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Ōhoka Residential Subdivision Expert Panel Chair

7 October 2026

Attention: Kate Barry-Piceno

Dear Kate

Ohoka FTAA - Water

Introduction

Purpose of the document

1. The purpose of this evidence is to set out my review of the proposed water-supply arrangements for the proposed Ōhoka residential development, from a civil water-infrastructure and production-bore delivery perspective.
2. I have considered the hydrogeological information provided by the applicant only to the extent necessary to assess the implications for bore development, water-supply reliability and infrastructure design. I do not offer independent opinions on regional aquifer properties, groundwater allocation, environmental effects, cumulative drawdown or effects on other groundwater users. Where those matters are material to the decision, or further technical detail is required, evidence from a suitably qualified hydrogeologist should be obtained.
3. Similarly, detailed source-water treatment performance should be confirmed by an appropriately qualified drinking-water treatment specialist once representative raw-water quality data are available.

Documents reviewed

I have referred to the following documents as part of my review:

- Water Supply Strategy by Inovo Projects Ltd; Version 5 - 10/09/2026, Project Code 16013 – File: *Appendix 29 (UPDATED) - Water Supply Strategy – Inovo.pdf*
- Fast Track Application – 535 Mill Road, Ōhoka – Water Supply Assessment of Environmental Effects Rev 6 (25 May 2026) by Pattle Delamore Partners Ltd. Job Reference: C045180002. File: *RC255196 FTAA - 2606 - 1253 WATER SUPPLY STRATEGY CARTER GROUP WAIMAKARIRI LIMITED 531 MILL ROAD OHOKA.pdf*
- PDP Memorandum to Bruce Van Duyn (Carter Group Limited) from Nic Love and Carl Steffens (PDP) dated 10 September 2026 RE: Water Supply – Beca Questions. File: *Appendix 17c SUPPLEMENTARY Water Supply Memo PDP.pdf*
- Plan Set, Rev. A by Inovo (Drawing No 16013-00-RC-1000-6007) – Index Sheet 1000 as Rev B
- Scheme Plans by Inovo (Drawing No 16013-00-RC-1010 – 1017) File: *Appendix 26 (UPDATED) – Scheme Plans – Inovo.pdf*



Key areas discussed in this memo

Key areas discussed in this memo are:

- a. Water Supply Redundancy Required
- b. Unproven Borefield
- c. Bore Construction and Water Quality
- d. Bore sites – location and size
- e. Other supply sources need investigating
- f. Treatment Requirements
- g. Potable Water Storage and Pumping

Qualifications

- 4. I hold a Bachelor of Engineering with First Class Honours (Civil) from the University of Canterbury and am a Chartered Professional Engineer (Civil, Water).
- 5. I am a Chartered Member of Engineering New Zealand and a member of Water New Zealand.
- 6. I have 32 years' water and wastewater engineering experience, with a focus on design, design management, contract management and construction monitoring for three waters infrastructure.
- 7. My experience includes the design of water and wastewater infrastructure, delivering end-to-end outcomes from feasibility and consenting through design, verification, construction support, and project management. I am experienced in water bores, treatment plants, reservoir planning, water and wastewater pump stations, and long-distance water pipelines - with strong constructability-led design review, trenchless methods, and environmental/stakeholder integration. I have recently worked on new bore water supplies for Christchurch City Council (Woolston, Montreal, Grampian) and Clutha District Council (Greenfield scheme including treatment). I also oversaw input Beca's input into the bore head and reservoir security work programme for Christchurch City Council throughout the city.
- 8. I am familiar with the Ōhoka area and the Kaiapoi area including the current water and wastewater systems. I was responsible for the design of the Kaiapoi and Rangiora Water Treatment Plants that the Kaiapoi bores feed into and supply the respective reticulations, that the proposed Ōhoka residential development may connect into. I worked with Waimakariri District Council (WDC) for a period of approximately 8 years from 2011 through to 2019, as the Water and Wastewater Discipline Lead for the Earthquake Infrastructure Recovery. I've recently been overseeing the design of a new water system for a large new development in Christchurch.

