Mid-Waikato Water & Wastewater Servicing Strategy

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Issue and Revision Record

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Executive Summary

The Mid-Waikato region is undergoing rapid population growth. Watercare has engaged Stantec and Mott MacDonald to develop a long-term strategy for water and wastewater servicing. This project builds on previous studies with updated growth forecasts, revised options to suit the new growth predictions and updated costings.

The water supply and wastewater services within the Waikato District were historically provided by Waikato District Council (WDC). From October 2019, Watercare has been responsible for the operation and maintenance of the services. WDC continues to own the assets and as such the outcomes of the strategy will feed into the WDC Activity Management Plan, the Waikato District Long-Term Plan and Infrastructure Strategy.

The study area encompasses five urban centres within the Mid-Waikato region: Meremere, Te Kauwhata, Rangiriri, Ohinewai and Huntly.

As a first step, previous studies and information on existing assets were reviewed, water and wastewater demand forecasts were revised, and potential constraints and opportunities in the study area were identified. The outcomes of this work were agreed with Watercare and informed the development of this long-term strategy.

A long-list of options was identified, based on the recommendations from previous studies and updates or modifications suggested by the project team, and then further developed at a workshop with Watercare and WDC. The long-list phase was intended to capture all possible options, including alternative water sources, alternative treatment and disposal technologies for wastewater and complementary strategies such as demand management and re-use.

Options were short-listed through a series of workshops with Watercare and WDC, including identification of fatal flaws, high-level costings and assessment against the key environment, social, cultural, operational and financial criteria.

A multi-criteria analysis was completed for the short-list of options. Scoring was completed in partnership with Watercare and WDC through a series of workshops.

Based on the multi-criteria analysis, the project team identified the following preferred options:

- **Option 1a for water supply**:
  A centralised scheme for Mid Waikato, with a new water intake and treatment plant at Te Kauwhata and Ohinewai being serviced initially from Huntly and then from Te Kauwhata. It is proposed to continue to source water from the Waikato River and for Huntly to continue to be supplied from the Huntly WTP.
- **Option 2b for wastewater**:
  A centralised WWTP for the Huntly and Ohinewai catchments located in Huntly and a stand-alone WWTP in Te Kauwhata for that catchment. Both WWTPs are proposed to discharge to the Waikato River.

Figure 0-1: Preferred Water Supply Solution – Option 1a

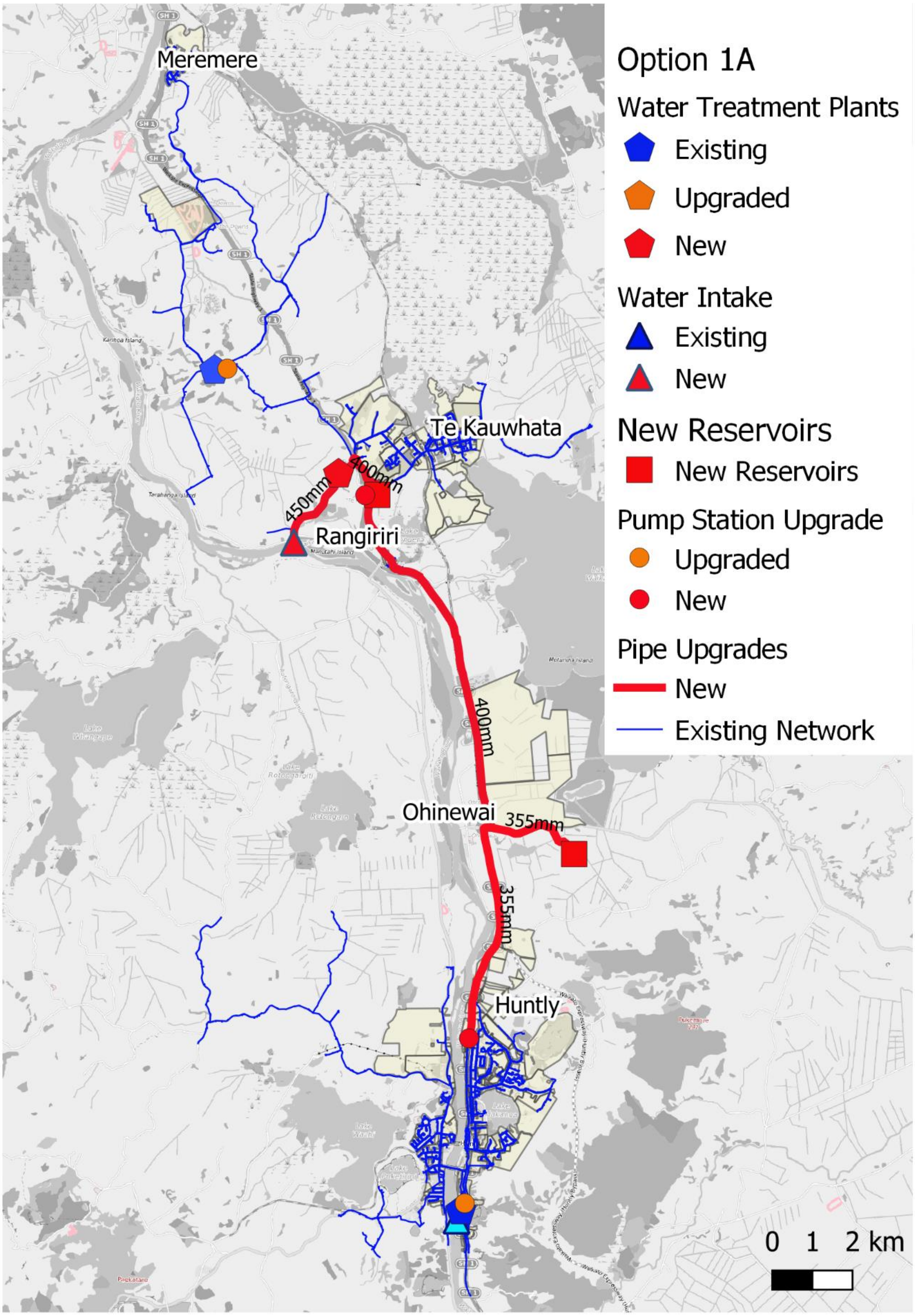
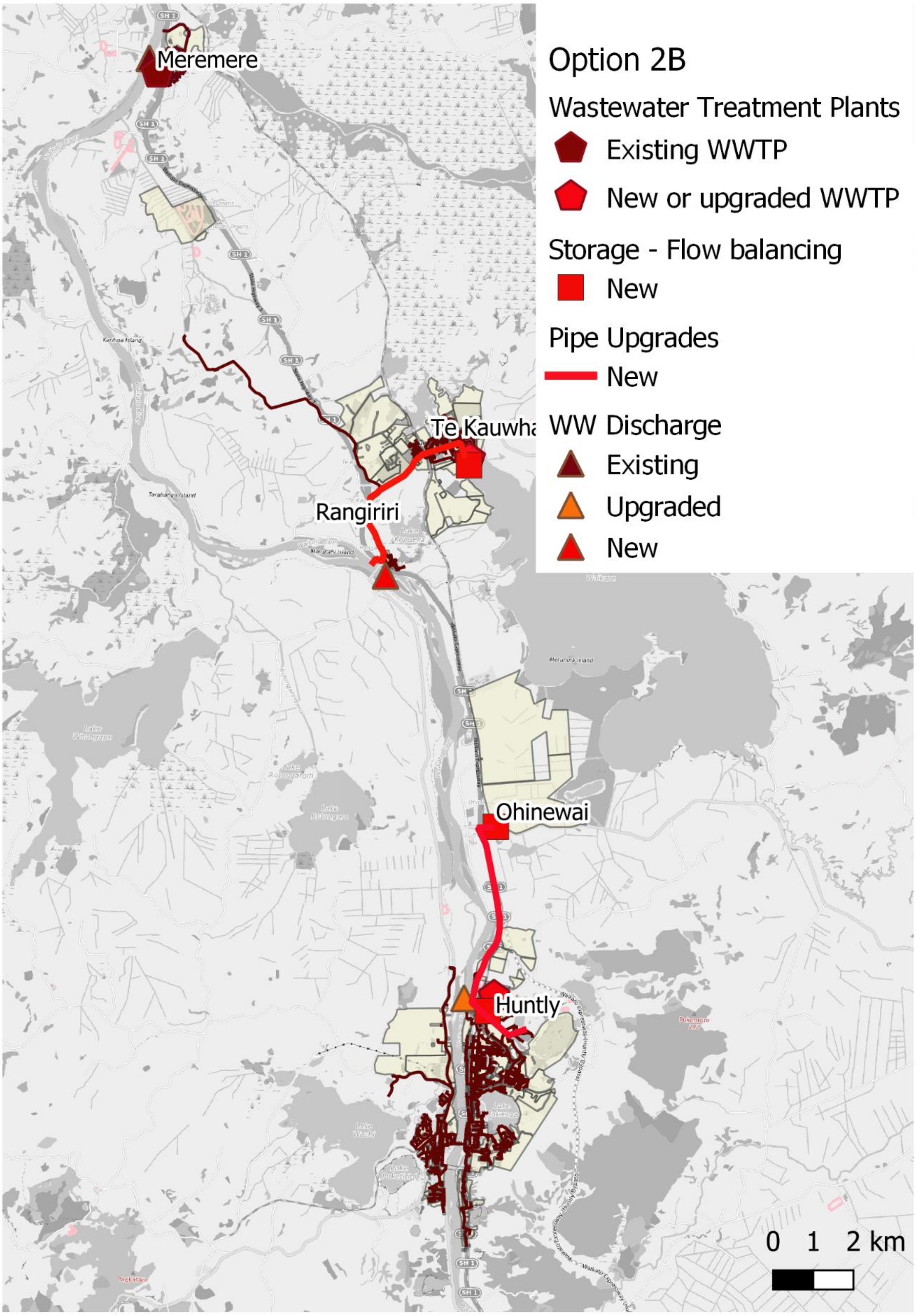


Figure 0-2: Preferred Wastewater Solution – Option 2b



This study has been delivered rapidly to meet the Waikato District Council LTP deadline and has by necessity been high-level. We recommend the following next steps:

- Prepare a consenting strategy which includes iwi and stakeholder engagement processes,
- Refine population growth forecasts and existing infrastructure capacity assessments,
- Assess the affordability of options for local communities,
- Develop the preferred options in more detail, including staging opportunities, land requirements and site investigations,
- Develop a programme and procurement strategy, including risks/opportunities associated with upcoming regulation changes.

Acronyms Definitions

ADWF – Average Dry Weather Flow

AMP – Activity Management Plan

CAPEX – Capital Expenses

I&I – Infiltration and Inflow

LTP - Long Term Plan

MBIE – Ministry of Business, Innovation and Employment

MCA – Multi- Criteria Analysis

NPV – Net Present Value

OPEX – Operational Expenses

PDF – Peak Daily Flow

PWWF – Peak Wet Weather Flow

RITS – Regional Infrastructure Technical Specifications

TKWA – Te Kauwhata Water Association

WDC – Waikato District Council

WRC – Waikato Regional Council

WTP – Water Treatment Plant

WWTP – Wastewater Treatment Plant

kg – kilograms

kWh – Kilo Watt per hour

L – Litres

L/s – Litres per second

m^3 – Cubic meters

m^3/day – Cubic meters per day

MLD – Mega Litre per Day

tCO_2e – Tonnes of Carbon Dioxide Equivalent

tDS – Tonnes of Dry Solids

1 Introduction

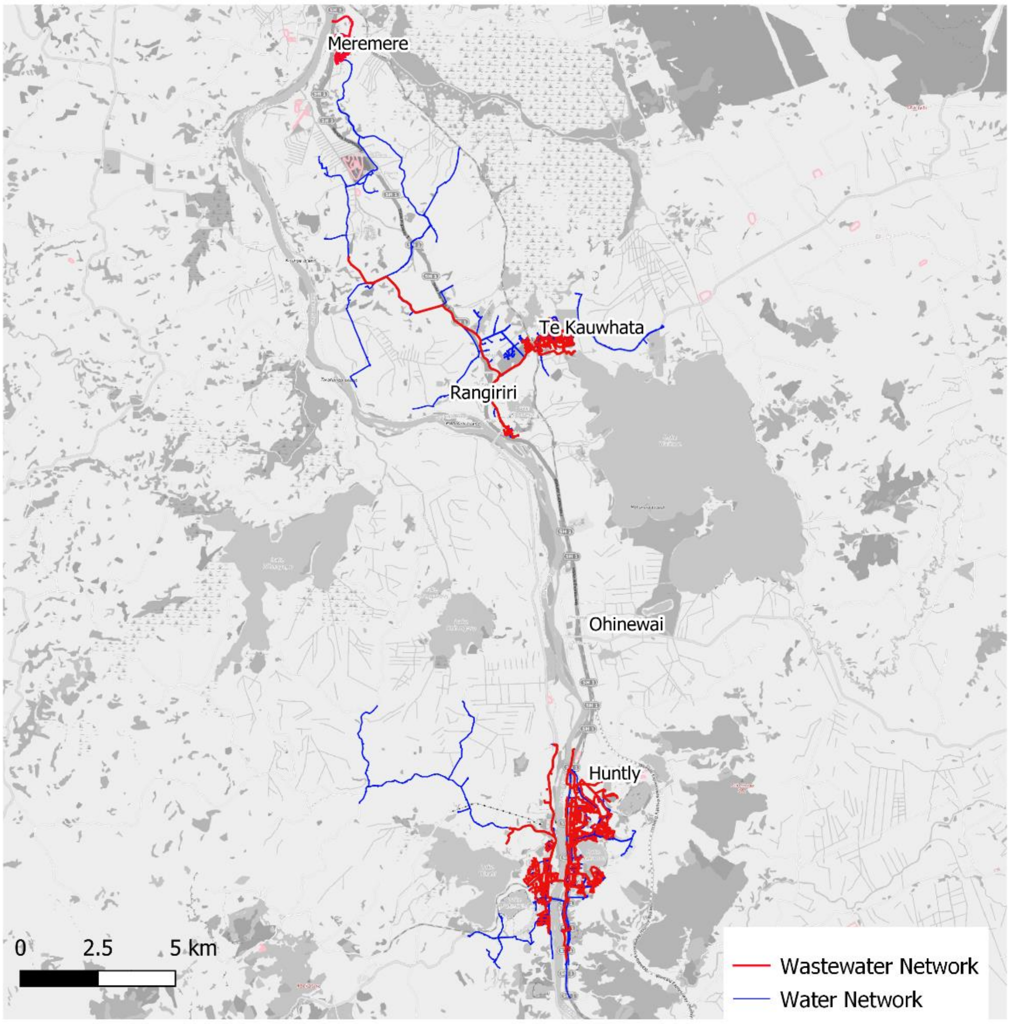
1.1 Purpose of this study

The Mid-Waikato region is undergoing rapid population growth and requires a long-term strategy for water and wastewater servicing. Watercare has engaged Stantec and Mott MacDonald to develop the strategy, including analysing options and determining a preferred set of solutions for water supply and wastewater servicing. The results of this study will feed into the Waikato District Council Activity Management Plan, the Waikato District Council Long-Term Plan and Infrastructure Strategy.

1.2 Study region

The study area encompasses five urban centres within the Mid-Waikato region: Meremere, Te Kauwhata, Rangiriri, Ohinewai and Huntly (Figure 1-1).

Figure 1-1: Study Area with Existing Services



1.3 Existing water supply and wastewater services

Water supply and wastewater services within the study area were historically provided by Waikato District Council (WDC). From October 2019, Watercare has been operating Waikato District's water supply, wastewater and stormwater services. Waikato District Council will continue to own the assets while Watercare Waikato will manage the infrastructure.

The sections below give a brief overview of the existing water supply and wastewater services in each urban centre, including the key issues.

1.3.1 Meremere

Meremere is currently included in the Te Kauwhata water supply scheme. More detail of this scheme is provided in the section below.

Meremere is served by a reticulated wastewater network. The Meremere wastewater treatment plant (WWTP) includes a single oxidation pond, subsurface wetland, holding pond, UV disinfection and a discharge to the Waikato River.

The key issues for Meremere's wastewater system are:

- Network issues, including high inflow & infiltration. These issues are outside the scope of this project but should be addressed in future in complement to any proposed upgrades to the WWTP;
- The existing pond-based WWTP does not meet current consent limits and any new consent requirements may be more stringent;
- The discharge consent expired on 15 August 2018; WDC have lodged a new application with Waikato Regional Council (WRC) to enable ongoing legal operation;
- Long conveyance distances and difficult terrain between other nearby WWTPs, making transfer to another facility prohibitively expensive.

WDC have already committed to the upgrade of the Meremere WWTP to an MBR plant. We have assumed that this upgrade will accommodate the population growth forecast for Meremere and provide the level of treatment required by future consents. Therefore, we have not included Meremere in the options considered in this study.

1.3.2 Te Kauwhata

The Te Kauwhata water supply scheme supplies Te Kauwhata, Rangiriri, Meremere and the Whangamarino and Te Kauwhata rural areas. The supply also provides potable water to the Springhill Corrections Facility, a 650-bed prison located nearby.

The water source is the Waikato River. The water intake and raw water pipeline are owned by a third party, the Te Kauwhata Water Association (TKWA).

The water take consent is held by TKWA and expires in 2024. TKWA supply only raw water to all customers; their ability to continue to do this may be affected by the incoming national drinking water regulations, expected to be implemented from 2020/21.

WDC historically had an agreement with TKWA covering the supply of raw water to the Te Kauwhata Water Treatment Plant. This agreement expired on 30 June 2016. Since the expiry date, TKWA have continued to supply water but without any formal agreement.

The Te Kauwhata Water Treatment plant (WTP) is a conventional treatment process comprising PAC dosing (as required), coagulation/flocculation, clarification, dual media filtration, UV disinfection, pH correction, chlorination and fluoridation. WTP residuals are discharged to settling ponds. The supernatant is discharged to surface water, and sludge is stored within the ponds with periodic removal off site. WDC have already committed to an upgrade of the Te Kauwhata WTP, from 3MLD to 4.5MLD.

The key issues for Te Kauwhata' s water supply system are:

- The water take consent is held by TKWA, not WDC/Watercare, and expires in 2024;
- The existing water supply arrangement between TKWA and WDC/Watercare is no longer covered by a formal agreement;
- TKWA's continued ability to supply water may be affected/limited by new drinking water regulations;
- Uncertainty about the condition and construction of the existing intake, headworks or raw water line assets;
- The consents for the WTP discharges expire from 2024;
- Water demand is predicted to exceed the WTP capacity from 2025, including capacity of the bulk main from the WTP to the reservoir;
- The water supply system provides an inadequate level of service, including areas of low pressure in some parts of the network;
- The network experiences high water loss.

The Te Kauwhata wastewater scheme includes flows from Te Kauwhata township, Rangiriri and the Springhill Corrections Facility. The Te Kauwhata WWTP is located beside Lake Waikare.

Treatment includes inlet screening, two aerated ponds in series, biological growth media (Aquamats), wetland and rock filter. Coagulant is dosed near the end of the first pond to reduce phosphorus. The WWTP discharges to Lake Waikare.

The key issues for Te Kauwhata's wastewater system are:

- Network issues, including high inflow & infiltration. These issues are outside the scope of this project but should be addressed in future in complement to any proposed upgrades to the WWTP;
- The discharge to Lake Waikare (a site of significance to local iwi) is culturally unacceptable;
- Waikato District Council have signed a consent agreement with interested parties (Waikato Tainui, Ngaa Muka Development Trust, Auckland-Waikato Fish and Game, the Department of Conservation and Waikato Regional Council River and Catchment Services Group), committing to ceasing the discharge to Lake Waikare in as short a timeframe as possible, but no later than 2023;
- The WWTP is only partially compliant with effluent quality consent conditions;
- Wetland and rock filters are vulnerable to flooding;
- There is poor access to the WWTP for maintenance;
- The discharge consent expires in 2028 and any new consent conditions may be more stringent.

1.3.3 Rangiriri

Rangiriri is currently included in the Te Kauwhata water supply scheme, as outlined above.

Rangiriri's wastewater scheme was installed in 2008. A gravity wastewater network serves properties, with a single pump station transferring wastewater to the Te Kauwhata WWTP. Key issues for the Te Kauwhata wastewater scheme are outlined in the previous section.

1.3.4 Ohinewai

There is currently no reticulated water supply or reticulated wastewater service for Ohinewai. Most households have individual water and septic tank systems.

The predicted growth in Ohinewai will require a reticulated water supply and wastewater network by year 2025. This is when significant residential development is expected to occur.

1.3.5 Huntly

The Huntly water supply scheme takes water from the Waikato River, supplying Huntly with a reticulated on-demand system. The scheme also supplements the water supply for Ngaruawahia, currently providing up to 1MLD out of the maximum allocation of 2MLD.

The Huntly WTP is a conventional treatment process comprising PAC dosing (as required), coagulation/flocculation, clarification, filtration, UV disinfection, pH correction, chlorination and fluoridation. WTP residuals are discharged to a holding tank. The supernatant is discharged to the Waikato River, and sludge is discharged to the wastewater system.

Consents for the water take and the discharge of WTP residuals expires in 2046.

The key issue for Huntly's water supply is that, beyond 2035, the demand from Huntly (including the allocation to Ngaruawahia) will exceed the consented maximum water take.

The Huntly wastewater scheme includes the main township of Huntly, Te Ohaaki Marae and the surrounding community. Wastewater is pumped to the WWTP and treated with inlet screening, primary and secondary oxidation ponds with aerators, UV disinfection, surface-flow wetlands and rock-lined channels. The WWTP discharges to the Waikato River.

The key issues for Huntly's WW services are:

- Network issues, including high inflow and infiltration, poor condition etc. These issues are outside the scope of this project but should be addressed in future in complement to any proposed upgrades to the WWTP;
- Oxidation ponds occasionally overtop in wet weather;
- WWTP is vulnerable to flooding from the Waikato River;
- WWTP is only partially compliant with effluent quality consent conditions and discharge limits;
- Poor access to WWTP for maintenance;
- Unreliable septage handling facility;
- Sludge build-up within WWTP, reducing pond capacity and treatment performance;
- Huntly WWTP discharge consent expires on 31 March 2029 and any new consent conditions may be more stringent.

1.4 Our approach

Stantec & Mott MacDonald have completed the following tasks to develop the long-term water supply and wastewater strategy:

- Review of previous studies and documents, and summarise findings in Technical Memo 1, including:
  - Compile and summarise growth predictions;
  - Establish the Level of Service to be provided for under this strategy;
  - Describe the policy and regulatory context for this strategy, including status of existing consents;
  - Describe existing water supply and wastewater assets and associated issues;
  - Compile and summarise options proposed in previous studies;
  - Describe stakeholder engagement completed in previous studies and recommend future engagement.
- Estimate of the annual water demand and wastewater discharge rates and summary of findings in Technical Memo 2, including:
  - List of agreed assumptions for demand calculations;
  - Identify key design parameters for WTP, WWTP and conveyance options (i.e. average daily flows, peak daily flows, etc.);
  - Sensitivity analysis of demand/growth projections to different assumptions;
  - Comparison to Watercare and WDC design guides and SCADA data;
  - Assessment of existing infrastructure capacity vs. estimated demands;
  - Estimate of wastewater loads for each scheme;
  - High level risks identification.
- Development of long-list of options, short-listing these options using an MCA and summary of findings in Technical Memo 3, including:
  - Preparation of a long-list of options, including alternative water sources, alternative treatment and disposal technologies for wastewater and complementary strategies such as demand management and re-use;
  - Identification of site constraints relevant to the proposed options;
  - Development of fatal flaw criteria and then fatal flaw assessment to screen the long-list. This was undertaken via a workshop with Watercare and Waikato District Council;
  - Development of assessment criteria and preliminary round of multi-criteria analysis, to reduce the screened long-list to a shortlist of options. This was undertaken through a series of workshops with Watercare and Waikato District Council;
  - Summary of the short-list of options considered for more detailed analysis.
- Development of short-listed options, including development of staged options (water supply only), preparation of CAPEX and OPEX estimates, and capital carbon estimates.
- Completion of a multi-criteria analysis for the short-list of options. Scoring was completed in partnership with Watercare and Waikato District Council in a workshop.
- This final report includes the results of the multi-criteria analysis and our recommendations, with the Technical Memos and additional information summarised and appended.

2 Previous Studies and Demand Forecasts

Our study builds on previous reports completed since 2013.

Stantec and Mott MacDonald completed a literature review of previous studies, consents and asset condition reports. This was followed by a growth review, demand and discharge calculations and risk identification. The findings from this first stage of work are summarised below (for more details, refer to Appendix A and B).

2.1 Literature and Growth Review

Technical Memo 1 (Appendix A) provides an overview of the previous studies carried out to date, the existing assets in the Mid-Waikato region, the level of service required for any new infrastructure, the regulatory context for this project and the forecasted growth for the study area. The findings of this review were discussed at a workshop on 14 February 2020.

2.2 Demand and Discharge Calculation and Risks Identification

Technical Memo 2 (Appendix B) provides a demand and discharge forecast until year 2060, which is the maximum design horizon considered in this project (“Ultimate” scenario). The forecast water demand and wastewater discharge was compared to the capacity of existing assets and the current resource consents.

Table 2-1 below summarises the residential growth that was considered in this investigation, while Table 2-2 shows the equivalent population calculated for commercial and industrial areas. Assumptions are detailed in Technical Memo 2 (Appendix B).

Table 2-1: Mid-Waikato Region Residential Growth Projection Used in this Study

Horizon	Current	2025	2030	2050	Ultimate	Area (ha)
Huntly	8,035	8,526	8,759	9,278	27,053	695
Te Kauwhata	3,397	10,491	12,398	18,821	18,761	501
Meremere	638	674	704	824	884	22
Ohinewai	0	1,625	3,250	3,250	3,250	56
Rangiriri	78	85	92	140	150	6
Total	12,148	21,401	25,203	32,313	50,098	1,280

Table 2-2: Commercial and Industrial Population Equivalent

Area	Commercial Population Equivalent					Industrial Population Equivalent				
Horizon	**Cur-rent**	**2025**	**2030**	**2050**	**Ulti-mate**	**Cur-rent**	**2025**	**2030**	**2050**	**Ulti-mate**
Huntly	134	269	537	537	537	7,614	8,829	10,044	10,044	10,044
Te Kauwhata	0	261	522	522	522	0	0	558	1,116	1,116
Meremere	35	35	35	35	35	0	0	0	0	2,196
Ohinewai	0	130.5	261	261	261	0	1,418	2,835	9,135	15,435
Rangiriri	37	37	37	37	37	0	0	0	0	0
Total	**206**	**732**	**1,392**	**1,392**	**1,392**	**7,614**	**10,247**	**13,437**	**20,295**	**28,791**

As agreed with Watercare, the RITS was used in this investigation to calculate the water demands and wastewater discharge, respectively shown in Table 2-3 and Table 2-4 below.

Table 2-3: Average and Peak Demands

Area	Total Average Demand (m³/day)					Peak Demand (L/s)				
Horizon	Current	2025	2030	2050	Ultimate	Current	2025	2030	2050	Ultimate
Huntly	2,436	2,622	2,745	2,880	7,502	141	152	159	167	434
Te Kauwhata	883	2,735	3,264	4,959	4,944	51	158	189	287	286
Meremere	167	176	184	215	330	10	10	11	12	19
Ohinewai	0	490	980	1,778	2,702	0	28	57	103	156
Rangiriri	21	23	25	37	40	1	1	1	2	2
All Schemes	**3,507**	**6,047**	**7,199**	**9,870**	**15,518**	**203**	**350**	**417**	**571**	**898**

Table 2-4: Average Dry Weather Flow (ADWF), Peak Daily Flow (PDF) and Peak Wet Weather Flow (PWWF)

Scheme	ADWF (m³/day)				PDF (L/s)				PWWF (L/s)			
Horizon	2025	2030	2050	Ulti-mate	2025	2030	2050	Ulti-mate	2025	2030	2050	Ulti-mate
Huntly	3,437	3,658	3,832	7,700	74	78	82	193	198	21	222	359
Te Kauwhata	2,756	3,332	5,052	5,040	71	85	129	129	126	154	233	233
Meremere	176	183	214	438	6	6	7	11	9	9	11	24
Ohinewai	537	1,073	2,185	3,425	14	27	47	71	27	51	99	149
Rangiriri	28	30	44	47	1	1	2	2	2	2	3	3
All Schemes	6,933	8,278	11,328	16,651	166	198	267	405	362	429	567	768

In Huntly, the population is predicted to triple post 2050 (ultimate scenario), as two different growth scenarios were considered before and after 2050 (refer to Technical Memo 2 for details). However, for the purpose of this study and as agreed with Watercare, options were only sized for the 2050 horizon (Huntly only) as the Ultimate scenario was deemed too optimistic and would result in oversized infrastructure. The Ultimate scenario was used for the other urban centres.

3 Long-List to a Shortlist

A long-list of options was prepared for both water supply and wastewater servicing. The full option lists and descriptions are provided in Technical Memo 3 (refer to Appendix C). The broad criteria developed to assess the fatal flaws of options was as follows:

- Failure to meet statutory requirements (listed below),
- Inability to accommodate the anticipated growth,
- Inability to be delivered within the timeframe required to support anticipated growth in the project horizon (e.g. obtaining consents, securing access to land),
- Terrain, sustainability and adaptability.

3.1 Water Supply

The water supply long-list of options included decentralised, partly centralised and fully centralised options. Both intake and water treatment plant locations were considered. A range of complementary sub-options, including water demand management and re-use of treated wastewater, were also considered.

A fatal flaw assessment was completed with Watercare in Workshop 2, to eliminate less feasible options from the long-list (refer to Appendix I).

As a result of this workshop, the 'do nothing' and Huntly stand-alone WTP options (1 & 2) were eliminated, as growth could not be accommodated and Ngaruawahia was still required to be supplied (Table 3-1). The centralised mid and north Waikato option (5a, 5b & 5c) were also eliminated as the Waikato WTP has no capacity to accommodate growth.

Reservoir storage, demand management and wastewater re-use were kept as sub-options which were not considered individually in the Multi-Criteria Assessment (MCA).

Table 3-1: Fatal Flaw Assessment of Water Options

Option	Option No.	Assessment Reasoning / Conclusion	Fatal Flaw
Decentralised – Status Quo ('Do nothing').	1	Not feasible as Te Kauwhata is already at capacity, will not be able to accommodate the growth. Not included in the shortlist of options.	Yes
Decentralised – Huntly WTP stand alone.	2	Huntly needs to continue supplying Ngaruawahia, thus this option is not feasible. There are also reputational risks associated. Not included in the shortlist of options.	Yes
Decentralised – 2-3 WTPs ('do minimum or 'base case').	3a and 3b 3c	Added to the shortlist of options but amend this option to reflect "do-minimum' based on workshop discussion.	No
Centralised 3 WTPs.	4a	Added to the shortlist of options at this stage.	No
Centralised 2 WTPs.	4b	Added to the shortlist of options at this stage.	No
Centralised 1 WTP.	4c,4d & 4e	Added to the shortlist of options at this stage.	No
Partially Centralised – 2 WTPs not interconnected.	4f & 4g	Equivalent to Options 3a and 3b.	No
Centralised – Mid & North Waikato.	5a, 5b & 5c	There is no capacity at the Waikato WTP to accommodate the projected growth. Not included in shortlist of options.	Yes

Option	Option No.	Assessment Reasoning / Conclusion	Fatal Flaw
Out-of-District Supply.	6a & 6b	Waikato and Hamilton WTP's are almost at capacity; vulnerability/low resilience of having a single WTP.	Yes
Other options – reservoir storage, demand management and wastewater reuse.	7a, 7b, 7c & 7d	Added to the shortlist of options as sub-options. Linkage to wastewater options.	No
Other options – alternative source and treatment.	7e & 7f	Groundwater limited in area. Adopt conventional treatment as default for strategy; not strategic differentiator based on previous studies.	Yes

The options considered in the MCA in Workshop 3 and 4 (refer to Appendix I) are shown in Table 3-2 below.

Table 3-2: List of Water Supply Options for MCA

Option No.	Option Concept	WTP Location	Description
3a	Decentralised – 2-3 WTPs ('do minimum or 'base case')	Te Kauwhata, Huntly	Te Kauwhata - New intake + upgraded WTP (<2025). Huntly - Existing intake + upgraded WTP (<2030, including <2MLD to Ngaruawahia). Ohinewai - network serviced by Huntly WTP.
3b	Decentralised – 2-3 WTPs ('do minimum or 'base case')	Te Kauwhata, Huntly	Te Kauwhata - New intake + new WTP (<2025). Huntly - Existing intake + WTP (if demand from Ngaruawahia can be managed to 2050; upgrade needed for ultimate). Ohinewai - network serviced by Te Kauwhata WTP.
3c	Decentralised – 2-3 WTPs ('do minimum or 'base case')	Te Kauwhata, Huntly, Ohinewai	Te Kauwhata - New intake + upgraded WTP (<2025). Huntly - Existing intake + WTP (if demand from Ngaruawahia can be managed to 2050; upgrade needed for ultimate). Ohinewai - New intake + WTP.
4a	Centralised 3 WTPs	Te Kauwhata, Huntly, Ohinewai	3 WTPs (like Option 3c), trunk main from Te Kauwhata to Huntly. Te Kauwhata - New intake + upgraded WTP (<2025). Huntly - Existing intake + WTP (if demand from Ngaruawahia can be managed to 2050; upgrade needed for ultimate). Ohinewai - New intake + WTP.
4b	Centralised 2 WTPs	Te Kauwhata, Huntly	2 WTPs (like Option 3c/4a), trunkmain from Te Kauwhata to Huntly. Te Kauwhata - New intake + upgraded WTP (<2025). Huntly - Existing intake + WTP (if demand from Ngaruawahia can be managed to 2050; upgrade needed for ultimate). Ohinewai - network serviced primarily by Te Kauwhata WTP.
4c	Centralised 1 WTP	Ohinewai	1 WTP at Ohinewai, trunkmain from Te Kauwhata to Huntly. Ohinewai - New intake and WTP. Te Kauwhata & Huntly - existing plants decommissioned, network serviced by Ohinewai WTP (including <2MLD to Ngaruawahia).
4d	Centralised 1 WTP	Te Kauwhata	1 WTP at Te Kauwhata, trunkmain from Te Kauwhata to Huntly. Te Kauwhata - New intake + upgraded WTP (<2025). Huntly & Ohinewai - existing Huntly plant decommissioned; network serviced by Te Kauwhata WTP (including <2MLD to Ngaruawahia).
4e	Centralised 1 WTP	Huntly	1 WTP at Huntly, trunkmain from Te Kauwhata to Huntly. Huntly - New intake + upgraded WTP (<2025). Te Kauwhata & Ohinewai - existing Te Kauwhata plant decommissioned; network serviced by Huntly WTP (including <2MLD to Ngaruawahia).

Options 3a, 3b and 4b were the highest scoring options.

Option 4b provides the most resilience of these three options, as it involves creating a centralised scheme for Mid Waikato with a WTP in Te Kauwhata to the north and another in Huntly to the south. This scheme would service Ohinewai and allow supplementing water demand to Huntly or Te Kauwhata as required via a centralised pipeline.

Options 3a and 3b are essentially stages of Option 4b and offer little benefit by way of comparison. Hence, rather than short-listing Options 3a, 3b and 4b, it was agreed with Watercare to investigate sub-options and staging of Option 4b, developed for further analysis.

3.2 Wastewater

The wastewater long-list of options included both centralised and decentralised options for wastewater treatment plant locations. Alternative discharge locations were also considered, including discharges to the Waikato River, nearby lakes, the sea, to land, to groundwater and a combination of land/river discharges. Sub-options including direct potable re-use and indirect potable re-use were also considered.

A fatal flaw assessment was completed with Watercare in Workshop 2, to eliminate less feasible options from the long-list (refer to Appendix I).

As a result of this workshop, many options were eliminated from the long-list (Table 3-3). All fully centralised options were eliminated due to the long conveyance distances and difficult terrain between Meremere and Te Kauwhata (options 1a, 2a, 2g, 2k, 2o, 3e, 3g, 3m & 3k). All options involving lake discharges were eliminated, for environmental, cultural and social reasons (options 3a, 3d, 3e, 3f, 3h, 3i, 3j, 3l, 3n, 3o, 3p, 3q).

Re-use of treated wastewater was kept as a sub-option, and was not considered individually in the Multi-Criteria Assessment (MCA).

Table 3-3: Fatal Flaw Assessment of Wastewater Options

Option	Option No.	Assessment Reasoning/Conclusion	Fatal Flaw
Status quo- “Do nothing” options for Huntly, Te Kauwhata and Meremere.	2f, 2n & 3b	This option does not meet the criteria of accommodating anticipated growth and does not meet statutory requirements. Not considered in the shortlist of options.	Yes
“Do minimum” – upgrades to the existing Huntly and Te Kauwhata plants.	2e & 3a	Huntly experiences significant growth after 2029 which an upgraded plant will not be able to handle. Te Kauwhata discharge consent to Lake Waikare will end in 2023. Not considered in the shortlist of options.	Yes
“Do minimum” – upgrades to the existing Meremere plant.	2m	Added to the shortlist of options, though considered as part of all options shortlisted.	No
Centralise all 4 catchments (Huntly, Ohinewai, Te Kauwhata and Meremere) at 1 WWTP.	1a, 2a, 2g, 2k, 2o, 3e, 3g, 3m & 3k	Difficult terrain between Meremere and Te Kauwhata. Not likely to be able to be centralised within this project timeframe. Possibility in the future. Not considered in the shortlist of options.	Yes
Centralise Te Kauwhata, Ohinewai and Huntly at 1 WWTP at either of the three locations. Meremere would be decentralised.	1b, 2b, 2h, 2p, 3d, 3h & 3n	Added to the shortlist of options.	No

Option	Option No.	Assessment Reasoning/Conclusion	Fatal Flaw
Centralise Huntly and Ohinewai. Te Kauwhata and Meremere would remain decentralised.	1c, 2c, 2r, 3i & 3p	Added to the shortlist of options.	No
Centralise Te Kauwhata and Ohinewai. Meremere and Huntly would remain decentralised.	2i, 2s, 3e & 3q	Added to the shortlist of options.	No
Decentralised – 4 WWTPs.	1d, 2d, 2j, 2l, 2q, 3f, 3j & 3o	Added to the shortlist of options.	No
New individual WWTPs at Huntly and Te Kauwhata, combined discharge to Waikato river at Ohinewai.	2t	Added to the shortlist of options.	No
Out of region – convey and discharge WW to a WWTP out of the region to be treated.	5a, 5b & 5c	Significant distance and difficult terrain between the locations. Not considered in the shortlist of options.	Yes
Discharge to Land from Te Kauwhata, Ohinewai and Meremere.	1e, 1f & 1g	Not feasible as there are no suitable areas of land around Te Kauwhata, Meremere and Ohinewai.	Yes
Discharge to Lake from Meremere.	3l	Difficult due to the distance and terrain between Meremere and lakes in the region. Not added to shortlist of options.	Yes
Groundwater recharge (discharge to groundwater via deep injection well or aquifer recharge) at any of the four sites.	4a, 4b, 4c, 4d	No precedent in NZ. Significant investigative work required to demonstrate feasibility and public health risks will put meeting project timeframes at risk	Yes
Discharge to sea.	6	Difficult terrain and long distance to the sea makes this unfeasible. Not added to shortlist of options.	Yes
Direct Potable reuse.	7	No precedent in NZ. Significant investigative work required to demonstrate feasibility and public health risks will put meeting project timeframes at risk.	Yes
Indirect potable reuse.	8	No precedent in NZ. Significant investigative work required to demonstrate feasibility and public health risks will put meeting project timeframes at risk.	Yes
Industrial, agricultural, forestry and horticulture reuse.	9	Added to the shortlist of options as a sub option.	No
Recycle treated water.	10	Added to the shortlist of options as a sub option.	No
Offset discharge by providing environmental impacts elsewhere.	11	Added to the shortlist of options as a sub option.	No
Site locations between Te Kauwhata and Huntly.	12, 13, 14, 15, 16, & 17	Added to the shortlist of options.	No

After the fatal flaw assessment a wide range of options remained, therefore a high-level evaluation was completed to ensure the options considered in the MCA were the most feasible. The reasons for excluding excess and infeasible options is outlined in Technical Memo 3 (Appendix C). For example options with very large areas of land for irrigation were excluded, as they were prohibitively expensive. The options considered in the MCA in Workshops 3 and 4 (refer to Appendix I) are shown in Table 3-4 below. The option numbers are not related to the numbering of options in the long-list.

