Dannevirke Impounded Water Supply

Assessment of options

August 2024

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Dannevirke Impounded Water Supply

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Tararua District Council

Quality Assurance Statement

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Executive Summary

Background

Dannevirke's water supply is faced with issues regarding its safety and resilience following detection of a leak from the impounded water storage reservoir (covered dam) in 2021. Temporary repairs have been undertaken and the dam is being monitored for leakage while being operated at a reduced water level. However, there is a limit to how much the water level can be lowered without disrupting the dam's functionality. This situation raises concerns about whether Dannevirke's water supply can meet demand.

Investigations to date have highlighted the condition of the dam and recommended mitigation or remediation options proposed, and separate technical reports have looked at other aspects of the scheme including the water source and water treatment plant. However, TDC does not currently have a full understanding of the potential investment options, including alternatives to the impounded supply altogether. This risks committing to an investment path from which they cannot retreat and has significant uncertainty for cost and scope at this time.

Purpose

Take a strategic approach to:

- Identify and assess a range of viable options for investment in Dannevirke's water supply source, treatment, storage (including the impounded dam), and network reticulation.
- Enable an informed decision on the way forward that represents the best course of action to address current and long-term issues with Dannevirke's water supply.

Recommendation

Council reports and the 2024-34 LTP consultation document budget have so far been based on partial or full remediation of the impounded supply, as well as improvement to the water source, water treatment plant, and treated water reservoirs that are needed to reliably provide drinking water while the dam is drained, and repair work undertaken.

Tonkin & Taylor's July 2024 report suggests critical remediation works on the impounded supply could be at least $8.65m, with the added cost of other upgrades included in the LTP to enable these works the figure rises to $15.7-$18.7m, with a high degree of uncertainty remaining. It is worth noting that some of the improvements needed to guarantee supply during impounded supply repairs are not temporary in nature, e.g. water treatment plant upgrades.

At this level of investment alternative options warrant immediate investigation, particularly the cost of decommissioning the impounded supply altogether and instead investing in improved water source, treatment processes, and storage that can reliably provide compliant drinking water during low flow and high turbidity events, without the need for a large raw water reservoir. Options may include:

- Supplement the Tamaki River take with an additional bore source.
- Abstract water from the Manawatu River, either as supplementary to the Tamaki River take or to wholly replace it.
- Pipeline from Woodville to Dannevirke, with a shared water treatment plant and water source(s) (this is considered a very high ambition option at present).

Doing so will allow Council to more effectively compare the cost of these two different investment pathways (remediate / decommission), and to consult with the community on the preferred way forward.

1 Introduction

1.1 Why is Tararua District Council undertaking this work?

Dannevirke's water supply is faced with issues regarding its safety and resilience following detection of a leak from the impounded water storage reservoir (covered dam) in 2021. Temporary repairs have been undertaken and the dam is being monitored for leakage while being operated at a reduced water level. However, there is a limit to how much the water level can be lowered without disrupting the dam's functionality. This situation has raised concerns about the overall capacity of Dannevirke's water supply to meet demand.

Tararua District Council's (TDC) decision-making process regarding a long-term solution has been challenging due to the lack of comprehensive information and a structured approach. Several technical experts have advised on the condition of the dam and recommended mitigation or remediation options.

While these reviews have highlighted key issues, they have not provided TDC with surety on the best course of action for the scheme, rather they have focused on the issue of the impounded supply without in-depth assessment of alternate options for Dannevirke.

Further, the possibility that the impounded supply could deteriorate rapidly and require emergency intervention at any time risks committing TDC to an investment path from which they cannot retreat and has significant uncertainty for cost and scope at this time.

It is hoped a strategic view of other potential options, including alternatives to the impounded supply, and without a full understanding of the potential costs and benefits in the context of the wider scheme source, treatment, storage, and distribution will mitigate this risk and provide greater confidence in decision making.

1.2 What are the objectives?

The purpose of this document is to:

- Describe the key issues and opportunities that could be addressed through future investment in Dannevirke's water supply.
- Identify and assess a range of viable options for investment in Dannevirke's water supply source, treatment, storage (including the impounded dam), and network reticulation.
- Enable an informed decision on the way forward that represents the best course of action to address current and long-term issues with Dannevirke's water supply.

2 Dannevirke's Water Supply

Raw water for the Dannevirke water supply is extracted via an infiltration gallery from the Tamaki River and gravitates to the impounded water storage reservoir (covered dam) adjacent to Laws Road. Water is treated at the plant located on-site beside the dam before being pumped to a treated water reservoir to the west of town.

