turn driven the Project's design parameters. The Project Objectives⁹ are:

Objective 1: *To address the current storage shortfall and ensure sufficient storage for future growth in the Lower Hutt Central and Taitā Water Storage Areas (WSA) by:*

- i Ensuring the Lower Hutt Central and Taitā WSAs are operationally resilient by providing sufficient secure, safe and reliable water storage to supply 48 hours of water to residents, businesses and critical water*

⁷ Lower Hutt Central and Taitā Storage Volume Assessment, Connect Water, October 2023, Section 4

⁸ Section 2.2. of the AEE, p 9.

⁹ Notice of Requirement, AEE, Section 2.3

users (including Fire and Emergency NZ) under normal operating conditions, based on projected demand with appropriate consideration of population growth; and

- ii Improving disaster resilience of the Lower Hutt Central and Taitā WSAs by providing a seismically resilient water supply capable of meeting Wellington Water’s target level of service.*

Objective 2: *To deliver a secure, safe and reliable water storage solution that has a 100-year design life.*

Objective 3: *To integrate the chosen solution into the Lower Hutt Central WSA network in a cost-effective manner.*

- 9.3 The interconnected nature of the two WSAs means that a combined approach for addressing the storage deficit is feasible and preferred.
- 9.4 Due to the level of service being driven both by demand and by seismic measures, an increase in storage capacity provided a new reservoir is the optimal solution.
- 9.5 The 15 ML proposed Eastern Hills reservoir and the subsequent replacement of the Gracefield reservoir will meet the current volume shortfall (of approximately 12ML). This will allow WWL to provide reliable service to customers and also accommodate future population growth.
- 9.6 The project requirements were developed so that the project objectives would be met, as follows.
 - a **Objective 1** is met by requiring new storage capacity of 15 ML, and by requiring the reservoir to be designed and constructed to a seismic importance level 4, as is appropriate for structures that are essential to post-disaster recovery¹⁰. This will ensure existing target levels of service are achieved and facilitate further growth in the WSAs. Together with planned replacement of the Gracefield reservoir, it will also provide for growth until at least 2040 and potentially longer depending on the success of demand reduction and water conservation measures and provide sufficient capacity for operational resilience objectives at both average daily and maximum day demand conditions.

¹⁰ Building Regulations 1992, Schedule 1, clause A3.

- b **Objective 2** is met by designing the new reservoir appropriately, including with a 100-year design life.
 - c **Objective 3** is met by setting the top water level to match the top water level of other reservoirs in the WSA, and by requiring the reservoir to be located to service the Lower Hutt Central WSA and receive treated drinking water from the Waterloo Water Treatment Plant. Alternatives to this (i.e. different elevations or locations) would require significant additional costs for network reconfiguration and significantly increase the operational complexity of the WSAs. As water always follows the path of least resistance, construction of reservoirs within the WSAs at other elevations risks water bypassing the higher reservoirs in preference to those at lower elevations, potentially resulting in redundancy of storage capacity.
- 9.7 The new reservoir will provide for future growth, which means that WWL can provide reliable service to the current and future populations of the Hutt Valley. It will increase available stored water by 15ML, improve operational resilience, and improve disaster resilience for critical users and the community following a natural hazard event.¹¹
- 9.8 The proposed Eastern Hills Reservoir will significantly expand local water supply storage for the combined WSAs. The additional storage in this location will:
- a Improve storage capacity to service and support continued residential and business growth and community well-being;
 - b Enhance the operational and disaster resilience of the local water supply network, by improving the WSAs ability to meet local water supply needs in response to disruptions to the bulk water supply;
 - c Support initial survival and subsequent recovery from significant supply disruption events, such as a large earthquake. In this respect it is important to have the storage facility as close as possible to the customers that will rely on it for survival following a natural disaster;
 - d Enhance WWL's ability to be able to undertake necessary network management and maintenance activities (including for example taking other reservoirs offline for maintenance, strengthening, or replacement) with minimal or no disruption to local water supply.

¹¹ Notice of Requirement, AEE, Section 2.2.3

9.9 In achieving the objectives, a number of alternative methods and sites were considered. These are addressed in the evidence of **Mr Paul Carran**. I agree with the summary that **Mr Paul Carran** has provided and confirm that the selected reservoir option and location is preferred for achieving the objectives of the Project.

10 Response to submissions

10.1 I have reviewed the submissions lodged in relation to the notice of requirement for the Project. Where I am able to respond to the matters raised, I do this below.

Submission from J Foster

10.2 J Foster suggests other possible reservoir names and asks why these were not used. He suggests Rau-manakau, Te Mako or Naenae Reservoir No 2. The proposed reservoir was previously called Naenae No. 2. A HCC meeting in early 2023 resulted in the reservoir being renamed the Eastern Hills Reservoir,. The final name of the Reservoir has not been finalised; however, a name proposed by Taranaki Whānui, Waiwerowero, is likely to be applied to the Eastern Hills Reservoir once it has been constructed.

10.3 Mr Foster also suggests that building the proposed reservoir will affect the “planned road from the Upper Fitzherbert Road area of Wainuiomata is planned to come out at Summit Road” and he states the road will have to go elsewhere. I am not aware that there is a planned road between Fitzherbert Road and Summit Road. There have been no resource consents or notices of requirement submitted and granted/confirmed that would mean it formed part of the existing environment, nor is there recognition or acknowledgement of it in Hutt City Council’s Long Term Plan.

Submission from R Parry

10.3 R Parry suggests that construction of a new reservoir should not take priority over fixing leaking pipes. The proposed Eastern Hills Reservoir is only one project that WWL is undertaking. WWL is addressing water shortfalls through a range of other methods as part of a three-pronged regional sustainable water supply strategy to:

- a Keep water in the pipes through increasing investment in water loss reduction
- b Reduce demand and support water loss reduction activities in both the public and private networks through implementing customer metering; and

- c Add additional untreated water storage capacity at the Te Marua treatment plant.
- 10.4 The water loss reduction activities included in a) above include repairing leaking pipes, replacing older pipes, pressure management, and network calming to reduce the impact of hydraulic transients damaging the network.
- 10.5 It is important to note however that implementing this strategy does not remove the requirement for additional treated water storage reservoirs such as is proposed for the Eastern Hills reservoir.

11 Conclusions

- 11.1 The proposed Eastern Hills reservoir will significantly expand local water supply storage serving the WSAs, support continued residential and business growth and community well-being, enhance the operational and disaster resilience of the WSAs, and enhance WWL's ability to undertake network management, maintenance and improvement activities with minimal or no disruption to customers.
- 11.2 In my opinion, this project will provide significant regional benefit as it will help to increase potable water storage volume for the Lower Hutt Central and Taitā Water Storage Areas, where there are currently shortfalls. The Project will also contribute towards the Hutt Valley's water resilience following a significant natural hazard event, which will allow the region to recover more effectively. The Project will improve water supply safety and reliability.

Laurence George Edwards

14 November 2024