Table 3-4: List of Wastewater Options for MCA

Option No.	Option	Site Location	Disposal Option
1a	1 Centralised Plant for Te Kauwhata, Ohinewai and Huntly. Separate plant for Meremere	Huntly	Combined land and river
1b	1 Centralised Plant for Te Kauwhata, Ohinewai and Huntly. Separate plant for Meremere	Huntly	Waikato River
1c	1 Centralised Plant for Te Kauwhata, Ohinewai and Huntly. Separate plant for Meremere	Between Te Kauwhata and Ohinewai.	Waikato River
2a	1 Centralised plant for Huntly and Ohinewai. Separate plants for Te Kauwhata and Meremere.	Huntly	Combined land and river
2b	1 Centralised plant for Huntly and Ohinewai. Separate plants for Te Kauwhata and Meremere.	Huntly	Waikato River
3	1 Centralised plant for Te Kauwhata and Ohinewai. Separate plants for Huntly and Meremere.	Between TK and Ohinewai - as close to Te Kauwhata as possible.	Waikato River
4a	Decentralised 4 WWTPs	Meremere, Te Kauwhata, Ohinewai and Huntly have individual plants and individual discharges.	Waikato River
4b	Decentralised 4 WWTPs	Meremere, Te Kauwhata, Ohinewai and Huntly have individual plants and individual discharges.	Waikato River, combined Land & river

Options 1b, 1c, 2b and 3 were the highest scoring options. These options were shortlisted, developed further and costed.

In general, the land discharge options did not score well due to affordability and long construction timeframes, which would not meet the forecast growth being addressed by this project.

4 Short-Listed Option Analysis

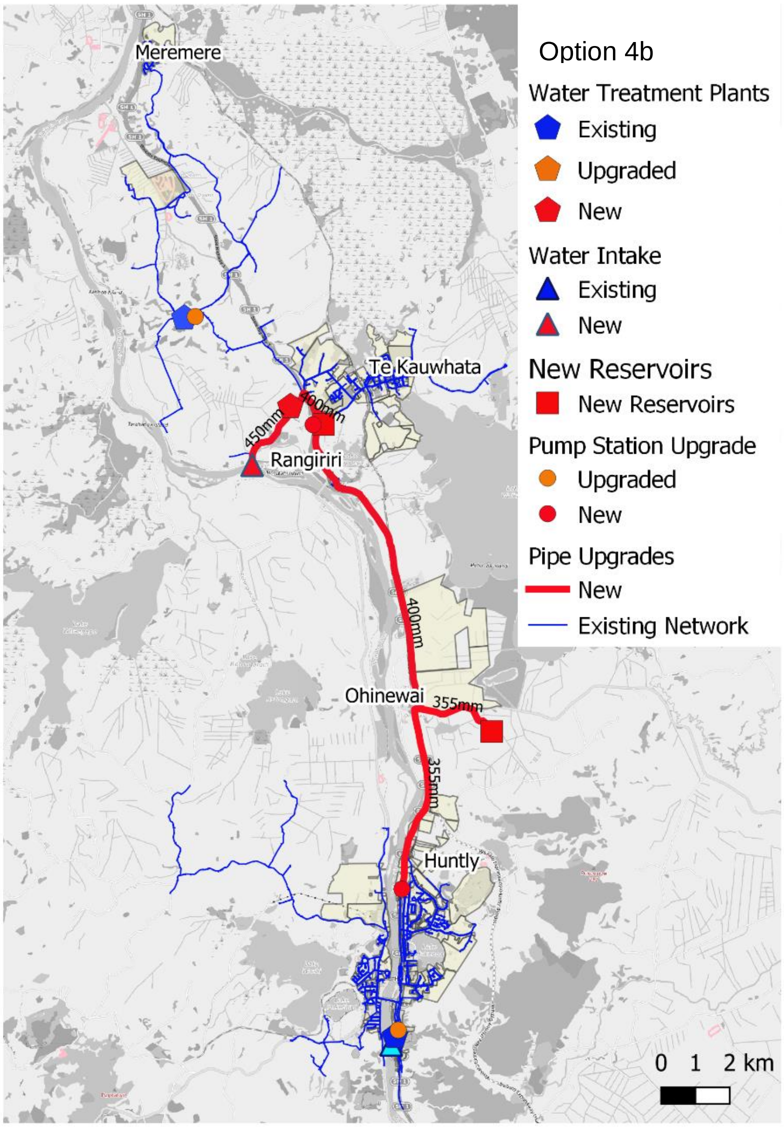
All shortlisted water supply and wastewater options were developed in more detail, to allow a capital and operational cost estimate and NPV to be prepared.

4.1 Water Supply

4.1.1 Further Development of Short-Listed Option 4b

Option 4b comprises treatment plants at Huntly and Te Kauwhata, with supply of Ohinewai from a bulk main (Figure 4-1). Under this option, as currently occurs, Meremere and Rangiriri are supplied by Te Kauwhata and Ngaruawahia is provided with a supplementary supply from Huntly.

Figure 4-1: Option 4b Layout



As agreed with Watercare, several sub-options of Option 4b were considered. These sub-options considered staging of the works, location of Te Kauwhata assets and configuration of supply to Ohinewai.

Staging enables up-front capital costs to be minimised whilst giving flexibility to defer or bring forward upgrades to match actual growth.

A new numbering system was adopted for the short-listed sub-options, based on which treatment plant was ultimately the primary supply for Ohinewai: Option 1 – Te Kauwhata (sub-options a to d) and Option 2 – Huntly (sub-options a to c).

Table 4-1 to Table 4-3 outline the issues and key assumptions for the shortlisted options.

All assessment of sub-options was completed as a desktop exercise; no site investigations or concept design work were carried out. Consenting issues are identified in Section 1.

Table 4-1: Te Kauwhata Water Supply: Issues & Assumptions

Element	Issues	Assumptions
Intake	Existing intake & bulk raw water main owned by TKWA has a capacity of 16MLD, which could supply forecasted ultimate demand. However, the TKWA consent expires in 2024 and there is uncertainty about the condition and construction of the existing assets.	New intake & bulk main adopted for all options. Location of intake & bulk main dependent on assumed WTP location (i.e. existing or new site). 2025 timeframe adopted as beyond this the bulk main from existing WTP to reservoir needs upsizing to match forecasted demand. For options where existing WTP is decommissioned, assumed existing TKWA intake & bulk main is used until this point.
WTP	Existing WTP has a capacity of 3MLD. However, WDC have recently committed to upgrading the WTP to 4.5MLD. Additional WTP capacity required to meet demand beyond 2025. Large growth predicted, however uncertainty around timing, extent and location. A new WTP located to the south west of Te Kauwhata would be closer to area of forecast growth, however a detailed site selection process has not been carried out. Reputational risk if existing WTP decommissioned after upgrade. However, this needs to be balanced with period that two plants are operated in Te Kauwhata. Bulk main from existing WTP to reservoir needs upsizing in 2025 (see conveyance).	Existing WTP assumed to be 4.5MLD. One option considered expansion of existing WTP (i.e. maximise use of existing assets) (Option 1c). Other options considered new WTP to south west of Te Kauwhata. It was assumed a suitable site could be found in the general vicinity of the three sites identified by Watercare. The general characteristics of the site that appeared most suitable out of the three (see Appendix D) was used to develop high-level costs for the strategy. Provision of additional WTP capacity was considered in two stages based on forecasted demand – 2025 (due to bulk main capacity limitations) and 2040 (due to timing of plant decommissioning). A 2035 timeframe was considered (Option 1b) but discounted; whilst the capital cost is the same, it brings forward the spend and increases NPV by about $2M. Retention of existing WTP in combination with new Te Kauwhata WTP and upgrade at Huntly to enable supply from Ohinewai was also considered (Option 2b) but discounted due to higher costs and retention of three WTPs.
Conveyance	Bulk main from existing WTP to reservoir needs upsizing in 2025 to accommodate forecast demands (if supplying all town demand from existing WTP). Additional pump stations and reservoirs required to meet demand.	Additional pump stations and reservoir storage considered in stages based on forecasted demand and timing of WTP upgrades. New assets assumed to be located adjacent to existing assets, on land owned by WDC. Bulk mains sized for the ultimate design capacity (i.e. not staged).

Table 4-2: Ohinewai Water Supply: Issues & Assumptions

Element	Issues	Assumptions
Conveyance	No existing reticulated supply in Ohinewai. High level short-listed options are supply from Huntly/Te Kauwhata WTP to a reservoir in Ohinewai. A detailed site and route selection process has not been carried out for pipeline or reservoir siting, nor has network modelling been completed for Huntly or Te Kauwhata.	Road corridors were adopted as far as possible for bulk main routes and it was assumed reservoirs were located on an elevated area to the south of Ohinewai. Bulk mains were sized for the ultimate design capacity (i.e. not staged). See Huntly conveyance below. Additional pump stations and reservoir storage considered in stages based on forecasted demand.

Table 4-3: Huntly Water Supply: Issues & Assumptions

Element	Issues	Approach taken in short-list options
Intake	Existing intake can supply forecasted demand to Huntly alone (with Ngaruawahia allocation) to 2050. Alternatively, existing intake can supply forecasted demand to Huntly (with Ngaruawahia allocation) and Ohinewai up to 2030.	New intake not required for options where Ohinewai ultimately supplied by Te Kauwhata (Option 1), assuming condition of intake is satisfactory. New intake near existing intake adopted for options where Ohinewai ultimately supplied primarily by Huntly (Option 2). 2030 timeframe adopted to meet forecasted demand.
WTP	Existing WTP has a design capacity of 8MLD. No upgrades required to supply forecasted demand to Huntly (with Ngaruawahia allocation) to 2050. Relatively large growth predicted in Ohinewai, however uncertainty around timing, extent and location. Additional WTP capacity required beyond 2030 to supply Ohinewai. Site investigations have not been carried out, however WDC planning maps show it is within the floodplain of the Waikato River.	Expansion of existing WTP considered in three stages based on forecasted demand and uncertainty associated with growth. One stage expansion of existing WTP (to 10MLD) was also considered (Option 2a) but discounted; whilst it enables supply of Ohinewai from Huntly until 2045, the total capital cost is higher than supply from Te Kauwhata from 2025, initial capital cost of bulk main from Huntly to Ohinewai is higher, and the additional WTP capacity at Huntly is not required once Ohinewai is supplied from Te Kauwhata.
Conveyance	Forecast demands from Ohinewai to 2025 (~1MLD) can be supplied from northern part of existing Huntly network via small bore bulk main. Ultimate demands from Ohinewai can be supplied from Huntly if a larger bore bulk main is laid through built-up area of Huntly to the WTP.	One group of options considered installing small bore bulk main to supply Ohinewai to 2025 (Option 1, except Option 1d). Other group of options considered installing larger bulk main to supply Ohinewai for the long-term (Option 2). Bulk mains sized for a single design capacity as above (i.e. not staged).

Based on the above considerations, four short-listed water supply options (Options 1a, 1c, 1d and 2c) were carried forward to high-level costing and a multi-criteria analysis. Options 1b, 2a and 2b were discounted for reasons described in the tables above.

4.1.2 Shortlisted Water Supply Options

The four short-listed water supply options (Options 1a, 1c, 1d and 2c) are described below along with time-series graphs comparing the future water treatment plant capacity (current and following staged upgrades) against the predicted peak demands. For Huntly, the current consented limit is also shown.

Variations on short-listed Option 1 result in additional treatment capacity being provided at Te Kauwhata, with Ohinewai ultimately being supplied from Te Kauwhata.

Option 2 has additional treatment capacity provided at Te Kauwhata and Huntly, with Ohinewai ultimately supplied from Huntly.

Options 1a and 1c result in a centralised scheme to supply Ohinewai and supplement water demand as required.

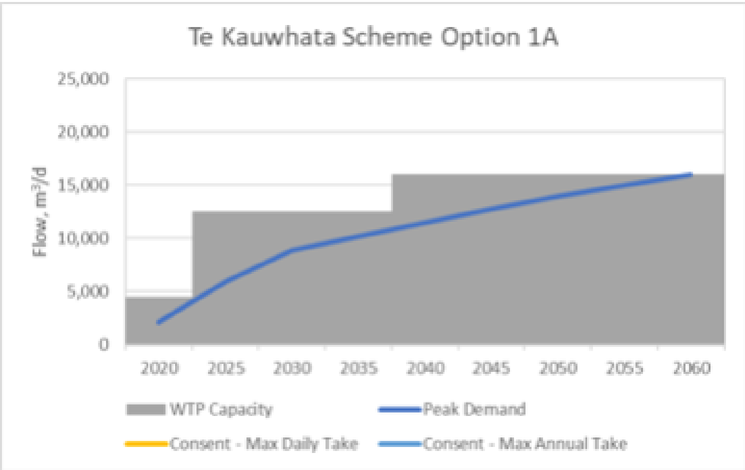
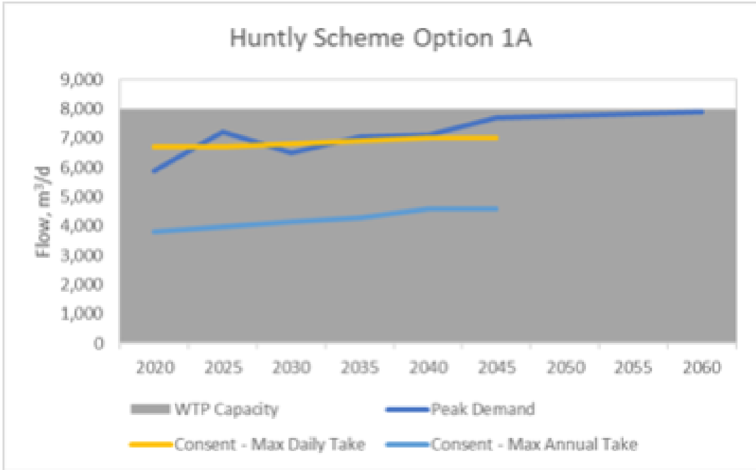
Options 1d and 2a are partly centralised to supply Ohinewai, but don’t enable Te Kauwhata to supplement water demand to Huntly (or vice versa).

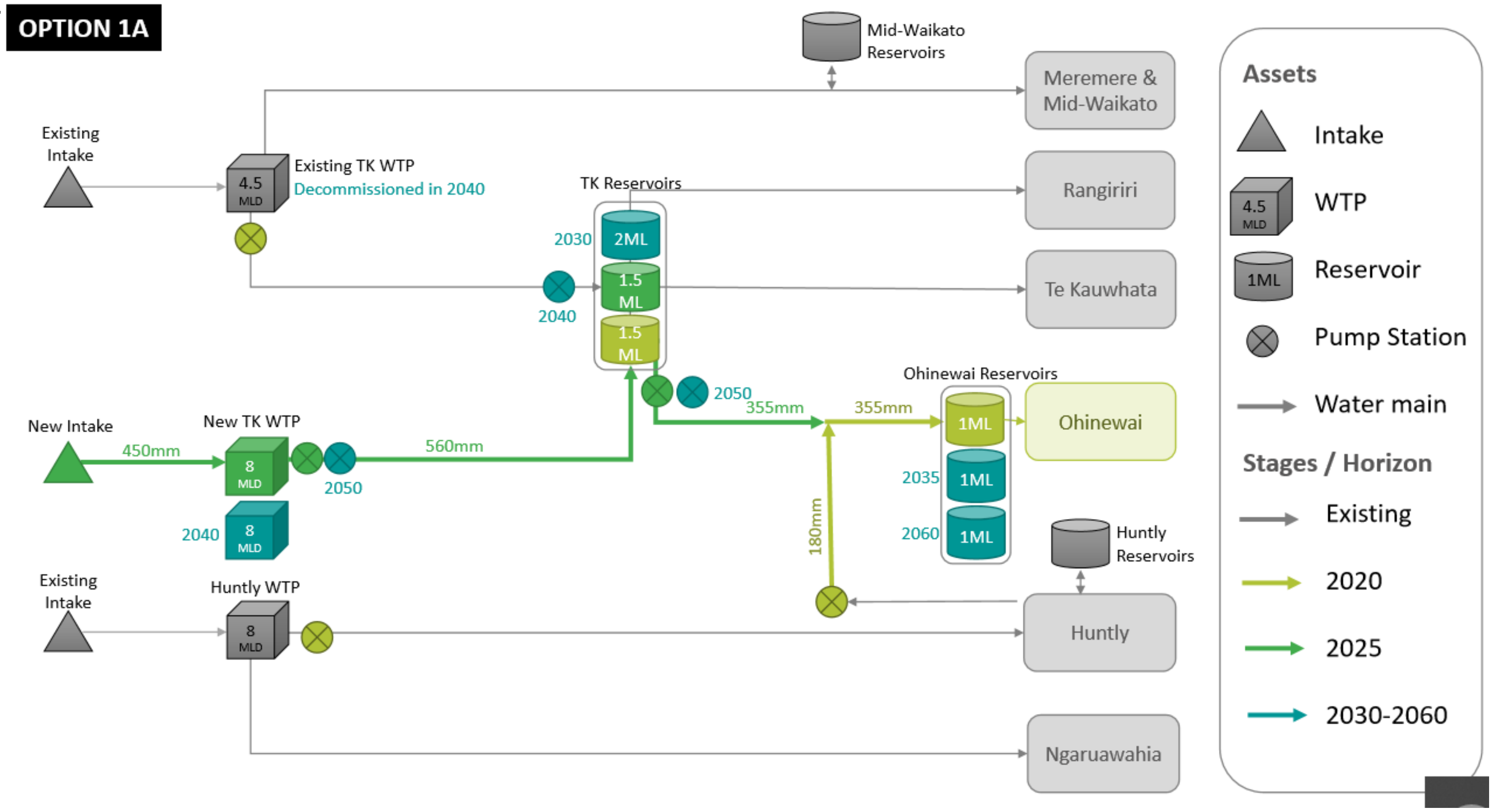
4.1.2.1 Option 1a: Centralised - New Te Kauwhata WTP, Ohinewai serviced from Huntly then Te Kauwhata.

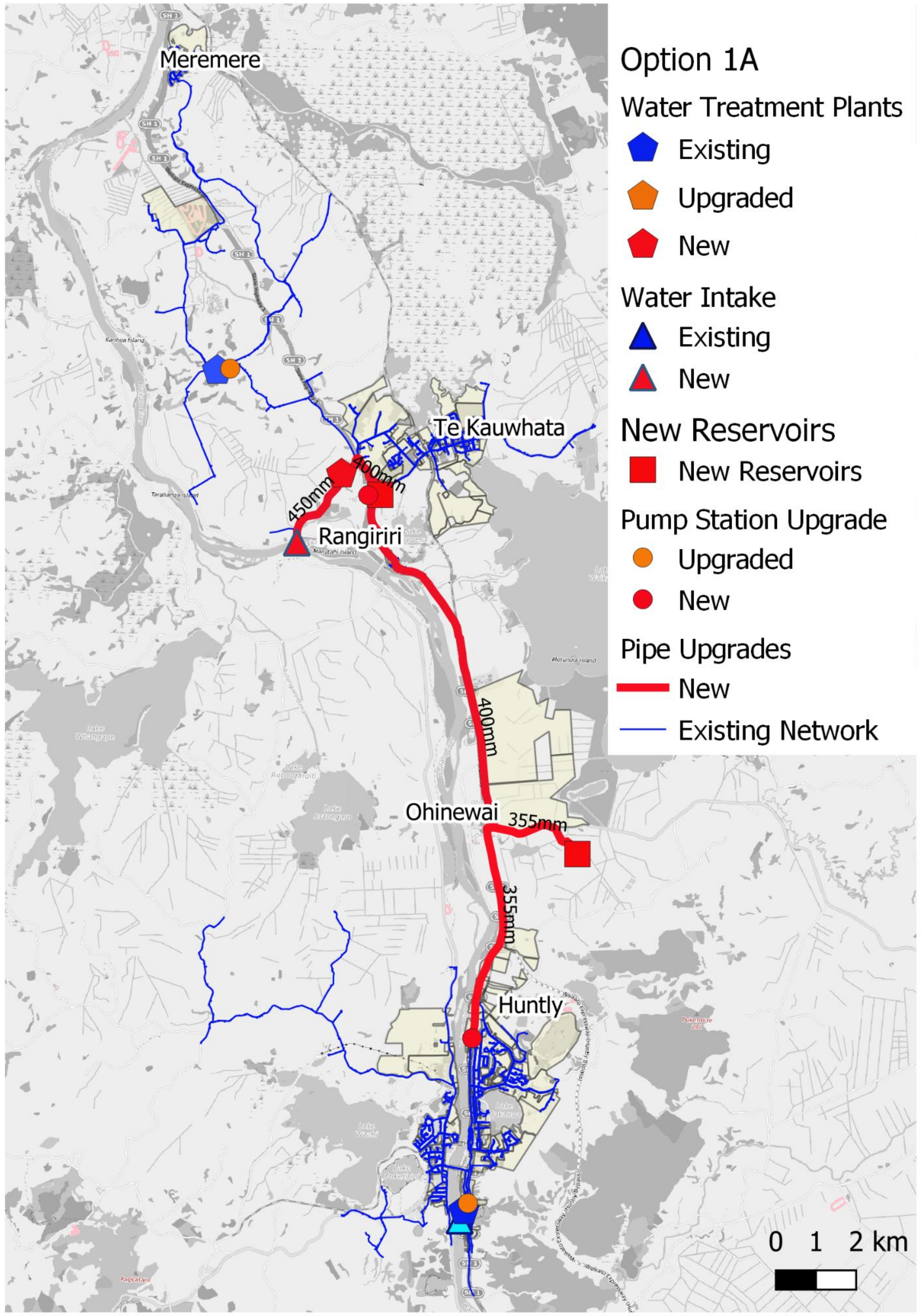
Option Description

- Te Kauwhata - New intake + new 8MLD WTP 2025; upgrade to 16MLD 2040. Existing WTP decom. 2040;
- Huntly - Existing intake + WTP (to 2050, including Ngaruawahia);
- Ohinewai - Network serviced by Huntly WTP to 2025 (<1MLD), then Te Kauwhata WTP;
- Staged upgrades of pump stations and reservoirs.

Peak WTP Demand vs WTP Capacity

Te Kauwhata WTP	Huntly WTP
	



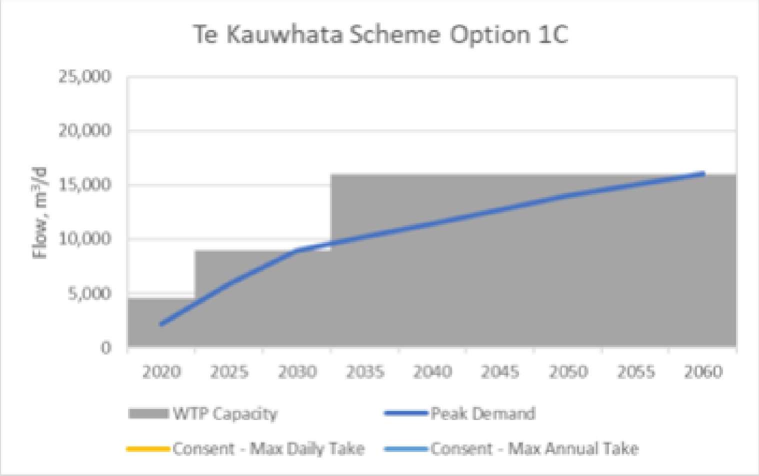
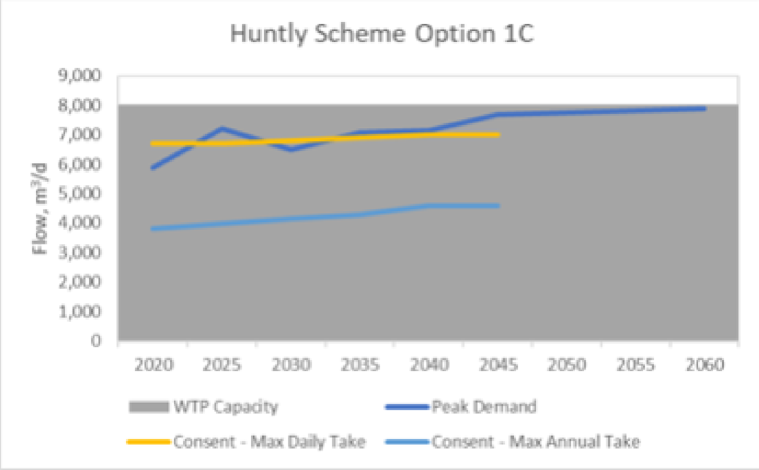


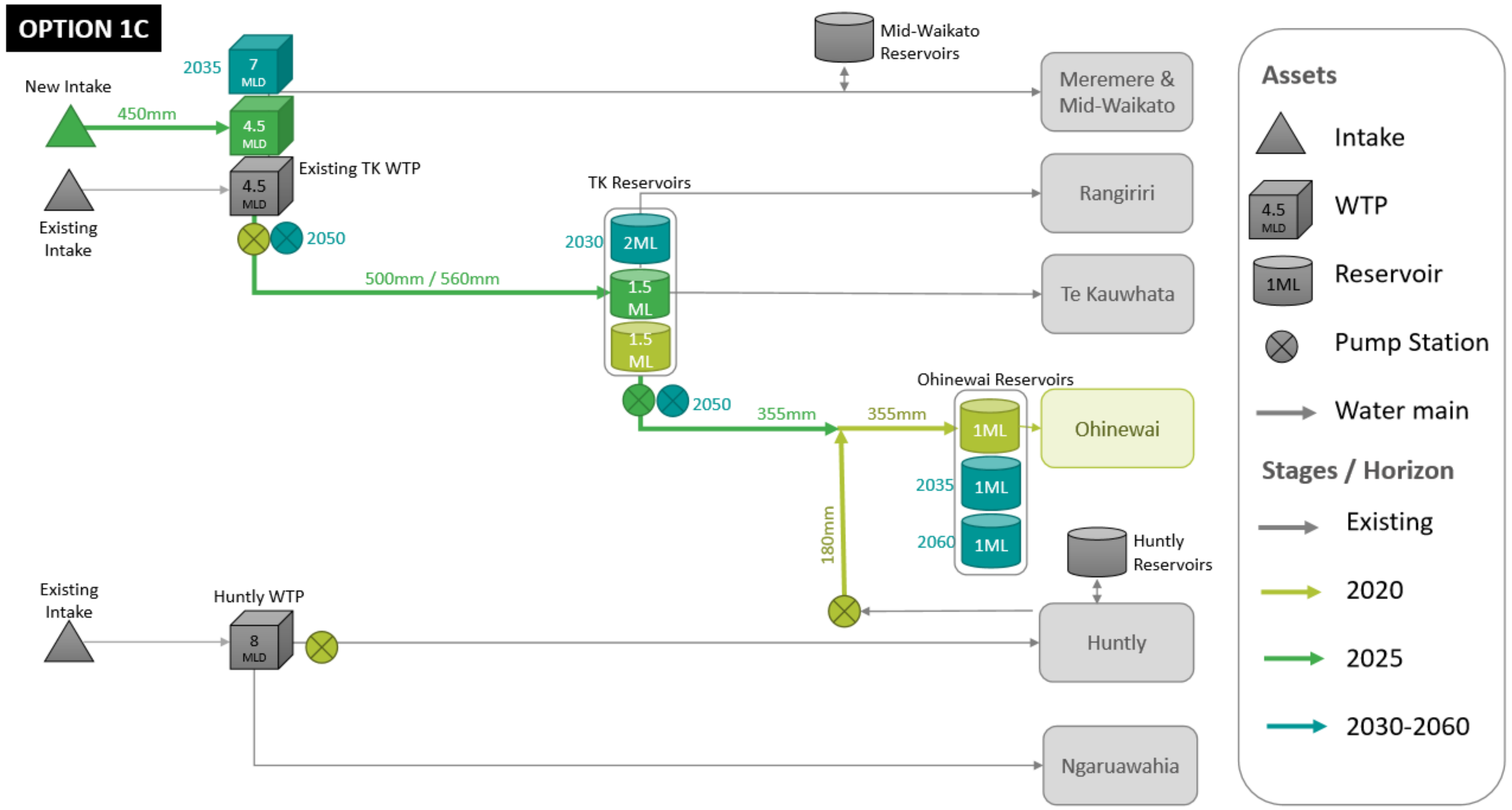
4.1.2.2 Option 1c: Centralised - Te Kauwhata WTP Upgrade, Ohinewai serviced from Huntly then Te Kauwhata.

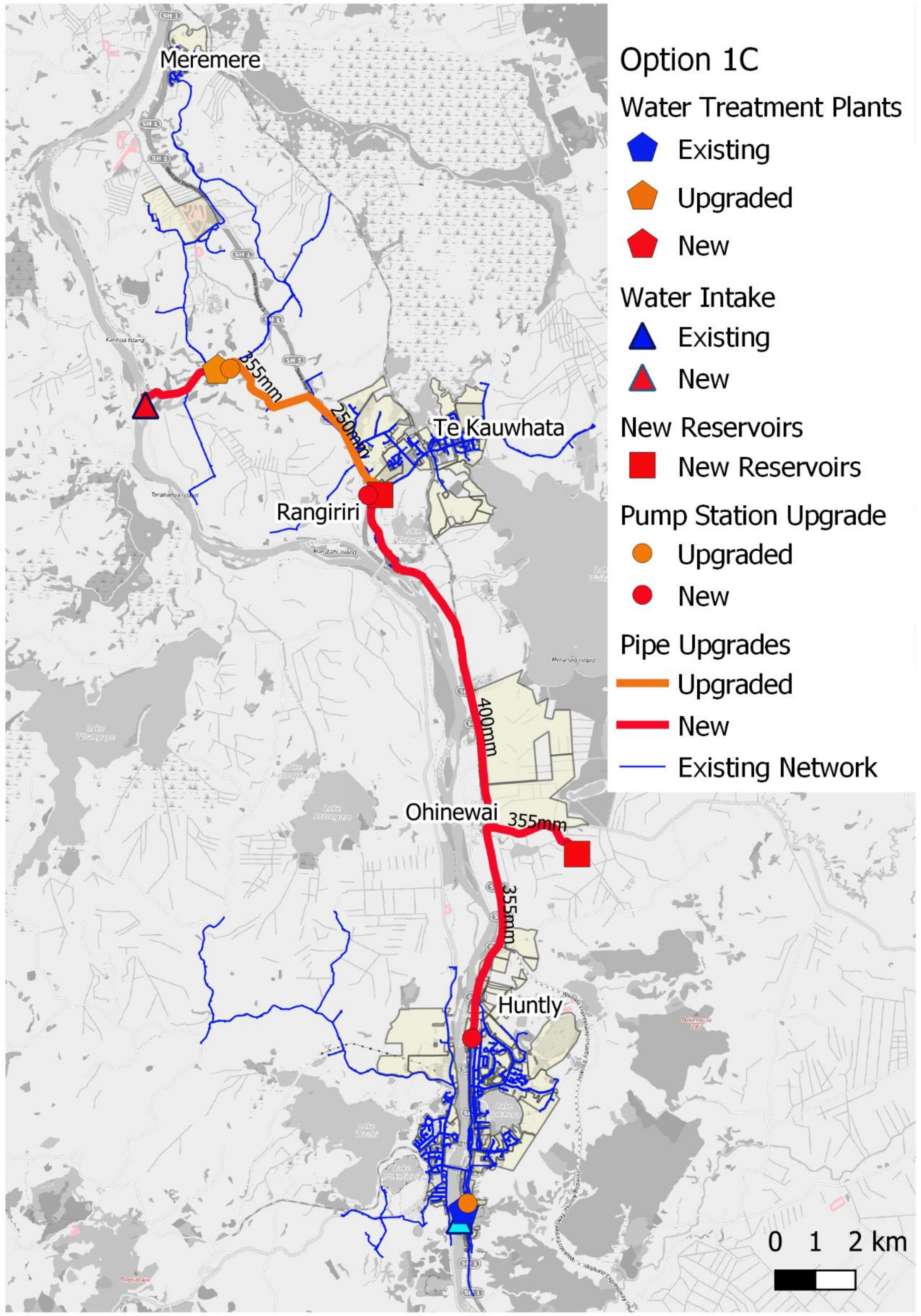
Option Description

- Te Kauwhata - New intake + existing WTP upgraded to 9MLD 2025, with upgrade to 16MLD in 2035;
- Huntly - Existing intake + WTP (to 2050, including Ngaruawahia);
- Ohinewai - Network serviced by Huntly WTP to 2025 (<1MLD), then Te Kauwhata WTP;
- Staged upgrades of pump stations and reservoirs.

Peak WTP Demand vs WTP Capacity

Te Kauwhata WTP	Huntly WTP
	



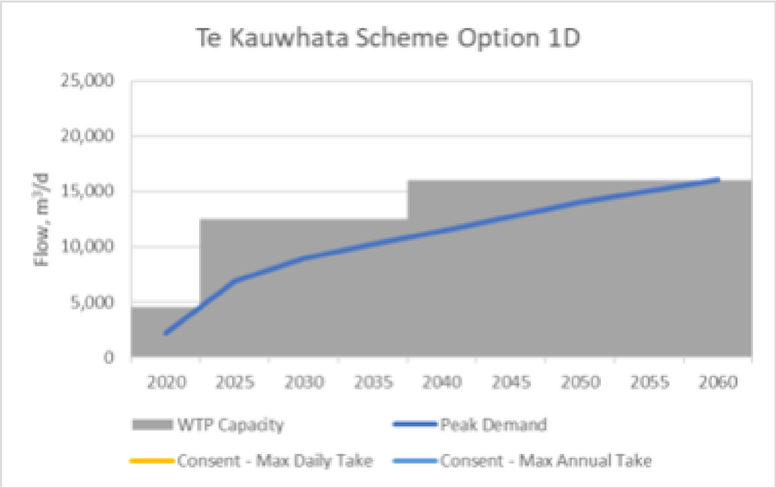
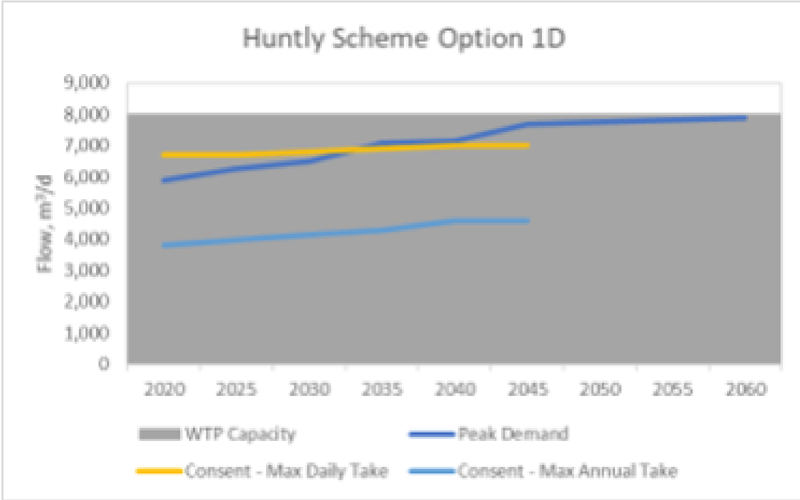


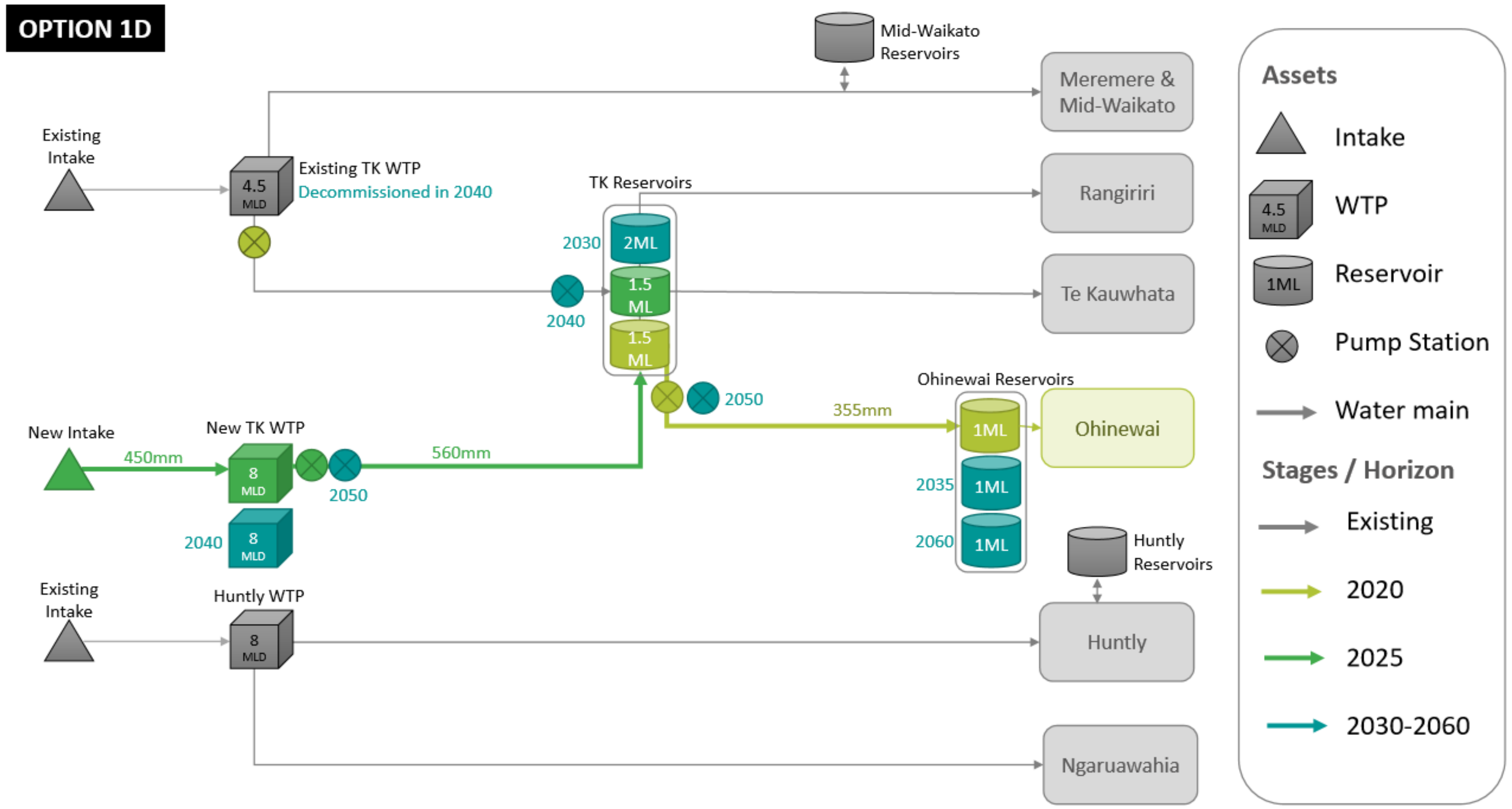
4.1.2.3 Option 1d: Part Centralised - New Te Kauwhata WTP, Ohinewai serviced from Te Kauwhata only

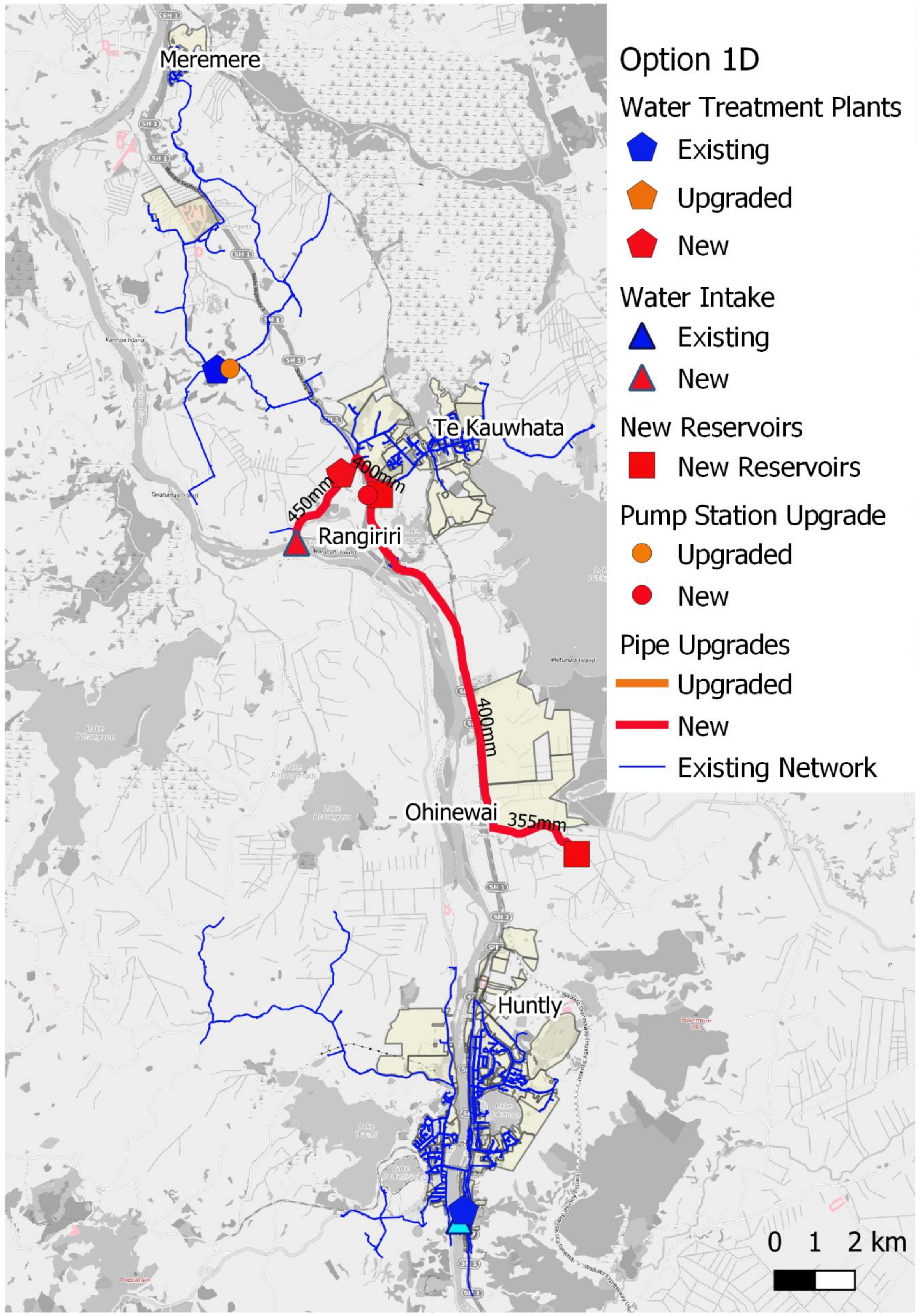
Option Description

- Te Kauwhata - New intake + new 8MLD WTP 2025; upgrade to 16MLD 2040. Existing WTP decom. 2040.;
- Huntly - Existing intake + WTP (to 2050, including Ngaruawahia);
- Ohinewai - Network serviced by Te Kauwhata from 2020;
- Staged upgrades of pump stations and reservoirs.