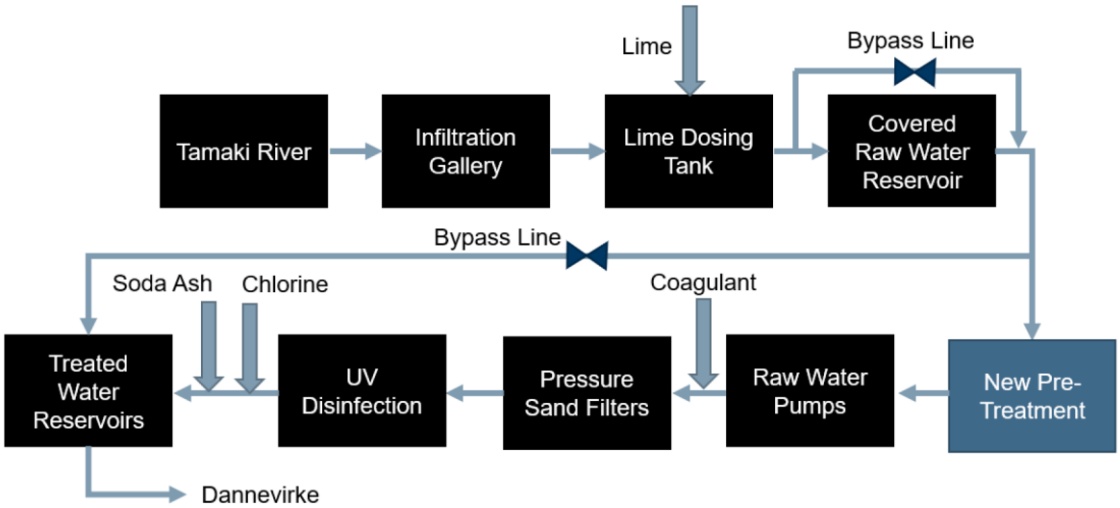

Figure 1: Dannevirke water supply schematic (GHD, 2024)

Treated water is supplied via dual trunk mains to the west of Dannevirke at Adelaide Road (which forms the western boundary of the new residential and rural residential growth areas). Each trunk main supplies a different pressure zone. The lower section is fed by gravity. The upper section is fed from a single booster pump to provide sufficient pressure to the northeastern part of the town.

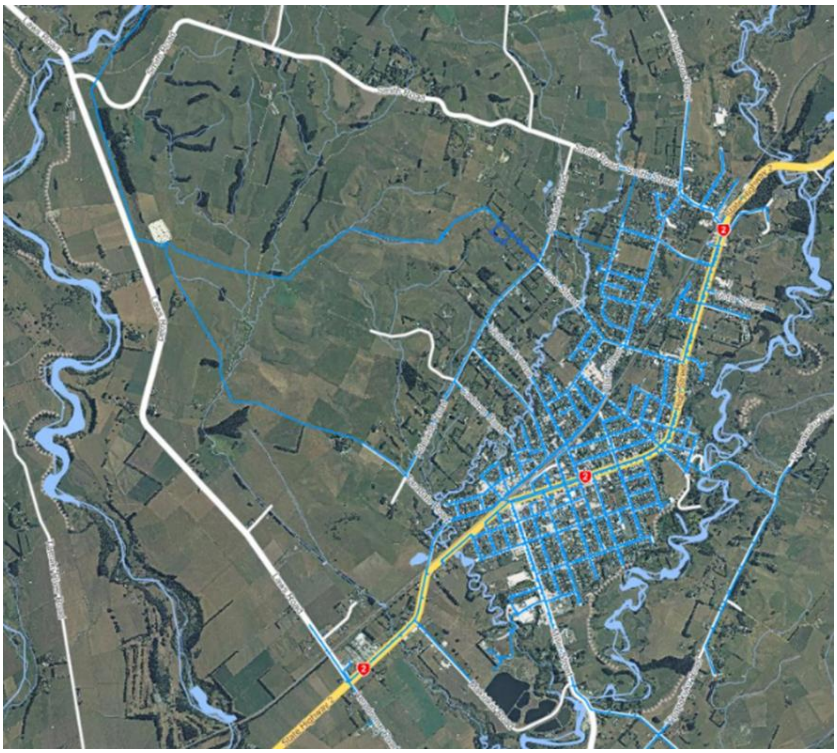

Figure 2: Dannevirke water supply overview (TDC GIS, 2024)

3 Impounded raw water storage reservoir (dam)

3.1 History

The Dannevirke water supply dam, owned and operated by TDC, serves as a community water supply and is particularly critical when direct supply from the Tamaki River is limited due to naturally low or turbid stream flows. This is a core aspect of TDC's resource consent (No. 104947) to take surface water from the Tamaki River, with the consented take at low river flows (<238L/s) reducing from 6,048m^3/day prior to dam construction to 4,677m^3/day after dam construction.