Code of Conduct

- 9. I confirm that I have read and agree to comply with the Code of Conduct for Expert Witnesses contained in the Environment Court Practice Note 2023. This evidence has been prepared in accordance with that Code. Except where I identify reliance on another discipline, the opinions I express are within my area of expertise. I have not omitted to consider material facts known to me that might alter or detract from those opinions. Matters outside my expertise are identified and should be addressed by the relevant subject-matter expert if they are material to the decision.

Key Issues

Water Supply Redundancy Required

10. Supply redundancy (i.e. N+1) is an important requirement to ensure a compliant and resilient water supply and should not be deferred until later stages of the development. While it is proposed that Stage 1 will initially be supplied from the existing WDC network while the first new bore is drilled, a single bore arrangement would not provide sufficient redundancy in the event of outage or maintenance. Accordingly, both a duty bore and a standby bore will be required to supply the first stage of the development.
11. Currently, the Ōhoka supply relies on a single primary bore (BW24/0262) that meets sanitary borehead requirements and therefore provides an important treatment barrier in the event of a UV treatment outage.
12. The existing backup bore (M35/5609) is shallow and has nitrate concentrations greater than half the Maximum Acceptable Value (MAV) and is therefore not considered to provide an appropriate or resilient N+1 backup source.
13. The majority of existing houses within Ōhoka are supplied via restrictors into on-site storage tanks, which helps moderate peak demand on the bore supply and reduces the risk associated with short-term interruptions to the network. However, some existing properties operate as semi-on-demand connections and do not rely on on-site storage, meaning the current supply already experiences a degree of direct peak demand.
14. Stage 1 of the proposed development comprises approximately 100 additional on-demand lots, which would greatly increase peak demand and reliance on the existing supply system, beyond what is reasonable.
15. In my opinion, new bores should be developed and commissioned in time to supply Stage 1, so that the development is not reliant on the existing bore supply.
16. It is expected that the new bores will also supply the existing Ohoka community to improve supply resilience for both the new development and the existing network. This should be confirmed.
17. Given that the proposed borefield yield and water quality are unproven, it is recommended that drilling and testing more than one production bore should be carried out for Stage 1. Enough bores should be drilled to demonstrate the ultimate borefield capacity and redundancy, early in the development.

Unproven Borefield

18. PDP uses the existing WDC Ōhoka bore BW24/0262, together with two nearby deep bores of reportedly similar specific capacity, as the principal basis for concluding that a new deep-bore supply can be developed. BW24/0262 has an estimated long-term sustainable yield of about 13 L/s. In my opinion, that data provide a reasonable basis for further investigation but is not a substitute for drilling and testing production bores at the proposed locations.
19. From a water-supply and bore-delivery perspective, the available yield and raw-water quality at the proposed site remains unverified.
20. Any independent opinion on aquifer continuity, groundwater availability or the likelihood of achieving the proposed borefield yield should be provided by a suitably qualified hydrogeologist. There is a significant level of uncertainty regarding the availability and yield of groundwater in this area. The

Council has experienced challenges with securing reliable well water supplies in this locality previously.