Peak WTP Demand vs WTP Capacity

Te Kauwhata WTP	Huntly WTP
	





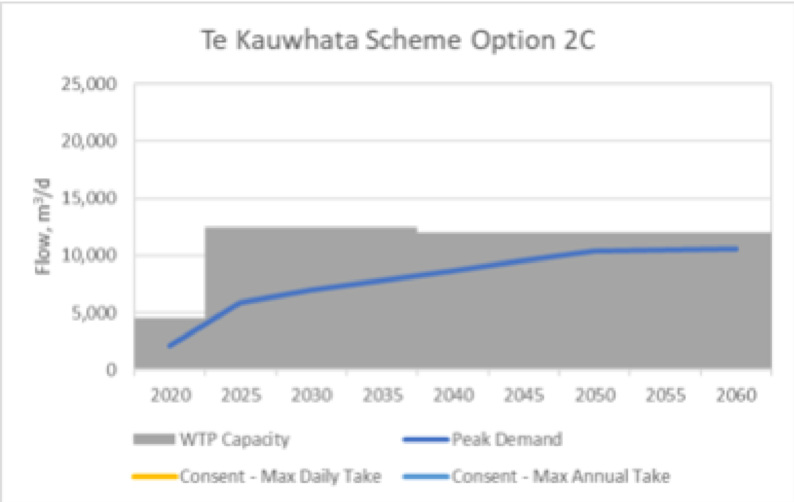
4.1.2.4 Option 2c: Part Centralised - Huntly WTP Upgrade, Ohinewai serviced from Huntly only

Option Description

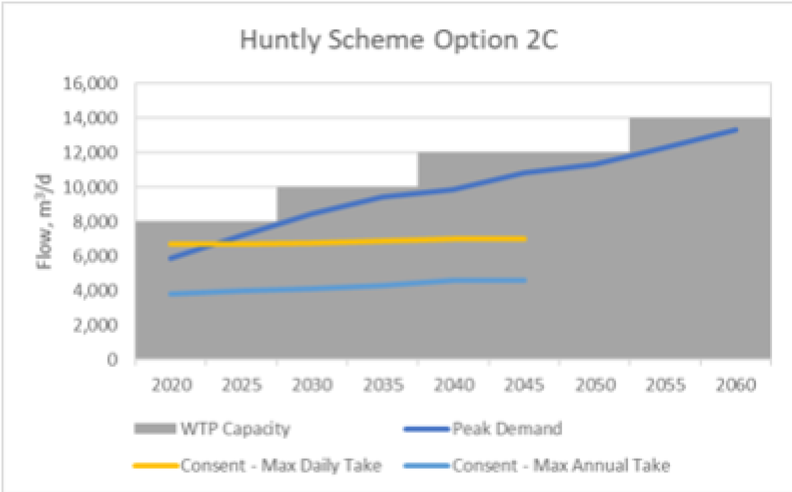
- Te Kauwhata - New intake + new 8MLD WTP 2025, with upgrade to 12MLD 2040. Existing WTP decom. 2040;
- Huntly - New intake + existing WTP upgrade to 10MLD 2030, with upgrade to 12MLD 2040, upgrade to 14MLD in 2055 (Huntly to 2050, including Ngaruawahia);
- Ohinewai - Network serviced by Huntly WTP from 2020;
- Staged upgrades of pump stations and reservoirs.

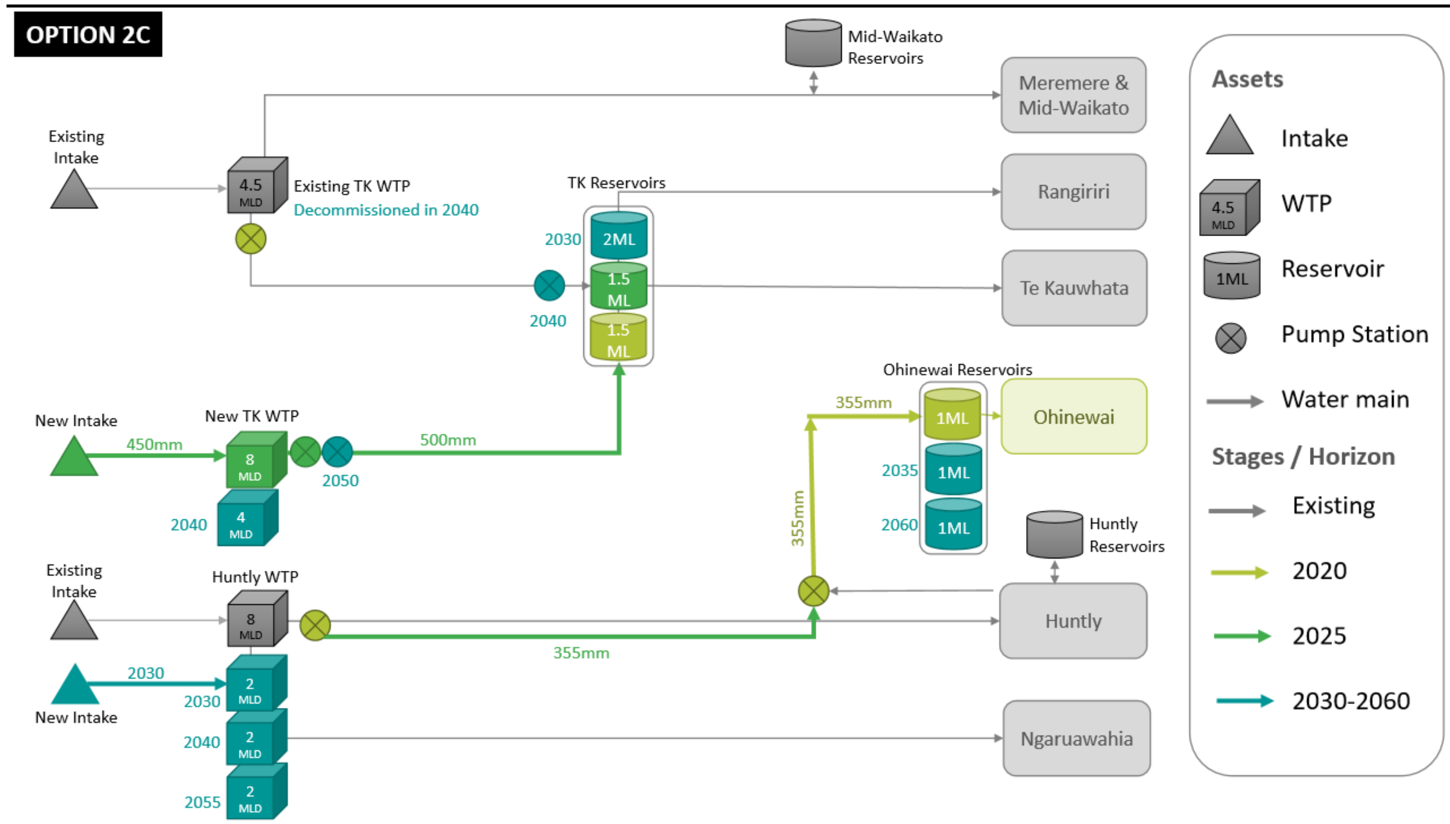
Peak WTP Demand vs WTP Capacity

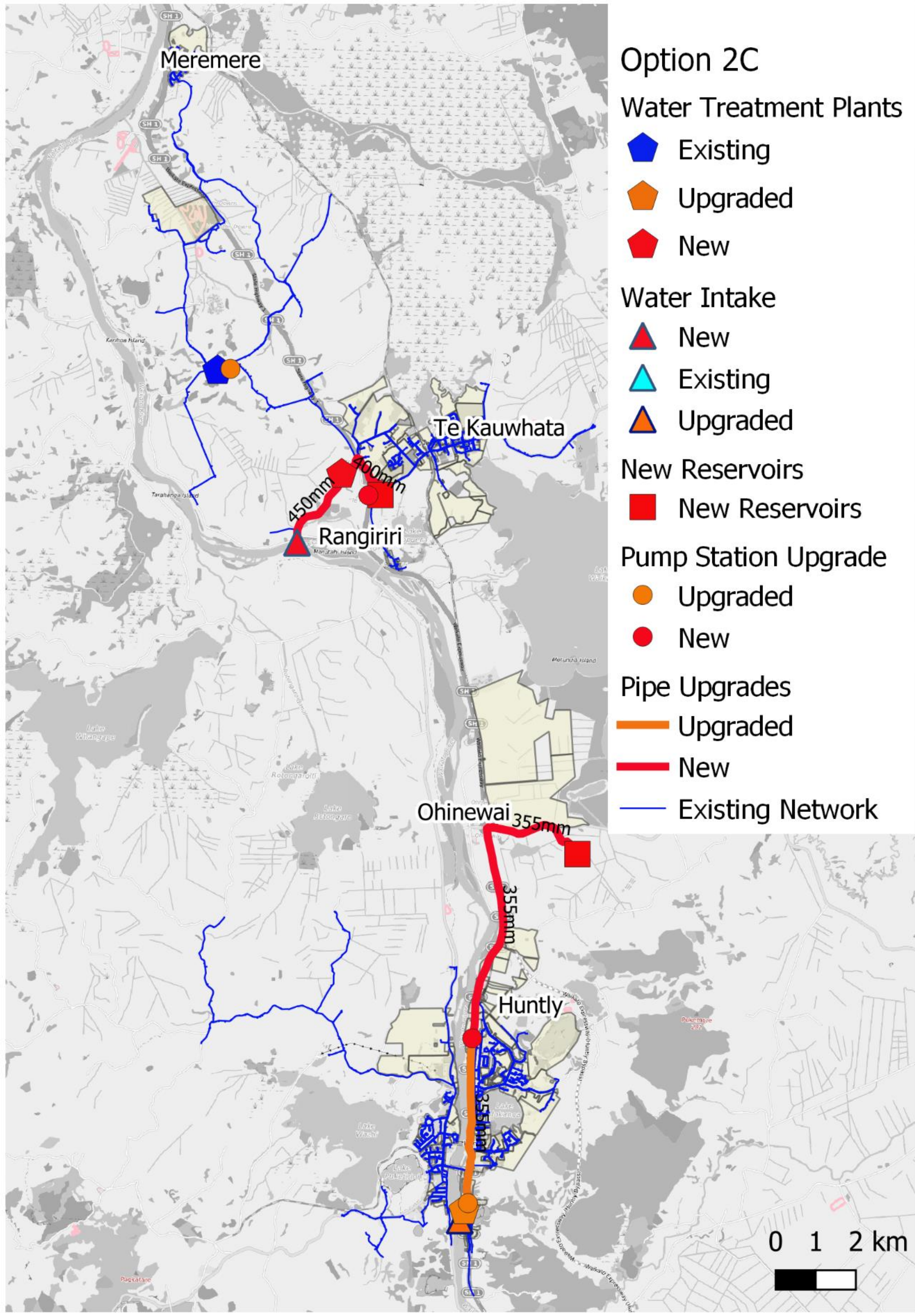
Te Kauwhata WTP



Huntly WTP







4.1.3 Cost Estimate

High-level cost estimates have been prepared for each of the options, including:

- River intake works and inlet screening;
- Conveyance of raw water to the WTP including pump stations and conveyance mains;
- New or upgraded WTPs;
- Additional pump stations, reservoirs and bulk treated water mains.

Capital and operational expenses have been considered for each option.

The cost estimates only include bulk supply and treatment assets. Although significant network assets will be required to service the growth (e.g. reticulation of Ohinewai), these costs have not been included as they are outside the scope of this project.

4.1.3.1 Assumptions

Appendix G details the key assumptions used to develop the cost estimates.

The high-level costs do not include GST and are a best estimate at the time of pricing. All costs are estimates based on a level of design appropriate for strategic planning and for options comparison purposes only, and as a result have a wide margin of error (level of accuracy is assumed to be approximately ±50% at this stage). Further development and more detailed costing of preferred solution(s) is recommended before any commercial decisions are made.

In general costs have been developed from published rates (2011 AECOM report, New South Wales Guidance Manual) and/or Stantec/MWH legacy data for comparable projects. Where not already allowed, allowances for preliminary and general (15%), contingency (30%) and professional and non-works costs (30%) have been added. No allowance has been made for geotechnical investigations, surveying, feasibility studies or fast-tracking.

Watercare's NPV spreadsheet and standard defaults were used for the NPV calculation.

4.1.3.2 Cost Estimates

The high-level estimates of capital and operating costs for each option are shown below in Table 4-4 alongside the NPV. The operational costs shown are the average costs over a 40-year design period.

Refer to Appendix F for a breakdown of capital and operating costs as well as NPV from 2020 to 2060.

Table 4-4: Water Supply Option Cost Estimates

	Option 1A	Option 1C	Option 1D	Option 2C
Capex - Total, 40 years	$65,000,000	$61,400,000	$66,500,000	$82,300,000
Opex - Average, 40 years	$940,000	$930,000	$930,000	$990,000
NPV (@8%, 40 years)	$53,600,000	$53,300,000	$56,500,000	$62,000,000

Option 1A and 1C have the lowest NPV, with similar capital spend in the first 10 years ($42.6M for Option 1A and $40.8M for Option 1C).

Option 1D, whilst having a similar overall capital spend to Option 1A, has a higher NPV due to the early installation of the conveyance main from Te Kauwhata to Ohinewai. Option 2C is the most expensive in terms of overall capital spend, operating costs and NPV.

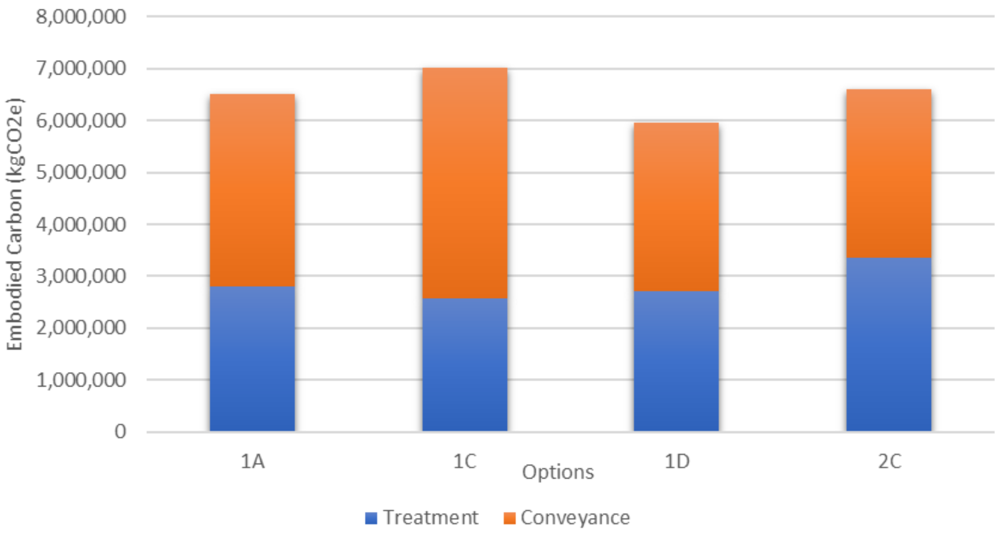
4.1.4 Carbon Assessment

A quantitative capital carbon assessment has been done through Mott MacDonald's Carbon Portal. This assessment is intended to be a like to like comparison between the options as the models used are based on global best practice standard design and emission factors. A quantitative assessment of operational carbon was not carried out.

The carbon assessment of each option is high level (made up of items that contribute to majority of the overall capital carbon). A contingency of 15% has been applied to all four options to account for the modelling uncertainties and minor items not included. Refer to Appendix G for assumptions used in this assessment.

Figure 4-2 below shows the embodied carbon calculated for each of the options and the contributions from the treatment and conveyance aspects of the option.

Figure 4-2: Composition of Embodied Carbon - Water Supply Options



The capital carbon associated with treatment was similar for all options (in the order of 3,000tCO_2e). The minor difference between options is due to the location of the upgrades, rather than the overall capacity.

Option 1c has the lowest capital carbon associated with treatment, as the existing Whangamarino WTP is retained (whereas it is decommissioned in other options).

The greatest difference in capital carbon is associated with conveyance. Again, this is to be expected as there is a significant difference in the length and size of pipelines required in the different options. Option 1c, which requires upgrading the existing raw water bulk main and a centralised bulk main from Te Kauwhata to Huntly, has the greatest capital carbon associated with conveyance. Options 1c and 2c are similar; these options are only partly centralised.

The total capital carbon is similar for all options (in the order of 6,000 to 7,000tCO_2e). This is due to options with higher treatment capital carbon having lower conveyance capital carbon and vice versa. As the capital carbon was similar over the four options, it is not a major differentiator between the options.

4.2 Wastewater

As a result of Workshops 2, 3 and 4 (refer to Appendix H) with Watercare, four wastewater options were short-listed. These were the highest scoring options – 1b, 1c, 2b and 3.

Options 1b and 1c involve creating a centralised scheme with the WWTP at Huntly (1b) or between Te Kauwhata and Ohinewai (1c). This plant will receive and treat wastewater from Huntly, Te Kauwhata, Rangiriri and Ohinewai.

Option 2b is a centralised WWTP at Huntly treating wastewater from Huntly and Ohinewai, and a standalone WWTP for Te Kauwhata.

Option 3 is a variation to option 2b, with a centralised WWTP located between Te Kauwhata and Ohinewai treating wastewater from those two catchments, and a standalone WWTP for Huntly.

These four options were carried forward to high-level costing and a multi-criteria analysis.

4.2.1 Issues and Assumptions

A full assessment of treatment requirements for each locality has not been carried out. For the purpose of this strategy, wastewater treatment plant technologies and configurations have been selected to achieve compliance with assumed future resource consent limits, including stringent limits for total phosphorus and total nitrogen. It has been assumed that advanced treatment technologies will be required to meet increasingly strict discharge consents until the ultimate design horizon. These treatment processes include:

- Membrane bioreactor;
- Biological nitrogen removal;
- Chemical phosphorous removal;
- UV disinfection.

The configuration of all the treatment plants are identical. The WWTPs have 2-stage inlet screening (coarse and fine), and grit removal. The wastewater then undergoes nitrification and denitrification in a 4- stage Bardenpho process before being filtered through the membranes. Chemical (e.g. alum) is added to the bioreactor for chemical phosphorus removal. The permeate is then further disinfected through UV disinfection before being discharged to the Waikato River. The generated sludge is processed on site, through the thickening and dewatering plant.

For the purposes of this study, we have assumed that the dewatered solids will be disposed of to landfill. In future design stages, opportunities for on-site monofill (e.g. through conversion of existing treatment ponds) can be explored.

All the options described below have the same storage arrangements at the source locations. There is an opportunity to repurpose the existing ponds into storage, however for the purpose of this study underground storage was included to be conservative. Underground storage is provided at each urban centre for storage of peak wet weather flows:

- 2,520m^3 at Te Kauwhata;
- 1,720m^3 at Ohinewai;
- 1,920m^3 at Huntly;

Option 2B has the potential to be staged. The new WWTP in Te Kauwhata and centralised WWTP in Huntly would be constructed in 2025. However, initially there is a possibility the new

Te Kauwhata WWTP could continue to discharge to Lake Waikare and the outfall to the Waikato river constructed in future. This staging has not been reflected in the costing exercise, due to time constraints. This staging approach has another benefit being that in the future instead of building a river outfall, a conveyance pipeline to the centralised plant could be built, centralising all three catchments.

Refer to Appendix E for more detail about the assumptions used to develop these options.

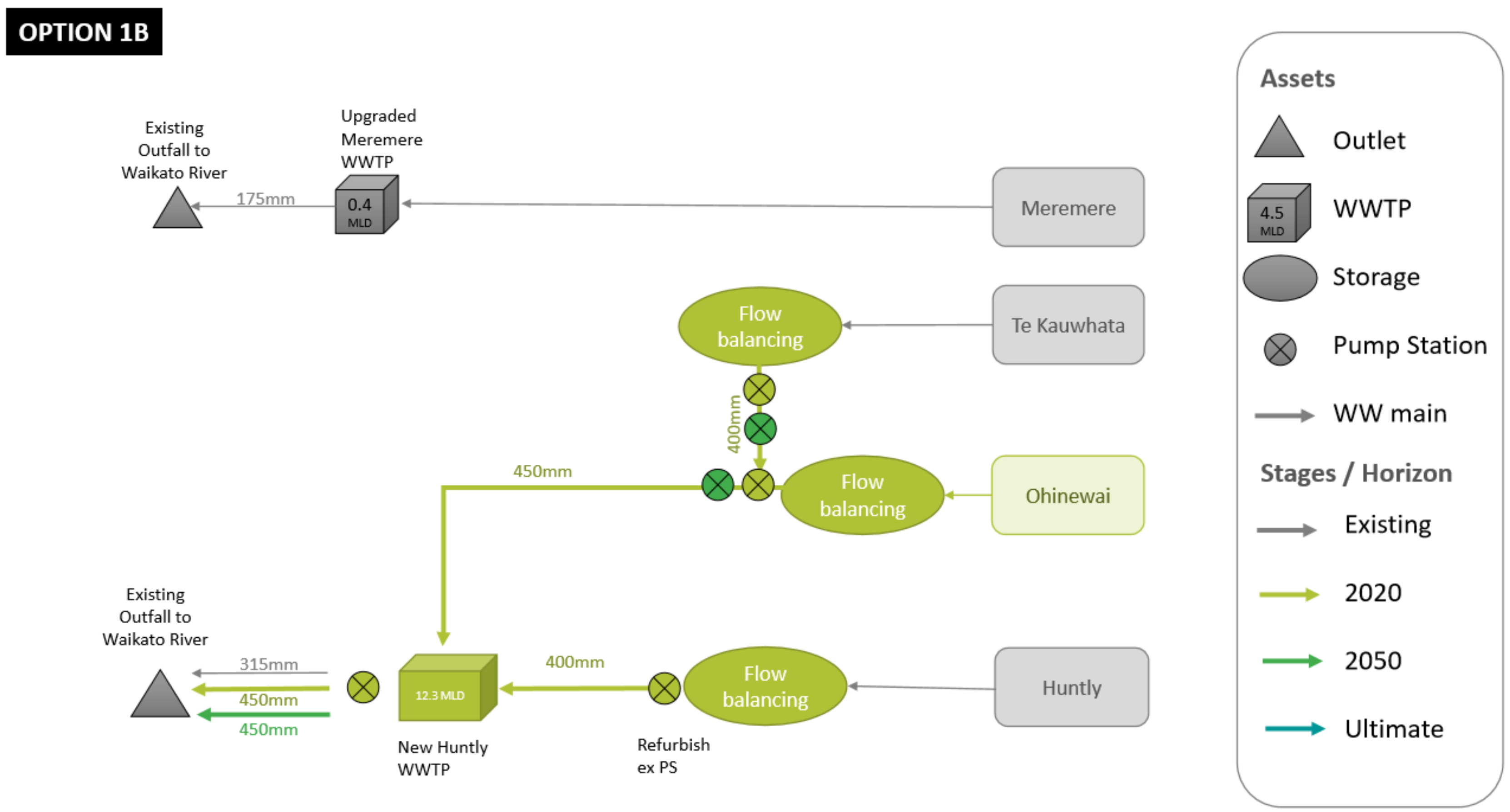
4.2.2 Shortlisted Wastewater Options

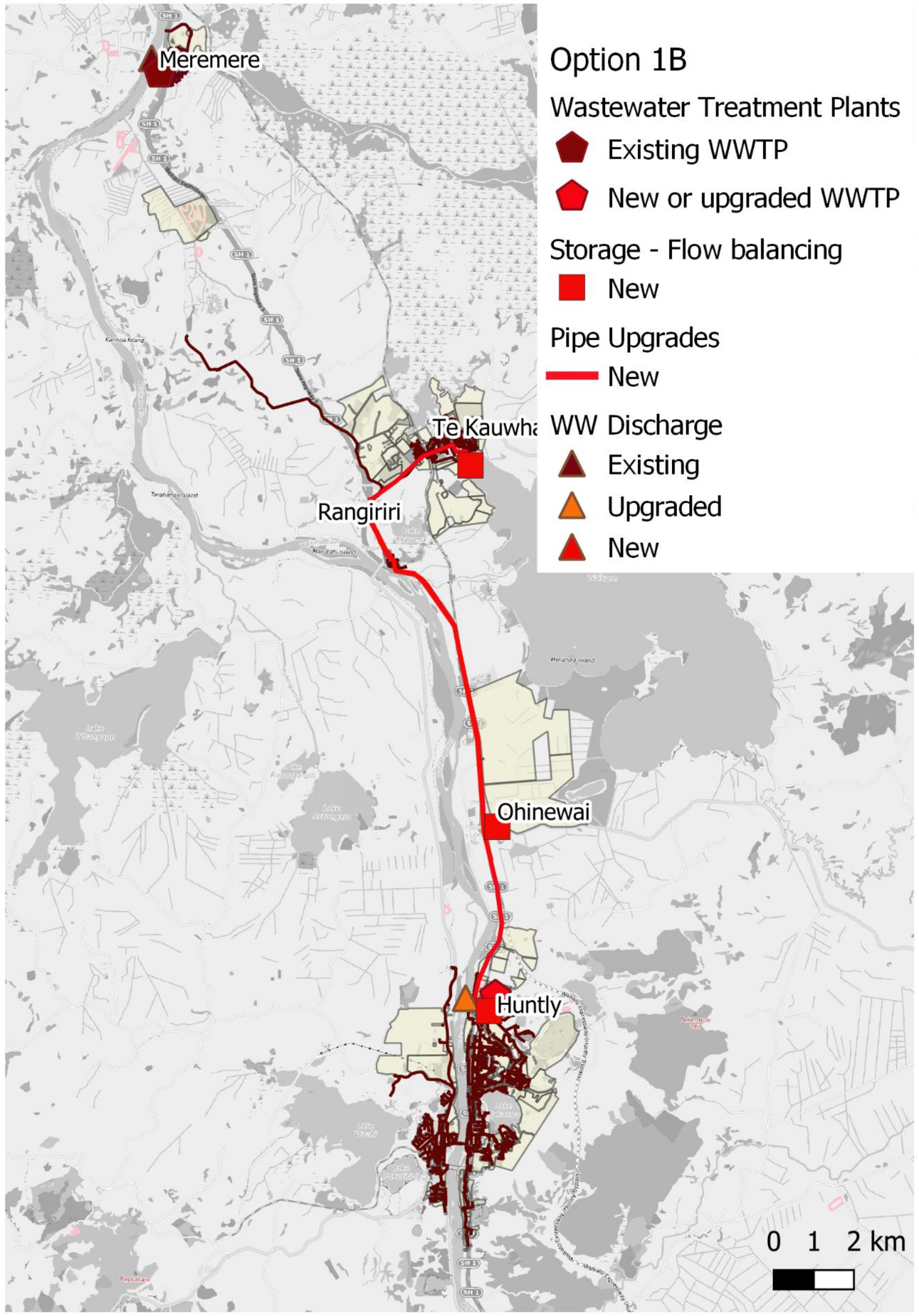
The four short-listed wastewater options (Options 1b, 1c, 2b and 3) are described below.

4.2.2.1 Option 1b: Centralised WWTP at Huntly

Option Description

- WWTP capacity of 25,000m³/day (PDF) at Huntly;
- Discharge to the Waikato River at the current consented location;
- Conveyance consists of:
  - 9.4km rising main from Te Kauwhata to Ohinewai pump station;
  - 2x pump stations, one main Te Kauwhata pump station and one booster pumping station (not required until year 2050);
  - 9.5km rising main from Ohinewai to the new Huntly centralised WWTP;
  - 2x pump stations, one main Ohinewai pump station and one booster pumping station (not required until year 2050);
  - 500m pipeline connecting the existing Huntly WWTP to the new centralised WWTP;
  - The existing Huntly WWTP pump station is to be refurbished and used for the transfer of wastewater from the underground storage to the new WWTP site;
  - 1.5km new discharge pipeline from the new WWTP to the river discharge, with a duplicate pipe of the same size to be installed in 2050;
  - The existing discharge pipe will be retained until 2050 (the feasibility of this is dependent on location of the new WWTP);
  - New discharge pump station from the new WWTP to the river.

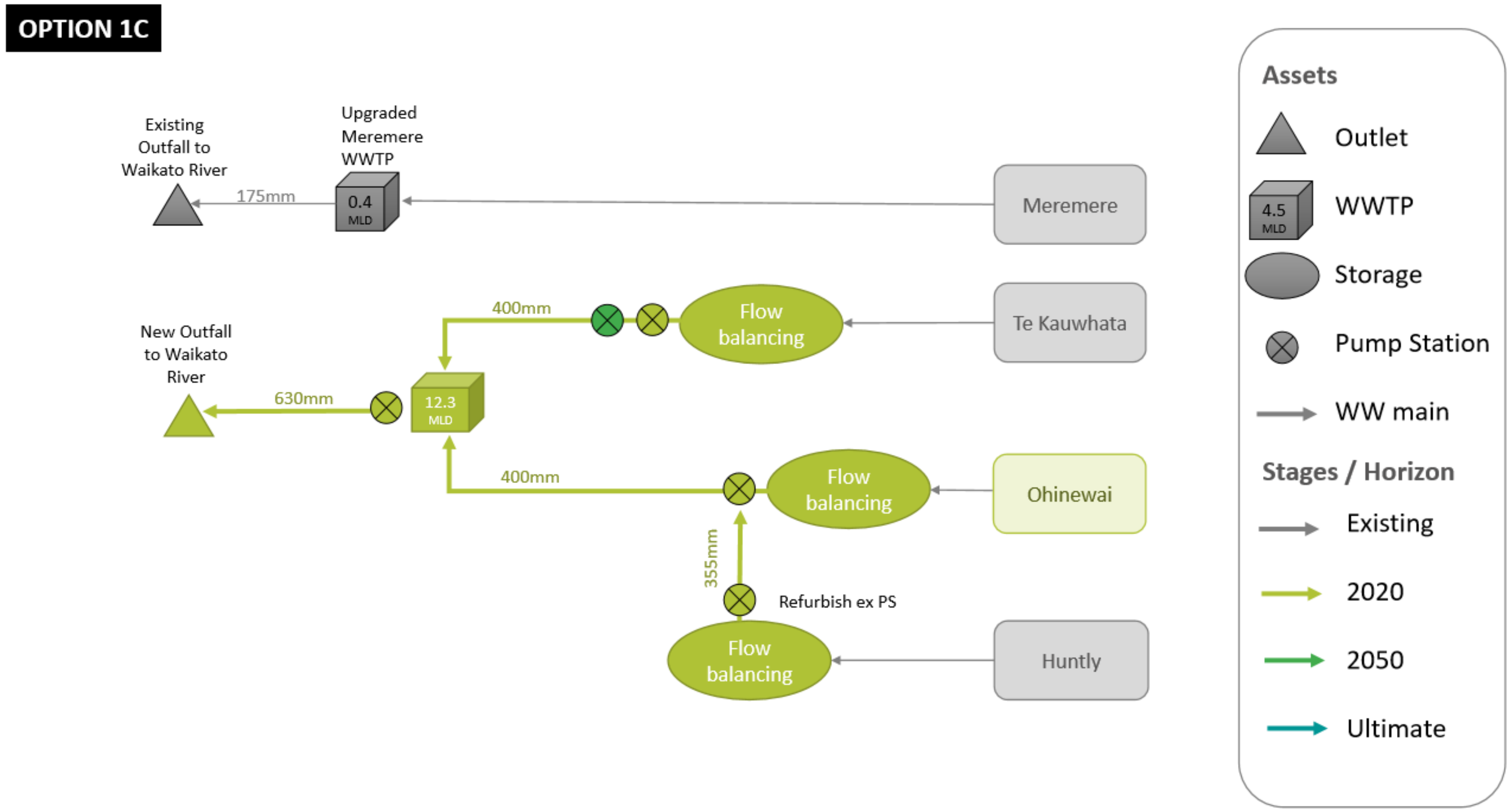


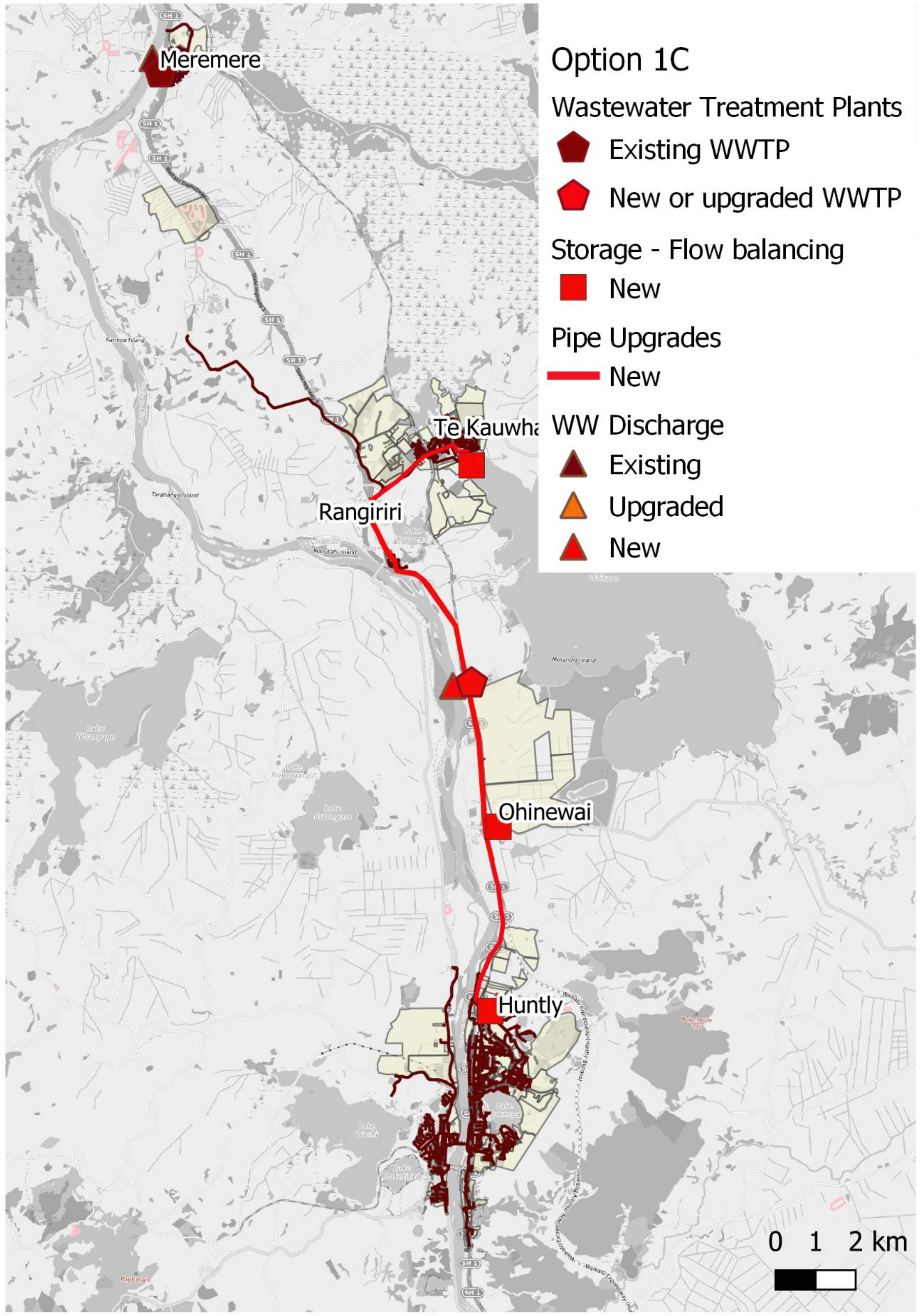


4.2.2.2 Option 1c: Centralised WWTP at Ohinewai

Option Description

- WWTP capacity of 25,000m³/day (PDF) at Ohinewai;
- Discharge to the Waikato River through a new outfall;
- Conveyance consists of:
  - 2x pump stations, one main Te Kauwhata pump station and one booster pumping station (not required until year 2050);
  - 9.4km rising main from Te Kauwhata to centralised WWTP;
  - 5.9km rising main from Huntly to Ohinewai;
  - Refurbish the existing Huntly WWTP pump station to pump wastewater to Ohinewai;
  - 3.5km rising main from Ohinewai to centralised WWTP;
  - Pump station pumping flows to the centralised WWTP from Ohinewai and Huntly;
  - 700m discharge pipeline to river;
  - Discharge pump station from the new WWTP to the river.