The reservoir is located on a natural terrace and is mostly formed by excavation into natural clay materials, though sections of the reservoir rim are formed by earth-fill bunds, the largest of which is the eastern fill embankment.

The reservoir is filled by raw water piped from the Tamaki River, its full supply depth is approximately 12m and full supply volume is approximately 120,000m^3. The reservoir is topped by a floating geomembrane cover, while the inside faces and floor are lined with HDPE overlying 300mm of compacted clay. Underneath a network of subsoil drains were installed to prevent uplift pressures on the liner from natural groundwater seepage.[1]

3.2 Leak detection and response

In 2021 a leak was detected in the impounded supply liner, and remotely operated underwater vehicle inspections found the liner was 'shredded' near the inlet and there were depressions under the liner.

Repairs to the liner were undertaken in 2021, however an elevated level of water loss continued. Further temporary repairs were undertaken in 2023, since then sub soil drainage flows have slowed, but not stopped, and some further minor degradation in the sub soil drains have been detected. In addition to the temporary repairs and dam safety monitoring, the impounded supply is being operated at a maximum of 9 metres (below maximum 12 metre depth) to reduce the risk of deterioration and safety consequences of a failure.

While the impounded supply continues to deteriorate, imminent failure is considered less likely after these actions.[2]

3.3 Consequence of failure

If the impounded supply fails or is required to be dewatered, Dannevirke will be solely reliant on water drawn from the Tamaki River with no buffer. This includes during periods of high turbidity when the treatment plant cannot produce compliant drinking water, and during periods of low flow when Council's water abstraction limit may be insufficient to meet demand. A failure of the embankment also presents a potential risk to people and property.

In summary, the current state of the dam and the water supply system poses a risk to the community's access to a reliable and safe water source.

3.4 Council recommendations

Several recommendations have been made to Council, most recently at the 31 May 2023 and 26 October 2023 Council Meetings. At the October meeting it was recommended that the Council delay the decision to commence remedial works until design work, geotechnical investigation, and liner system confirmation is complete. It was also recommended Council approve $3,200,000 to purchase a pre-treatment plant, $400,000 to purchase raw water Kliptanks, and $2,500,000 to purchase a 6,000m^3 treated water storage tank.

[1] Tonkin & Taylor (2022) Dannevirke Water Supply Reservoir – Preliminary dam safety advice on abnormal seepage.
[2] Tararua District Council (2023) Council Report – Dannevirke Impounded Supply Request for Funding, 26 October 2023 Meeting

3.5 Long Term Plan 2024-34

Council staff developed three options as part of the LTP budget setting, the LTP consultation document has budgeted $5.6m for the impounded supply in Years 1-2.

Table 1: LTP option estimates

	Option 1 Supplementary bore with new treated water storage	Option 2 Water Treatment Plant upgrade to treat turbid water	Option 3 Supplementary bore with Water Treatment Plan upgrade
Water source	$3,000,000	-	$2,000,000
Impounded supply	$1,100,000	$2,150,000	$2,900,000
Raw water storage	-	$500,000	-
Water treatment plant	-	$4,250,000	$3,500,000
Treated water storage	$2,800,000	-	-
TOTAL	**$6,900,000**	**$6,900,000**	**$8,400,000**

3.6 Tonkin & Taylor July 2024 investigations

Tonkin & Taylor subsequently carried out the investigations recommended to Council on 26 October 2023 and reported back to Council officers in July 2024. The report focused on recommendations and concept design for:

1. **Remedial works needed to address critical risks - RECOMMENDED**

   Tonkin & Taylor recommends these components are included as a minimum in any remedial works. They provide a step change reduction in the level of risk of a dam safety incident, emergency, or failure occurring. The recommendation predominantly relates to:

   a. Replacement of subsoil drainage bedding with filter compatible material.

   b. Reinstatement of the subgrade to support a new liner system.

   c. Replacement of the existing HDPE and LPF liner with a new liner system.

   The P50 estimate for these works are $8.0m - $9.3m, though there is considerable uncertainty about the extent of work required until the reservoir is dewatered, and the cost range (-30% to +100%) is $6.0m - $17.2m.

2. **Remedial options to address remaining lower risks – OPTIONAL AT PRESENT**

   Some residual risk of internal erosion and seismic risk remains following the remedial works above, Tonkin & Taylor identify potential remedial works to address these risks, though further investigation and evidence is needed to confirm the benefit of these. The most promising options include:

   a. Upstream filter blanket (P50 est. $0.7m - $0.8m).

   b. Drainage and stability berm (P50 est. $2.8m - $3.2m).

   c. Full rebuild of the easter dam embankment (P50 est. $12.2m - $14.3m).