21. The proposed borefield remains unproven. In my opinion, the water-supply design, and staging approval should not rely on the proposed Borefield until the applicant has demonstrated, that a reliable and suitable water supply can be achieved. The applicant should confirm both bore yield and raw-water quality through an agreed bore acceptance and testing process, that production bores can provide a reliable yield and suitable raw-water quality. At a minimum, this process should demonstrate:
- a. The sustainable yield of each production bore and the methodology used to establish it and include redundancy and clear requirements for flow, drawdown and water quality. The sustainable yield of each bore should not be less than 13L/s. A lower yield would require an excessive number of bores, meaning higher maintenance costs for the water service provider.
 - b. Pumping-testing (variable and constant rates tests) duration, pumping rates, drawdown, and recovery characteristics.
 - c. The effects of simultaneous operation and hydraulic interference between the new bores and BW24/0262
 - d. Turbidity/TSS and raw-water quality during bore development, pumping testing, commissioning, and sustained pumping operations. The water quality testing attributes and acceptance thresholds should be agreed prior to the bores being constructed.
22. I have not identified a cumulative drawdown assessment for simultaneous operation of the completed borefield. The material reviewed appears to focus mainly on BW24/0262 and interference from individual bores. Once sufficient site-specific aquifer and bore-performance data are available, a suitably qualified hydrogeologist should assess the combined borefield response, including interference with BW24/0262 and provide input to a review of the current pump set depth and selection due to the additional drawdown.

Bore Construction and Water Quality

23. It is reasonable to use BW24/0262 water quality data as an initial working assumption, but the future bore water quality has not yet been demonstrated. Bore acceptance should therefore be based on sampling during development, pumping testing and sustained pumping.
24. The bore acceptance criteria should address both drinking-water compliance and reliable source operation. They should include microbiological parameters, nitrate, relevant metals, pH/conductivity, turbidity/TSS, colour, UV transmittance and other parameters relevant to the proposed treatment process. The criteria should identify the applicable MAVs and aesthetic values, and applicable Drinking Water Quality Assurance Rules (DWQAR) and align with the drinking-water requirements in force when the supply is commissioned. The final parameter suite, sampling programme and treatment implications should be confirmed by appropriately qualified hydrogeological and drinking-water treatment specialists.
25. The proposed raw-water turbidity criterion of 5 NTU still looks high for acceptance of a new production bore intended for UV/chlorine treatment, particularly if filtration is to be avoided. I suggest PDP provides the basis for this value and includes a specific TSS criterion (including start-up) performance

requirement. Any numerical criterion should relate directly to UV performance, treatment and operational requirements.

- 26. Run-to-waste also needs to be worked through, including likely start-up flows, where the water goes and how sediment would be managed.
- 27. The proposed bore diameter range is 200–300 mm. I favour the higher end of this range where practicable because it gives more flexibility for screen and pump selection, bore development and future redevelopment.
- 28. The proposed bores are required to meet the sanitary bore head requirements for both construction and operational aspects. Compliance with these requirements should be specifically referenced against the relevant DWQAR rules.

Bore sites – location and size

- 29. The revised information (Appendix 26 – Scheme Plans) shows indicative bore sites of approximately 100 m², which PDP considers sufficient to establish, access and maintain the bores. I am not convinced that is enough without looking at the actual drilling and maintenance requirements. Construction of a production-bore drilling needs more room than the completed permanent bore head, sufficient for the drilling rig, crange, drilling-fluid management, pump installation/removal and safe vehicle movements.
- 30. As a minimum, a bore site area of approximately 20 m by 20 m per bore, similar to the size of the existing bore site, should be provided and confirmed with the drilling contractor and against WDC requirements, rather than assuming that 100 m² is sufficient.
- 31. I don't recommend putting production bores immediately beside residential lots. Future drilling or redevelopment can involve considerable noise including heavy vehicles and rig activity. That is harder to manage next to houses and may make access for routine maintenance or future bore pump replacement difficult. Reasonable separation should be retained, without relying on neighbouring residential land for access. The new bore sites should be integrated with other utility sites (e.g. reserves or stormwater management areas).
- 32. The permanent bore sites will also need appropriate site security i.e. security fencing and gates. Fencing and access control should suit public drinking-water infrastructure and sanitary bore-head requirements and may not suit a residential environment.