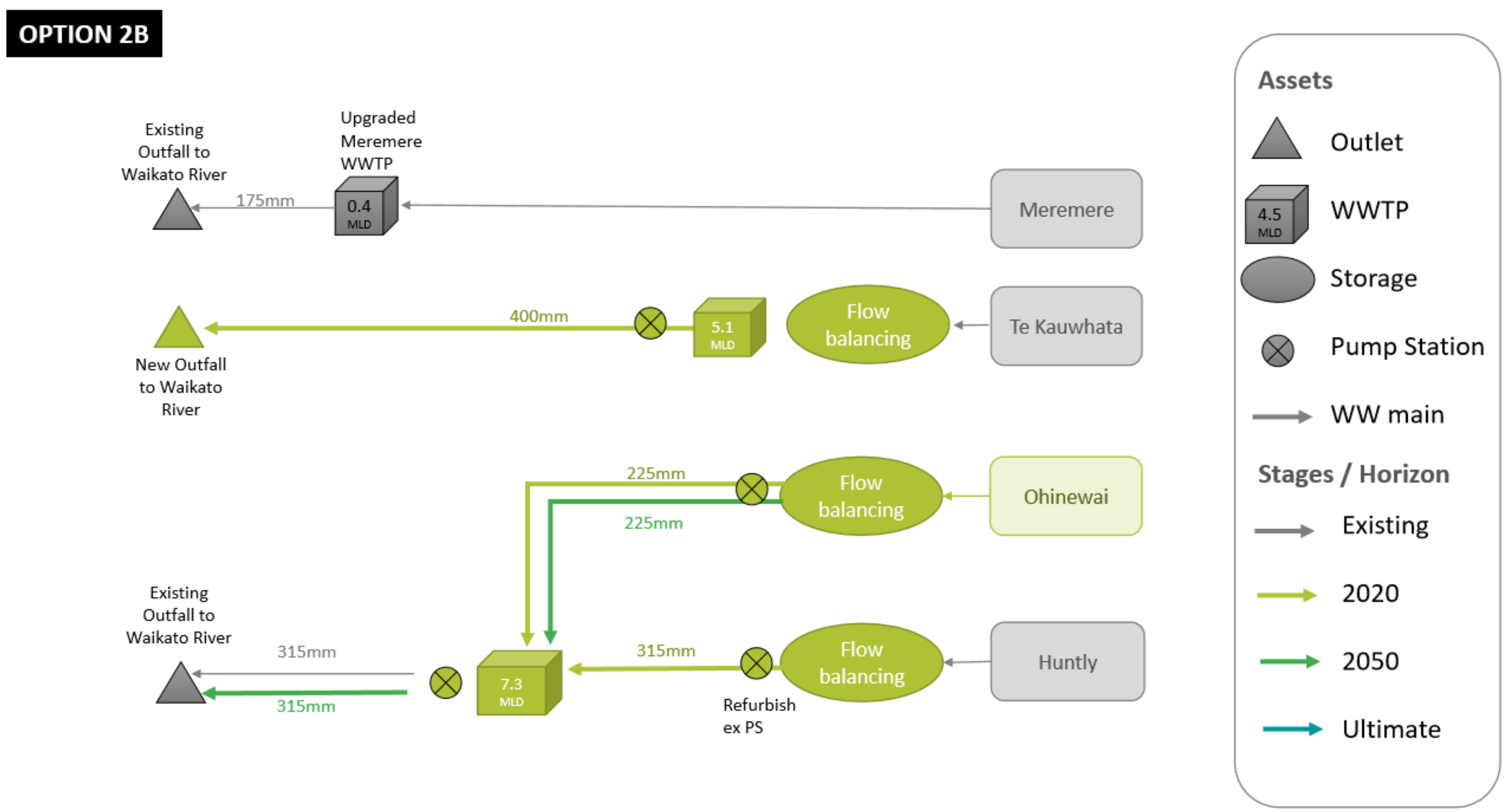


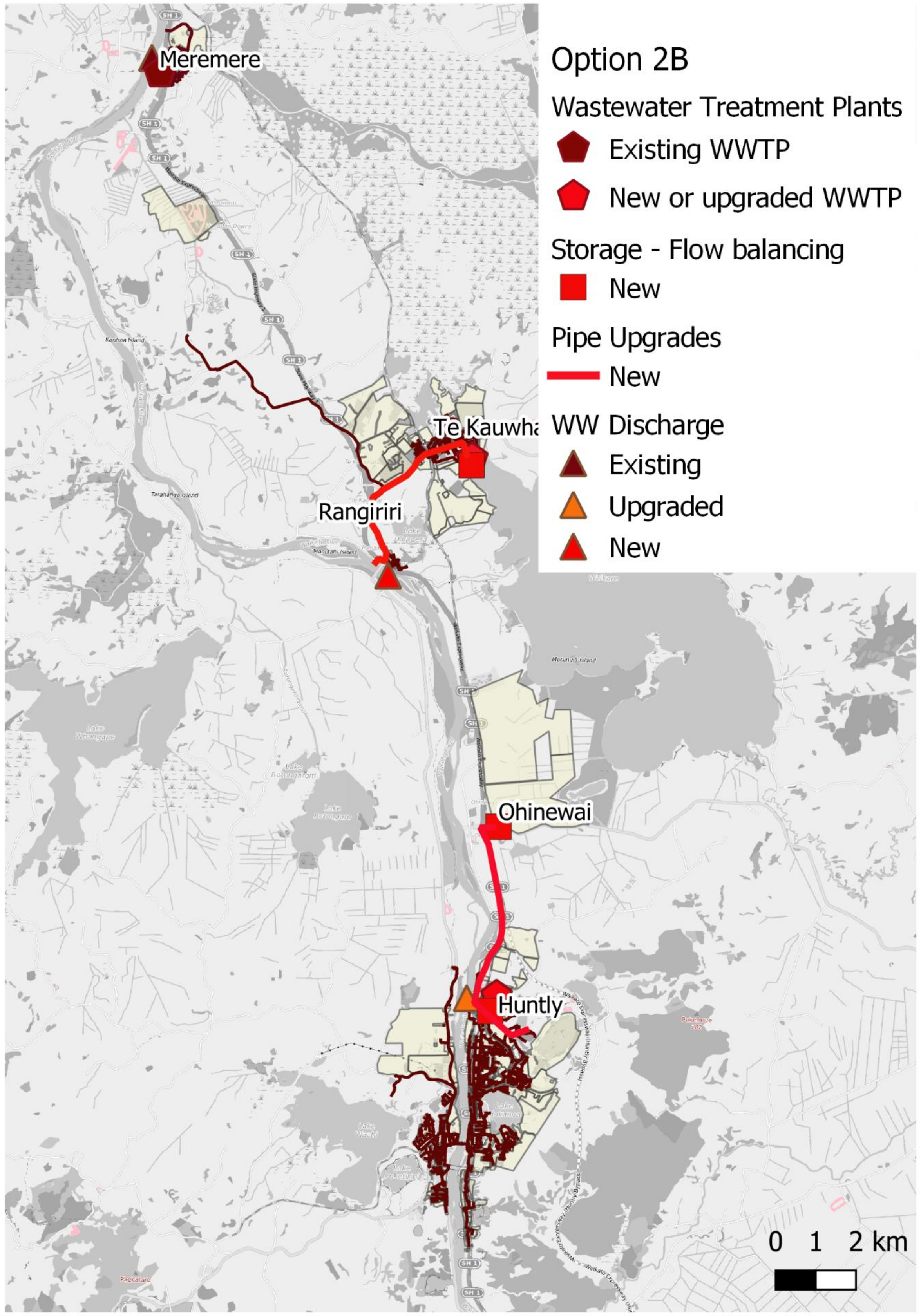


4.2.2.3 Option 2b: Part Centralised – New WWTP at Huntly (for Huntly and Ohinewai) and new WWTP at Te Kauwhata.

Option Description

- WWTP capacity of 11,500m³/day at Te Kauwhata; discharge to the Waikato River through a new river outfall;
- Centralised WWTP at Huntly capacity of 13,500m³/day; discharge to the Waikato River through existing outfall;
- Conveyance consists of:
  - Pump station from Te Kauwhata WWTP to the new river discharge;
  - 5.5km pipeline for discharge to the Waikato River from the Te Kauwhata WWTP;
  - 3.6km rising main from Ohinewai to Huntly WWTP. This pipe will be duplicated in 2050;
  - Pump station, pumping flows from Ohinewai to Huntly;
  - 500m pipeline between the existing Huntly WWTP and the new centralised WWTP;
  - The existing inlet PS at the Huntly WWTP will be refurbished to pump flows to the new centralised WWTP;
  - New pump station at the centralised WWTP, discharging to the river;
  - The existing discharge pipe will be retained (the feasibility of this depends on the location of the new WWTP);
  - A 1.5km duplicate discharge pipeline to the river will be added in 2050.

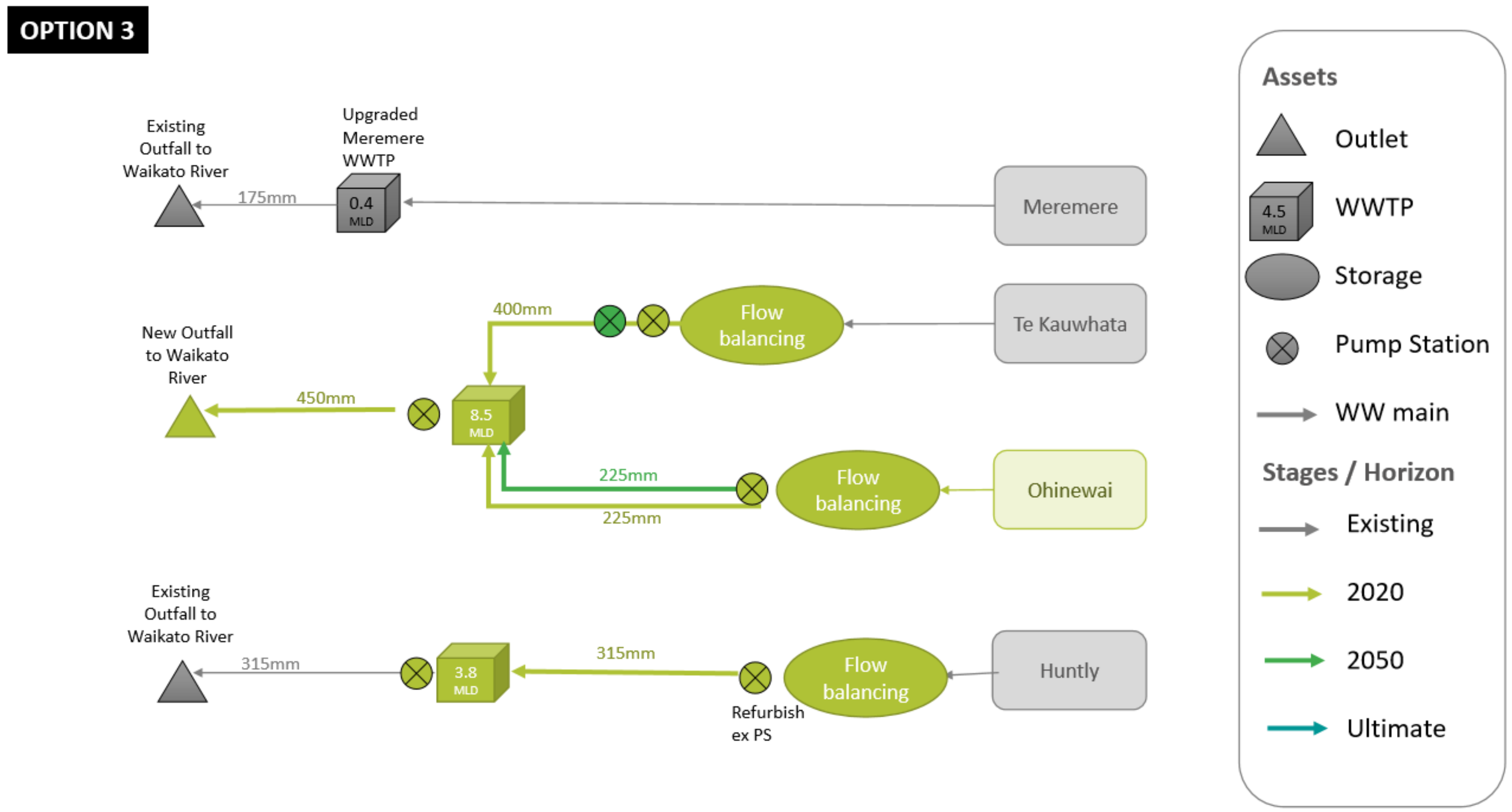


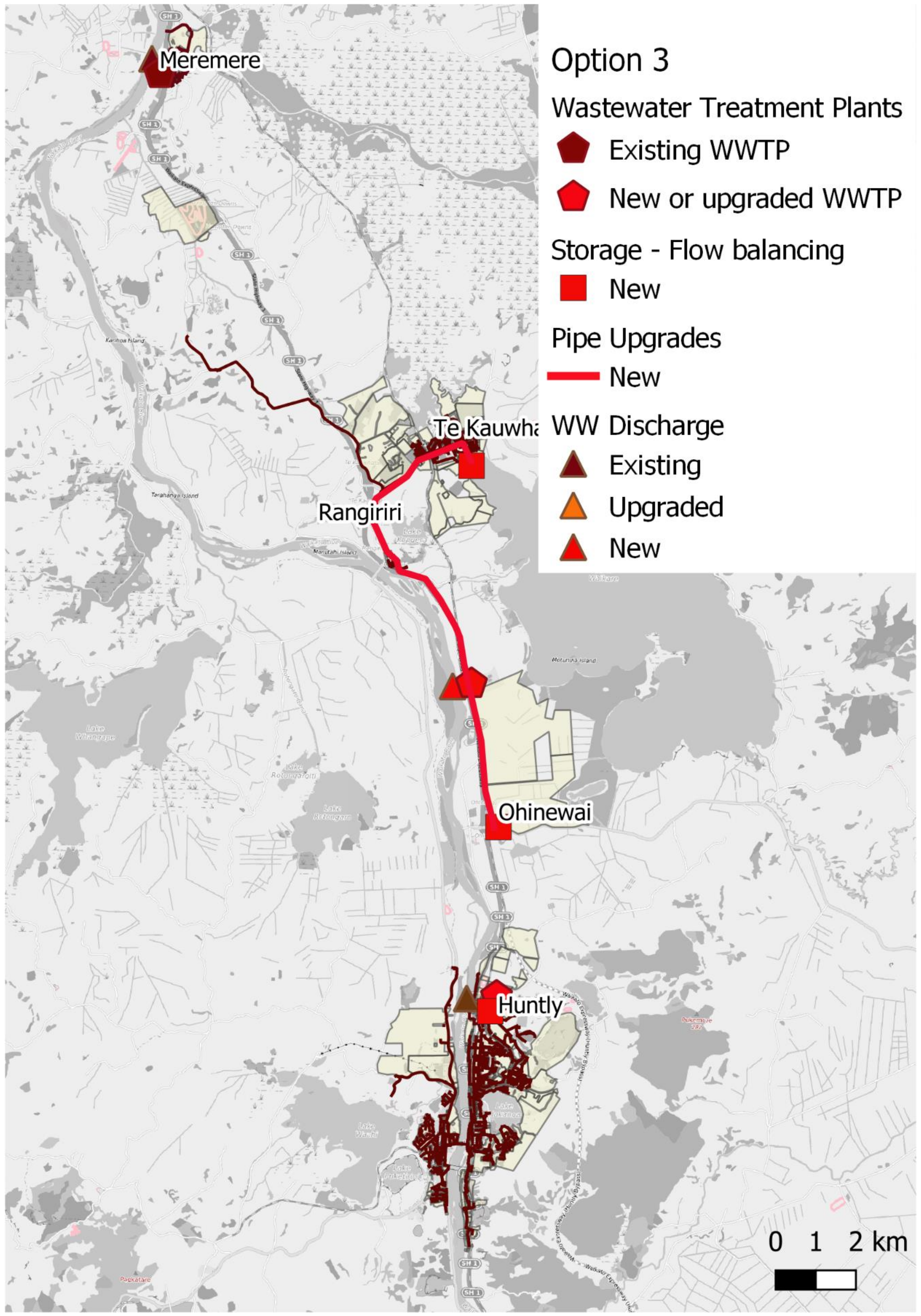


4.2.2.4 Option 3: Part Centralised – New WWTP between Te Kauwhata and Ohinewai (for Te Kauwhata and Ohinewai) and new WWTP at Huntly.

Option Description

- Centralised WWTP capacity of 17,500m³/day (PDF) between Te Kauwhata and Ohinewai; discharge to the Waikato River through a new river outfall;
- New Huntly WWTP capacity of 7,100m³/day (PDF); discharge to the Waikato River through existing outfall;
- Conveyance consists of:
  - 2x pump stations, one main Te Kauwhata pump station and one booster pumping station (not required until year 2050);
  - 9.4km rising main from Te Kauwhata to centralised WWTP;
  - 3.5km rising main from Ohinewai to centralised WWTP. This will be duplicated in 2050;
  - Pump station in Ohinewai pumping to the centralised WWTP;
  - 600m discharge pipeline from centralised WWTP to Waikato River;
  - Discharge pump station from centralised WWTP to Waikato River;
  - Refurbish the existing Huntly WWTP pump station to pump wastewater from the underground storage to the new Huntly WWTP;
  - 500m pipeline from existing Huntly WWTP to new Huntly WWTP;
  - Pump station from new Huntly WWTP to river outfall;
  - The existing discharge pipe from Huntly WWTP to the river will be retained (the feasibility of this depends on the location of the new WWTP).





4.2.3 Cost Estimate

High-level cost estimates have been prepared for each of the options, including:

- Conveyance of raw wastewater to the designated WWTPs, including pump stations and conveyance mains;
- Underground storage at each urban centre, for peak wet weather buffering. This is conservative as it is likely that existing ponds can be reused for storage in Huntly and Te Kauwhata. This was listed as an opportunity in Section 7;
- Construction of the MBR wastewater treatment plants;
- Outfall pipelines and river outfall structures.

Capital and operational expenses have been considered for each option.

The cost estimates only include bulk wastewater conveyance and treatment assets. Although significant network assets will be required to service the growth (e.g. reticulation of Ohinewai), these costs have not been included as they are outside the scope of this project.

4.2.3.1 Assumptions

Appendix F details the key assumptions used to develop the cost estimates.

The costs do not include GST and are a best estimate at the time of pricing. All costs are estimates based on a level of design appropriate for strategic planning and for options comparison purposes only, and as a result have a wide margin of error (level of accuracy is assumed to be approximately ±50% at this stage). Further development and more detailed costing of preferred solution(s) is recommended before any commercial decisions are made.

In general costs have been developed from published rates (2011 AECOM report, New South Wales Guidance Manual) and/or Stantec/MWH legacy data for comparable projects. Where not already allowed, allowances for preliminary and general (15%), contingency (30%) and professional and non-works costs (30%) have been added. No allowance has been made for geotechnical investigations, surveying, feasibility studies or fast-tracking.

Watercare's NPV spreadsheet and standard defaults were used for the NPV calculation.

4.2.3.2 Cost Estimates

The high-level estimates of capital and operating costs for each option are shown below in Table 4-4 alongside the NPV. The operational costs shown are the average costs over a 35-year design period. The design period for wastewater servicing differs from water servicing as we have assumed the wastewater treatment plants will not be constructed until 2025 due to the requirement of the planning, design and consenting phases.

Refer to Appendix F for a breakdown of capital and operating costs as well as NPV from 2020 to 2060.

Table 4-5: Wastewater Option Cost Estimates

	Option 1B	Option 1C	Option 2B	Option 3
CAPEX	$115,200,000	$105,200,000	$113,400,000	$118,500,000
OPEX (average)	$2,200,000	$2,200,000	$2,100,000	$2,400,000
NPV (at 8.0%)	$133,200,000	$127,800,000	$133,400,000	$140,900,000

Option 1B and 2B have a similar NPV, with a similar initial capital spend ($107.7M for Option 1B and $110M for Option 2B). Although these two options are very different, the capital costs for the treatment and conveyance balance each other. Option 1B has a lower treatment but higher conveyance cost, and vice versa for Option 2B.

Option 2B has the potential to be staged by deferring the river discharge, which would reduce the 'up-front' costs slightly.

Option 1C is the lowest capital spend as the treatment plant is expected to be built on good ground conditions and requires less pumping than Option 1B. Option 3 is the most expensive option in terms of overall capital spend, operating costs and NPV.

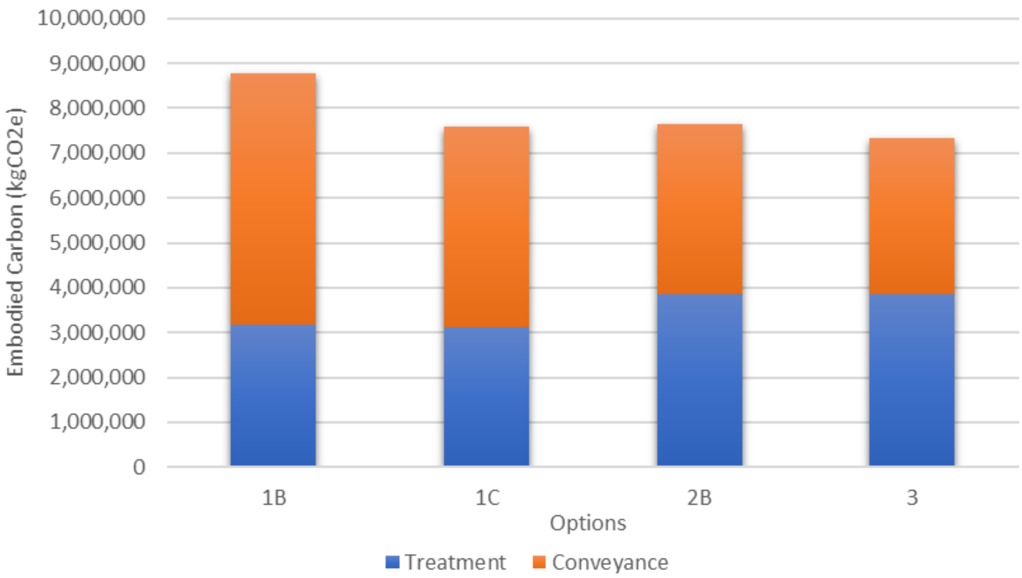
4.2.4 Carbon Assessment

As stated in Section 4.1.4, this capital carbon assessment has been done through Mott MacDonald's Carbon Portal and is intended to be a like to like comparison between the options.

The carbon assessment of each option is high level (made up of items that contribute to majority of the overall capital carbon). A contingency of 15% has been applied to all four options to account for the modelling uncertainties and minor items not included. Refer to Appendix G for assumptions used in this assessment.

Figure 4-3below shows the embodied carbon calculated for each of the options and the contributions from the treatment and conveyance aspects of the option.

Figure 4-3: Composition of Embodied Carbon - Wastewater Options



The capital carbon associated with treatment is slightly higher for the partly centralised options as there are two wastewater treatment plants as opposed to one.

The capital carbon associated with conveyance is larger for centralised options (1b & 1c) than partly centralised options (2b & 3). However, the capital carbon for option 1b is significantly greater than option 1c. This is because option 1b has approximately 3km more pipe (and associated chambers) and requires an additional booster pump station compared to option 1c.

The total capital carbon for options 1c, 2b and 3 is similar (in the order of 7,000 to 8,000tCO_2e). The capital carbon for option 1b sits close to 9,000tCO_2e.

5 Multi Criteria Analysis

A multi-criteria analysis was completed for each of the short-listed options. A summary is provided here, with full details of the analysis included in Appendix H.

The criteria for analysis and relative weightings in the analysis were as follows:

- Natural Environment Improvement Capability (10%);
- Public Health Protection/Statutory Compliance (10%);
- Cultural Benefits/Impacts on Māori cultural values (20%);
- Social and Community (5%);
- Flexibility/Scalability/Risk (10%);
- Sustainability (15%);
- Whole of life cost (20%);
- Constructability (10%).

Mott MacDonald and Stantec completed an initial analysis of each option against the criteria, scoring each option out of 5 (with 1 being a ‘poor’ result and 5 being an ‘excellent’ result). During Workshops 3, 4 and 5, Watercare Waikato and the consultants examined and modified these scores.

For ‘Cultural Benefits/Impacts on Māori cultural values’ scores have not been provided, as these scores will need to be discussed with iwi representatives during consultation and scoring updated.

The overall results of the multi-criteria analysis are shown in Table 5-1 and Table 5-2 below. A detailed breakdown for each option is included in Appendix H.

Table 5-1: Summary of Water Supply Options MCA

		Option 1a: New TK WTP, Ohinewai from Huntly then TK. Centralised.	Option 1c: TK WTP Upgrade, Ohinewai from Huntly then TK. Centralised	Option 1d: New TK WTP, Ohinewai from TK only Part Centralised	Option 2c: Huntly WTP Upgrade, Ohinewai from Huntly only Part Centralised
		Te Kauwhata - New intake + new 8MLD WTP 2025; upgrade to 16MLD 2040. Existing WTP decom. 2040. Huntly - Existing intake + WTP (to 2050, incl Ngaruawahia). Ohinewai - Network serviced by Huntly WTP to 2025 (<1MLD), then Te Kauwhata WTP.	Te Kauwhata - New intake + existing WTP upgraded to 9MLD 2025, with upgrade to 16MLD in 2035. Huntly - Existing intake + WTP (to 2050, incl Ngaruawahia). Ohinewai - Network serviced by Huntly WTP to 2025 (<1MLD), then Te Kauwhata WTP.	Te Kauwhata - New intake + new 8MLD WTP 2025; upgrade to 16MLD 2040. Existing WTP decom. 2040. Huntly - Existing intake + WTP (to 2050, incl Ngaruawahia). Ohinewai - Network serviced by Te Kauwhata from 2020	Te Kauwhata - New intake + new 8MLD WTP 2025, with upgrade to 12MLD 2040. Existing WTP decom. 2040. Huntly - New intake + existing WTP upgrade to 10MLD 2030, with upgrade to 12MLD 2040, upgrade to 14MLD in 2055 (Huntly to 2050, incl Ngaruawahia). Ohinewai - Network serviced by Huntly WTP from 2020
Capex - Total, 40 years		$65,000,000	$61,400,000	$66,500,000	$82,300,000
Opex - Average, 40 years		$860,000	$880,000	$860,000	$910,000
Pumping Station Opex, Average, 40 years		$80,000	$50,000	$70,000	$80,000
NPV (@8%, 40 years)		$53,600,000	$53,300,000	$56,500,000	$62,000,000
Ratio NPV/NPV lowest cost		1.0	1.0	1.06	1.16
Criteria	**Weighting**	**Score**	**Score**	**Score**	**Score**
Natural Environment Impact Improvement Capability	10%	3	3	3	2.5
Public Health Protection/Statutory Compliance	10%	4	4	4	4
Cultural Benefits/ Impacts on Maori Cultural values	20%	TBC	TBC	TBC	TBC
Social and Community	5%	4	4	4	4
Flexibility/Scalability/ Risk	10%	4	3.5	2	2
Sustainability	15%	3.5	4	3.5	3
Whole of life	20%	4	4	3	2
Constructability	10%	4	3	3	2
Score		3.03	2.95	2.5	2.1

Table 5-2: Summary of Wastewater Options MCA

		Centralised - 1 WWTP for Huntly, Ohienewai and Te Kauwhata catchments and separate plant for Meremere		Centralised - 1 WWTP for Ohienewai and Huntly catchments. Separate plant for Te Kauwhata and Meremere	Centralised - 1 WWTP for Ohienewai and Te Kauwhata catchments. Separate plant for Huntly and Meremere
	Options	**1b**	**1c**	**2b**	**3**
		High rate treatment plant such as MBR located at Huntly, discharging to the Waikato river. Individual MBR at Meremere discharging to the Waikato river.	High rate treatment plant such as MBR located between Te Kauwhata and Ohinewai discharging to the Waikato river. Meremere MBR discharging to Waikato river.	High rate treatment plant such as MBR located at Huntly to treat Huntly and Ohinewai with a River disposal. Individual MBR's at Meremere and Te Kauwhata discharging to the Waikato River.	High rate treatment plant between Te Kauwhata and Ohinewai (as close to Te Kauwhata as possible) discharging to Waikato River. Individual MBR's at Meremere and Huntly discharging to the Waikato River.
CAPEX		$115,200,000	$105,200,000	$113,400,000	$118,500,000
OPEX		$2,200,000	$2,200,000	$2,100,000	$2,400,000
NPV		$133,200,000	$127,800,000	$133,400,000	$140,900,000
Ratio NPV/NPV lowest cost		1.04	1.00	1.04	1.10
Criteria	**Weighting**	**Score**	**Score**	**Score**	**Score**
Natural Environment Improvement Capability	10%	3	3	3	3
Public Health Protection/Statutory Compliance	10%	3	3	4	3.5
Cultural Benefits/ Impacts on Maori Cultural values	20%	TBC	TBC	TBC	TBC
Social and Community	5%	3.5	3.5	4	4
Flexibility/Scalability/ Risk	10%	3	3	4.5	4.5
Sustainability	15%	3	3	4.5	4
Whole of life	20%	3	3.5	3	2.5
Constructability	10%	3.5	3.5	4	3.5
Score		**2.48**	**2.58**	**3.03**	**2.75**

6 Preferred Strategic Options

Based on the results of the MCA (refer to Section 4), the preferred strategic options for water supply and wastewater are:

- **Option 1a for water supply**
  A centralised scheme for Mid-Waikato, with a new water intake and treatment plant at Te Kauwhata. Ohinewai is serviced initially from Huntly and then from Te Kauwhata. Huntly continues to be supplied from the Huntly WTP.
- **Option 2b for wastewater**
  A centralised WWTP for the Huntly and Ohinewai catchments, located in Huntly. A stand-alone WWTP in Te Kauwhata for that catchment. Both WWTPs will be discharging to the Waikato River.

The capital cost estimates for these options have been broken into the key components in Table 6-1(water supply) and Table 6-2 (wastewater).

Table 6-1: Preferred Water Supply Option (1A) Capital Cost Breakdown

Horizon	Category	Description	Capacity	Cost	Cost for Year
2020	Pipe	Huntly to Ohinewai roundabout	5600m - 180ND	$1,700,000	$7,700,000
		Ohinewai roundabout to Ohinewai Reservoir	2600m - 355ND	$1,500,000	
	Reservoir	Ohinewai (including land acquisition)	1ML	$1,900,000	
		Te Kauwhata	1.5ML	$1,600,000	
	PS	North of Huntly	1MLD	$300,000	
		Huntly WTP booster upgrade	1MLD	$300,000	
		Existing TK WTP PS Upgrade	4.1MLD	$400,000	
2025	Intake Works	New Te Kauwhata intake works	16MLD	$3,600,000	$34,900,000
	Raw water PS	New Te Kauwhata raw water PS	16MLD	$2,100,000	
	Raw water pipe	New Te Kauwhata raw water pipe	2200m - 450mmND	$2,100,000	
	WTP	New Te Kauwhata WTP	8MLD	$16,800,000	
	Pipe	Te Kauwhata Reservoir to Ohinewai Roundabout	9500m - 355ND	$5,700,000	
		Te Kauwhata New WTP to TK Reservoir	1800m - 560ND	$1,700,000	
	Reservoir	Te Kauwhata expansion	1.5ML	$1,600,000	
	PS	TK New WTP PS	21MLD	$900,000	
		Te Kauwhata Reservoir, towards Ohinewai	5.3MLD	$400,000	
2030	Reservoir	Te Kauwhata expansion	2ML	$2,100,000	$2,100,000
2035	Reservoir	Ohinewai Reservoir expansion	1ML	$1,100,000	$1,400,000
	PS	Te Kauwhata Reservoir, towards old TK WTP	1MLD	$ 300,000	

Horizon	Category	Description	Capacity	Cost	Cost for Year
2040	WTP	Te Kauwhata WTP extension	8MLD	$15,700,000	$15,700,000
2050	PS	PS Augmentation at TK WTP, towards TK Res	24MLD	$1,100,000	$2,100,000
		PS Augmentation at TK Reservoir, towards Ohinewai	8.1MLD	$1,000,000	
2060 - Ultimate	Reservoir	Ohinewai Reservoir expansion	1MLD	$1,100,000	$1,100,000
TOTAL					**$65,000,000**

Table 6-2: Preferred Wastewater Option (2b) Capital Cost Breakdown

Horizon	Category	Description	Capacity	Cost	Cost for the year
2025	Pipework	Te Kauwhata to Waikato River discharge	5520m - 400 OD	$6,300,000	$110,000,000
		Ohinewai to Huntly WWTP	3600m - 225 OD	$2,200,000	
		Huntly ex WWTP to new WWTP (new)	500m - 315 OD	$500,000	
	Pump stations	Te Kauwhata WWTP pump station	131L/s	$2,500,000	
		Ohinewai main pump station	71L/s	$1,800,000	
		Huntly old WWTP to new WWTP pump station - refurb existing	82L/s	$500,000	
		WWTP discharge pump station	153L/s	$2,700,000	
	Underground Storage	Te Kauwhata	2,520m³	$5,700,000	
		Ohinewai	1,713m³	$4,600,000	
		Huntly	1,916m³	$4,900,000	
	Treatment Plants	Huntly (centralised) Plant & TK Plant	13.2MLD & 11.3MLD	$78,300,000	
2050	Pipework	Huntly WWTP to river Duplicate	1,490m - 315 OD	$1,200,000	$3,400,000
		Ohinewai to Huntly WWTP duplicate main	3,600m - 225 OD	$2,200,000	
TOTAL					**$113,400,000**

7 Risks and Opportunities

7.1 Opportunities

Stantec and Mott MacDonald have identified the following opportunities for refinement and improvement in future phases of this study:

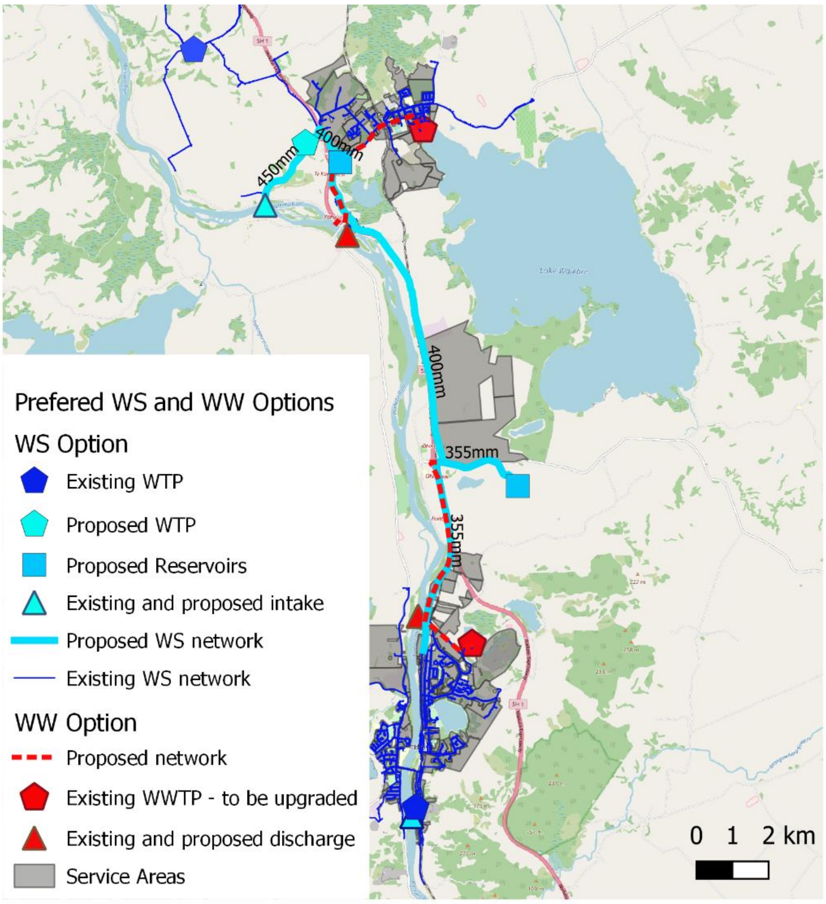
- The design flows can be refined based on actual measured flows;
- Demand and discharge forecasts can be refined once there is more certainty regarding population growth and industrial growth within the study area;
- Staging of the preferred options can be considered in more detail, supported by improved residential and industrial growth forecasts;
- I&I reduction could return savings, for example through additional treatment capacity;
- Existing wastewater treatment ponds could be re-used for peak wet weather storage and for sludge monofill;
- Obtain scientifically robust evidence on the assimilative capacity of the receiving environment at each WWTP location for key contaminants, to support identification of required level of wastewater treatment;
- Sub-options can be developed in more detail to refine and optimise the preferred water supply and wastewater options (for example, non-potable reuse, water demand management, etc.);
- New technologies can be assessed for conveyance and treatment;
- If further work is completed to assess the feasibility of land application of treated wastewater, this could complement the preferred wastewater option and/or support consent applications.

The following opportunities were related to assessing the water and wastewater servicing together:

- Potential opportunities for non-potable reuse, especially in new developments;
- Combined consent application, potentially reducing cost/timeframes of consenting;
- Standardisation / bulk buying of material / purchasing efficiency;
- Combining the water and wastewater schemes in procurement and planning will allow opportunities associated with a larger scheme and combined assets, including:
  - Shared trenches or common corridor;
  - Reduced disruption to residents;
  - Reduced construction costs by single contract & having the same crews in an area;
  - More competitive rates for larger contracts.