   Tonkin & Taylor recommend these options are deferred until after the subsoil, subgrade, and liner works, but to assess the benefit of the upstream filter blanket further during detailed design, and if confirmed as beneficial, install this blanket at the same time.

   In the meantime, Council should mitigate the unresolved risks by surveillance and emergency preparedness.

It is important to note that both options require dewatering the impounded supply causing Dannevirke to be reliant on the Tamaki River source for the duration of the outage. So, a solution is needed to ensure sufficient water is supplied to meet peak demand during low flow and/or high turbidity events, which is something that is not achievable under the current water take consent and with the existing treatment process.

To date, TDC have focused primarily on supplementary source water via a new bore nearby the treatment plant, and an upgrade to the water treatment plant to improve source water quality to mitigate these risks while the impounded supply is dewatered. If these improvements are needed, TDC should consider if there is opportunity to install more permanent upgrades that might negate the need for the impounded supply altogether with the goal of reducing long-term asset and financial risk.

There are many unknowns about potential supplementary / alternative water sources, and current estimates are very indicative, creating significant uncertainty. In contrast, while the costs may be high, the impounded supply is a more familiar and better understood problem and has been subject to more robust investigation.

In summary, TDC is challenged to make a confident decision, especially for any option that proposes decommissioning the impounded supply and establishing an alternative solution for Dannevirke.

4 Longlist options

4.1 Longlist development

A wide range of options were developed following a review of technical and strategic reports previously delivered to Council, and engagement with Council staff at a workshop held 11 July 2024. The longlist identified potential options for investment across: Water supply source(s), Raw water storage, Water treatment plant, Treated water storage, and Network and demand management.

4.2 Longlist assessment

Rationale's longlist assessment tool supported an initial screening of these options and alternatives. It is designed to quickly and robustly rule out options that do not achieve the investment objectives, service requirements, or demonstrate value for money. The criteria for the longlist assessment were:

1. Investment Objectives:
    a. Improved reliability and resilience of source water (30% weight).
    b. Safe drinking water meets statutory requirements (40% weight).
    c. Meeting current and future levels of service and managing demand (20% weight).
    d. Fit-for-purpose infrastructure delivering public value for money (10% weight).
2. Critical Success Factors – as these are crucial (not desirable) any options that score a 'no' are automatically discounted from further analysis:
    a. Strategic fit and business needs: political acceptability, Local Water Done Well, optimal performance of existing assets, demand management and reduction.
    b. Potential value for money: right solution, right time, at the right price.
    c. Supplier capacity and capability: is it a sustainable arrangement (internal)?
    d. Potential affordability: is it financially sustainable?
    e. Potential achievability: consent-ability, community support, land access / availability.

4.2.1 WATER SUPPLY SOURCE(S)

Option 1a	Option 1b	Option 1c	Option 1d	Option 1e
Tamaki River Status quo	**Tamaki River (new)** Downstream of the current Tamaki River intake	**Laws Road Bore** West of WTP adjacent to Tamaki River	**Alliance Meatworks Bore** Northern end of Carlson Road adjacent to Mangatera Stream	**Tributary Bore Source** 2-3km away form WTP and adjacent to a tributary of the Tamaki River
Continue with current water take. Abstraction limits are tied to river flows, so cannot reliably meet demand during low flow & peak demand. WTP is unable to treat source water during periods of high turbidity. Impounded supply is therefore needed to ensure sufficient quantity and quality of drinking water. Recommended to be retained.	Surface water take downstream of existing intake. This is the best-known local source of all identified / explored. Has potential to supplement Tamaki River source to meet current demand, but still has variable quantity and quality as for the existing take. Likely to be difficult to consent and subject to flow restrictions, so does not solve peak demand issue. Requires land access / acquisition. Not recommended.	New bore field adjacent to Tamaki River near Laws Roads. There has been multiple investigative surveys finding a potentially productive source. The impact of these bores on the main Tamaki River is not clear, so it may be impacted by existing low flow restrictions. Recommended for further consideration.	Investigations for a new bore field in this area have found it is unlikely the required flow rates could be produced due to poor aquifer development at the site. Not considered worth exploring further. Not recommended.	Initial desktop investigations suggest a new bore field adjacent to a tributary to the Tamaki River has potential to be a reliable source. As this is not on the main river it would not be subject to the same flow restrictions at the current Tamaki River intake. Requires land access / acquisition. Recommended for further consideration.
Preferred	**Discount**	**Preferred**	**Discount**	**Possible**