Other Supply Sources Need Investigating

- 33. PDP identifies both Rangiora and Kaiapoi as technically credible alternatives and notes a possible connection to the 500 mm diameter Lineside Road main about 6.1 km from the development. However, it is noted that WDC has indicated there is no spare bore capacity within the Kaiapoi or Rangiora water supply schemes and, therefore, at least one new bore would be required if connecting to these schemes.
- 34. WDC has also advised that there is insufficient capacity within the existing Rangiora or Kaiapoi reticulation network to service the development, meaning new transmission mains would be required from any new bore or existing treatment plant infrastructure.
- 35. The assessment for the connection to Rangiora or Kaiapoi infrastructure is still high level and does not include sufficient engineering detail relating to the possible connection.

36. I think the comparison needs to go further to determine the most suitable source. The onsite option will require approx. 5 new production bores whose yield and water quality are not yet known. The off-site option uses established deep artesian bores. A useful comparison would cover source yield and reliability, source-water quality and treatment, bore numbers and redundancy, trunk main requirements, pumping, storage, staging and operational implications. Capital and operating costs would also help the wider options assessment.
37. The Rangiora arrangement is relevant because the Lineside Road main brings water from the Kaiapoi deep artesian source to Rangiora. If the earlier WDC/PDP source assessment is available, it would be useful to check whether low local bore yields, the need for multiple bores and/or water-quality issues were factors in adopting that arrangement. If they were, that is directly relevant context for assessing the same risks at Ōhoka.

Treatment Requirements

38. The developer proposes UV treatment and chlorination. Whether that process is sufficient will depend on the raw-water quality demonstrated by the new bores and the requirements applying when the supply is commissioned. For example, UV and chlorination would not address elevated nitrate, and filtration or other treatment may be required if turbidity or other source-water characteristics affect reliable operation. In my opinion, consent should not be granted until the applicant has confirmed the source water quality and demonstrated that a practicable, appropriate and compliant treatment process can achieve the required drinking-water outcomes before the final water-supply design is relied on. Detailed treatment selection and performance should be confirmed by an appropriately qualified drinking-water treatment specialist.
39. The type of chlorine treatment is not stipulated but it would need to be compatible with what is used in other nearby plants in the district that are of a similar size.
40. The treatment plant building and pipework will need to be sized for the ultimate flow ie to house treatment equipment needed to service the entire development. However, it may be acceptable to leave a gap for increasing the treatment capacity when required in the future (eg initially 1 duty and 1 standby UV reactor but space allowed for a 2nd duty UV reactor when required in the future).
41. It is expected that fluoride dosing will be required by Taumata Arowai in the near future. The new treatment building should include space for dosing fluoride – this has also been a requirement on treatment plants installed in Kaiapoi and Rangiora recently.
42. The treatment plans and pump station site will need to be adequately secured ie security fencing and gates. Fencing and access control should suit public drinking-water infrastructure and sanitary requirements and may not suit a residential environment. Adequate room will be required on the treatment site so that service vehicles can be parked on site with the gates closed to keep the public out. Currently no information is given on the proposed location and size of the water treatment plant (WTP). The existing Ōhoka WTP site is too small to accommodate the higher flows required for the proposed development. However, it may be possible to construct a new WTP adjacent to the existing facility to enable integration of the two systems.

Potable Water Storage and Pump Station Capacity

43. There is currently insufficient information regarding the proposed potable water storage volumes and the staging of this infrastructure. The water storage will need to provide for operational storage, firefighting storage, and emergency storage requirements. An assessment of the required firefighting

storage volume can and should be undertaken at this stage, noting that this will depend on the floor area of buildings within the retirement village and commercial areas, and whether sprinkler systems are proposed.