Figure 7-1 below shows the preferred water supply and wastewater options, highlighting the common pipeline routes.

Figure 7-1: Preferred Water Supply and Wastewater Options



7.2 Risks

The MCA process identified risks for each of the options. The key risks noted for the preferred water supply option (1a) are:

- Maximum consented take (7MLD) for Huntly may be exceeded with Ohinewai to 2025, or may be sufficient to consent expiry in 2046, depending on supply to Ngaruawahia;
- Requires extension of existing consented take for Te Kauwhata (expires 2024);
- Requires new intake at Te Kauwhata - additional disturbance to riverbed;
- Consenting new additional intake (Te Kauwhata) may take longer / be harder than reconsenting existing intakes/sites;
- Additional extraction from Waikato River due to growth & reticulation of Ohinewai;
- Will require new residuals handling and disposal route for Te Kauwhata (and consents);
- Cultural benefits/impacts are yet to be addressed with iwi;
- Limited to 1MLD (peak) from Huntly until 2025 when Te Kauwhata WTP constructed;
- Potential for increased property rates in Ohinewai (initial scheme / ongoing costs) and thus negative perceptions;
- Long conveyance pipelines that need to be sized for future flows, which may mean low flows and long water age in early years;

- Need to investigate/consent/procure new intake, raw water pipeline and WTP site at Te Kauwhata. Possible WTP sites within 2km of river with pipeline along road corridors to south west of Te Kauwhata, with suitable elevation and access to electricity;
- Pipeline route from Te Kauwhata to Ohinewai challenging but may be feasible largely within road/rail corridor or open country.

The key risks identified for the preferred wastewater option (2b) are:

- Potentially not consistent with the Te Kauwhata discharge agreement with stakeholders to investigate options to discharge to land and to remove the discharge from Lake Waikare;
- New Te Kauwhata discharge is upstream of Te Kauwhata water intake;
- Additional consent required to discharge Te Kauwhata to the Waikato river;
- Cultural benefits/impacts need to be addressed with iwi;
- Potential effects on kai awa not yet assessed;
- New discharge may be viewed negatively by the community and iwi;
- Location of underground storage tanks (or repurposed WWTP ponds) near residential areas may not be received well by the community;
- Increased operational costs as there is an additional plant to run;
- Ground conditions at Huntly and Te Kauwhata need to be investigated - potential preloading required at both sites.

7.3 Additional Risks

Risks identified in addition to those highlighted in the MCA, are:

- Location of water supply intake - Proposed new Te Kauwhata WWTP treated wastewater discharge to Waikato River is currently shown on layout plans as being located immediately upstream of proposed new Te Kauwhata water supply intake. This should be addressed in future planning and design stages (including site, pipeline route and discharge/intake selection), so that any new wastewater discharge is downstream of existing and new water intakes;
- Uncertain ground conditions – This strategy has mitigated the risk of poor ground conditions in part by allowing extra cost where it is known there are poor ground conditions. There is an opportunity to provide further certainty around the cost estimate by gathering additional geotechnical information;
- No I&I assessment was undertaken during this study; large wet weather flows caused by high I&I could result in:
  - Larger reticulation required or increased risk of overflow;
  - Larger storage volumes required for flow balancing during high flow;
  - Greater treatment capacity required and additional operational costs;
  - increased risk of non-compliance if a large proportion of the flows must be bypassed and discharged without treatment.

8 Next Steps

This study has by necessity been delivered rapidly to meet time constraints applied by Council funding planning processes. As a result, several areas have been identified that require further investigation or consultation with stakeholders. In addition, some opportunities have been highlighted that would require quick action to realise.

We have set out below the recommended next steps in order of programme criticality. We recommend that Watercare addresses these actions while the project team is still available.

Many of the below actions need to be commenced in the near term to either realise the potential benefits (fast tracking consents etc), meet consent deadlines, or be implemented in time to service the rapid growth predicted. For example:

- Pipeline routes need to be confirmed quickly to start the consenting process. Huntly-Ohinewai pipeline – hearings for rezoning set down for September 2020;
- Te Kauwhata lake discharge required under the consent to cease to end by 2023;
- Te Kauwhata water take consent expires in 2024 and to meet forecasted demand and required level of service needs an upgrade and new intake by 2025.

8.1 Consenting

We recommend that a consenting strategy is developed quickly to ensure that the opportunities and risks identified below are addressed.

- **Consenting strategy**. A consenting strategy should be drawn up first to align the water and wastewater consent requirements with iwi and the stakeholder groups. This will highlight the time-critical nature of some of the recommended actions noted below and identify which parts of the scheme require more urgent development and consultation in order to meet capacity shortfalls and consenting constraints.
- **Water take consents**. Recent water shortages in Auckland and surrounding regions have highlighted the importance of securing water take consents early. This will be critical for any scheme in the Waikato and needs to be progressed as soon as possible. As well as new sources and takes, this should consider 'grandparenting' of existing consents in the region and transferring existing allocations (such as the Te Kauwhata take). Existing municipal supply takes have a controlled activity status.

  Members of the project team are advisors to the Waikato River Municipal Users Group (WRMUG), which includes Watercare and WDC. In addition, as part of the Regional Plan Variation 6, Water Conservation and Demand Management Plans (WCDMP) are required for water take consents. Early preparation of the WCDMPs will be required to support the future water permit applications.
- **RMA Streamlining or Fast Tracking**. There are several consenting pathways available which could significantly speed up the process. Establishing a consenting strategy early will allow Watercare and WDC to identify which of these processes could benefit all or part of the overall scheme.
  - Applicants can apply for a Streamlined consent to the Minister for plan changes.

  - In mid-June 2020, the Government is expected to release the COVID-19 Recovery (Fast Track Consenting) Bill. If enacted, this bill is expected to fast-track resource consenting and designation processes for eligible projects.
- **Receiving environment investigations**. Regardless of the consenting approach selected, a large amount of receiving environment information will need to be gathered. Experience supports the need to start this early to ensure an adequate body of data is available to support claims of impact. Investigations need to be carefully considered through the consent planning process, but some will need to start soon. To illustrate this, wastewater discharge consents applications are likely to include as a minimum physiographic zone analysis, water quality testing, contaminant and pathogen testing, flora and fauna analysis, scientifically robust evidence on the assimilative capacity of the receiving environment at each WWTP location for key contaminants, and a quantitative microbiological risk assessment of public health risks associated with treated wastewater discharge.
- **Iwi and stakeholder consultation**. It is imperative that a structure and approach to iwi and stakeholder consultation is developed and started as soon as possible. In our experience, getting key stakeholders involved in the option selection process at an early stage significantly increases the success of the consenting process. We recommend that this is agreed with the establishment of the consenting strategy.

8.2 Risk Mitigation and Opportunities Realisation

The following areas have been identified by the project team as requiring further attention to confirm study findings or realise opportunities for Watercare and WDC. The project team has the local knowledge, recent project knowledge, and capacity to act quickly on these opportunities and progress them quickly to support consenting requirements.

- **Population and capacity data**. The tight programme for this project governed the need to use existing data sets. A bottom up approach is recommended to refine population and capacity data. There is expected to allow further refinement of future design flows based on actual measured flows, revised population growth projections and revised industrial growth projections.
- **Affordability**. To date, a Watercare lens has been applied to the affordability assessment. This now requires a focus on the affordability for local Waikato communities.
- **Staging.** Detailed investigation of staging opportunities for the preferred solutions has not yet been undertaken. This should be investigated soon, as it may allow significant investments to be deferred. This was demonstrated in part by work carried out when developing the short-listed water supply options.
- **Land parcels.** The potential land parcels need to be identified for the preferred schemes, then investigated for options and alternatives, and planned for purchase. To date new treatment plants have only been located in a very broad sense on a desk-top basis. No site and soil investigations have been carried out.
- **Pipelines.** Investigation of pipeline routes have also been a very high level to date. Specific corridors should be identified early to allow alignment with other roading and rail projects, and to identify savings through shared trenches and common corridors. Early identification of these options may also reduce interruption to residents.
- **Reuse opportunities**. Other than broad reuse opportunities from land discharge, specific opportunities have not been investigated to date. Now that preferred solutions have been identified, a greater focus can be applied to identify opportunities for non-potable reuse of treated wastewater, particularly in new developments and industrial areas. If feasible opportunities can be identified, these can have significant benefits for the communities they

serve, through reducing discharges to sensitive environments, and reducing the need for expanding potable water treatment capacity.

- **Surveys**. Assessment of existing LIDAR and survey information can now be undertaken for preferred pipeline routes and plant locations. If appropriate, the project team has experience with deploying rapid drone surveys to gather and analyse detailed information quickly.
- **Inflow and Infiltration**. It is likely that wastewater treatment plant capacities could be reduced if increased spending on inflow and infiltration was undertaken in areas with high I&I, e.g. Tuakau. Assessment of the cost to remedy I&I issues versus increased treatment capacity can quickly identify the most economical solution and may allow reductions in planned treatment plant capacity.
- **Geotechnical investigations**. Consideration of geotechnical constraints has been kept at a high level to date. Contingency sums have been applied accordingly. The project team's Hamilton geotechnical resources have excellent local knowledge of the region and are available to investigate these risks for the preferred options, and better assign contingencies.

8.3 Programme Management and Procurement

The multiple locations, and combined water and wastewater assets of this scheme add to its complexity, but also provide several unique opportunities that should be investigated:

- **Provincial Growth Fund.** The New Zealand Government's Grow Regions scheme includes the Provincial Growth Fund (PGF). This fund is available for schemes that lift productivity in regions and meet the PGF objectives. This funding mechanism should be investigated and considered for this scheme, given the growth and development that it unlocks.
- **Bulk procurement.** This scheme includes significant pipelines and multiple treatment plants. Bulk procurement and contract support should be considered, similar to the Waikato LASS. This has potential benefits for WDC, including:
  - Reduced construction costs by single contract and having the same crews in an area,
  - More competitive rates for larger contracts.
- **Product based design**. There will be many opportunities to develop repeatable designs for this project. Having a standard design for items that are repeated regularly in a region or project allows for lower cost construction and supply chain costs. It can also increase the ability to construct components offsite – which brings health and safety improvements as well as cost and carbon savings. Now that preferred solutions have been identified, taking a view of the entire scheme to identify items assets that will be repeated many times will allow Watercare and WDC to capitalise on the savings from this approach. But it needs to be investigated early on, to ensure that the supply chain can be ready with suitable products.
- **Programme management support**. The high value, high profile, and complex nature of this project will require attention at a programme level to ensure that consenting, design, procurement, stakeholder engagement elements are coordinated and implemented in sufficient time to service the rapid growth predicted in the Mid-Waikato. The project team has the capability to assist Watercare and WDC with managing all these elements through the entire project lifecycle.

It will be challenging to obtain required consents, secure access to land and procure new facilities within the required timeframes without a clear programme that is adhered to. Table 8-1provides a draft programme for discussion with Watercare and WDC prior to the finalisation of this report.

Table 8-1: Draft Programme for Discussion

Activity	Indicative Timeframe	Lead Owner	Support
	High Level	Driving the task	Providing supporting info
Consenting			
Consenting Strategy	4 weeks	Panel Member	Watercare
Water Take and Wastewater Discharge Consents and Water Demand Management Plan	12 months	Watercare	Panel Member
RMA Fast tracking	6 months	Panel Member	Watercare
RMA normal process	Depends on WDCs place in the queue	Panel Member	Watercare
Receiving environment Investigations	3 months	Panel Member	Watercare
Iwi and Stakeholder Engagement	6 months	Watercare	Panel Member
Detailed Project Constraints Assessments			
Population and capacity data	4 weeks	Watercare	Panel Member
Affordability	2 months	Watercare	Panel Member
Staging	2 months	Panel Member	Watercare
Land parcels	6 months	Watercare	Panel Member
Pipelines	3 months	Panel Member	Watercare
Reuse opportunities	2 months	Panel Member	Watercare
Surveys	2 months	Panel Member	Watercare
Inflow and Infiltration	3 months	Watercare	Panel Member
Geotechnical investigations.	2 months	Panel Member	Watercare

Appendices

A. Technical Memo 1

Mid Waikato W&WW Servicing Strategy

Technical Memo 1: Literature & Growth Review

Project:	Mid Waikato W&WW Servicing Strategy		
Our reference:	415939 Rev Final	**Your reference:**	CT 6484-7035
Prepared by:	Atisha Daya, Giulio Pozzuto, Kirsten Norquay, Alex Ross	**Date:**	11 June 2020
Approved by:	Nick Dempsey	**Checked by:**	David Hume, Julie Plessis
Subject:	Technical Memo 1: Literature and Growth Review		

The purpose of this study is to develop a long-term water supply and wastewater strategy to enable the rapid growth predicted in the Mid-Waikato region, while protecting water supplies and receiving environments. Key to this will be understanding the anticipated growth, completing a high-level bulk supply and wastewater supply analysis to enable this growth; ultimately, determining a preferred set of solutions and staging.

1 Introduction

This memo is intended to provide an overview of the previous studies carried out to date, the existing assets in the Mid-Waikato region and the forecasted growth. The findings of this review were discussed at a workshop on 14 February 2020.

The following documents were provided by Watercare at the start of the project, and have been included in this review:

- Operative Waikato District Plan, Waikato District Council, 2017 (encompasses the Te Kauwhata Structure Plan, 2012).
- Proposed Waikato District Plan, Waikato District Council, 2018.
- Waikato Growth Strategy, Waikato District Council, 2019 (DRAFT currently going through Council processes).
- Pokeno, Te Kauwhata and Huntly Water Supply Ultimate Development study, Beca, October 2018.
- Waikato District Blueprint, Urbanismplus Ltd, June 2019.
- Water Infrastructure Concept Design Report, GHD, December 2017.
- Mid-Waikato Water Supply Model Conversion & Update, Jacobs & HAL, May 2019.
- Te Kauwhata (Whangamarino) WTP Options Investigation Report FINAL, Beca, October 2018.
- Te Kauwhata Intake and Pump Station Condition Assessment, Beca, February 2019.
- Huntly Water Supply Zone Management Plan, Mott MacDonald, September 2014.
- Ngaruawahia-Huntly Water Supply Model Conversion and Update, Jacobs & HAL, May 2019.
- Te Kauwhata WWTP – Site Selection, Beca, September 2019.
- Te Kauwhata WWTP - On-site MBR Option Concept Design, Beca, January 2018.
- Housing Infrastructure Fund (HIF) - Wastewater Conveyance Risk Analysis, Opus, December 2017 (includes Risk register spreadsheet).

- Centralised and Decentralised Wastewater Treatment Plant Investigation, Stantec, October 2017.
- High-Level Desktop Contamination Assessment - Te Kauwhata Wastewater Treatment Plant, Beca, October 2019.
- Te Kauwhata HIF – Wastewater Treatment Plant Concept Design, Beca, October 2017.
- Meremere WWTP Upgrade Options Assessment, Beca, July 2019.

Additional reports and data have been provided by Watercare, or downloaded from the Waikato District Council (WDC) website, and included in the review as follows:

- Email from Watercare (P. McFall) to Mott MacDonald (J. Plessis) 02/02/2020 related to growth.
- WDC Long Term Plan (levels of service).
- Te Kauwhata Discharge to Land Consent.
- Te Kauwhata, Meremere and Huntly Discharge to Water Consent.
- Te Kauwhata and Huntly Water Take Consents.
- Mid-Waikato water supply network system performance & Options Analysis, HAL, February 2020.
- 50 year Wastewater Strategy for Waikato District Council – MWH, 2014.
- 50 year Water Supply Strategy for Waikato District Council – MWH, 2014.
- Waikato Sub-Regional Three Waters Investigation project, draft report – Stantec, 2020.
- Wastewater Demand Forecasts 2017 to 2048, MWH/Stantec, 2017.
- Water Demand Forecasts 2017 to 2048, MWH/Stantec, 2017.
- Hopuhopu Water Supply Scheme – options investigation, AWT/Mott MacDonald, November 2013.
- Whangamarino WTP Upgrade – Preliminary Design Report, Beca, February 2020.

This technical memo will form part of a wider study setting out options for the long-term servicing strategy for the Mid-Waikato area. This is intended to include:

- Literature and data review (this memo).
- Future demand and discharge calculation and high-level risk assessment
- High level solution options.
- Solution options long list.
- Multicriteria assessment and options short list.
- Option analysis report.

2 Growth

Mid-Waikato is situated in the "Golden Triangle" between Auckland, Hamilton and Tauranga. For the purposes of this study, Mid-Waikato refers to the water and wastewater services provided for the following communities:

- Meremere,
- Te Kauwhata,
- Rangiriri,
- Ohinewai (no water or wastewater service currently), and
- Huntly.

Rapid urban growth is predicted in this area, and as per Watercare's brief, two main forecasts have been considered for the purpose of this investigation (source: Watercare, email from Pearl McFall, 02 February 2020):

- **Waikato Growth Projection** (2016) – this forecast, generated by Waikato District Council, is based on past growth and census data, further separated into low, medium and high household and population projections (high projection is shown in Table 2-1 below).
- **Waikato Strategic Planning** (Capacity) – this forecast was generated by the Waikato District Council (WDC) Strategy Team, which estimates how and when each area will be rezoned, or growth enabled. The total potential residential population capacity is mostly based on a 450m² lot size and 2.6 people per lot basis.

As shown in Table 2-1 below, the two forecasts differ in Meremere / Te Kauwhata and Huntly:

Table 2-1 – Forecasted Residential Growth in Mid-Waikato - Comparison Between Forecasts

Area	Current population	2025 (1 – 3 years)		2030 (3-10 years)		2050 (10-30 years)		2060 (30+ years)	
		Growth Projection	Capacity	Growth Projection	Capacity	Growth Projection	Capacity	Growth Projection	Capacity
Meremere	2,535	3,078	13,249	3,584	13,762	4,310	18,145	4,233	18,145
Te Kauwhata									
Rangiriri	1,218	1,322		1,423		2,172		2,321	
Ohinewai	0	see notes below on Ohinewai							
Huntly	8,035	8,526	15,600	8,759	19,898	9,278	27,053	9,809	27,053

Source: Email from Pearl McFall, 02 February 2020 – except for Ohinewai – see notes below
"Growth Projection" refers to the high projection of population growth from past growth and census data in Waikato Growth Projection (2016). "Capacity" refers to data from the WDC Strategy Team's Waikato Strategic Plan.
Rangiriri refers to the entire meshblock, not just township.

After assessment of the figures provided and discussion with regards to the likelihood of potential growth to the full capacity as indicated, Watercare concluded the following:

- **Meremere & Te Kauwhata** – The Waikato Growth Projection (2016) predicted a growth of 4,310 people by 2050. However, this growth model was generated before the Housing Infrastructure Fund (HIF) Business Case was published, which created new residential zones and indicated other growth zones within Te Kauwhata and the surrounding areas. Lakeside Development has approval for an estimated 1,600 dwellings, highlighting a discrepancy between the Waikato Growth Projection (2016) and the zone enabled capacity. Therefore, the growth projections that have been most recently approved and publicised in the HIF document will be used to inform this study. Additionally, there is a requirement to be able to service the ultimate zone, with a capacity of 18,145 people by 2050. Although it is unlikely that Te Kauwhata will grow to this number, it is important to assess it at this stage and consider the possible infrastructure requirements needed to enable this capacity, while developing solutions based on the HIF numbers.

- Meremere: limited growth is expected in Meremere, with a predicted population increase of 6 person per year.
- Te Kauwhata: It was agreed to consider a population increase of 10,898 by 2030 (as publicised in the *Housing Infrastructure Fund - Te- Kauwhata Detailed Business Case*, WDC April 2018). The ultimate capacity was assumed to be reached by 2050. The Spring Hill Prison maximum residential population (1,500) was added to the current population and assumed to remain constant in the future.

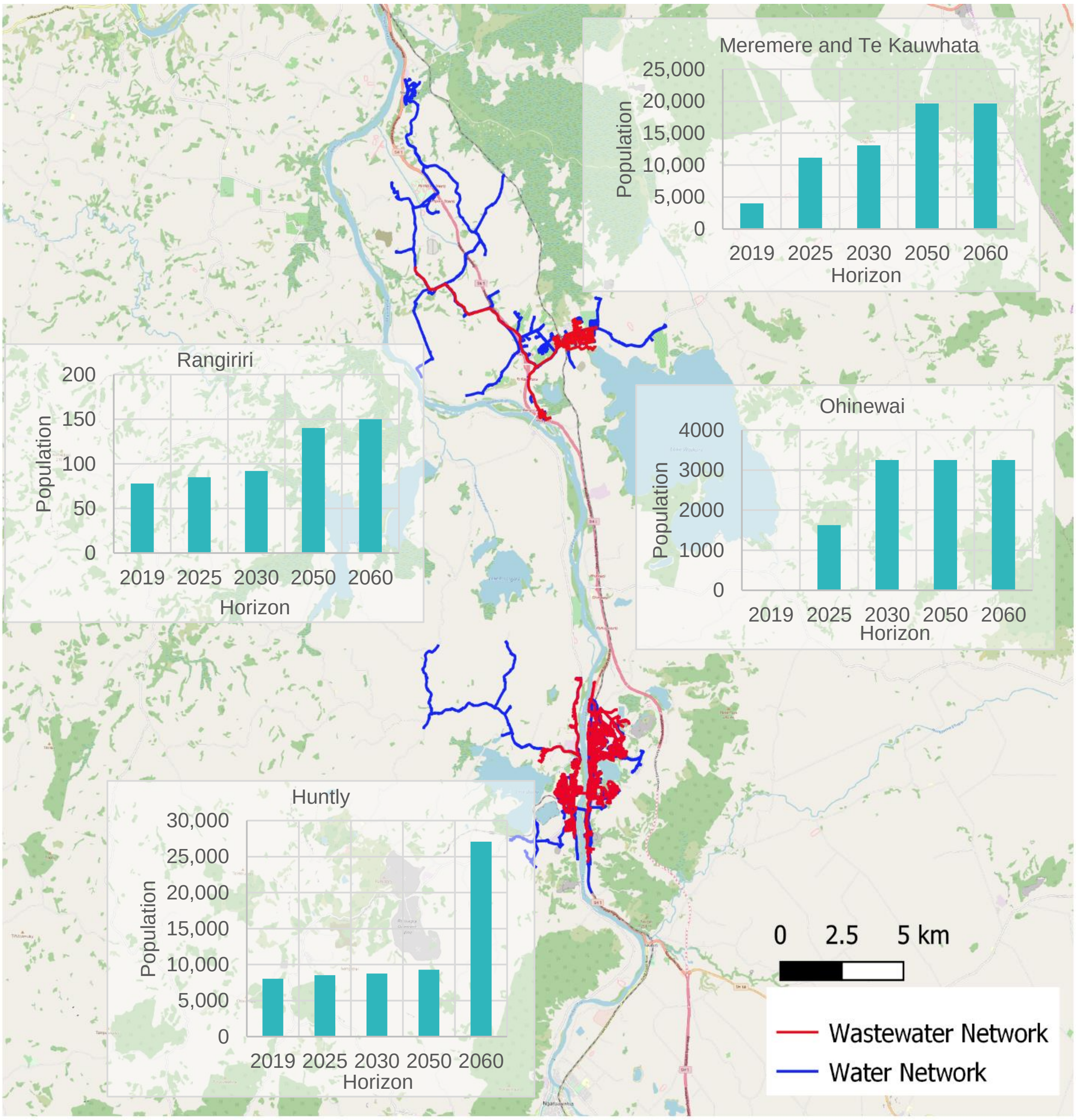
- **Rangiriri**: The population growth was available at the meshblock level, which encompasses a large rural area, not connected to water or wastewater services. The current population was estimated based on the number of meters (30) and a density of 2.6 person per dwelling. The future growth in Rangiriri township was assumed to follow the same trend as the entire meshblock.
- **Huntly** – WDC rezoning could unlock land that has the potential to accommodate up to 27,053 people, however, to allow this growth to happen in Huntly, multi-storey buildings would need to be constructed. Due to the uncertainty of the growth timing, the Waikato Growth Projection (2016) will be used to inform this study for the 2025 to 2050 scenarios. The Waikato Strategic Planning ultimate capacity (27,053) will be considered in the 2060 scenario, to assess the service requirements needed in the zone for maximum enabled capacity.
- **Ohinewai** – Consented developments in this area are mainly industrial and business/commercial developments. Sleepyhead residential development has been indicated by Watercare to be unlikely to be granted consent. For the purpose of the study, the following was assumed:
  - 50% of the Ohinewai South growth (industrial, commercial and residential) will occur within the next 3 years;
  - The full industrial/commercial area will be developed by 2030;
  - Residential development (Sleepyhead or equivalent – 1,250 dwellings) will be developed by 2030;
  - Existing population in Ohinewai is considered marginal;
  - The Ohinewai North industrial area will be developed by 2050.

Table 2-2 and Figure 2-1 below summarises the residential growth that will be considered in this investigation. In addition to the residential growth, commercial and industrial developments will be included; assumptions in terms of catchment areas and timing will be detailed in the *Technical Memo 2 – Demand/supply balance and risks identification*.

Table 2-2 – Mid Waikato Region Growth Projection Used in Study

Horizon	Current	2025	2030	2050	Ultimate
Huntly	8,035	8,526	8,759	9,278	27,053
Te Kauwhata	3,397	10,491	12,398	18,821	18,761
Meremere	638	674	704	824	884
Ohinewai	0	1,625	3,250	3,250	3,250
Rangiriri	78	85	92	140	150
Total	12,148	21,401	25,203	32,313	50,098

Figure 2-1 Mid-Waikato Residential Growth



3 Levels of Service

From the 1st October 2019, Watercare operate and manage the water, wastewater and stormwater services in the Waikato District. Levels of service (LOS) will change over time with the management transition, as summarised in Table 3-1 below. Watercare have indicated that at this stage, the cost of transitioning to the Watercare LOS is not supported by Waikato District Council's long-term plan (LTP) budgets, but is likely to be included in future LTPs.

Table 3-1 - Levels of Service Comparison

Criteria	Watercare	Waikato District Council	Impact of LOS change
Carbon footprint reduction	Net zero emissions by 2050. 40% reduction in new infrastructure capital carbon by 2025.	N/A.	During option assessment, consider: • Low carbon infrastructure delivery options, • Product selection, • Energy efficiencies, • Carbon removal.
Climate change	Address the impact of climate change on new infrastructure.	+3°C average temperature in Waikato District over the next 70-100 years.	Allow for increased water demand due to longer, drier summers. Consider location of infrastructure and impact of flooding on infiltration & overflows, etc.
Water			
Minimum pressure.	25m with sensitivity to 20m.	10m.	May impact reservoirs levels and pumps operation.
Maximum pressure.	90m with sensitivity to 80m.	100m.	
Maximum pressure fluctuations.	30m.		May impact bulk main size.
Maximum pipe head loss.	10m/km.	5m/km.	
Maximum pipe velocity.	1m/s.	1.5m/s.	
Water age.	<3 days from BSP.	4 days.	May impact reservoirs operation.
Flow reversal.	<5.		
Fire supply.	As per firefighting classification, following the NZ Fire Service firefighting code of practice – SNZ PAS 45009 2008.	FW2 for residential and FW3/FW4 for other areas.	May impact storage required and pumping requirement to provide higher firefighting classification.
Storage.		24- & 48-hours average day demand.	
Water is safe to drink. The extent to which drinking water supply complies with: (a) Part 4 of the drinking water standards (bacteria compliance criteria).		100% (all WTPs to comply).	
(b) Part 5 of the drinking-water standards (protozoal compliance criteria.		100% (all WTPs to comply).	
Residents are satisfied with drinking water: The total number of complaints received by Council about drinking water clarity, taste, odour, water pressure or flow, continuity of supply and response to any of these issues		Less than or equal to 25 per 1,000 connections.	

Criteria	Watercare	Waikato District Council	Impact of LOS change
(expressed per 1,000 connections to the water system).			
Demand is managed: The average consumption of drinking water per day per resident within the Waikato District.		270L/day (2018/19) to 240L/day (2021+).	
Reticulation network is maintained: The percentage of real water loss from Council's networked reticulation system.		30% (2018-19) to 27% (2021+).	
Respond to faults in a timely manner.			Set service interruption response times.
Residents connected to a water scheme are satisfied with the service.			Based on satisfaction surveys.
Water is potable.			No boil water notices.
Wastewater			
Customers are satisfied with the wastewater system.		Number of customer complaints (entire district): <10 per year relating to safety. <85 relating to overflows. <40 relating to odour.	We recommend Watercare targets are adopted for customer complaints/customer satisfaction.
Wastewater does not cause safety or health risks. The wastewater system is reliable, efficient and effective and minimises harm to the environment.	No dry weather overflows. <2 wet weather overflows per year at each engineered overflow point. Existing uncontrolled wet-weather overflows shall not be made worse. No new predicted uncontrolled wet-weather overflow locations. Predicted wet weather overflow increases only at existing designated engineered overflow points.	<1 dry weather overflow per 1,000 properties in sensitive environments, or <3 per 1,000 properties for non-sensitive environments. Existing and predicted overflows shall not be made worse (volume or frequency).	Watercare targets are more stringent and may require infrastructure upgrades to reduce existing overflows.
Wastewater discharges are compliant.		>80% of wastewater consents achieve full compliance from WRC. >90% compliance of registered trade waste customers with Trade Waste Bylaw. <1 abatement notice, infringement notice, enforcement order or conviction for discharge from the Council sewerage system.	Existing non-compliance issues to be addressed.
Infiltration & inflow.	No stormwater entry to sewers. Zero infiltration into pipelines, structures or manholes on commissioning.		We recommend Watercare targets are adopted for new infrastructure.
Proposed additional measures			
Greenhouse gas emissions.	# total net greenhouse gas emissions (net tonnes CO_2		We recommend this target is adopted to allow progress over time to be measured.

Criteria	Watercare	Waikato District Council	Impact of LOS change
	equivalent per 1,000 properties).		
Network performance.	% pump stations with sufficient storage to prevent overflows during rainfall events with a return period of 1 in X years. # sewer main breaks and chokes per 100km of sewer main (or per 1,000 properties).		We recommend this target is adopted to allow progress over time to be measured.

4 Policy and Regulatory Context

4.1 Water Take and Treated Wastewater Discharge

Existing consents that regulate water abstraction and treated wastewater discharge in Mid-Waikato are listed in Table 4-1 to Table 4-3 below.

Table 4-1 – Water-Take Consents

Consent Type	Consent Dates	Max Daily Take (m^3)	Max Annual Take (m^3)	Max Abstraction Rate (L/s)	Max Velocity (m/s)	Other
RC109337 Te Kauwhata Water Take*	Expires 30 June 2024	22,900	2,000,000	210	0.1	Waikato River source For community water supply (486 properties), irrigation & stock Intake shall be screened with a 2.5mm slot wedge wire screen.
RC105034 Huntly Water Take	12 Jan 2011 – 30 June 2015	6,000	1,373,000	100	0.2	Waikato River source For WDC Huntly urban water supply scheme Max supply to industrial users – 15m³/d, 318,480m³/y. Intake shall have 3mm screen Expires 12 Jan 2046
Huntly Water Take	1 July 2015- 30 June 2021	6,700	1,395,000	210		Maximum rate of take 100L/s. Max Velocity of water through intake screen – 0.2 m/s. Max supply to industrial users – 15 m³/d, 318,480m³/y.
	1 Jul 2021 – 30 Jun 2027	6,700	1,451,000			
	1 Jul 2027 – 30 Jun 2033	6,800	1,509,000			
	1 Jul 2033 – 30 Jun 2039	6,900	1,569,000			
	1 Jul 2039 – 12 Jan 2046	7,000	1,672,000			

*consent belongs to Te Kauwhata Water Association (TKWA).
Source: Te Kauwhata and Huntly water take consents.

Table 4-2 – Treated Wastewater or WTP Discharge to Water Consents

Consent Type	Consent Date	Max Daily Discharge (m^3/day)	Max Annual Discharge (m^3/day)	Other
Treated Wastewater Discharge				
RC105031 Meremere WWTP. Discharge to Water.	Expired 15 Aug 2018. An application has been lodged with WRC to ensure ongoing legal operation. A revised application (MBR) to be lodged post December WGB meeting.	480 (wet weather flow) 160 (dry weather flow)		Discharge to Waikato River
RC117991 Te Kauwhata – Rata St WWTP Discharge to Water.	Expires 4 July 2028.	3,600	1,100	Discharge to Lake Waikare

Consent Type	Consent Date	Max Daily Discharge (m^3/day)	Max Annual Discharge (m^3/day)	Other
RC119647 Huntly – East mine road WWTP Discharge to Water.	Expires 31 March 2029.	11,500		Discharge to Waikato River. Consented load limits linked to Ngaruawahia WWTP consent
WTP Discharge				
RC105035 Huntly – WTP Jackson St Discharge to Water.	Expires 17 Jan 2046.	500		Discharge filter backwash water & sedimentation tank clear water to Waikato River
RC113133 Te Kauwhata WTP Discharge to water.	Expires 30 Nov 2030.	240		Discharge settlement pond supernatant to tributary of Ngariohe Stream Max discharge rate: 4L/s.
RC110823 Te Kauwhata - Irrigation Scheme Discharge to water	Expires 30 June 2024	173		Discharge filter backwash water to Waikato River for irrigation pipeline maintenance. Max. Discharge rate: 7.2m^3/hr

Source: Te Kauwhata and Huntly treated wastewater and WTP discharge to water consents.

Table 4-3 – Treated Wastewater and WTP Discharge to Water Consents – Discharge Quality

	Treated Wastewater Discharge			WTP Discharge		
Consent Type	**Meremere WWTP**	**Te Kauwhata WWTP** Rata St WWTP Discharge to Water	**Huntly WWTP** East Mine Road WWTP Discharge to Water	**Huntly WTP** Jackson St Discharge to Water	**Te Kauwhata WTP** WTP Discharge to Water	**Te Kauwhata WTP** Irrigation Scheme Discharge to Water
pH			Between 6 and 9	Between 6 and 9	Between 6 and 8.5	
Suspended solids (g/m^3)	20	15		25	80	not increased by >25
Median total Kjeldahl nitrogen (TKN) (g/m^3)	12	6				
Total nitrogen (g/m^3)		8				
Ammoniacal nitrogen (g/m^3)	8		10			
Median nitrogen load (TN_{load}) (kg/d)		8.8	57*			
Median total phosphorus (TP) (g/m^3)	5	5.6	8			
Median total phosphorus load (TP_{load}) (kg/d)		3.1	17.3*			
Median summer total phosphorus (kg/d)			8			
Median Escherichia coli (*E.coli*) (MPN/100mL)	3,500	1,500	126 cfu/100mL in a year			
Medium 5-day carbonaceous biochemical oxygen demand ($cBOD_5$) (g/m^3)		20	30			
5-day biochemical oxygen demand (g/m^3)	15					
Median summer total nitrogen (TN_{summer}) (g/m^3)			20			
Aluminium concentration (g/m^3)				1.5	0.1 (Dissolved)	
Max free chlorine (g/m^3)					0.1	
Peak wet weather flow and average dry weather flow ratio (PWWF:ADWF)			4.5			

* Total discharge from Huntly and Ngaruawahia WWTP.
Source: Meremere, Te Kauwhata and Huntly wastewater discharge to water consents.

The main known issues and considerations related to water and wastewater consents are listed below:

- The Te Kauwhata headwork assets and rising main are owned by the Te Kauwhata Water Association (TKWA), who also own the water-take consent. This consent expires in 2024. Out of the 24,000m³/day maximum abstraction allowed, only a peak abstraction of 5,000m³/day was used. Watercare Waikato have noted it is likely that the Waikato Regional Council (WRC) will lower the next water take consent value, unless reasons to do otherwise can be provided. The discharge consents for WTP residuals, owned by WDC, also expire in 2024. In addition, the consented activity states it is for community water supply (486 properties), irrigation and stock (i.e. only a portion of the consented allocation is for municipal water supply).
- The Te Kauwhata Wastewater Treatment Plant (WWTP) is required to cease discharging to Lake Waikare by 2023.
- The Meremere wastewater consent expired in 2018. However, an application has been lodged to enable the discharge to legally continue whilst the application is being processed.
- Treated wastewater discharge consent limits are currently exceeded at:
  - Meremere WWTP: TSS and outflows during permitted time limits are exceeded); and
  - Te Kauwhata WWTP: TKN, TN, TP and *E. Coli* concentration exceeded.
- The maximum consented water-takes and discharges for all schemes will need to be compared to the estimated forecasted population demands once calculated.
- Time required for consenting processes will need to be factored into option development and comparison.

4.2 Development Agreements

A MoU/developer agreement was developed with Winton Partners (Lakeside development, Te Kauwhata). Key principles were listed in the *Te Kauwhata Detailed Business Case – HIF*, Opus 2018 report:

- Lakeside Development 2017 Ltd. is to pay for growth related infrastructure (development contributions);
- Lakeside Development 2017 Ltd. will not fund backlog level of service or renewal of existing infrastructure.

4.3 Key Policies and Strategic Context

The following policies and strategic documents may impact the demand/discharge forecast and option selection process and should be taken into consideration for future, more detailed investigation:

- The National Policy Statement on Urban Development Capacity (NPS-UDC) requires Councils to monitor growth and ensure they have sufficient land and infrastructure available to meet demand plus an additional 20% (short term: 3 to 10 years) and 15% (long term: within 30 years).
- The North Waikato Integrated Growth Management Programme Business Case aims at managing population growth sustainably in North Waikato, including identifying land use patterns (residential and employment areas) and infrastructure required to meet the growth needs.
- FutureProof is a 50-year growth management strategy and implementation partnership between WDC, Hamilton City Council, Waipa District Council and the Waikato Regional Council. The NZ Transport Agency and Tangata Whenua are stakeholders. Its purpose is to identify the best way to manage growth at the sub-region level through integrated land use and infrastructure planning and encouraging development in targeted towns that can be efficiently serviced by infrastructure.
- The New Zealand Drinking Water Standards provide requirements for drinking-water safety by specifying the maximum amounts of substances or organisms or contaminants or residues that may be present in drinking-water, criteria for demonstrating compliance with the Standards and remedial action to be taken in the event of non-compliance with the different aspects of the standards. In the 2018 revision, routine

monitoring of total coliforms and enumeration testing for *E. coli* and total coliforms were added plus minor revisions throughout. A comprehensive review of the Standards is currently being carried out, which may have an impact on the WTP process selection.

- The National Policy Statement for Freshwater Management, which aims at setting objectives for the state of freshwater bodies in their regions and to set limits on resource use to meet these objectives, is currently being revised. The Freshwater NPS must be fully implemented by the end of 2025.
- National Environmental Standards for Wastewater Discharges and Overflows are pending, and will prescribe requirements for setting consent conditions on discharges from WWTPs and engineered overflow points. These requirements could include:
  - Minimum treatment standards or ‘limits’ for nationally applicable quality parameters;
  - Targets/limits on volume and frequency of overflows;
  - Methods for monitoring compliance;
  - Approach for incorporating culturally acceptable wastewater treatment processes.