Option 1f	Option 1g	Option 1h	Option 1i	Option 1j
Mangatera Stream Bore 3km away from WTP, borders north side of township at Mangatera Stream	**Alternative Bore** Location yet to be determined	**Mangatera River** East of Dannevirke township	**Manawatū River** East of Dannevirke township	**Woodville Pipeline** Connect Dannevirke to Woodville via pipeline with shared source(s)
Bore field adjacent to the Mangatera River has potential to provide a reliable quantity of water to supplement the existing take. However potential for poorer quality water than the current source, and quality is expected to degrade. Not recommended.	Continue investigations to locate a yet unidentified and reliable bore source. Investigations have been widespread to date, while there is potential for a site not yet considered the cost to continue looking is likely to be substantial. There are other more viable options already identified.	Mangatera River surface water take. Unknown volume and potentially poorer quality than current source, quality is forecast to degrade. May be options to abstract via public land, else land access / acquisition required. Not recommended.	Manawatū River is likely able to meet capacity, and most reliable water body in the region for volume. Potential to be controversial for consenting. Source water may require extensive treatment. Recommended for further consideration.	A connection to Woodville would consolidate the two towns to a single WTP reducing long-term operating costs. Survey investigations needed. Substantial capex for pipe, pump, and WTP upgrade. Recommended for further consideration.
Discount	**Discount**	**Discount**	**Preferred**	**Possible**

4.2.2 RAW WATER STORAGE

Option 2a	Option 2b	Option 2c	Option 2d	Option 2e
Monitor & Mitigate Status quo	**Partial Remediation** Tonkin & Taylor Option 1 above.	**Full Remediation** Tonkin & Taylor Option 1 + 2 above	**Alternate Raw Water Storage** Decommission impounded supply and construct an alternative	**No Raw Water Storage** Decommission impounded supply with no replacement
Maintain and monitor the impounded reservoir at reduced level. No intention for remediation works.	Undertake essential repairs to the impounded supply's subsoil drainage, subgrade, new liner system. Will require improved treatment processes and potentially additional source water quantity to ensure reliable supply during repairs. So cost is greater than just the repair to provide these upgrades.	Option 2b + works to address internal erosion and seismic risk to provide acceptable long-term solution. Will require improved treatment processes and potentially additional source water quantity to ensure reliable supply during repairs. So cost is greater than just the repair to provide these upgrades.	Decommission the current impounded reservoir and return land to an acceptable long-term state. Construction of replacement storage reservoir of the same or similar volume (120,000 m^3) as the current reservoir nearby.	Decommission the impounded reservoir and return land to an acceptable long-term state. Assumes sufficient quality and quantity of raw water can be treated and delivered to Dannevirke without the need for raw water storage.
Discount	**Preferred**	**Possible**	**Possible**	**Possible**

4.2.3 WATER TREATMENT PLANT[3]

Option 3a	Option 3b	Option 3c	Option 3d
Dannevirke WTP Status quo	**Option A** pH + Coagulation	**Option B** pH + Coagulation + Microfiltration	**Option C** PH + Sedimentation + Microfiltration
Maintain the existing WTP without upgrades. Relies on a raw water reservoir to ensure reliable supply during low flow / high turbidity events. Unable to guarantee reliable source water during repairs of the impounded supply. So, this option must have a raw water reservoir included.	Reduce raw water turbidity from at least 300NTU to 10NTU: *pH correction (if req.)* *Coagulation / flocculation / sedimentation (lamella settler)* Will require purchase of additional land to fit at current WTP location. Potential for enough improvement that raw water storage is no longer needed.	Reduce raw water turbidity from at least 300NTU to 10NTU: *pH correction (if req.)* *Solids / grit sep. (if req.)* *Coagulation / flocculation (if req.)* *Microfiltration.* Will require purchase of additional land to fit at current WTP location. Potential for enough improvement that raw water storage is no longer needed.	Reduce raw water turbidity from at least 300NTU to 10NTU: *pH correction (if required).* *Sedimentation.* *Microfiltration.* Will require purchase of additional land to fit at current WTP location. Potential for enough improvement that raw water storage is no longer needed.
Possible	**Preferred**	**Preferred**	**Possible**

[3] Water Treatment Plant options sourced from: GHD (2023) Dannevirke WTP – Stream 2 Pre-Treatment for Raw Water with High Turbidity

4.2.4 TREATED WATER STORAGE

Option 4a	Option 4b	Option 4c	Option 4d
Treated Water Reservoirs Status quo	**Repurposed Kliptank** 2,000m³ from Paihiatua	**New Kliptank** 2,000m³	**New Reservoir** 6,000m³
Treated water reservoir. Seismic / condition issues with current concrete reservoir require improvement.	These are part of a combined option with Council's preference being for 3 tanks (from a resilience / management perspective), built to IL4 seismic status, and with solid roofs. Locations for potential water storage are still being explored, once identified the feasibility for each site needs to be confirmed.		
Discount	**Preferred**	**Preferred**	**Preferred**