- 44. The pump station will need to be designed to accommodate the peak hourly flow required under the Waimakariri Engineering Code of Practice (CoP) (Clause 7.5.3). In addition, the operational storage volume within the reservoirs will need to account for the difference between peak hourly demand and daily demand (ie diurnal variation), in addition to providing the required emergency and firefighting storage volumes. Any future upgrades to the bores, treatment plant, storage, or pump stations would need to allow for the actual demand generated during the initial stages of development.
- 45. A comparison was made between the CoP design requirements and the demand assumptions provided by the developer. The developer has provided average daily and peak daily demand figures but has not provided peak hourly demand figures as required under CoP Section 7.5.3. The peak hourly demands are required to confirm the appropriate sizing of the water infrastructure. As the infrastructure sizing assessment currently appears to be based on daily demand assumptions only, there is a risk that it may be undersized.
- 46. The CoP peak-hour requirement per dwelling is 0.10 L/s (Section 7.5.3). The developer's quoted demands are summarised below:
 - a. Small lots:
 - i. Average demand: 1,000 L/day (approx. 0.012 L/s)
 - ii. Peak day demand: 2,500 L/day (approx. 0.029 L/s)
 - iii. Based on these number CoP peak hour / developer peak day ratio = 3.4
 - b. Large lots:
 - i. Average demand: 1,165 L/day (approx. 0.014 L/s)
 - ii. Peak day demand: 3,810 L/day (approx. 0.044 L/s)
 - iii. Based on these numbers CoP peak hour / developer peak day ratio = 2.3
- 47. For clarity, our understanding is that all lots within the proposed development will be provided with on-demand water connections as required by Council (i.e. not restricted connections) and assuming the CoP peak-hour requirement per dwelling of 0.10 L/s.
- 48. Staging of the storage is also important. While 2 tanks would seem reasonable for the full development, allowing one to be taken offline for maintenance, it would be unreasonable, in my view, to install more than two tanks for the full development – this would just create a maintenance issue for Council or the overseeing water business. A single tank installed immediately and then another tank later, when the number of lots increases, would be reasonable. A turnover of not more than 4 days will also be important for the water quality – a connection with the existing Ohoka township will be important to facilitate this.
- 49. The water storage tank material is an important consideration that should be agreed now. Concrete or welded stainless steel are the only suitable materials for a 100 year life expectancy with low

maintenance. This is my recommendation for the storage tank material. Bolted steel or bladder type tanks should not be acceptable due to their high maintenance requirements.

- 50. No information was available on the pump station that will draw potable water from the new tanks and deliver it into the reticulation. The pumps will need to be housed in a new building that provides sufficient noise reduction to prevent any disturbance to nearby residents – the expected noise level will need to be proved prior to construction. The switchboard and controls will need to be housed in a separate room to protect them from potential water damage. The delivery pumps will need to target a downstream pressure using variable speed drives. Low flows will need to be accommodated via a small jockey pump and/or a pressure tank. Fire pumps will be required to deliver the fire flow to hydrants. A permanent genset will be required for the pump station to ensure that the fire pumps can operate in a power outage.
- 51. The pump station building and pipework will need to be sized for the ultimate flow ie to house all pumps needed to service the entire development. However, it may be acceptable to leave a gap for increasing the pumping capacity when required in the future (eg initially 1 duty and 1 standby pump but space allowed for a 2nd duty pump when required in the future).
- 52. The bores, treatment, storage and pumping facilities will need to be sized for the actual demand from the development and not the estimated demand provided.
- 53. We note that the pipe diameters shown on watermain drawings 6013-00-RC-6000 – 6007 are incorrect and will be amended at a later time, prior to Engineering Acceptance. Furthermore, no information is provided on the pipework from the bores through to the treatment plant site. Monitoring stations will be required in the reticulation for continuous monitoring of, as a minimum, pH, FAC, pressure, turbidity and sampling bollards provided.
- 54. Based on the Water Supply Bore Indicative Locations Plan provided in Appendix B of the Inovo evidence (Appendix 29), the proposed reticulation layout appears to comprise four sub-zones connected by a single pipeline. While detailed design is yet to be completed, this arrangement would not be considered acceptable, and a ring-fenced reticulation system in accordance with WDC’s ECOP requirements would be required.