5 Existing Assets

5.1 Water Supply

5.1.1 Te Kauwhata and Meremere Water Supply Network

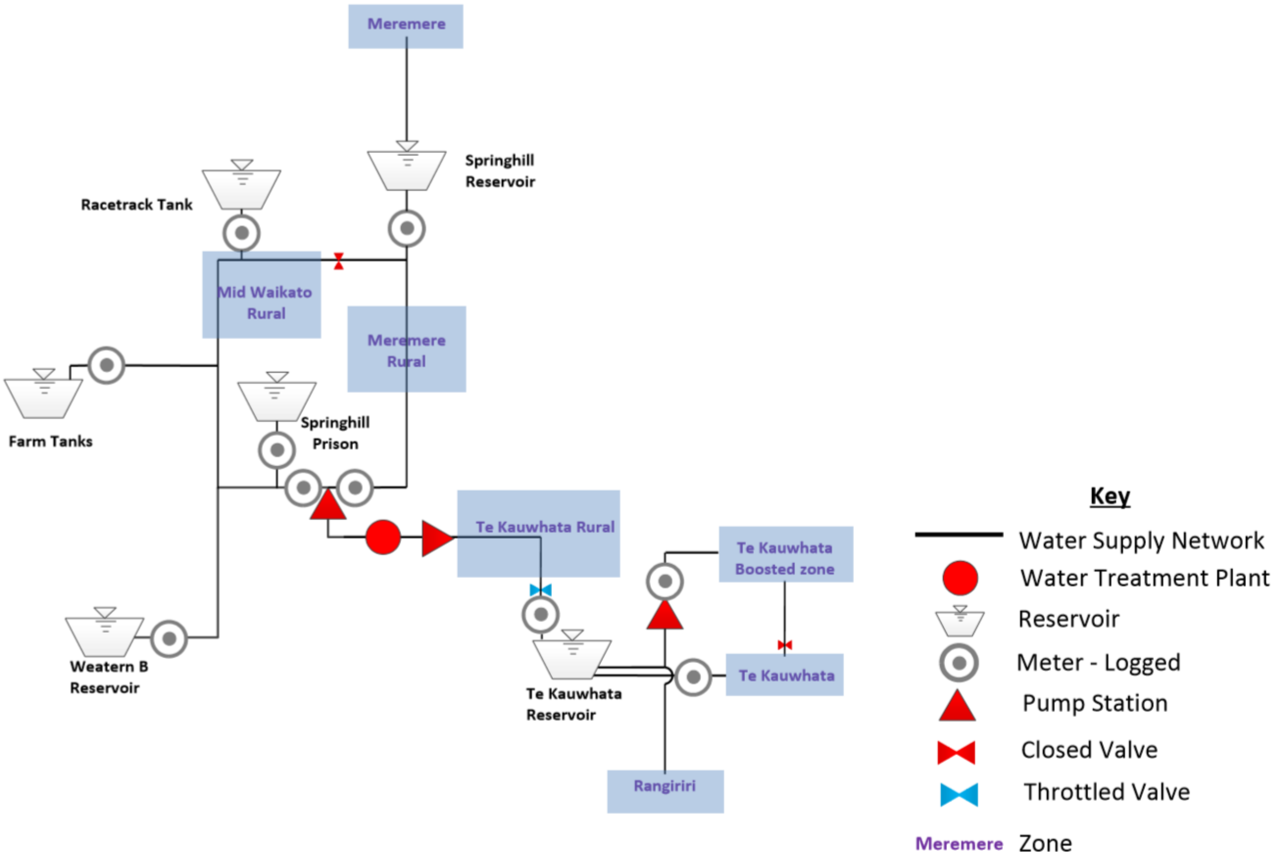
Water is abstracted from the Waikato River through the Te Kauwhata water intake (owned by the TKWA) and pumped to the Whangamarino WTP (also called the Te Kauwhata WTP).

A pump set at the WTP is used to fill the Te Kauwhata Reservoir and services Te Kauwhata Rural. The reservoir services Rangiriri and Te Kauwhata by gravity. A booster pump services Te Kauwhata boosted from the Te Kauwhata Reservoir.

Another pump set at the WTP is used to fill the Springhill Reservoir and Western B Reservoir. This pump set also services Meremere Rural, Mid-Waikato Rural, the Springhill Prison and fills the Racetrack tank and the Farm tanks. Meremere is serviced by gravity from the Springhill Reservoir.

Figure 5-1 below is a schematic of the Mid-Waikato water supply network including WTP, pump stations and reservoirs/tanks (source: *Mid-Waikato Water Supply Master Plan*, Opus, 2015).

Figure 5-1 Te Kauwhata and Meremere Water Supply Schematics

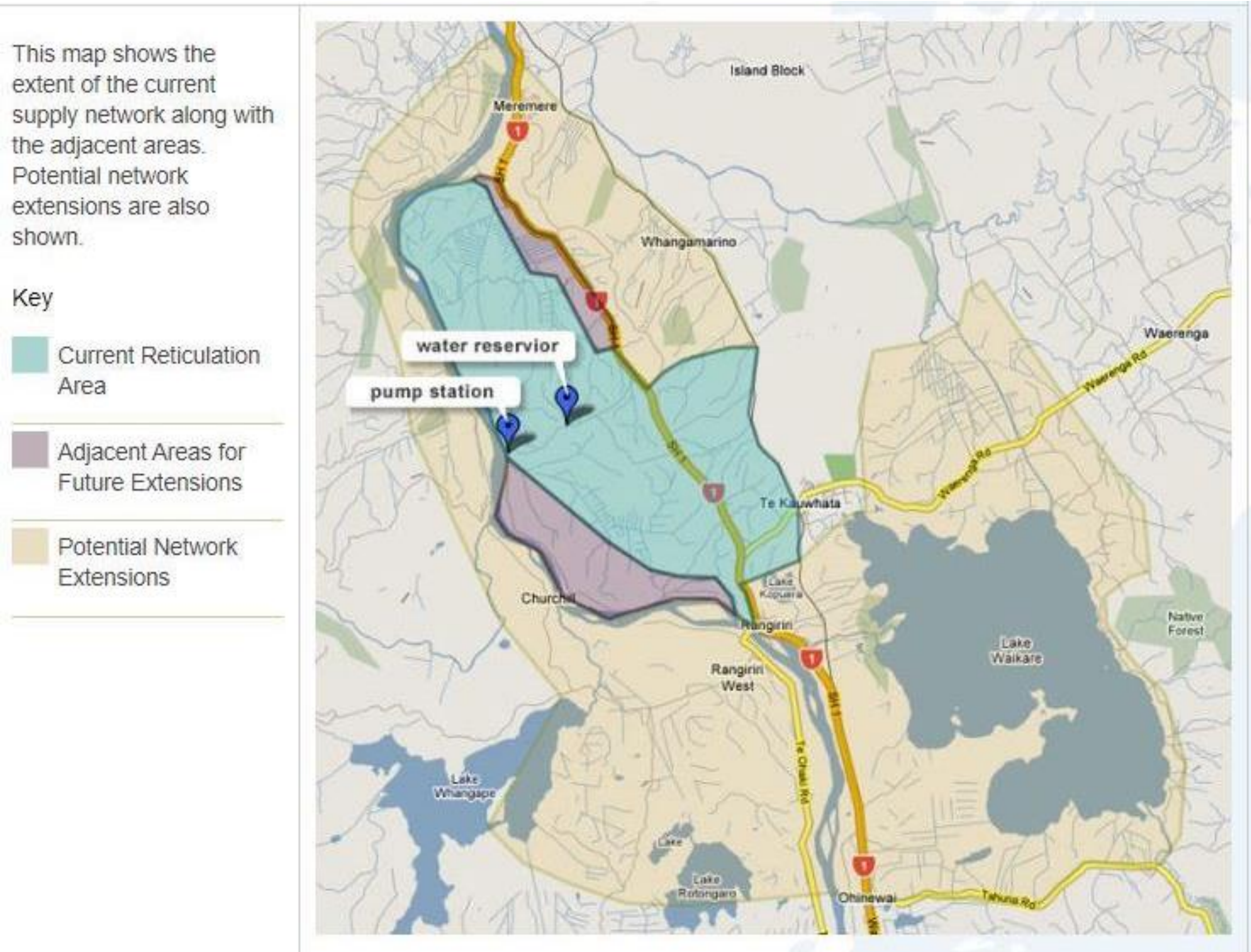


Source: Mid Waikato Water Supply Master Plan, Opus, 2015 (Figure 3-1)

5.1.2 Te Kauwhata Intake

Water is abstracted from the Waikato River through the Te Kauwhata water intake and pumped to the Whangamarino WTP. At the intake site there is an intake screen (2.5mm), pump station, and fine screening (100 or 135 micron). A 1.8km long rising main conveys water to the raw water reservoir, which is a timber tank with liner and roof. The intake and raw water pipeline are owned by the TKWA (refer Figure 5-2 below for location of intake pump station and raw water reservoir).

Figure 5-2 - Te Kauwhata Water Association (TKWA) Supply Network Reticulation Map



Source: http://www.tkwa.co.nz/

A recent condition assessment was carried out on the raw water intake, pipeline and the pump station (Beca, 2019). It noted that the pump station and associated assets are 34 years old. In general, a number of mechanical and electrical items of equipment are nearing the end of their life, while civil structures and pipelines are generally in a serviceable condition although a significant portion of their life has passed. The report highlighted several specific matters that need attention, including repair/replacement of the intake screen, surge vessel, switchboard and control system, and possibly the liner of the raw water reservoir.

5.1.3 Whangamarino WTP

The raw water source (i.e. Waikato River) is typically characterised by turbidity of <10 NTU (however increases significantly following rainfall), low colour, low iron and manganese, runoff from upstream land use, arsenic (upstream geothermal activity) and algal blooms (particularly frequent during summer). A minimum of 4 log protozoa removal is required (Beca 2018).

The existing Whangamarino WTP (also called the Te Kauwhata WTP), utilises a conventional treatment process comprising PAC dosing (as required), coagulation/flocculation, clarification, dual media filtration, UV disinfection, pH correction and chlorination. The assets were generally described as being in reasonable to good condition in a recent report (Beca, 2018).

Residuals (i.e. clarifier sludge and filter backwash) are discharged to one of two settling ponds, where the supernatant is discharged (consented) and sludge is periodically removed (either by draining the pond and allowing to naturally dry and evacuated or pumped out and mechanically dewatered with portable mechanical plant.

Of the two settling ponds, the newest one was built in 2005, and the older one is not currently functional – an embankment is damaged, and new outlet structure would be required. A recent report noted that the failed pond was currently limiting the ability to dewater the other pond that is in need of desludging (Beca, 2018).

The WTP is soon to be upgraded from 3MLD to 4.5MLD by the addition of a third BAC filter, replacing the existing Te Kauwhata treated water pumps, upgrading Pond 1 and the chlorine and pre-caustic dosing.

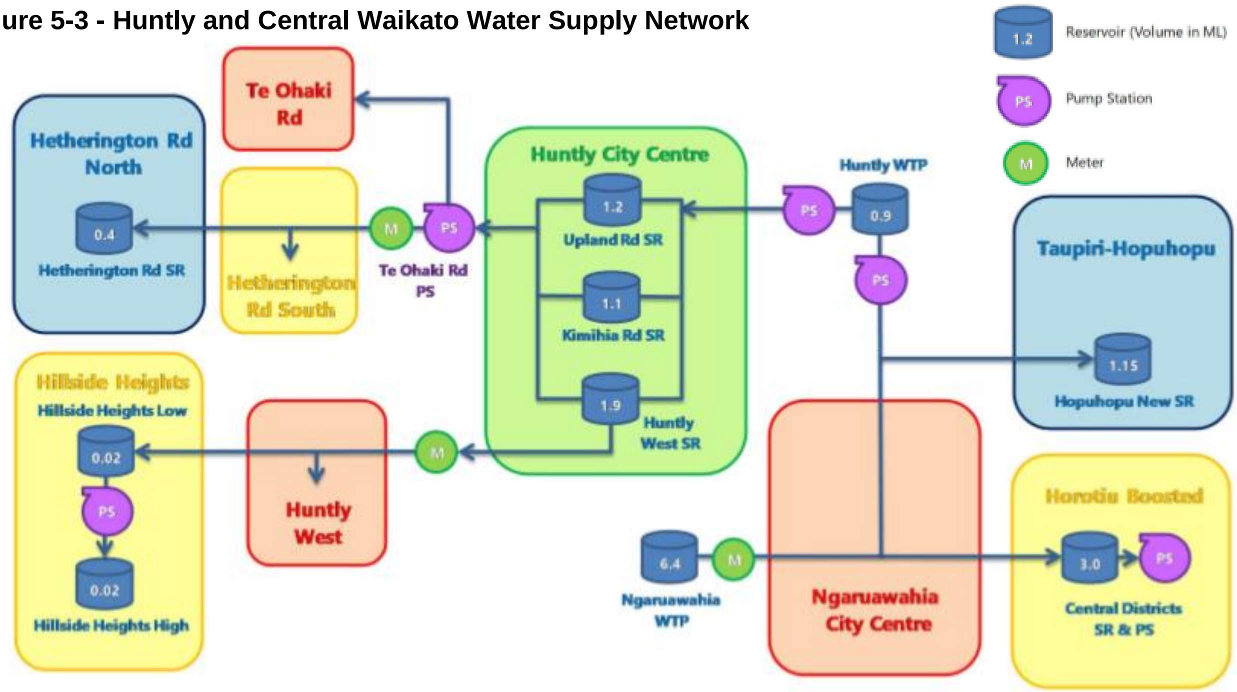
5.1.4 Huntly Water Supply Network

Water is abstracted from the Waikato River through the water intake at Huntly and pumped to the Huntly WTP. Four high lift pumps at the treatment plant provide water to the reticulation and five reservoirs.

The supply has two distribution zones: Huntly and Rotongaro. The Huntly zone services the urban centre of Huntly and is on-demand whilst the Rotongaro zone serves the rural community to the west of the town with a mix of on-demand and restricted supply.

A new bulk main was recently installed to be able to supply water from Huntly to the Central Waikato network (Ngaruawahia, Taupiri and Hopuhopu). This bulk main was operational from winter 2019. It is noted that Taupiri and Hopuhopu were previously supplied by a stand-alone WTP, however this was decommissioned and customers are now supplied from Huntly (Beca, 2018). Ngaruawahia (including Horotiu) is primarily supplied by a stand-alone WTP (Ngaruawahia WTP), supplemented by Huntly as required.

Figure 5-3 - Huntly and Central Waikato Water Supply Network



Source: Ngaruawahia-Huntly Water Supply Model, Conversion and Update, HAL 2019.

5.1.5 Huntly WTP

Water is abstracted from the Waikato River and pumped to the Huntly WTP. In 2012 the intake was upgraded to an offshore submerged screen, including an automated air backwash system, supplying pumps situated in a below ground wet well,

The raw water source is typically characterised by water similar to that treated by Whangamarino WTP (i.e. Waikato River). A minimum of 4 log protozoa removal is required. The Waikato River is known to sometimes contain cyanobacteria algal blooms during the warmer summer months. The existing Huntly WTP utilises a conventional treatment process comprising clarification, filtration, UV disinfection, chlorination and fluoridation. A powered activated carbon dosing system is used in the event of cyanotoxin contamination. Significant investment has been made in recent years into dosing equipment, monitoring instrumentation, and process controls in order to improve and ensure the final water quality.

The Huntly WTP currently has a capacity of 8MLD, of which 4MLD is typically used by Huntly, 2MLD is nominally allocated for use by Central Waikato via the new bulk main (typically 1MLD of the 2MLD allocation is currently used), typically leaving 2MLD available capacity for future growth.

5.1.6 Current Capacity and Issues

Table 5-1 – Current Capacity of Existing Assets

Scheme	Asset	Capacity / Storage
Mid-Waikato	Intake	27,600m³/d
	Intake Pump Station	215m³/h
	Whangamarino WTP	3,000m³/d
	Pump to Te Kauwhata Reservoir	25L/s (2,160m³/day)
	Pump to Springhill/Western B Reservoirs	64m³/h (based on pump model)
	Te Kauwhata Reservoir	500m³

Scheme	Asset	Capacity / Storage
	Springhill Reservoir	250m³
	Western B Reservoir	360m³
Huntly	WTP	8,000m³/d
	WTP Reservoir	1,500 m³
	Pump to Upland Rd, Kimihia Rd and Huntly West Resevoirs	90 L/s
	Upland Rd Reservoir	1,155m³
	Kimihia Rd Reservoir	1,128m³
	Huntly West Reservoir	1,948m³
	Hetherington Rd Reservoir	446m³

The main known issues with the existing water assets are summarised as follows:

- Te Kauwhata intake belongs to TKWA and has been estimated previously to require approximately $100,000 to upgrade.
- Ageing asbestos cement (AC) infrastructure in the Mid-Waikato scheme.
- The embankment of the old pond at Whangamarino WTP is damaged due to the cattle grazing around the area of the ponds. This pond requires a new outlet structure similar to the new pond. It is also not currently functioning, limiting the ability to dewater to the new pond.
- The Te Kauwhata, Meremere, and Rangiriri area includes:
  - isolated low-pressure issues throughout the network,
  - high pressure and leakage in the rural zones,
  - significant pressure fluctuations on pumped reservoir supply mains,
  - fire flow and pipe criticality issues (Rangiriri and Meremere townships), and
  - insufficient storage at Te Kauwhata reservoir.

5.2 Wastewater

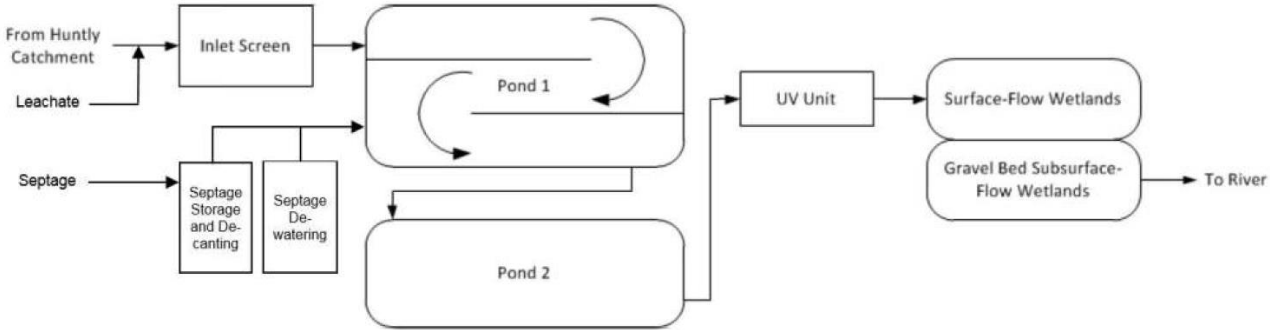
5.2.1 Huntly Wastewater Treatment Plant

Huntly WWTP services the main township of Huntly, Te Ohaki Marae and the surrounding community. The treatment comprises of inlet screening, septage (septic tank sludge) receival plant (including septage treatment pond), oxidation ponds, UV disinfection, wetlands, 'rock-lined' channel and discharge to the Waikato River. This plant has issues in meeting the TSS and ammonia discharge consents.

The oxidation ponds have been known to overtop, and surcharging has been observed on the manholes on the outfall pipeline to the river. 2014 flows to the WWTP were:

- ADWF: 1,816m³/day,
- PWWF: 10,000m³/day.

Figure 5-4: Huntly WWTP Schematic



Source: Te Kauwhata HIF – Wastewater Treatment Plant Concept Design, Beca October 2017.

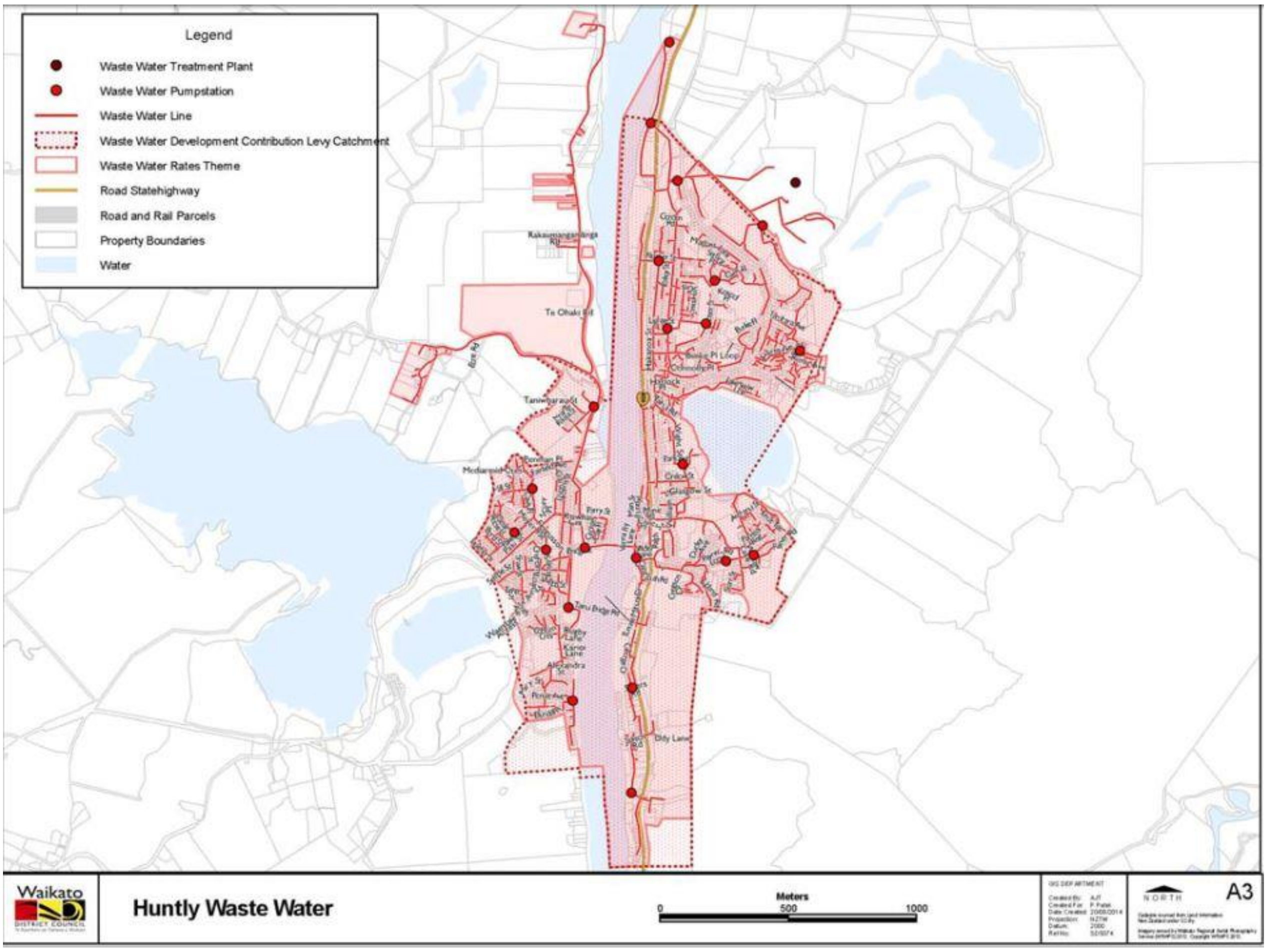
5.2.2 Huntly Wastewater Network

The Huntly wastewater network is a gravity sewer with pump stations (Figure 5-5). The network receives domestic wastewater, trade waste (including landfill leachate) and septage.

Pipe materials in the network include glazed earthenware, asbestos cement, concrete and uPVC. The network is in poor condition due to ground movement (causing dips and loss of grade); ageing pipes; cracked earthenware pipes; fat build-up and general lack of maintenance. The network has issues with blockages and high infiltration rates, exacerbated by root intrusion. Water ingress through low-lying manholes along the river also affects the network when river levels are high.

There are 22 pump stations in Huntly, all of which are connected to the SCADA system except North End Motel pump station. Overflows occur at pump stations and low points in the network during rain events.

Figure 5-5 - Huntly Wastewater Network

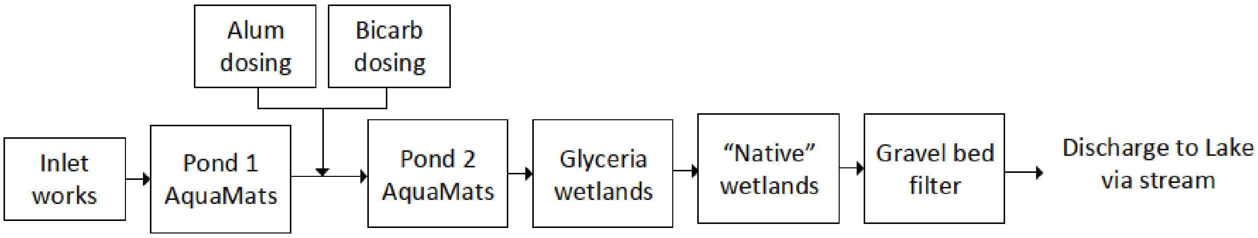


Source: Preparing a 50 Year Wastewater Strategy for the Waikato District", Stantec, 2014.

5.2.3 Te Kauwhata Wastewater Treatment

Te Kauwhata WWTP services Te Kauwhata, Rangiriri and the Springhill Corrections Facility. Treatment comprises of inlet screening, two aerated ponds in series each fitted with sub-surface aeration and biological growth media (Aquamats), wetlands, rock filter and discharge to Lake Waikare. TKN and TN concentrations are generally high and exceed consent limits.

Figure 5-6: Te Kauwhata WWTP Schematic



Source: High Level Desktop Contamination Assessment – Te Kauwhata Wastewater Treatment Plant, Beca October 2019.

Under the consent, the Te Kauwhata WWTP is required to cease discharging to Lake Waikare by 2023. Te Kauwhata WWTP receives domestic wastewater and trade waste, including landfill leachate and wastewater from Springhill Corrections Facility.

The developer for Lakeside has allegedly had agreement with Iwi about discharging highly treated wastewater to the Waikare Lake. But this consent application does not appear to be advancing. Watercare have therefore not yet ruled out a future lake discharge. For this study, we shall therefore only focus on long term solutions, while Watercare will deal with interim solutions and the lake discharge option.

2014 flows to the WWTP were:

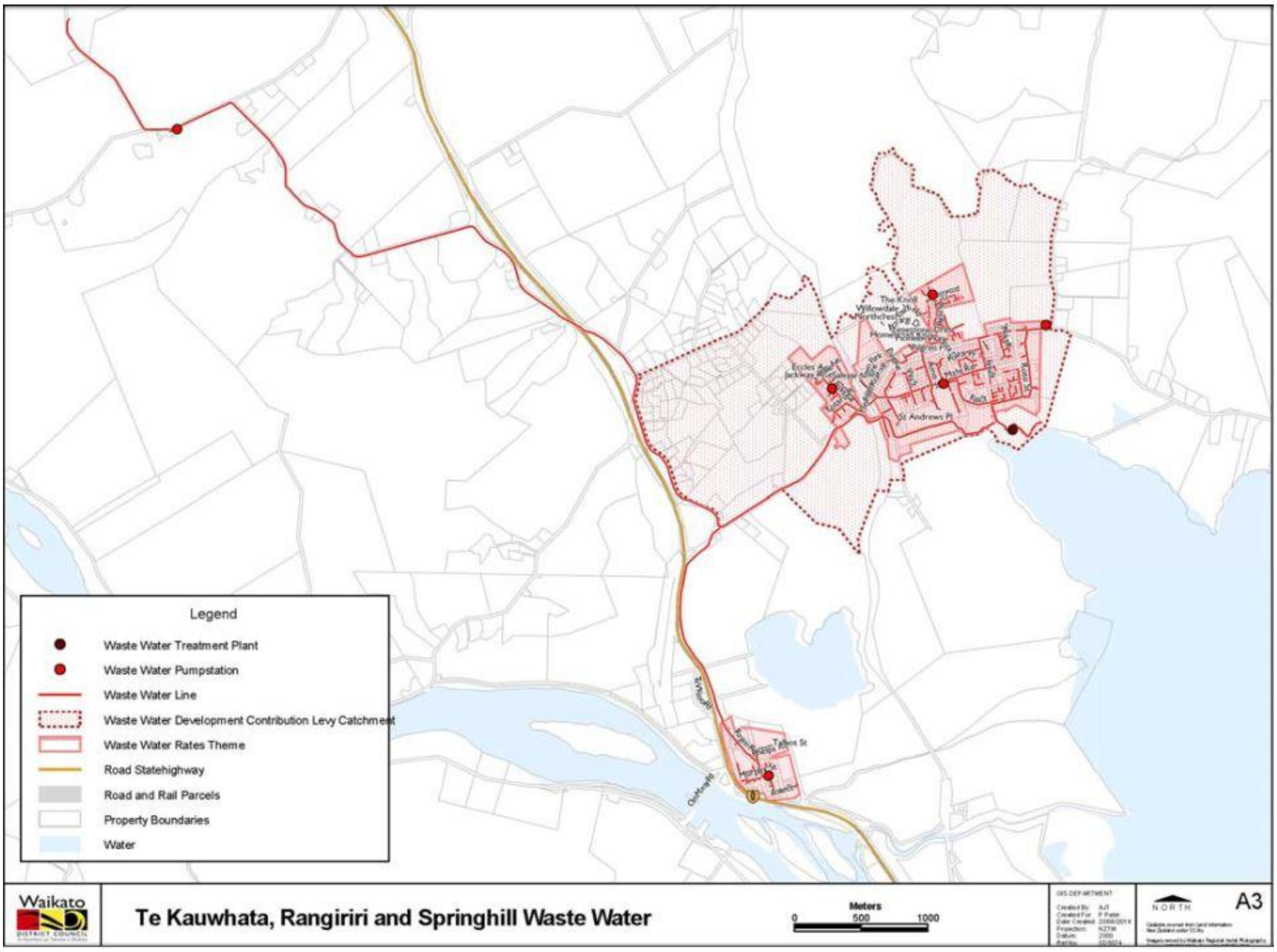
- ADWF: 476m³/day;
- PWWF: 2,061m³/day.

5.2.4 Te Kauwhata, Rangiriri and Springhill Wastewater Networks

Te Kauwhata has a conventional gravity sewer with pump stations (Figure 5-7). Pipe materials are primarily asbestos cement.

There are 5 pump stations in Te Kauwhata, 1 in Rangiriri and 1 in Springhill Corrections Facility. All but one connected to SCADA system. All are generally in good condition. The pump station in Rangiriri transfers flows to the Te Kauwhata scheme. The pump station in Springhill Corrections Facility transfers flows via a dedicated rising main to the Te Kauwhata WWTP. Rangiriri has a conventional gravity sewer installed in 2008 (previously unreticulated) with a pump station that transfers wastewater to the Te Kauwhata WWTP.

Figure 5-7 - Te Kauwhata, Rangiriri and Springhill Wastewater Network



Source: Preparing a 50 Year Wastewater Strategy for the Waikato District", Stantec, 2014.

5.2.5 Meremere Wastewater Treatment Plant

Meremere WWTP serves the township of Meremere. Treatment includes a primary oxidation pond with curtains to minimise short-circuiting and 1 aerator; subsurface wetland; holding pond; strainer; and UV disinfection. Flows gravitate through the WWTP, except for the UV disinfection system which includes pumping. The WWTP discharges to the Waikato River.

The WWTP struggles to cope with high I&I during wet weather, due to the poor condition of the wastewater network. There is insufficient storage capacity at the WWTP, which has caused discharge to the Waikato River outside of consented times.

The WWTP has also had issues with meeting consented limits for ammonia, TKN, TSS & $cBOD_5$. The discharge consent RC105031 expired in 2018. However, an application has been lodged to enable the discharge to legally continue whilst the application is being processed.

2014 flows to the WWTP were:

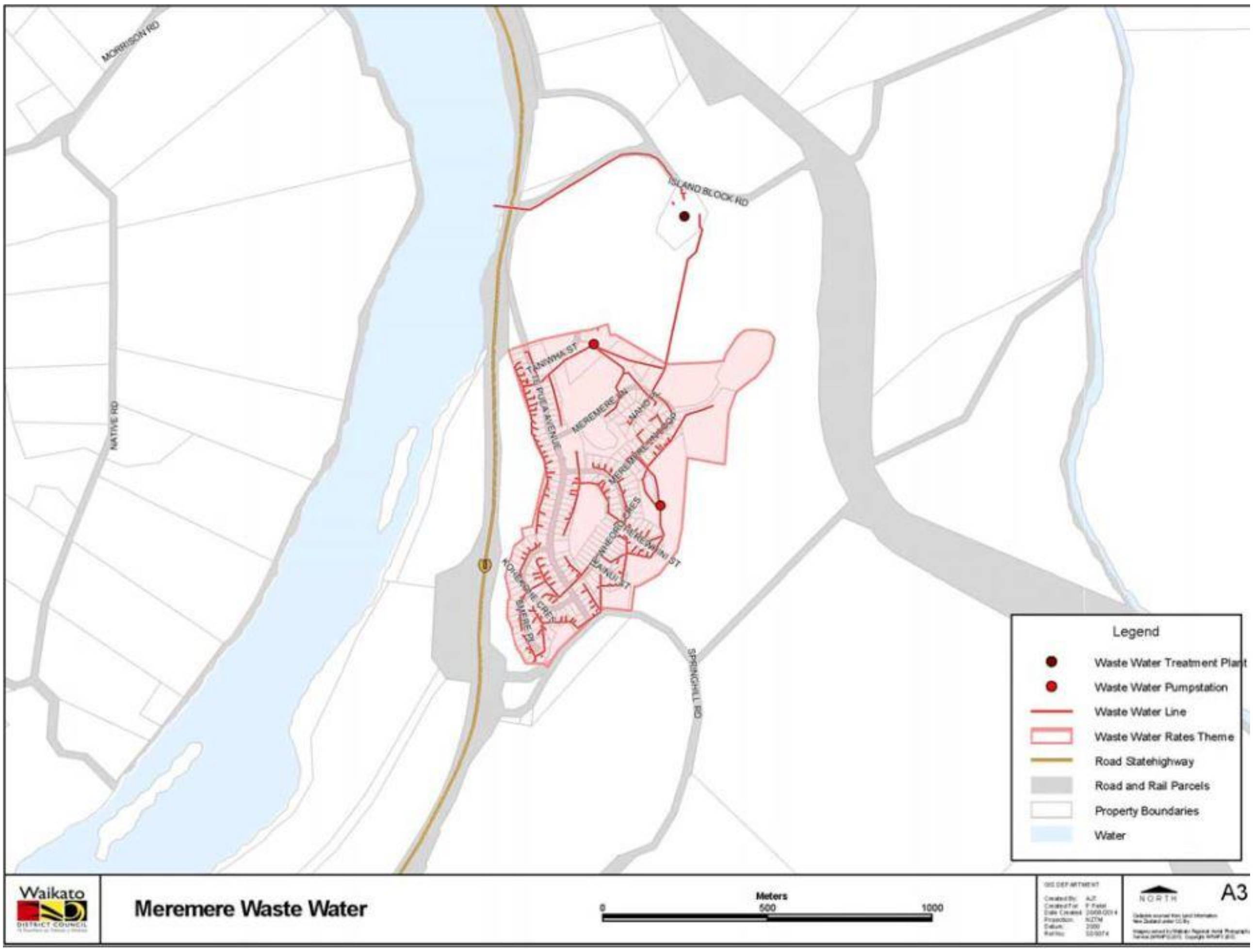
- ADWF: 91m^3/day;
- PWWF: 1,325m^3/day.

5.2.6 Meremere Wastewater Network

The Meremere wastewater network is a conventional gravity sewer with pump stations (Figure 5-8). Pipe materials are a mixture of asbestos cement, glazed earthenware, concrete and uPVC. Generally, the network is in poor condition and requires upgrading. Past population decreases in Meremere have caused large parts of the network to be decommissioned and not maintained. Inflow & infiltration is high in the network, primarily due to stormwater ingress. The network receives only domestic wastewater.

Major renewals are required to the two wastewater pump stations in the network, due to the age of the assets including the submersible pumps, switchboards and communication units. The pump stations are connected to the SCADA system.

Figure 5-8 - Meremere Wastewater Network



Source: Preparing a 50 Year Wastewater Strategy for the Waikato District", Stantec, 2014.

5.2.7 Current Capacity and Issues

Table 5-2 – WWTP Capacities

Wastewater Treatment Plant	Capacity
Huntly WWTP	Designed for ADWF of 2,100m³/d
Ngaruawahia WWTP	1,685m³/d (ADWF observed)

Wastewater Treatment Plant	Capacity
Te Kauwhata WWTP	674m^3/d (ADWF observed)

Source: Centralised and Decentralised Wastewater Treatment Plan investment, Stantec October 2017.

The main known issues with the existing wastewater assets are summarised as follows:

- The wastewater plants are not meeting discharge consents,
- The capacity of the WWTPs is not enough to cater for future demands,
- Electrical issues are common to all plants.

6 Previous studies and options

6.1 Committed work

Te Kauwhata WWTP - On-site MBR Option for existing flows only

The option to install the 2.25MLD MBR at Te Kauwhata WWTP is purely to handle existing flows, in order to meet discharge consents. The report details that it is likely to apply some staging to the development of the treatment plant. It is assumed another MBR will be installed in the future.

Te Kauwhata Treated Water Reservoirs – Addition of 2,000m^3 storage

The preferred option consists in keeping the existing 500m^3 reservoir as it is in good condition, and building 2 new 1,000m^3 reservoirs in two stages: one in the short term and the other one as growth occurs.

Whangamarino WTP Upgrade – From 3MLD to 4.5MLD

The WTP is soon to be upgraded from 3MLD to 4.5MLD by the addition of a third BAC filter, replacing the existing Te Kauwhata treated water pumps, and upgrading Pond 1 and the chlorine and pre-caustic dosing.

6.2 Preferred Options

6.2.1 Te Kauwhata and Huntly WWTP

Te Kauwhata HIF – Wastewater Treatment Plant Concept Report (Beca, Oct 2017). This report considers the decommissioning of the Te Kauwhata WWTP with a centralised WWTP plant at Huntly with capacity to treat Huntly and Te Kauwhata flows. The existing Huntly WWTP does not have the capacity to be upgraded to provide the level of treatment required for discharge to the Waikato River. Therefore, the concept design is based on a new WWTP. The preferred option was sub-option 1- the membrane plant due to the potential large ground improvement costs on site which made the MBR and BNR options comparable in CAPEX. Also, the MBR plant will have a much smaller footprint than a clarifier-based plant.

Te Kauwhata WWTP - Site Selection (Beca, Jan 2018). A list of options was short listed for the location of the Te Kauwhata WWTP. However, of all 5 site location options considered none of them demonstrated significant advantage over the site location adjacent to the Huntly WWTP. It is recommended that a detailed site investigation be carried out at Huntly WWTP to confirm likely ground improvement costs and mitigation measures to address potential flooding impacts.

Centralised and Decentralised Wastewater Treatment Plant Investigation (Stantec, Oct 2017). This report considers two options to treat wastewater from the Huntly, Ngaruawahia and Te Kauwhata catchments. One option is decentralised treatment through construction of separate MBR plants at each location with interim construction of a solids removal process at Huntly. The other option is centralised treatment through conveyance of raw wastewater from Te Kauwhata and Ngaruawahia to a new MBR plant constructed at the Huntly WWTP in either one or two construction stages. The decentralised option has a lower capital and ongoing cost, as 30% of ongoing costs for the centralised option would be due to the conveyance and septicity control. However, the non-fiscal benefits should be considered too.