4.2.5 NETWORK & DEMAND MANAGEMENT

Option 5a	Option 5b	Option 5c	Option 5d	Option 5e
No Demand Management Status quo	**Reduce Leakage** Leakage reduction programme	**Water Metering** Install universal water meters	**Major Water Users** Reduce consumption / alternate source water	**Rural Offtakes** Set maximum daily take
No specific demand management beyond routine maintenance and pipe renewals.	Targeted renewals programme to reduce leakage by repairing / replacing old poor condition pipes.	Install water meters to monitor usage. Inform behaviour change and water restrictions. No intention to charge for water use at present.	Alliance Meatworks uses 20-25% of Dannevirke's daily supply. Providing a separate source would reduce demand on the public network, there are already water treatment facilities on-site to aid in their industrial processes.	Metering rural offtakes and setting a maximum daily take, currently these are unlimited.
Discount	**Preferred**	**Preferred**	**Possible**	**Preferred**

5 Shortlisted options

5.1 Shortlist development

The shortlist combines preferred options from the longlist assessment into integrated 'packages' of work (the options) that provide direction to inform planning and decision making.

At this early stage of planning there are many unknown factors, particularly for options that do not involve remediation of the impounded supply and have received less investigation to date, so the shortlist can be used to inform the way forward but should not be considered final projects for inclusion in TDC's capital works programme.

The shortlist is shown in Table 2, the options for the impounded supply can be broken down into:

- Retaining the impounded supply, with increasing levels of monitoring and remediation.
- Decommissioning of the impounded supply, replaced by an alternate raw water reservoir.
- Decommissioning the impounded supply, replaced with an improved water source that negates the need for a raw water reservoir.

Underlying all the options for the impounded supply are some common options included in each package including water treatment and source water improvements, treated water storage, and network improvements and demand management. The nature of these varies depending on the future of the impounded supply.

5.2 Shortlist assessment

The criteria for the shortlist assessment were:

1. Investment Objectives (see Section 4.2):
2. Cost – assessed on a 5-point scale from Very Low-Very High given the uncertainty at this stage.
3. Risks – technical, operational, financial, legal, political, economic, stakeholder / public.
4. Business Needs – TDC Infrastructure Strategy, LTP, 3W AMP, Local Water Done Well, financial sustainability, DWSNZ, consents.

The full Multi Criteria Analysis assessment is included in Appendix A.

Table 2: Shortlist Multi Criteria Analysis Assessment Summary

#	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6	Option 7
Option	**Status quo**	**Impounded supply urgent remedial works**	**Impounded supply full remediation**	**New raw water reservoir** **Decommission impounded supply**	**Bore water source (supplementary)** **Decommission impounded supply**	**Manawatū River (supplementary)** **Decommission impounded supply**	**Woodville Pipeline** **Decommission impounded supply & WTP**
Description	2024-34 LTP proposal. Monitor and maintain impounded reservoir at reduced depth. Minor works to repair impounded supply, without draining. No source water improvement. **While not a long-term solution, Option 1 provides TDC with time to plan and implement other Options here.**	Tonkin & Taylor recommended urgent repairs to the impounded supply's subsoil drainage, subgrade, new liner system. WTP pre-treatment upgrade for high turbidity events. Extra water needed to supply during peak periods / low flow events while the reservoir is empty. Options 2-3 can be implemented as a staged approach over time.	Option 2 + Tonkin & Taylor recommended works to address residual risk of internal erosion and seismic risk. Current recommendations include upstream filter blanket, drainage and stability berm, and potential for full rebuild of the eastern dam embankment.	Construct a replacement raw water storage reservoir nearby the existing treatment plant. Volume to be determined, the current 120,000m^3 capacity provides approx. 4 weeks storage at peak demand, or nearly 12 weeks at typical demand.	Secure a second bore water source to supplement the Tamaki River take and meet peak demand during low flow periods, without the need for raw water storage. WTP pre-treatment upgrade for high turbidity events. Potential to reduce / balance water take from the Tamaki River.	As for Option 5 but second water source secured from the Manawatū River. Currently assumes source water is piped to the existing WTP and fed into the network via existing reticulation.	Decommission the impounded supply and Dannevirke WTP. Commission a pipeline connective Woodville and Dannevirke, with a single WTP located at Woodville treating water for both towns. Requires a new / supplementary water source to provide enough water as the current Woodville source is constrained.
Source	**Tamaki River**	**+ supplementary local bore for repair outage**		**Tamaki River**	**+ supplementary local bore (permanent)**		**New / added source**
Raw water	**Impounded supply**	**+ remedial works**		**Decommission & build new reservoir**	**Decommission & do not operate a reservoir**		
Treatment	**Existing WTP + pre-treatment upgrade (may be temporary)**			**Existing WTP**	**+ pre-treatment upgrade (permanent)**		**New / upgraded Woodville WTP**
Treated water	**Condition based renewal / replacement of existing assets (assumes WTP remains in current location for all options)**						**To be determined**
Demand	**Reduce leakage + Water metering**			**+ restrict rural offtakes (intended to reduce size of new reservoir / new abstraction consent)**			
	4	**3**	**5**	**6**	**2**	**1**	**7**