Information Gaps / Clarification Required

- 55. Information gaps and clarifications are as follows:
 - a. Clarify Confirmation of Stage 1 supply arrangements: Confirmation that the first two production bores will be drilled, tested, commissioned and operational before Stage 1 connections occur.
 - b. Borefield capacity and yield:
 - i. Demonstration of the sustainable yield of the proposed borefield based on site-specific testing rather than reliance on nearby bore data.
 - ii. A cumulative drawdown assessment for simultaneous bore operation.
 - iii. Assessment of interference effects between proposed bores and BW24/0262.
 - iv. Clarification of bore acceptance criteria and testing methodology.

- c. Bore testing framework:
 - i. Minimum acceptable sustainable yield per bore.
 - ii. Required pump-test duration and pumping rates.
 - iii. Raw-water quality criteria during development and sustained pumping.
- d. Water quality and treatment:
 - i. Confirmation that the installed treatment plant will achieve compliance with Taumata Arowai requirements at the time of commissioning.
 - ii. Clarification of chlorine type and compatibility with other WDC systems.
 - iii. Allowance for future fluoride dosing requirements.
 - iv. Confirmation that treatment buildings and pipework are sized for ultimate development demand.
- e. Bore and treatment site requirements:
 - i. Confirmation that the proposed bore site areas will be large enough for drilling, maintenance and future redevelopment activities.
 - ii. Information on proposed run-to-waste system. Where will water go?
 - iii. Clarification of separation distances from residential lots.
 - iv. Confirmation of security and fencing requirements around boreheads
 - v. Confirmation that sufficient operational space is available for treatment, storage and pump station facilities. Provide a site plan.
 - vi. Confirmation that the proposed bores will meet the sanitary bore head requirements for both construction and operational aspects; specifically referencing DWQAR rules.
- f. Alternative supply assessment:
 - i. A more detailed comparison between the onsite borefield option and the Rangiora/Kaiapoi supply option including lifecycle costs.
 - ii. Clarification of why the Lineside Road/Kaiapoi source option was not preferred.
- g. Storage requirements:
 - i. Confirmation of required storage volume to be provided
 - ii. Firefighting storage assessment
 - iii. Clarification of staging and timing of tank construction.
 - iv. Confirmation of tank turnover

- v. Proposed tank material and design life.
- h. Pump station design:
 - i. Confirmation of duty/standby arrangements and redundancy.
 - ii. Clarification of fire-flow pumping arrangements.
 - iii. Confirmation that a noise assessment will be undertaken to consider nearby residents
 - iv. Confirmation that the constructed pump station will accommodate ultimate demand.
 - v. Clarification of pressure control methodology and low-flow management.
- i. Demand assumptions and CoP compliance:
 - i. Confirmation that all infrastructure sizing will be based on CoP peak-hour flows rather than average or peak-day demands.

Areas of Agreement

- 56. It is agreed that deep bores may be a suitable method of supplying water to the development
- 57. It is agreed that a new treatment plant, reservoir and pump station will be required for the new development and that connecting to the existing Ohoka reticulation will be beneficial for both the new development and the existing township.
- 58. It is agreed that separate utility lots are required for the new bores, however they need to be large enough for future maintenance and far enough away from residence that future operations (eg redevelopment of the bore) will not disturb the nearby residence.

Recommendations / Conditions

- 59. I recommend that consent conditions are included to address the following items:
 - a. At least two new production bores will be drilled, tested, commissioned and demonstrated to meet agreed yield and water-quality acceptance criteria prior to new houses being supplied in the development. Following this redundancy requirements (N+1) will be provided as the development grows.
 - b. A minimum number of two production bores shall be drilled and tested prior to Stage 1 coming on-line to demonstrate adequate long-term borefield capacity, redundancy and resilience for both the development and existing Ōhoka supply.
 - c. Bore acceptance testing shall include minimum sustainable yield, pump testing, drawdown/recovery assessment, cumulative interference assessment, and raw-water quality testing during start up and sustained pumping.
 - d. The consent holder shall demonstrate that the borefield can achieve the required demand in accordance with the Waimakariri CoP, including firefighting and emergency storage requirements.