Housing Infrastructure Fund – Te Kauwhata Detailed Business Case (WDC, April 2018). This report considers multiple wastewater treatment options. Out of the long list of options, the following were shortlisted: Te Kauwhata wastewater on site treatment plant with a suitable land contact discharge location near SH1 and Waikato river, wastewater connection to Huntly and treatment plant upgrade, Te Kauwhata on site treatment plant with discharge to wetland via retention system and then to the Lake Waikare and the last option was to do the minimum- upgrade the existing Te Kauwhata WWTP. The preferred option was the Te Kauwhata on site WWTP and discharging to a suitable land contact point near SH1 and Waikato River. Though, this option does have some consenting risks.

6.2.2 Meremere WWTP

Meremere WWTP Upgrade Options Assessment (Beca, July 2019) considered five potential options in a multi-criteria analysis (MCA) workshop and concluded that the preferred option would be to improve the treatment at the existing site and continue with a discharge to the Waikato River. Upgrading the existing facultative ponds with tertiary treatment, such as DAF (Option A) was the highest ranked option, based largely on it having the lowest whole of life cost, but is likely only appropriate for a shorter consent duration (10-15 years). Upgrading with side stream MBR treatment (Option B) scored best based on non-cost considerations, including quality of discharge, and could be suitable for a longer consent term (25-35 years). An Offset option was considered, but not scored during the MCA. This identified that the overall nutrient contribution of the Meremere discharge to the Waikato River is relatively small, and a better overall benefit to the River may be achievable by providing environmental improvements elsewhere, e.g. at Huntly or Te Kauwhata. A preferred option was not selected and was deferred subject to final WDC and Watercare review.

6.2.3 Whangamarino WTP and Te Kauwhata Intake

Te Kauwhata Intake and Pump Station Condition Assessment. (Beca, 2019). This report summarised the key findings of a condition assessment of the existing raw water intake, pumping, rising main and reservoir for the Te Kauwhata Intake and Pump Station. In general, a number of mechanical and electrical items of equipment are nearing the end of their life, while civil structures and pipelines are generally in a serviceable condition although a significant portion of their life has passed. The report highlighted several specific matters that need attention, including repair/replacement of the intake screen, surge vessel, switchboard and control system, and possibly the liner of the raw water reservoir, as well as several reviews.

Te Kauwhata WTP Options Investigation Report. (Beca, 2019). This report considered four options for providing additional capacity for Te Kauwhata: an upgrade of existing Whangamarino WTP to 9MLD, a new 6MLD WTP on Hall Road (near existing WTP), a new 6MLD WTP on Wayside Road, and a new 9MLD WTP on Wayside Road. A weighted attributes analysis identified that the expansion on the existing WTP site (i.e. Whangamarino) to be the favoured option as it was the lowest capital cost ($12.5M) and the lowest risk in terms of programme in particular with lower level of risk regarding consenting and land acquisition.

6.2.4 Sub-Region Water Infrastructure

Pokeno, Te Kauwhata and Huntly Water Supply Ultimate Development. (Beca, 2018). This report provided a high-level consideration of future water supply options for the Pokeno, Te Kauwhata, Huntly and Ngaruawahia areas, together with the towns between these centres such as Ohinewai and Mercer. Three options were outlined. Each had a single WTP servicing Pokeno and then between one and three centralised WTPs servicing Meremere, Te Kauwhata, Ohinewai, Huntly and Ngaruawahia. The total costs range from $97M to $128M. The report concluded that the preferred long-term solution was Option 2 with WTPs centred at Pokeno, Te Kauwhata and Huntly as it balanced resilience, cost (lowest capital cost, $97M) and built on existing infrastructure. The report included several recommendations for consideration as part of long-term planning.

Mid-Waikato Water Supply Network System Performance & Options Analysis (HAL, February 2020)**.** This report summarises the system performance and options analysis carried out on the Mid-Waikato water network (here including Te Kauwhata, Rangiriri and Meremere). Main issues identified include isolated low-pressure issues throughout the network, high pressure and leakage in the rural zones, significant pressure fluctuations on pumped reservoir supply mains, fire flow and pipe criticality issues (Rangiriri and Meremere townships) and insufficient storage at Te Kauwhata reservoir. All proposed options described in the table below are recommended to address those issues.

Scheme	Report	Option	Advantages/Opportunities	Disadvantages/ Risks	Growth Considered
Huntly, Ngaruawahia and Te Kauwhata catchments	Centralised and Decentralised Wastewater Treatment Investigation – Stantec October 2017.	**Option 1: Decentralised,** **$69 million:** Through the construction of separate membrane bioreactor (MBR) treatment processes at each location (interim construction at Huntly).	- Lower costs when compared over a 50-year period. - Huntly and Ngaruawahia will not require MBR upgrades until 2028.	- Te Kauwhata WWTP will require upgrades in 2020 including the construction of an outfall diffuser. - Huntly will need an Actiflo or equivalent to meet TSS discharge requirements in 2020.	Te Kauwhata 2068 7,700 Huntly 2068 9,500 Ngaruawahia 2068 8,500 The population increases proposed in the HIF application for the Te Kauwhata area have been used for this project 90% of the combined growth will occur before 2030.
		Option 2: Centralised, **$81-$84 million:** Through the conveyance of raw wastewater from Te Kauwhata and Ngaruawahia to new MBR treatment plant in Huntly **in either one/two construction stages**.		For this option, upgrades would be required by 2020 in order to receive and treat the wastewater from the Te Kauwhata catchment.	
Te Kauwhata	Housing Infrastructure Fund - Te- Kauwhata Detailed Business Case, WDC April 2018. Bring forward the construction of 1,190 houses by 3 to 5 years earlier than scheduled in the WDC Long Term Plan. Facilitate an additional 1,600 households within the Lakeside Development proposed by Winton Partners.	WW Option - Wastewater connection to Pokeno (Tuakau). Pipe untreated wastewater through new pipe to Pokeno to be processed in an upgraded MBR wastewater plant.		Not strategically aligned. Does not support growth pattern set out in NWIGBC, or Future Proof. Requires a 37km pipeline which engineering feasibility has confirmed will be technically challenging and Capex cost estimates are in the order of $53 million making this project unaffordable from WDC under current funding constraints.	Te Kauwhata Population Growth: 2025: 8,991 2045: 10,898
		WW Option - Do minimum - upgrade existing on-site wastewater treatment plant	Maintain and improve the existing on-site wastewater treatment plant and continue discharging into Lake Waikare.	Not precluded. Consentability issues.	
		WW Option - Wastewater connection to Huntly and treatment plant upgrade. Pipe untreated wastewater through new pipe to Huntly to be processed in an upgraded MBR wastewater plant. Continue to discharge to Waikato river.	Would provide wastewater services for other areas as well as Te Kauwhata.	Not precluded. Affordability issues	
		WW Option - Wastewater on-site treatment plant and discharge in Lake Waikare Build new MBR Treatment plan in Te Kauwhata and discharge into Waikare Lake.	Supported by key stakeholder - Winton Partners and is part of the Lakeside Development Plan Change Application.	Consentability issues	
		WW Option - Wastewater connection to Huntly with super treatment plant in Ngaruawahia. Pipe untreated wastewater through new pipe to Huntly to be processed in an upgraded MBR treatment plant. Continue discharge to Waikato River. Pump wastewater from other satellite towns including Ngaruawhahia to Huntly to be treated.		Council have identified a super wastewater treatment plant to be unaffordable. While operational economies of scale are likely due to three existing wastewater treatment plants being replaced by one, the costs of upgrading the treatment plant and connecting to Huntly alone are in the order of $105 million which does not accommodate connections to and between Ngaruawahia and other towns.	
		WW Option - Wastewater on-site treatment plant and discharge to land contact point near SH1 and Waikato river. Build a new MBR treatment plan in Te Kauwhata, discharge to a suitable land contact point.	Likely to be more affordable and supported by local community.	Affordability Issues.	
		WW Option - Wastewater is discharged to land Wastewater from a Te Kauwhata based wastewater treatment plant is discharged to land.		Insufficient appropriate (and affordable) land near the potential Te Kauwhata treatment plant location to accommodate the discharge as the Lakeside Development takes the land that could otherwise have been used. Also, the ground conditions do not easily support land discharge– especially in winter.	
		WW Option - MBR system is used to treat wastewater Use MBR wastewater treatment system in the wastewater treatment plant design.	This option was identified as the preferred system due to the upgraded environmental outcomes it achieves in comparison to the BNR. Further, MBR systems are less susceptible to differential ground settlement and have a smaller footprint meaning less exposure to substantial geotechnical risks.		
		WW Option - BNR system used to treat wastewater Use BNR system to treat wastewater rather than MBR system. The BNR system is an older technology which has been previously used.		The BNR is more sensitive to differential ground settlement and therefore a bigger technical risk.	

		WS Treatment Option 1 - Bring forward and expand the existing LTP plans to provide a new reticulated water treatment plant in Te Kauwhata – more sub-options are described below	Preferred option as it provides the infrastructure requirements, in time, for the additional 1600 dwellings planned in Te Kauwhata and 1190 dwellings planned in this area		
		WS Treatment Option 2 - Continue on with the existing Long-Term Plan reticulated water treatment upgrade plans and timing (supply increased from 5000m^3/day to 7000m^3/day).		Doesn't meet project objectives. Limits growth which can occur in Te Kauwhata. Is not able to cater for the additional 1600 dwellings not initially accounted for in the Te Kauwhata structure plan	
		WS Treatment Option 3 - Do nothing		Doesn't meet project objectives. Existing infrastructure is already at capacity. Without upgrades to the existing infrastructure, Te Kauwhata will not be able to provide for any additional households.	
		WS Treatment Option 1-1- Build new pump station to convey flows between the treatment plant and the Te Kauwhata reservoirs without PSV.	Preferred - most cost efficient and effective. Retains some existing pipeline segments	High head losses through the main. PN class of existing oPVC and mPVC between proposed PS and reservoir is not suitable.	
		WS Treatment Option 1-1a- Build new pump station with larger pipe size to reduce pumping head.	Lower pumping costs, reduced pump capex.	Not as cost effective as preferred option. Higher pipe costs. Relatively minor reduction in pumping head at a significant cost.	
		WS Treatment Option 1-2- Install break tank between treatment plant and the reservoirs	Provides hydraulic break negating need for PSV. High reservoir TWL provides driving head instead of pumping the entire length.	Higher upfront costs, less flexibility in design. Flow cannot easily be increased from the Break Tank. Reservoir capex, O&M and inspection costs.	
		WS Treatment Option 1-3 - Drill deeper below the high point to avoid head loss	Mitigates the high point issue.	Not feasible. 15m deep drill at ~500m long.	
		WS Storage Option – Keep existing 500m^3 reservoir and build 2 new reservoirs providing an additional 2,000m^3 storage in two stages.	Preferred option. Keeping the existing reservoir is cost effective as it is in good condition. Two reservoir improves system resilience, allows for more flexibility in maintenance, and improves water quality		
Te Kauwhata	Te Kauwhata HIF - Wastewater Treatment Plant Concept Design, Beca October 2017 Waikato District Council (WDC) has been allocated $37m from the national Housing Infrastructure Fund. This will allow the WDC to provide in excess of 2,000 new dwellings in the next 10 years in Te Kauwhata. Infrastructural upgrades are required in order to ensure adequate levels of service to meet this proposed growth.	Current: The original wastewater treatment plant was upgraded in 2005-07 from a basic two-pond waste stabilisation pond (WSP) system to an enhanced pond system using Aquamat technology to accommodate the loading from Rangiriri, the Corrections Facility and future growth in the area. Following this upgrade, the treated effluent discharged from the Te Kauwhata WWTP consistently met all resource consent conditions until 2015. In 2015, effluent TKN and TN concentrations increased dramatically to significantly exceed consented limits and have generally remained high since.			**Population Growth** Huntly **2017-** 7,799 **2048-** 8,496 **2068-** 9,420 Te Kauwhata **2017-** 1,258 **2048-** 7,489 **2068-** 7,489
		Membrane Bioreactor (MBR)	Much smaller footprint. With the membranes the concentration of activated sludge (and hence loading rate) in the reactors can be substantially increased, thus decreasing the necessary reactor size. The membrane tank is also substantially smaller than the equivalent clarifier. This is a significant advantage given the likely ground conditions. On poor ground, the membrane tank will be less affected by differential settlement than will a circular gravity clarifier. No risk of biomass loss. The physical barrier of the membrane prevents washout of biomass from the reactor, which would otherwise reduce the capacity and negatively impact on the effluent quality. Simpler biomass management. The management of sludge age and biomass inventory is simplified as there is no biomass loss, poor settling sludge does not cause a problem and sludge can be wasted directly from the reactor. Less chemical for phosphorus removal. Because the membranes removal all the particulate phosphorus, slightly less chemical is required to precipitate out the necessary amount of phosphate. Better and more reliable effluent quality. If WDC were to elect to collaborate with Watercare in future, a membrane-based plant at Huntly would be consistent with the strategy that Watercare is currently implementing.	Limited hydraulic capacity. It will be cost prohibitive to install enough membrane capacity to treat the peak wastewater flow as it arrives, thus either a bypass (with partial treatment) or raw wastewater storage and flow equalisation will be required. More complex O&M. The membranes require regular cleaning, and although this is largely automated, it still requires more operator attention and CIP chemicals. Additional screening required. Due to the sensitivity of the membranes to fine particles and fibres, fine screening (1mm) is required. This requires a two-stage screening process, further increasing the capital cost. Higher operation cost. All wastewater needs to pump out through the membranes. The greater extent of mechanical equipment leads to a higher maintenance cost and renewals budget requirement. Chemicals required for cleaning the membranes Slightly more aeration required due to high MLSS. Ongoing membrane replacement costs. Membranes have a limited life ~10 years and require funds to be set aside every year for eventual replacement.	
		Conventional Biological Nutrient Removal (BNR) plus clarifier and UV treatment	Increased hydraulic capacity. Clarifier through-put is more flexible (i.e. can be increased more easily. Therefore, smaller raw wastewater storage is required. Although some raw wastewater storage will likely be required due to the large peak flow (8-10 times ADWF). Could even dose polymer to further	Bulking sludge / sludge washout If sludge bulking occurs it will likely lead to a wash out of sludge and poor effluent quality. UV required for disinfection and less stable. Variability in the performance of the clarifier (e.g. changing sludge settle-ability) will impact on the UV performance.	

			increase the through-put. Lower operating cost. Wastewater flows by gravity through the clarifier. No cleaning chemicals required Lower mechanical maintenance cost.		
Te Kauwhata- Provide information on potential sites for construction of a new wastewater treatment plant (WWTP) in the Ohinewai area to service Te Kauwhata and Huntly communities	Te Kauwhata WWTP - Site Selection, Beca January 2018	Combined Te Kauwhata/Huntly WWTP and/or discharge location.	Scored highest using an MCA ranking, Similar capital cost and NPV to the stand-alone plant options if the required upgrades to Huntly WWTP post 2028 are considered. This strategy allows for simpler construction on a new greenfield site with good foundation conditions. Excellent site access available. Economics of scale for WWTP construction. Potential for reuse of treated effluent during dry periods (e.g. of nearby reserves planting). Provides flexibility for additional growth areas and WWTP could be built in stages. i.e. Huntly specific capacity build could be deferred until 2029. Discharge is removed from Lake Waikare. Less staff required to operate WWTP.	Operational costs influenced by pumping of peak raw wastewater flows and odour control chemicals. Takes longest to implement due to requirement to consent a discharge to the Waikato River in a new location and to secure alignments for conveyance pipelines. Increased process management complexity due to long pumping mains (but not unmanageable). Ability to acquire and designate site needs to be confirmed.	**2017** Huntly: 7,799 Te Kauwhata (excluding Spring Hill population equivalent): 1,258 Meremere: 588 **2048** Huntly: 8,496 Te Kauwhata (excluding Spring Hill population equivalent): 7,489 Meremere: 588 **2068** Huntly: 9,420 Te Kauwhata (excluding Spring Hill population equivalent): 7,489 Meremere: 588
		Lumsden Road (site 4)	Greenfield and better soils	Flood risk from river scheme/land drainage scheme failure. Private ownership	
		Tahuna Road (site 16)	Greenfield, elevated above floodable land, better soils and good access.	Adjacent significant natural areas around lake Ohinewai, possible conflict with reserve use and small size restricts future expansion.	
		Ralph Road (site 18)	Greenfield, elevated above floodable land and better soils.	Increased pumping distance.	
		Frost Road (site 19)	Greenfield, elevated above floodable land and better soils.	Increased pumping distance.	
		East Mine Road (site 36)	Area already designates, good access, existing resource consent for discharge to Waikato River, Availability of existing ponds for flow buffering and biosolids, land availability for future expansion.	Huntly subsidence zone, flood risk from local overland flow and river scheme stopbank failure (need to raise building platform and access) and uncertain ground conditions.	
		Rata Street (site 37)	Area already designated and availability of existing ponds for flow buffering.	Flood risk from local overland flow and Lake Waikare/river scheme, poor ground conditions, limited area available for future expansion, close to residential areas and distance from Waikato river.	
Te Kauwhata	Te Kauwhata WWTP - On-site MBR Option Concept Design, Beca, 2018	Current system: oxidation ponds			
		Installation of a 2.25MLD membrane bioreactor on the existing WWTP site. Includes: Inlet lift PS, inlet works, screening washer, MBR, WAS Dewatering, new transformer and overflow balancing through the reconfiguration of the existing pond 1.		The location of the WWTP is adjacent to a closed landfill. Due to unknown ground conditions, the new WWTP cannot be built on the closed landfill. It might be possible to build on certain areas of the old landfill however further historical operational knowledge and/or data from the landfill site is required.	MBR is sized off the 2048 population growth (7489) provided in the concept design report (Beca, November 2017). The MBR is assumed to be installed in stages. The first 2.25MLD will treat the current flows and another reactor will be installed in the future.
Te Kauwhata	Te Kauwhata (Whangamarino) WTP Options Investigation Report FINAL, Beca, October 2018. Options assessment to determine the preferred site for development of the expanded water supply Three site options have been identified.	**Option 1: Existing WTP Site** Upgrade WTP to 9,000 m^3/d Expansion is the favoured option – lowest cost 1 plant total	Utilise existing pond. Extension to an existing site may be simpler than obtaining a new site and land area is less	Reduced resilience. Requires a willing buyer / willing seller agreement to meet required timeframes.	Existing Capacity = 3000m^3/day
		Option 2: Hall Road Site Build a WTP to 6,000 m^3/d 2 plants total	Utilise existing pond. Provides a level of diversity and resilience	Requires a willing buyer / willing seller agreement to meet required timeframes.	
		Option 3: Wayside Road Site Build a WTP to 6,000 m^3/d 2 plants total	Provides a level of diversity and resilience. Routine discharges to sewer.	Consent for non-routine discharges required. Uncertainty over land ownership and acquisition. Additional costs for the WWTP upgrades and potential sewer upgrades may be required.	
		Option 4: Wayside Road Site Build a WTP to 9,000 m^3/d 2 plants total	Provides a level of diversity and resilience. Routine discharges to sewer.	Consent for non-routine discharges required. Uncertainty over land ownership and acquisition. Additional costs for the WWTP upgrades and potential sewer upgrades may be required.	
Te Kauwhata	Water Infrastructure Concept design, GHD, 2017	Storage. 2x 1,000m^3 reservoirs.			Water supply system to meet future demand from Te Kauwhata including Lakeside. Te Kauwhata = 1,190 dwellings
		Trunk main 1 (WTP PS to Reservoir): **Option 1** Pumped: Design flow is 37.5L/s. The existing	Retains some of the existing pipeline segments	High head loss through the main.	

		200mm diameter pipework can be retained if pipe class and condition permit (head loss would be above 5m/km).			and Lakeside Ultimate = 1,500 dwellings.
		Option 2 Break tank: Construction of break tank at the high point, allows flows to be pumped here then gravitate to existing storage.	Provides hydraulic break negating the need for PSV. High reservoir TWL provides driving head instead of pumping the entire length.	Not feasible: head losses between high point and existing reservoir greater than available head.	
		Option 3 Drilled: Lower the level of the pipe below the hydraulic grade line. Dill ~500m of pipe, max depth ~ 15m. **Not feasible**	Mitigates the high point issue.	15m deep drill at ~500m long	
		New Pump Station located at new WTP providing peak flow of 37.5L/s and 20m head.	Lower pumping costs, reduced pump capex	Higher pipe costs. Relatively minor reduction in pumping head.	
		Trunk main 2- Lakeside supply. **Option1:** Section 1- retaining existing DN375 and DN200 along Te Kauwhata road, option to upgrade Dn200 to DN375 to reduce head loss. Section 1 upgrade existing pipe along Scott road to DN375, ~1174m long.	More cost effective, using existing infrastructure	Risk associated to PN rating of existing network	
		Option 2: install twin pipes, 2x265mm ID	Improve security of supply.	More costly	
		New WTP of 5.5MLD capacity. Treatment to include PAC dosing, sedimentation (lamella plate/tube) Coarse granular media filtration UV disinfection Chlorine contact	Opportunity to repurpose existing WTP into sludge handling. Opportunity to abandon existing WTP for new infrastructure at marginal additional cost (if there are operational issues).	The existing waste consent is not sufficient to accept flows from the new WTP. Both plants will supply the same treated water main, potential issues of pressure difference between the plants, consistency of chemicals or cross contamination of treated water.	
Pokeno, Te Kauwhata and Huntly	Pokeno, Te Kauwhata and Huntly Water Supply Ultimate Development study (Beca, October 2018)	Current system: 4 WTP (Tuakau, Whangamarino, Huntly, Ngaruawahia – 19,800m³/day)			
		Option 1: Four WTP ($109 million): - Pokeno WTP (20,000m³/d) - 3 additional WTP: 1. Te Kauwhata (20,000 m³/d) 2. Huntly (10,000 m³/d) 3. Ngaruawahia (10,000 m³/d)		The current 3,800 m³/d capacity of Ngaruawahia is too small to add significantly to the resilience of the overall system and the site will be challenging to expand.	Total current population: 18,578 Total ultimate population: 105,000.
		Option 2: Three WTP – PREFERRED ($97 million): - Pokeno WTP (20,000m³/d) - 2 additional WTP: 1. Te Kauwhata (20,000 m³/d) 2. Huntly (20,000 m³/d)	- Utilising the current Te Kauwhata WTP allows for smaller staging steps, with a relatively low-cost expansion being adequate for several years. - Building on the current Te Kauwhata WTP is the most economic option now, and this option also fits with a longer-term water supply vision. - Three water treatment plants, Option 2, centred on Pokeno, Te Kauwhata and Huntly is the preferred long-term solution for the area.		
		Option 3: Two WTP ($128 million): - Pokeno WTP (20,000m³/d) - 1 additional WTP: 1. Ohinewai (40,000m³/d)	Ohinewai is a good location for a central larger treatment plant, being reasonably centrally placed and close to the Waikato River.	To adopt this option would need a substantial step up in cost now, due to there being no existing infrastructure, and the abandonment of existing assets at Te Kauwhata.	
Meremere	Meremere WWTP Upgrade Options Assessment, Beca July 2019 WDC has submitted an application to renew the resource consent for the Meremere WWTP discharge to the Waikato River. Options assessment is required to inform WDC of the future plan for the discharge.	Current system: Waste Stabilisation Pond (WSP)			
		Upgrading the Meremere WWTP for continued discharge to the Waikato River. Additional tertiary treatment (DAF + alum dosing) after existing facultative ponds to provide additional solids and phosphorus removal.	Improved effluent quality. The compact plant footprint could fit within the existing site.	DAF will introduce additional operating costs including, maintenance, labour, pumping and chemical (alum and polymer) costs. The DAF float would result in solids reject stream requiring management. DAF float is assumed to return to the WSP which will increase the frequency of desludging of the ponds.	Meremere Population Growth 2019- 638 2044- 716 Wastewater dry weather flow average (m³/d)- 2019- 115 2044- 130 Wastewater flow design peak (m³/day) – 2019- 600 2044- 600
		Upgrading the Meremere WWTP for continued discharge to the Waikato River. Side stream MBR treatment up to a maximum flow.	Improved effluent quality. Plant footprint is expected to be in the order of 16m by 24m which, based on their initial high-level assessment will fit in the area of the site.	A side stream MBR comes with additional complexity and operating costs for labour, maintenance, chemicals and power over the existing system. The MBR would result in solids reject stream (WAS) requiring management. WAS is assumed to return to the WSP which will increase the frequency of desludging of the ponds. An additional 50KW of power may be required on site.	
		Pumping of the wastewater to another existing treatment plant. Pukekohe WWTP (via Pokeno pump station)	Higher quality effluent as Pukekohe WWTP will be an MBR designated for nutrient removal.	The retrieving treatment plant needs to have the capacity to accept the flows and loads from the Meremere WWTP. This is a key risk for this option and will need to be confirmed with Watercare should this option progress further.	

		Pumping of the wastewater to another existing treatment plant. Te Kauwhata WWTP		Te Kauwhata WWTP is also a pond-based system with Aquamats installed to improve nutrient reduction. Transferring the flow from Meremere could increase the flow discharge from Te Kauwhata WWTP by approximately 10% which would increase the nutrient load in the discharge to Lake Waikare by a similar proportion, assuming the effluent concentrations remain unchanged. Given the frequency of cyanobacteria blooms and the contribution of chlorophyll a from the lake to the Waikato River, any increase in nutrient load is unlikely to be consented.	
		Summer Discharge to land up to maximum flow, winter discharge to Waikato River	Significantly reducing the discharge to river during the months of November – April is likely to result in a net improvement in the solids, BOD, phosphorus and pathogens entering the river. We have not assessed the impact on nitrogen, more detailed Overseer modelling would be required to do so.	For this option to be viable, WDC would need to secure approximately 5 hectares. of land, suitable for irrigation, within the vicinity of the existing treatment plant. WDC could either purchase this land or enter an agreement with a landowner to undertake third party irrigation. Whilst irrigation may be a promising prospect in summer to farmers, it will be challenging to find a third party willing to accept treated wastewater from a human source due to the potential impacts on their farming operation. For this reason, we have assumed land purchase would be required. WDC could lease the land in the non-irrigation months (e.g. for dry stock) to return some money on the land.	
		Offset discharge by providing environmental improvements elsewhere.		To use offsetting as the basis for achieving a new consent to discharge, a definitive scheme for which the net benefits can be demonstrated would need to be identified. In the absence of such a scheme, this option could not be recommended at this stage, however, it may be worthy of a discussion with Waikato Regional Council as to the likely acceptance of this option if there is potential to implement it in the future.	
Wastewater pipeline corridor and pumping stations	Waikato District Council: Housing Infrastructure Fund – Wastewater conveyance (2017)	Concept requirements for the pump station and pipeline route has been taken from the Stantec report. On review of the concept parameters, the following risks were identified: 1. The wastewater will remain in the pipeline for an average of 23.1 hours per day and this will result in both septicity and advanced degradation of any assets susceptible to Hydrogen Sulphide attack. 2. The low velocities in the pipeline (0.92m/s) may cause blockages in the rising main compromising the operability of the system. 3. The long rising main (20km) will result in limited control over the flowrates in the pipeline as these will be subject to long friction lengths. 4. The long rising main will have limited capacity to cater for any future growth above the current system. The high fictional losses will limit the ability for upgrades to the future system.			
Mid-Waikato	Mid Waikato Water Supply Network System Performance & Options Analysis (Feb 2020)	All options below are recommended to address existing LoS issues and future ones related to growth. The Project name was kept from the report for reference.			<u>Population Considered in Mid-Waikato (Te Kauwhata, Rangiriri, & Meremere)</u> 2016: 1,770 2045: 10,898 <u>Water demand (m^3/day):</u> 2018: 2,165 2025: 3,559 2045: 5,610
		CAP1 – 2 new reservoirs (1500m^3 each) – elevation: 46mRL, TWL: 52mRL	Provides 24 hours storage	Decommission of the existing reservoir required due to access issue on the site	
		CAP2 – new booster pump on Swan Rd	Address the low pressure issue along Swan Rd (15m)		
		CAP3 – 1000m of 100mm ID main along te Kauwhata Rd downstream of the Te Kauwhata Reservoir	Address low pressure issues on the outlet of Te Kauwhata reservoir (10m)		
		CAP4 – new 200mm PSV and metering on Te Kauwhata Reservoir inlet	Address low pressure issues upstream of the Te Kauwhata reservoir		
		CAP5 – new booster pump on Waerenga Rd	Address low pressure issues on Waerenga Rd (19m)		
		CAP6 – new 150mm PRV downstream of the Farm Tanks take-off, new zone valve on Foster Rd and district metering	Address high pressure and leakage issue in the low elevation Hampton Downs Road area		

CAP7 – Install 1750m of 100mm ID main on Te Kauwhata Rd between Te Kauwhata Reservoir and Rangiriri	Address fire flow issues in Rangiriri
CAP8 – Install 1600m of 150mm ID main along Spring Hill Rd	Address fire flow issues in Meremere
CAP9 – Upgrade pump station on Wayside Rd	The Wayside Rd PS is already at capacity
CAP10 – Install 2640m of 250mm ID main downstream of Te Kauwhata WTP	Maintain satisfactory level in the Te Kauwhata Reservoir to service increased demand in Te Kauwhata township
CAP11 - Upgrade Te Kauwhata pump station (55l/s and 25m head)	The Te Kauwhata PS is already at capacity
CAP12 – Upgrade Spring Hill 50mm rising main and PS	Spring Hill PS at capacity
CAP13 – new supply main & reservoir to supply Swan Rd development	Future Swan Rd supply
CAP14 – new supply main to Lakeside development	Future Lakeside supply
CAP15 – 110m of 150mm ID main where	Address low pressure issue along Eccles Ave (17m)

7 Stakeholder Engagement

The *Housing Infrastructure Fund – Te Kauwhata Detailed Business Case,* Waikato District Council, April 2018 and *Wastewater Conveyance Risk Analysis*, Opus, December 2017 reports list the stakeholder engagement carried out southbound from Pukekohe to Huntly. This is summarised in the table below:

Table 7-1 – Stakeholder Engagement

Stakeholders	Involvement
Iwi, Winton Partners, Jetco, Te Kauwhata Wastewater Treatment Consultation Group, Te Kauwhata Community Committee, Waikato River Authority, Wastewater Advisory Group (WAG), Future Proof and KiwiRail. Partners: NZ Transport Agency, MBIE, Waikato District Council, Hamilton City Council	Input allowing for the production of a discharge solution, acceptable for all stakeholders.
MBIE (Ministry of Business, Innovation and Employment)	Progress updates and presentations on a monthly basis to the Project Steering Group, of which MBIE is a part.
Hamilton City Council, Waipa District Council, Auckland Council, Watercare.	Adjoining local government authorities and their organisations (such as Watercare) have been consulted over the IBC and DBC especially around providing wastewater solutions.
NZ Transport Agency (NZTA)	Progress updates and presentations on a monthly basis to the Project Steering Group, of which NZTA is a part.
Future Proof	Future Proof has been fully briefed on the Private Plan Change which led to a submission in support of the proposed development. Future Proof also incorporates Hei Awarua ki te Oranga – the Hamilton to Auckland corridor strategic spatial plan.
Winton Partners	Regular dialogue and meetings between Winton Partners and key WDC staff to develop infrastructure options for Lakeside Development in Te Kauwhata and prepare for the first stage of development (being 400 houses).
Jetco Te Kauwhata Wastewater Treatment Consultation Group	Email and telephone engagement have been undertaken to explain the proposal. Consequently, Jetco have provided written support. There has been regular attendance at the Consultation Group Meetings, presentations and updates on the potential wastewater infrastructure options as they have developed.
Waikato River Authority	Direct engagement with the Waikato River Authority representatives as and when needed.
Wastewater Advisory Group	WDC have been investigating the use of WAG to facilitate the network overflow discharge consent discussion with Waikato Regional Council.
Te Kauwhata Community Committee	Presentations on the Detailed Business Case have been given at a Te Kauwhata Community Committee meeting. Prior to this, Winton Partners have presented to the Committee on the proposed development and held a public community open day in December 2016. The Committee has continued to be briefed by Council staff on the progress of the Plan Change 20 process during monthly meetings.
Community	Waikato District Council notified the Lakeside Development Plan Change publicly
Department of Conservation	Submitted on the Lakeside Development Plan Change notification requesting some proposal plan changes.
Fish and Game	Submitted on the Lakeside Development Plan Change notification requesting some proposal plan changes.
KiwiRail	KiwiRail submitted on the Lakeside Development Plan Change, recommending a safety assessment to be undertaken for the railway crossing in Te Kauwhata in light of the expected growth of the town.
Professional Engagement with procured consultancies	Beca – wastewater design, GHD – water design, Jacobs – transport design, OPUS – wastewater design, WT Partners – design specification and costing.
Iwi	Nga Muka Development Trust and Waikato Tainui provided formal support to the Lakeside Development Plan Change.

It is recommended that further engagement should be undertaken with the following additional stakeholders:

Table 7-2 – Future recommended Stakeholder Engagement

Stakeholders	Involvement
Waikato Regional Council	The council are responsible for some but not all water-related issues, including: Environmental monitoring, water take and discharge, catchment management. Rivers (Quality, levels, flow readings, etc), Lakes (monitoring and reporting, algal bloom), Rainfall (readings, flood warnings, updates), Water Allocation (resource consents, allocation calculation), Coasts (biodiversity, processes, quality, monitoring), Wetlands (types, threats, monitoring), Storm Water (management, discharge, policies and rules) and Other (Groundwater, Technical reports, Maritime).
Water Governance Board (WGB)	Drives the preparation and implementation of the Council's contract with Watercare for the delivery of water management services. This will include strategic input, oversight and monitoring of progress and subsequent delivery of service.
Waikato Raupatu River Trust	Treaty Claim (group set up to look after the health of the river) separate trust. Lake Waikare - A wide range of stakeholders have expressed their concerns about poor lake water quality and the impact of increasing sediment and nutrient loads to the lake and wetland.
Community Boards in: Huntly, Onewhero-Tuakau, Taupiri, Ngaruawahia	Express the community's views on local issues to the Council. Meetings are held every month for the residents to share their opinion.
Mercer Rowing Club – Mercer Rahui Pokeka Waka Sports	All clubs part taking in water sports on the Waikato River will be interested in the water quality and flow.
Marae	There is a total of seven marae within this study's extent.
Co-Governance Joint Committee (Waikato-Tainui, Maniapoto and Waikato Raupatu Rivers Trust)	Half councillors and half representatives of iwi (wide mandate).

B. Technical Memo 2

Mid Waikato W&WW Servicing Strategy

Technical Memo 2: Supply/Demand Balance and Risks Identification

Project:	Mid Waikato W&WW Servicing Strategy		
Our reference:	415939 – Rev Final	**Your reference:**	CT 6484-7035
Prepared by:	Atisha Daya, Kirsten Norquay, Alex Ross	**Date:**	11 June 2020
Approved by:	Nick Dempsey	**Checked by:**	David Hume, Julie Plessis
Subject:	Technical Memo 2: Supply/Demand Balance and Risks Identification		

The purpose of this study is to develop a long-term water supply and wastewater strategy to enable the rapid growth predicted in the Mid-Waikato region, while protecting water supplies and receiving environments. Key to this will be understanding the anticipated growth, completing a high-level bulk supply and wastewater supply analysis to enable this growth; ultimately, determining a preferred set of solutions and staging.

1 Introduction

This memo is intended to provide a demand and discharge forecast until 2060 for each scheme and compare this forecast to the existing assets capacity and the current resource consents. Key risks have also been identified and are discussed in this memo.

This technical memo will form part of a wider study setting out options for the long-term servicing strategy for the Mid-Waikato area. This is intended to include:

- Literature and data review (Technical Memo 1),
- Supply/demand balance and key risks identification (this memo),
- High level solution options – long list,
- Multicriteria assessment and options short list, and
- Option analysis report.

References are provided at the end of this document, and are indicated throughout the memo as follows: [#].

2 Assumptions

For the purpose of expediency, typical design standards have been used to calculate the water and wastewater flows. Where actual flows are known these would normally be used in preference to typical design standards. There is an opportunity to refine the design flows in future based on actual measured flows, population growth projections and as more becomes known about the types of industry planned.

2.1 Growth

Residential and commercial/industrial growth were considered in this study.

2.1.1 Residential Growth

Table 2-1 below summarises the growth that will be considered in this investigation. Residential growth assumptions are detailed in *Technical Memo 1: Literature and Growth Review [1]*. The total area covered by existing and future residential dwellings was extracted from the *Strategic Zones [2]* shapefile provided by Watercare, originating from the *Waikato Strategic Planning (Capacity) [3]* and is summarised in the table below.

Table 2-1 – Mid-Waikato Region Residential Growth Projection Used in Study

Horizon	Current	2025	2030	2050	Ultimate	Area (ha)
Huntly	8,035	8,526	8,759	9,278	27,053	695
Te Kauwhata	3,397	10,491	12,398	18,821	18,761	501
Meremere	638	674	704	824	884	22
Ohinewai	0	1,625	3,250	3,250	3,250	56
Rangiriri	78	85	92	140	150	6
Total	12,148	21,401	25,203	32,313	50,098	1,280

2.1.2 Commercial & Industrial Growth

Commercial and industrial growth parameters were taken from the *Waikato Strategic Planning (Capacity)*, the *Draft Waikato 2070 [4]*, and discussed with Watercare and Waikato District Council:

- Industrial and commercial areas were extracted from the *Strategic Zones* shapefile provided by Watercare, originating from the *Waikato Strategic Planning (Capacity)*,
- Timing of growth was estimated based on the report *Draft Waikato 2070*, and
- Waikato District Council advised to include 100ha of wet industry in Ohinewai, as there is now a moratorium on wet industries in Hamilton (developments with predicted demands greater than 15m³/day will not be granted consent).

Table 2-2 and Table 2-3 below summarise the commercial and industrial areas considered in this study. The assumptions have been discussed and agreed with Watercare and Waikato District Council.