5.3 Indicative way forward

5.3.1 DECOMISSION THE IMPOUNDED SUPPLY (OPTIONS 6 & 5)

Option 6 'Manawatū River (supplementary)' and **Option 5 'Bore water source (supplementary)'** are preferred and are notable for the fact both options involve decommissioning the impounded supply and moving to an improved water source and water treatment plant for Dannevirke.

The primary reason these options are favoured in this assessment is the potential to:

- Develop a water scheme that has greater long-term certainty over source water quantity and quality, with modern treatment systems and processes than are proven and can be upgraded over time.
- Reduce reliance on the impounded supply, a significant asset which may have residual issues and risk even after remediation and will inevitably require major renewals during its useful life, creating long-term operational and financial uncertainty.

Decommissioning the impounded supply is based on several key assumptions which TDC does not have surety on currently, so any decision to invest in this approach will require further investigation:

- **Supplementary source, not alternate.** For now, it is assumed the Tamaki River abstraction will continue and the upgraded WTP will remain in its current location with the existing connection to the reticulated network. Moving to an entirely new source and/or WTP may be considered in future investigations.

  Source water availability: sufficient source water can be found to supplement the existing take from the Tamaki River. Bore investigations to date have not found a definitive new source, and ideally TDC would have 12-months of test data to provide confidence before investing. So, the Manawatū River is favoured, as the assumption is there is sufficient volume available for surface water abstraction.
- **Consent-ability:** TDC can be successful in gaining a new water abstraction consent for its preferred supplementary water take. There is potential for TDC to strike a balance between the existing and new take to mitigate negative environmental impacts. For example, abstraction limits from the Tamaki River might be reduced if enough water is made available from elsewhere.
- **Operational feasibility:** water from the supplementary water source can be feasibly and affordably piped to the existing Dannevirke WTP to be supplied to the town via the existing connection to the reticulated network.

5.3.2 REMEDIATE THE IMPOUNDED SUPPLY (OPTIONS 2 & 3)

Option 2 'Impounded supply urgent remedial works' also scores well, proposing to undertake essential repairs to the impounded supply drainage, subgrade, and liner. This option is based on Tonkin & Taylor's July 2024 report which included:

1. Replacement of subsoil drainage bedding with filter compatible material.
2. Reinstatement of the subgrade to support a new liner system.
3. Replacement of the existing HDPE and LPF liner with a new liner system.

The P50 estimate of these works is $8.0 - $9.3m, and as this option will require the impounded supply to be de-watered for an extended period, this option also should also factor:

3. Water treatment plant pre-treatment upgrade (membrane filter) to mitigate high turbidity events (est. $4.3m).
4. Supplementary source water bore to mitigate low flow peak demand events (est. $3.0m).

However, Option 2 is not preferred in this assessment due to:

- **Cost uncertainty.** The full extent of work required will not be known until the reservoir has been drained, and the current cost range for remedial works (+100%) is up to $17.3m, with any treatment plant and/or source improvement works (if required) on top of this.

Residual risk. TDC risks making significant investment in an asset that has residual (though low) risk of internal erosion and seismic risk to the impounded supply, so has no guarantee of future deterioration or to be affected by a seismic event taking it offline and requiring further significant remediation or decommissioning. **Option 3 'Impounded supply full remediation'** does address these risks, but with the current estimate of an additional $15.7 - $18.3m and the uncertainty around the cost of urgent works it is not considered affordable at present. It could be implemented as a future stage after completion of Option.

- **Associated improvements.** While a WTP upgrade and/or water source improvement could be implemented as temporary solutions (e.g. a relocated treatment plant, or a temporary water abstraction consent), they are still high-cost works requiring detailed investigation and planning, and the cost to move to more permanent solutions may not be substantially more. It is also possible the added cost of implementing permanent solutions is equal to or less than the impounded supply remediation.