- e. Final treatment processes shall be confirmed following bore water-quality testing and shall comply with all applicable Taumata Arowai requirements and Drinking Water Standards in force at the time of commissioning.
- f. Provision shall be made within the treatment plant layout for the ultimate demand and allow for future fluoride dosing.
- g. Storage volumes for operational, firefighting and emergency purposes to be approved and staged appropriately with development growth.
- h. Reservoirs, treatment facilities and pump stations shall be designed for the ultimate capacity, with staged equipment installation permitted where appropriate.
- i. Water storage tanks shall be constructed from concrete or welded stainless steel for durability.
- j. Bore, treatment and pump station sites shall provide sufficient area for drilling, maintenance, operational access, security fencing and future redevelopment activities.
- k. Noise from pump stations and treatment facilities shall comply with applicable district plan limits and be demonstrated through detailed design.
- l. Prior to detailed design approval, the consent holder shall provide a comparative assessment of onsite and offsite water supply options, including reliability, resilience, treatment requirements, lifecycle costs and operational implications.
- m. Actual water demand data from initial development stages shall be reviewed periodically, so infrastructure upgrades are correctly staged.
- n. All water supply connections within the development shall be provided as on-demand connections. Connections utilising restrictors shall not be permitted. The water supply system shall be designed to achieve the WDC target level of service of pressures greater than 300 kPa for 95% of the time and greater than 250 kPa at all times.
- o. Consideration is being given to sourcing the development's water supply from Kaiapoi.

Overall Position / Conclusions

- 60. A deep-groundwater supply may be technically feasible, but the proposed production bores have not been drilled and tested. Their sustainable yield, combined performance, operational performance and raw-water quality remain unverified.
- 61. The development should not rely on the existing Ōhoka supply for Stage 1. New production bores should be proven and commissioned with appropriate N+1 redundancy before new connections are supplied. The role of the new bores in improving resilience for the existing Ōhoka community should also be confirmed.
- 62. Bore acceptance criteria should be agreed before construction and address sustainable yield, pumping-test performance, bore interference, drawdown, recovery and raw-water quality during development and sustained operation. Run-to-waste arrangements and the implications for the existing bore pump should also be resolved.

- 63. The proposed treatment process cannot be confirmed until representative raw-water quality data are available. The treatment plant should allow for the ultimate demand, compatible chlorination, any required filtration or nitrate treatment, and future fluoride dosing.
- 64. Storage, pumping and reticulation have not been sufficiently developed. The design should demonstrate compliance with WDC Code of Practice peak-hour demand, firefighting, emergency storage, pressure and redundancy requirements. Infrastructure sizing should not be reduced based on residential lot size where all lots will have on-demand connections.
- 65. Storage staging, turnover and tank materials require confirmation. The pump station design should also address ultimate capacity, duty/standby and fire pumping, low-flow operation, emergency power, controls, noise and future expansion.
- 66. The proposed bore, treatment, storage and pump-station sites have not been shown to be adequately sized or located. They must provide sufficient space for construction, secure operational access, service vehicles, maintenance and future redevelopment, with appropriate separation from residential properties.
- 67. The proposed watermain layout remains incomplete, including pipework between the bores and treatment plant, final reticulation sizing, ringmains and provision for operational monitoring and sampling.
- 68. The onsite borefield should be more fully compared with the Rangiora and Kaiapoi supply alternatives, including source reliability, treatment, transmission infrastructure, staging, operational implications and lifecycle cost, before the preferred long-term supply is confirmed.
- 69. My conclusions are limited to civil water infrastructure and production-bore delivery. Specialist evidence is required on groundwater availability, cumulative drawdown and interference effects, effects on other groundwater users, and detailed treatment performance where these matters are material.

Yours sincerely



Paul Reed

Principal - Civil Engineering

on behalf of

Beca Limited

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