5.4 Recommendation

To enable Council to more effectively compare the cost of these two investment pathways, and to consult with the community on the preferred way forward, it is recommended TDC:

1. Continue to monitor & manage the impounded supply at a reduced depth.

2. Investigate the feasibility and develop a concept design to:
    a. Secure a new local supplementary water source at Laws Road or Manawatū River.
    b. Upgrade the existing WTP to treat the increased source water volume from two abstractions, and during high turbidity events (e.g. 300NTU).
    c. Install raw and/or treated water reservoirs to support the new source water and treatment plant system.
    d. Decommission the impounded supply.

3. Confirm the pre-treatment upgrade needed at the existing WTP to treat high turbidity events (e.g. 300NTU) while the impounded supply is dewatered, and if the design will meet the long-term requirements of item 2b above also.

    If so, TDC might proceed with the pre-treatment upgrade if there is confidence the plant will be fit-for-purpose no matter the final decision on the impounded supply.

Appendix A: Multi Criteria Analysis

Option			Activity options						
			Option 1	**Option 2**	**Option 3**	**Option 4**	**Option 5**	**Option 6**	**Option 7**
			Status quo Long-term plan proposal	**Critical remediation** Remedial works to address critical risks	**Full remediation** Full remediation of impounded supply	**Alternate raw water storage** Decomission impounded supply & construct alternate storage	**New bore source** Decomission impounded supply & new local bore source	**Manawatū River** Decomission impounded supply & new water source	**Woodville** Pipeline from Woodville to Dannevirke
Description			Monitor and maintain impounded reservoir at reduced depth. Minor works to repair impoundes suppy, without draining. Requires WTP upgrade to mitigate risk of dam outage. Implement demand management activities.	Undertake essential repairs to the impounded supply's subsoil drainage, subgrade, new liner system. Addition of a supplementary bore (Laws Road / Tamaki tributary) to provide supply during reservoir repairs, may be retained as a long-term improvement to source water quantity.	Undertake all physical works needed to provide acceptable long-term solution. Addition of a supplementary bore (Laws Road / Tamaki tributary) to provide supply during reservoir repairs, may be retained as a long-term improvement to source water quantity.	Decommission the impounded reservoir and return land to an acceptable long-term state. Construction of replacement storage of the same or similar volume (120,000m3) as the impounded reservoir.	Decommission the impounded reservoir and return land to an acceptable long-term state. Assumes sufficient quality and quantity of raw water can be treated and delivered to Dannevirke without the need for raw water storage.	New water take from the Manawatū River replaces existing source.	Install a pipeline from Woodville to Dannevirke. Water source and treatment improvements at Woodville to ensure quantity and quality. Decomission impounded supply and Dannevirke WTP.
Water Source	Tamaki River (current)								
	+ supplementary bore								
	+ Manawatu River								
	New source								
Raw Water Storage	Impounded Reservoir								
	Alternate storage								
Water Treatment	Existing WTP								
	+ Pre-treatment upgrade								
	New WTP								
Treated Water Storage	Existing reservoirs								
	New storage								
Demand Management	Reduce leakage								
	Water metering								
	Rural offtakes								
Investment Objectives		Relative Importance of objective	**36%**	**71%**	**80%**	**80%**	**79%**	**85%**	**77%**
Investment Objective 1	Improve reliability and resilience of source water.	30%	20%	60%	80%	80%	80%	80%	70%
Investment Objective 2	Safe drinking water meets statutory requirements.	40%	60%	80%	80%	80%	80%	80%	80%
Investment Objective 3	Meeting current and future levels of service and managing demand.	20%	20%	70%	80%	80%	70%	100%	70%
Investment Objective 3	Fit-for-purpose infrastructure delivering public value for money.	10%	20%	70%	80%	80%	90%	90%	100%
		100%							
Cost									
Total Cost		100%	L	M	H	H	M	M	VH
Risks									
Technical - can it be delivered?		14%	L	M	H	H	M	M	M
Operational - how easy will it be to manage going forward?		14%	M	M	M	M	M	M	H
Financial - revenue certainty?		14%	H	M	H	H	M	M	H
Legal - will it be challenged?		14%	L	L	L	L	L	L	L
Political - will it be supported by the politicians?		14%	M	M	M	H	M	M	H
Economic - will it affect economic growth?		14%	M	L	L	L	L	L	L
Stakeholder/Public - will it be supported by the general public?		14%	M	L	H	M	L	L	L
		100%							
Business Needs									
TDC Infrastructure Strategy, LTP, AMP		17%	L	H	H	M	H	H	L
Local Water Done Well requirements		17%	L	H	H	H	H	H	H
Financially sustainable		17%	M	H	M	M	M	M	L
DWSNZ		17%	L	H	H	H	H	H	H
Consent conditions		17%	L	H	H	L	H	H	H
Operationally achievable		17%	M	H	H	M	M	H	M
		100%							
Ranking									
Final Ranking			**4**	**3**	**5**	**6**	**2**	**1**	**7**