Table 2-2 - Commercial Area (ha) per Scheme and Horizon

Horizon	Current	2025	2030	2050	Ultimate	Assumptions
Huntly	4	9	18	18	18	Business / town centre: 25% existing, additional 25% developed by 2050 and fully developed by 2030.
Te Kauwhata	0	9	17	17	17	Business / town centre: 50% developed by 2025 and fully developed by 2030.
Meremere	1	1	1	1	1	Business / town centre: 100% existing, no growth Racecourse included in the service area.
Ohinewai	0	4	9	9	9	Business / town centre: 50% developed by 2025 and fully developed by 2030.
Rangiriri	1	1	1	1	1	Business / town centre: 100% existing, no growth.
Total	**7**	**24**	**46**	**46**	**46**	

Table 2-3 - Industrial Area (ha) per Scheme and Horizon

Horizon	Current	2025	2030	2050	Ultimate	Assumptions
Huntly	169	196	223	223	223	East Mine Business Park: 50% developed by 2025 and 100% developed by 2030. Power station: existing – not connected to wastewater network.
Te Kauwhata	0	0	12	25	25	Industrial – north and south: assumed 50% developed by 2030 and 100% by 2050.
Meremere	0	0	0	0	49	Full industrial growth included in the Ultimate scenario only.
Ohinewai	0	32	63	203	343	Industrial south: 50% developed by 2030 and 100% by 2050. Industrial north: 50% developed by 2050, 100% developed in ultimate scenario. 100ha out of Industrial North will be wet industry.
Rangiriri	0	0	0	0	0	No industry.
Total	**169**	**228**	**299**	**451**	**640**	

Equivalent populations were calculated for the commercial and industrial areas, based on the following assumptions, sourced from the *Regional Infrastructure Technical Specification – (RITS) [5]*:

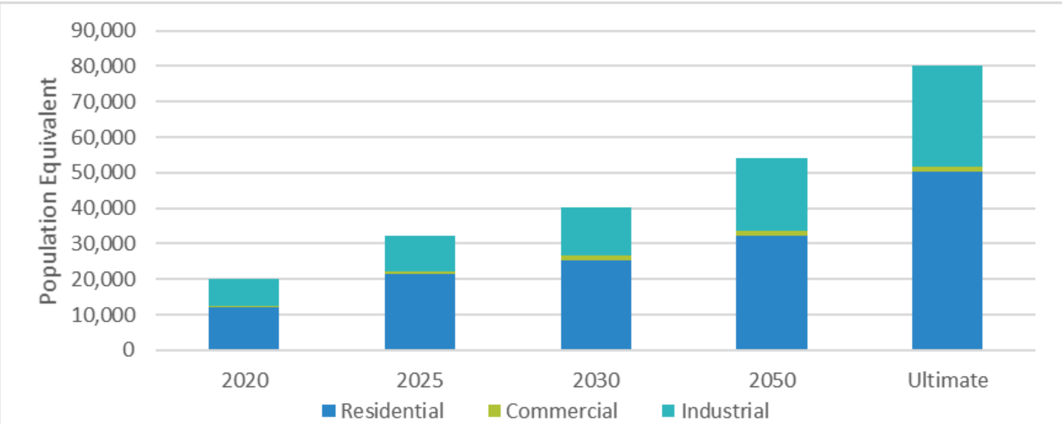
- Commercial population equivalent: 30 persons/hectare,
- Industrial population equivalent: 45 persons/hectare.

Table 2-4 - Commercial and Industrial Population Equivalent

Area	Commercial Population Equivalent					Industrial Population Equivalent				
Horizon	**Current**	**2025**	**2030**	**2050**	**Ultimate**	**Current**	**2025**	**2030**	**2050**	**Ultimate**
Huntly	134	269	537	537	537	7,614	8,829	10,044	10,044	10,044
Te Kauwhata	0	261	522	522	522	0	0	558	1,116	1,116
Meremere	35	35	35	35	35	0	0	0	0	2,196
Ohinewai	0	130.5	261	261	261	0	1,418	2,835	9,135	15,435
Rangiriri	37	37	37	37	37	0	0	0	0	0
Total	**206**	**732**	**1,392**	**1,392**	**1,392**	**7,614**	**10,247**	**13,437**	**20,295**	**28,791**

Figure 2-1 below shows the evolution of the total population equivalent predicted in Mid-Waikato.

Figure 2-1 - Population Equivalent per Horizon



2.2 Water Demand Calculations

As agreed with Watercare, the RITS was used in this investigation to calculate the water demands. The following parameters specified by the RITS and Watercare have been used to calculate average and peak demand flows:

- Domestic demand: 260L/person/day (source: RITS),
- Commercial demand: 30L/person/day (source: Watercare),
- Industrial demand: 45L/person/day (source: Watercare),
- Wet industry demand 330L/person/day (source: Waikato District Council – *Tuakau-Pokeno Industrial wastewater demand [6]*),
- Peak flow rate: five times the demand (source: RITS)

The RITS recommends that FW2 firefighting requirements are met in residential areas and FW3 provided to other zones (industrial and commercial). Some specific areas may require a higher level of service. For the purpose of this investigation, FW3 flow (50L/s) was added to 60% of the peak demand as per SNZ PAS 4509 guidelines and compared to the peak flow rate in each scheme to assess the highest possible flow required.

2.3 Wastewater Discharge Calculation

As agreed with Watercare, the RITS was used in this investigation to calculate the wastewater flows. The following parameters specified by the RITS and Watercare have been used to calculate average dry weather flow, peak daily flow and peak wet weather flow (source: RITS unless specified otherwise):

- Domestic Average Daily flow: 200L/person/day,
- Commercial Average Daily flow: 30L/person/day (source: Watercare, confirmed by email on 05/03/20),
- Industrial Average Daily Flow: 45L/person/day (source: Watercare, confirmed by email on 05/03/20),
- Wet Industry Average Daily Flow: 330L/person/day (source: Waikato District Council – *Tuakau-Pokeno Industrial wastewater demand*),
- Infiltration allowance: 2,250L/ha/day,
- Surface water ingress: 16,500L/ha/day.
- **Average Dry Weather Flow** = (infiltration allowance × catchment area) + (water consumption × population equivalent),
- **Peak Daily Flow** = (infiltration allowance × catchment area) + (peaking factor × water consumption × population equivalent),
- **Peak Wet Weather Flow** = (infiltration allowance × catchment area) + (surface water ingress × catchment area) + (peaking factor × water consumption × population equivalent).

Design flows are calculated based on a per capita flow allowance (population dependent) and an allowance for infiltration and stormwater runoff (land area dependent). This requires knowledge of both the population and catchment area split into industrial, commercial and residential. As this information is not always directly available for each year or consistent between the different data sources, it has been necessary to make some assumptions, as discussed below:

- The residential catchment area for Ohinewai was calculated by assuming 450m² size lot and 1,250 dwellings as per growth information provided.
- The ultimate (2060) catchment area (hectare) for residential areas was sourced from the *Strategic Zones* shapefile provided by Watercare on 03 Feb 2020. The catchment area for the current, 2025, 2030 and

2050 horizons was calculated based on the assumption that the catchment area increase is directly proportional to the population increase.

- In Huntly, the population is predicted to triple post 2050 (ultimate scenario). To fit such a population in the ultimate residential area, it is understood there will be intensification (with multiple storey building) of existing residential areas, therefore there will be a limited increase in surface area developed. It was then assumed that by 2050, 80% of the ultimate residential area would be developed.
- The peaking factor differs for commercial and residential areas were estimated based on the population equivalent per scheme and horizon.

3 Forecast Water Demand and Wastewater Discharge

3.1 Water Demands

Table 3-1 below summarises the average water demand and peak water demands, based on the assumptions listed above, for each scheme in the Mid-Waikato.

Table 3-2 summarises the water demand including FW3 at 60% of the peak demand. In smaller networks (Meremere, Ohinewai, Rangiriri), the demand for firefighting at 60% of peak demand is greater than 100% of the peak demand. This is also the case in Te Kauwhata for current conditions.

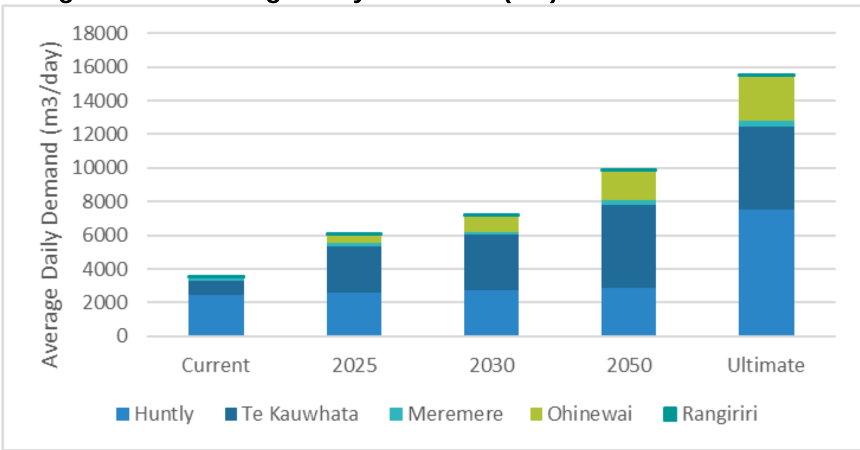
Table 3-1 - Average and Peak Water Demands

Area	Total Average Demand (m³/day)					Peak Demand (L/s)					60% Peak Demand and FW3 (L/s)				
Horizon	**Current**	**2025**	**2030**	**2050**	**Ultimate**	**Current**	**2025**	**2030**	**2050**	**Ultimate**	**Current**	**2025**	**2030**	**2050**	**Ultimate**
Huntly	2,436	2,622	2,745	2,880	7,502	141	152	159	167	434	135	141	145	150	310
Te Kauwhata	883	2,735	3,264	4,959	4,944	51	158	189	287	286	81	145	163	222	222
Meremere	167	176	184	215	330	10	10	11	12	19	56	56	56	57	61
Ohinewai	0	490	980	1,778	2,702	0	28	57	103	156	-	67	84	112	144
Rangiriri	21	23	25	37	40	1	1	1	2	2	51	51	51	51	51
All Schemes	**3,507**	**6,047**	**7,199**	**9,870**	**15,518**	**203**	**350**	**417**	**571**	**898**	**322**	**460**	**500**	**593**	**789**

Table 3-2 – Maximum Instantaneous Water Demand

Scheme	60% Peak demand and FW3 (L/s)				
Horizon	**Current**	**2025**	**2030**	**2050**	**2060**
Huntly	141	152	159	167	434
Te Kauwhata	81	158	189	287	286
Meremere	56	56	56	57	61
Ohinewai	-	67	84	112	156
Rangiriri	51	51	51	51	51
All Schemes	**329**	**484**	**539**	**674**	**988**

Figure 3-1 – Average Daily Demands (L/s)



3.2 Wastewater Discharge

Table 3-3 below summarises the average dry weather flow, peak daily flow and peak wet weather flows, based on the assumptions listed above, for each scheme in the Mid-Waikato.

Table 3-3 - Average Daily Flow (ADF), Peak Daily Flow (PDF) and Peak Wet Weather Flow (PWWF)

Scheme	Population					ADF (m³/day)				PDF (L/s)				PWWF (L/s)			
	Current	2025	2030	2050	Ultimate	2025	2030	2050	Ultimate	2025	2030	2050	Ultimate	2025	2030	2050	Ultimate
Huntly	8,035	8,526	8,759	9,278	27,053	3,437	3,658	3,832	7,700	74	78	82	193	198	212	222	359
Te Kauwhata	3,397	10,491	12,398	18,821	18,761	2,756	3,332	5,052	5,040	71	85	129	129	126	154	233	233
Meremere	638	674	704	824	884	176	183	214	438	6	6	7	11	9	9	11	24
Ohinewai	0	1,625	3,250	3,250	3,250	537	1,073	2,185	3,425	14	27	47	71	27	51	99	149
Rangiriri	78	85	92	140	150	28	30	44	47	1	1	2	2	2	2	3	3

Figure 3-2: Average Daily Inflow (m³/day)

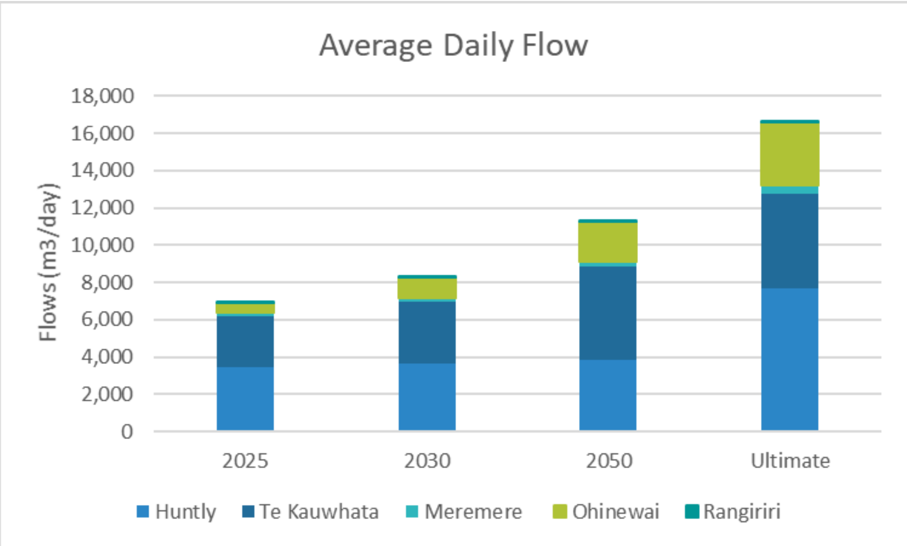
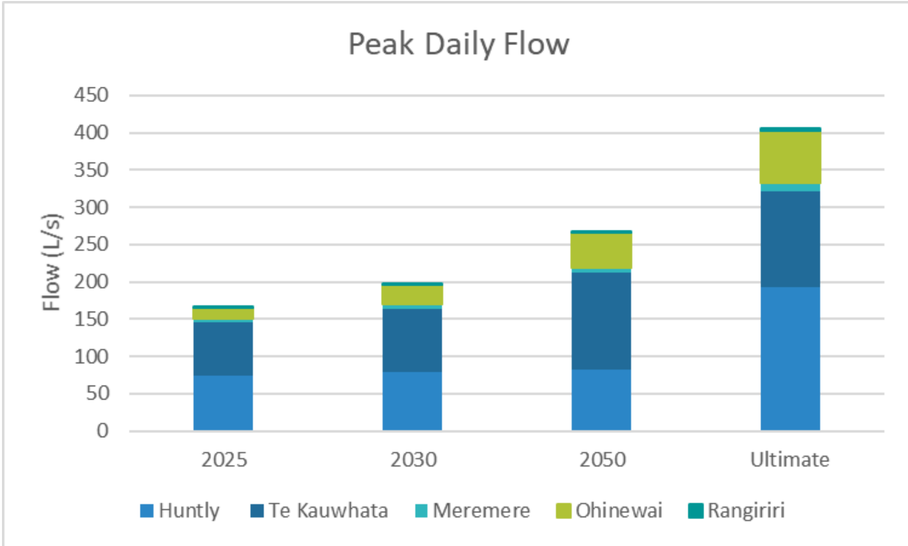


Figure 3-3: Peak Daily Inflow (L/s)



3.3 Water Demands and Wastewater Demand per Scheme and Combination of Schemes

Table 3-4 below shows the maximum instantaneous water demand (out of 100% peak demand and 60% of peak demand + FW3 fire flow), yearly average demand with a peaking factor of 2 (ADF ×2), wastewater PWWF and PDF for each scheme in the study area and potential combinations of schemes. The design of the infrastructure will be based on the following:

- Water network: maximum instantaneous water demand (out of 100% peak demand and 60% of peak demand + FW3 fire flow),
- Wastewater networks: Peak Wet Weather Flow (PWWF)
- Water treatment plant: Yearly average demand with a peaking factor of 2 (ADF ×2),
- Wastewater treatment: Peak Dry Weather Flow (PDWF).

Table 3-4 - Water Demands and Wastewater Demand per Scheme and Combination of Schemes

	Water – Network Design				Water – Treatment Design				Wastewater- Network Design				Wastewater – Treatment Design			
Scheme or combination	Maximum instantaneous water demand (L/s)				ADF ×2 (m^3/day)				PWWF (L/s)				PDF (L/s)			
Horizon	2025	2030	2050	Ultimate	2025	2030	2050	Ultimate	2025	2030	2050	Ultimate	2025	2030	2050	Ultimate
Huntly	152	159	167	434	5,244	5,491	5,761	15,004	198	212	222	359	74	78	82	193
Te Kauwhata	158	189	287	286	5,471	6,529	9,919	9,887	126	154	233	233	71	85	129	129
Meremere	56	56	57	61	353	368	431	659	9	9	11	24	6	6	7	11
Ohinewai	67	84	112	156	980	1,961	3,555	5,405	27	51	99	149	14	27	47	71
Rangiriri	51	51	51	51	46	50	75	80	2	2	3	3	1	1	2	2
All schemes	460	500	593	898	12,095	14,398	19,740	31,036	362	429	567	768	166	198	267	405
Te Kauwhata + Rangiriri	196	214	289	288	5,517	6,579	9,994	9,968	128	157	236	236	72	87	131	131
Te Kauwhata + Rangiriri + Meremere	252	271	331	334	5,870	6,947	10,424	10,627	137	166	247	260	78	93	138	141
Huntly + Ohinewai	208	229	270	591	6,225	7,452	9,316	20,408	225	263	320	508	89	105	130	264
Huntly + Ohinewai + Rangiriri + Te Kauwhata	404	444	559	879	11,742	14,030	19,310	30,376	353	420	556	744	161	192	261	395

3.4 Sensitivity Analysis

A sensitivity analysis was carried out on the demands and discharge by undertaking the following verifications:

- Comparing Watercare specifications to the assumptions used in this investigation,
- Comparing the water demands and wastewater discharge calculated to SCADA data.

3.4.1 Watercare Specifications

3.4.1.1 Water demands

Watercare Specifications for water demand calculation are summarised below:

- Average residential water consumption: 200L/person/day for Greenfield areas,
- Peaking factors:
  - Residential: 2.27,
  - Commercial (10 hour / 16 hour / 24 hour): 2.25 / 1.25 / 1,
- Industrial and commercial developments should be assessed in greater detail however for the benefit of this study the population equivalents were used.

Watercare specifications in terms of average residential demands and peaking factors are significantly lower than the RITS parameters (260L/person/day and peaking factor of 5) for Greenfield areas.

In brownfield areas, Watercare Specifications recommend that residential demands increase proportionally with population growth for each catchment, and similarly the commercial demands are to increase proportionally to change in commercial population equivalent. Based on SCADA data available it would be possible to estimate an average peak demand per person in each scheme and potentially derive diurnal patterns. For the purposes of expediency this process was not used in this investigation. There is an opportunity to refine the design flows in future based on actual measured flows, population growth projections and as more becomes known about the types of industry planned.

3.4.1.2 Wastewater

Watercare Specification for wastewater discharge calculation are summarised below:

- Design wastewater flow allowance is 180L/person/day,
- Peaking factors used:
  - Residential = 6.7,
  - Commercial/Business = 5, assuming office buildings and dry retail where toilet facilities are provided,
  - Industrial = 6.7, assuming light water users, or up to 2 storeys,
- Business ADWF is calculated by assuming 1 person per 15m² as per standard,
- Industrial ADWF is calculated using a routine peak daily discharge of 4.5L/m²/d,
- For Industrial the Peak Design Flow (PDF) is larger than the Routine Instantaneous Peak Flow to ensure that there is sufficient capacity in the network to convey spikes in discharge that may occur on occasion over the design life of the wastewater system. The PDF also provides an allowance for wet-weather inflow and infiltration that may start to occur as the network deteriorates over its 100-year design life.

Watercare specifications are more conservative than the RITS, mainly due to the business and industrial ADWF and PDF assumptions, which would result in significant difference with the RITS. After discussions with Watercare, it was agreed that Watercare Specifications are too conservative for the Mid-Waikato water and wastewater schemes and that for the benefit of this study the RITS figures would be used.

3.4.2 Comparison with SCADA data

The current demands and discharge calculated for water and wastewater were compared to historical SCADA data to understand whether the calculated flows were reasonably close to the current observations or significantly out of range. Figure 3-4 and Figure 3-5 below show the monitored (SCADA) average daily flow and the calculated ADF, PDF and PWWF in Huntly and Meremere.

Figure 3-4: Inflow at Huntly WWTP

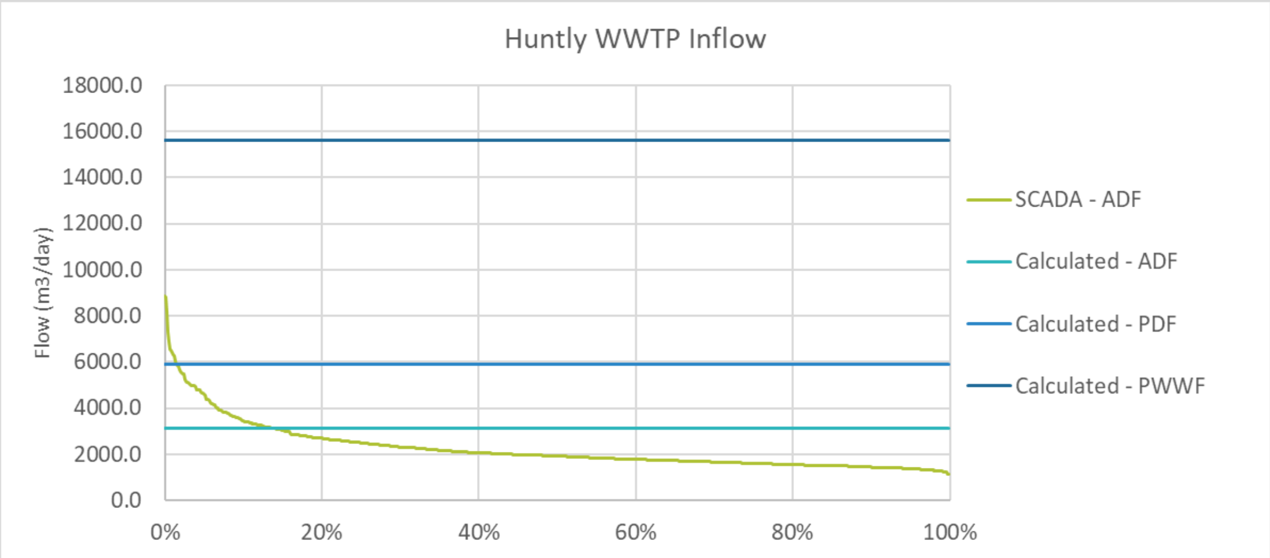
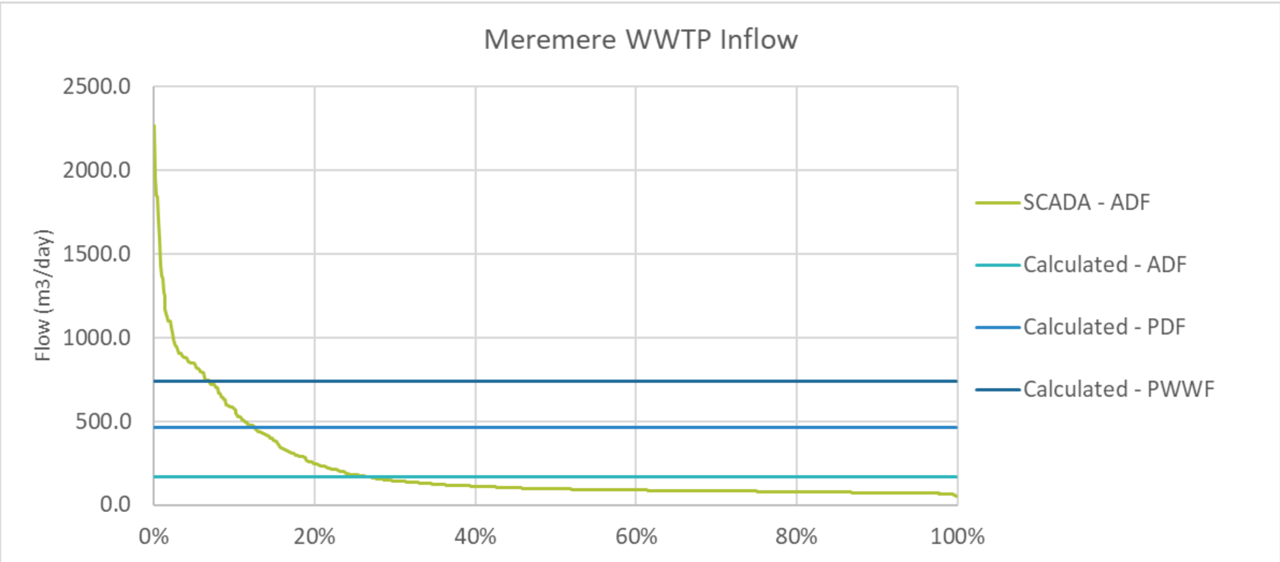


Figure 3-5: Inflow at Meremere WWTP



The following can be observed:

- **Huntly WWTP inflow**: the calculated ADF ×2 (which is the proposed basis of treatment options sizing) was exceeded 4 days per year over the past two years.
- **Meremere WWTP inflow:** The calculated PDF was exceeded over 50 times over the past two years. The calculated ADF however seems to match the lower ADF recorded on SCADA. The significant discrepancy

between calculated PWWF and SCADA is likely related to the high inflow and infiltration (I&I) issue know in Meremere. It should be agreed whether the wastewater servicing option need to include I&I or whether I&I reduction work currently under way in Meremere is expected to reduce I&I to standard levels.

Figure 3-6 and Figure 3-7 below show the monitored (SCADA) average daily flow and the calculated yearly average ×2 and instantaneous peak flow. As mentioned above, it is proposed to use two times the yearly average for WTP optioneering and the Instantaneous Peak Flow for water network.

Figure 3-6: Huntly WTP Outflow

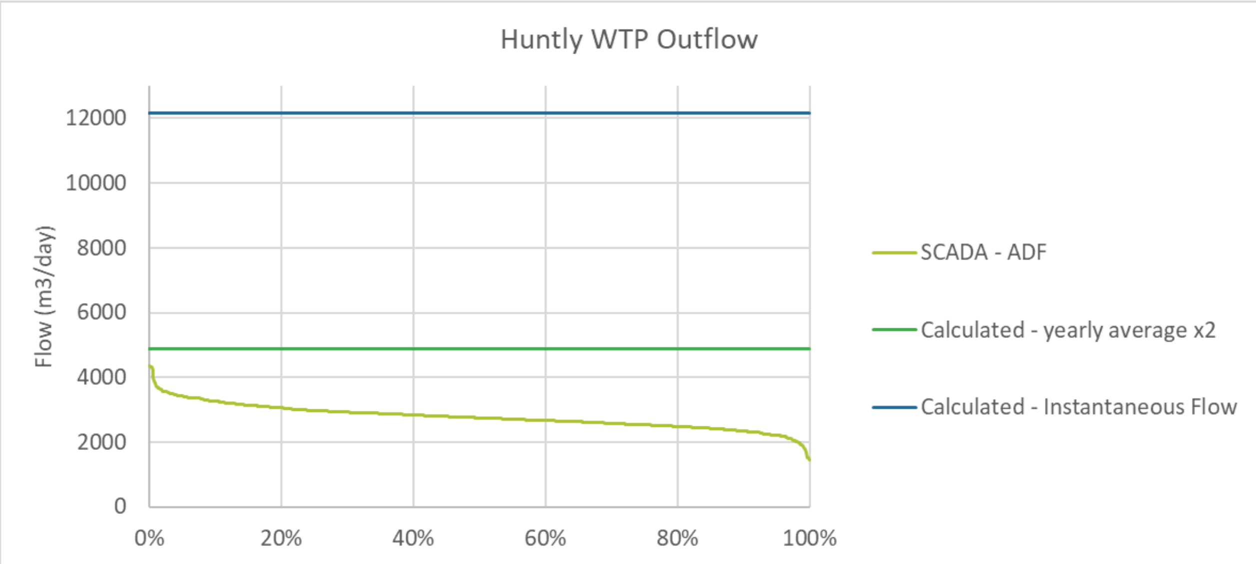
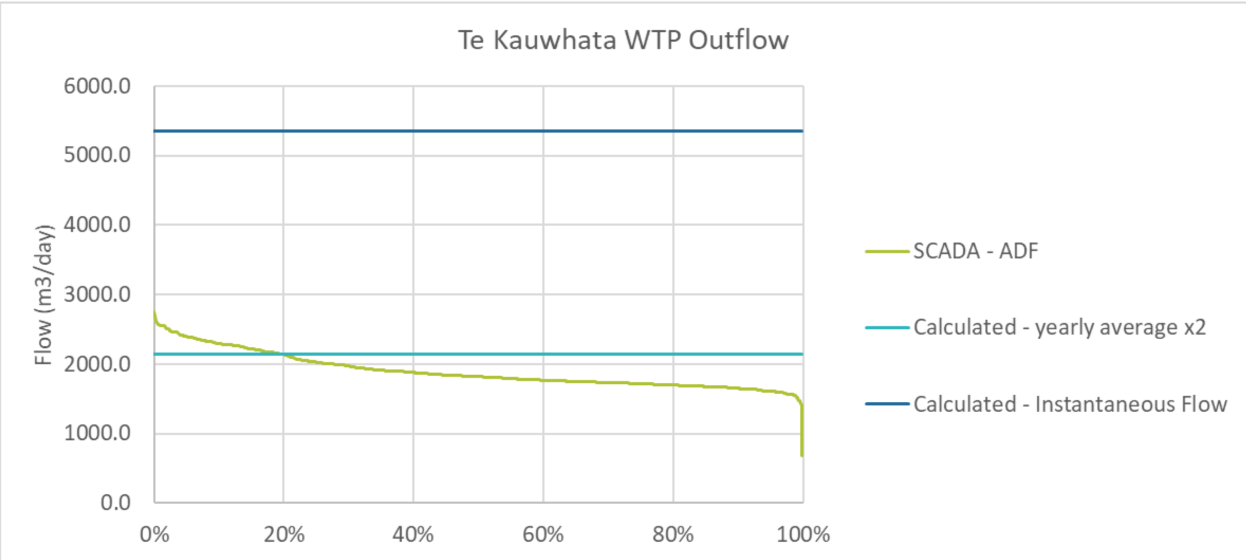


Figure 3-7: Te Kauwhata WTP Outflow



The following can be observed:

- **Huntly WTP outflow**: The maximum daily outflow recorded on SCADA matches the calculated ADF ×2. Figure 3-6

- **Te Kauwhata WTP outflow**: The highest ADF recorded on SCADA is approximately 1.3 times the calculated yearly demand ×2.

3.4.3 Impact of Inflow and Infiltration

No Inflow and Infiltration (I&I) assessment was undertaken as part of this study. During the next phase of work, it is recommended to undertake a sensitivity analysis to assess the impact of I&I in Mid-Waikato. I&I reduction could significantly reduce the size and cost of long-term treatment and disposal options. Not addressing high I&I can lead to the below:

- Larger reticulation required to convey high peak flows or increased risk of overflow if pipes are undersized,
- Larger pond volume required to provide storage and flow balancing during times of high flow,
- Greater treatment capacity and operational costs during high flows, or else a larger proportion of flows must be bypassed and discharged without treatment, increasing risk of non-compliance with effluent quality consent limits,
- Greater storage, land and irrigation infrastructure required to fully discharge wastewater to land.

I&I rehabilitation work should be assessed and compared to the potential saving generated by I&I reduction.

4 Comparison with Assets Capacity and Consent Limits

4.1 Water Take Consents and WTP Capacity

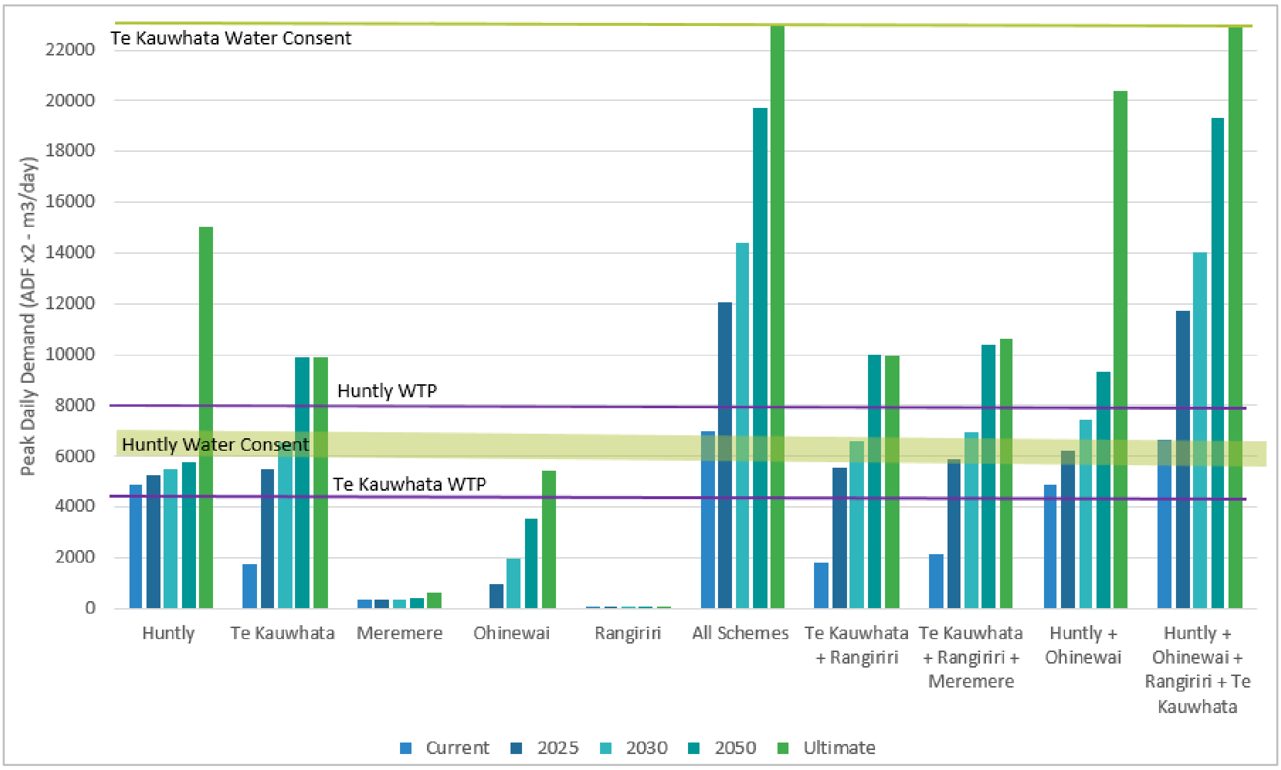
Figure 4-1 below shows the predicted Peak Daily Demand (ADF ×2) per horizon, per scheme and combination of schemes. The current water take consents and WTP capacity are shown for comparison:

- Water take consents:
  - Te Kauwhata: 22,900m³/day (expires 2024), It should be noted that only the treated water demand for Te Kauwhata is shown in the figure below, however the water take consent also includes irrigation demand.Huntly: 6,000m³/day (until 2021) to 7,000m³/day (until 2046),
- WTP capacity:
  - Te Kauwhata WTP: 3,000m³/day, committed to 4,500m³/day upgrade (shown on Figure 4-3),
  - Huntly WTP: 8,000m³/day.

The following can be observed:

- The Huntly WTP capacity is not sufficient to meet the Huntly and Ohinewai predicted demand beyond 2025 once the allocation for Ngaruawahia is accounted for. In addition the Huntly water take consented limit would also be exceeded at this point.
- The Te Kauwhata WTP capacity is not sufficient to meet the predicted demand in Te Kauwhata by 2025. Whilst the Te Kauwhata water take consented limit is sufficient to meet the predicted demand for all combined schemes, the consent expires in 2024 and the consent currently has a community water supply limit of 486 properties, with the balance for irrigation and stock. In addition the irrigation demand also needs to be included in predicted demands. . Watercare Waikato has also indicated it is likely that the Waikato Reginal Council will lower the next water take consent allocation as the peak abstraction until today was 5,000m³/day.

Figure 4-1 - Peak Daily Flow vs. Existing Water Take Consents and WTP Capacity



4.2 Wastewater Discharge and Water Consents and WWTP Capacity

Figure 4-2 and Figure 4-3 below shows the predicted Peak Daily Flow and Peak Wet Weather Flow respectively, per horizon, per scheme and combination of schemes. The current wastewater discharge to water consents and WWTP capacity are shown for comparison:

- Discharge Consents:
  - Te Kauwhata discharge to water: 3,600m³/day – expires 2028,
  - Huntly: 11,500m³/day – expires 2029.
- WWTP Capacity:
  - Huntly WWTP: designed for ADWF of 2,100m³/day,
  - Te Kauwhata WWTP: ADWF observed: 674m³/day.

The following can be noted:

- The Huntly discharge consent would be sufficient for Huntly and Ohinewai PDF until 2050. However, consent limits are in general based on PWWF (the maximum flow discharged). To reduce PWWF discharge, balancing through storage would be required.
- WWTP outflows monitored on SCADA are lower than the inflows, possibly due to balancing in the existing ponds as well as other mechanisms (eg seepage through the pond base and evaporation). Therefore, the influent PWWF is not necessarily the same as the outflow PWWF to which the consent applies.
- In addition, the Huntly WWTP PWWF monitored on SCADA is lower than the PWWF calculated (see Figure 3-4). Using the calculated PWWF may be too conservative and it is recommended to refine the flows calculation prior starting modelling work. However, for the purpose of this high-level study it is appropriate to use the calculated PWWF.

Figure 4-2 - Peak Daily Flow vs. Existing Discharge to Water Consents and WWTP Capacity

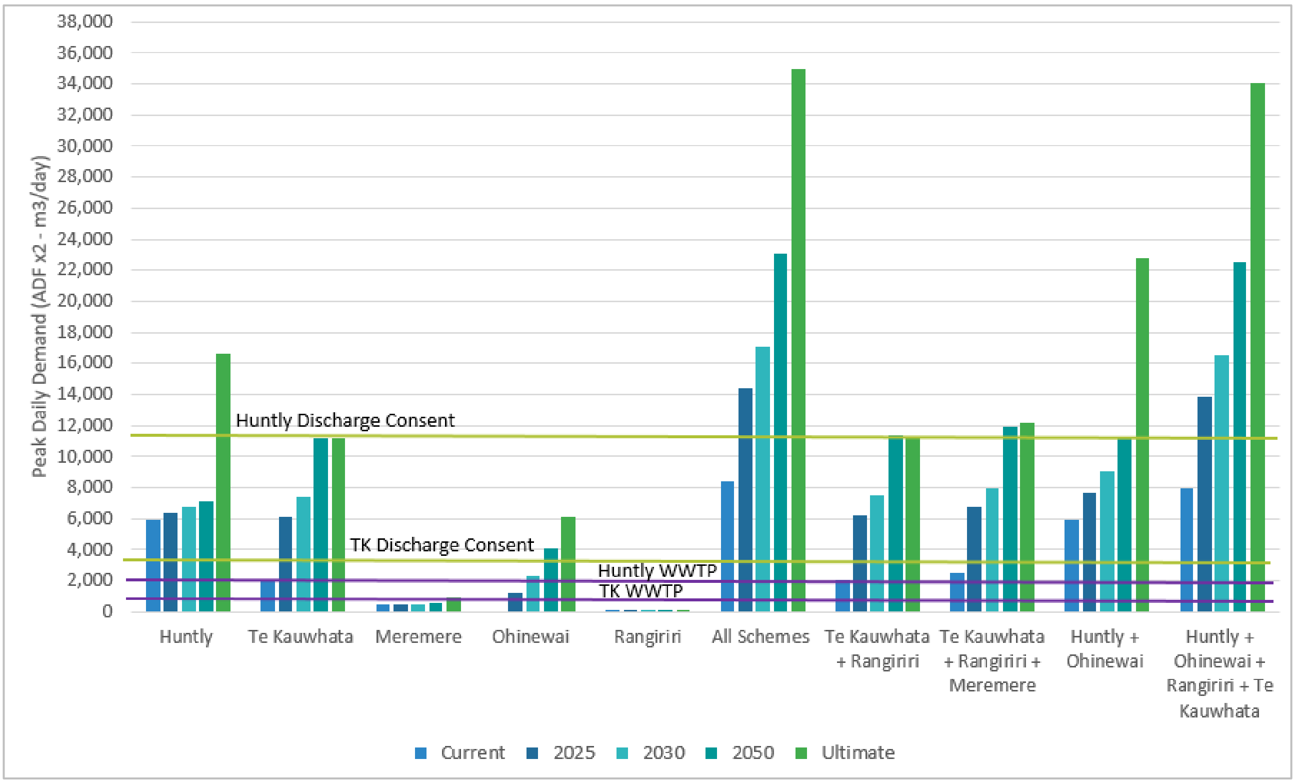
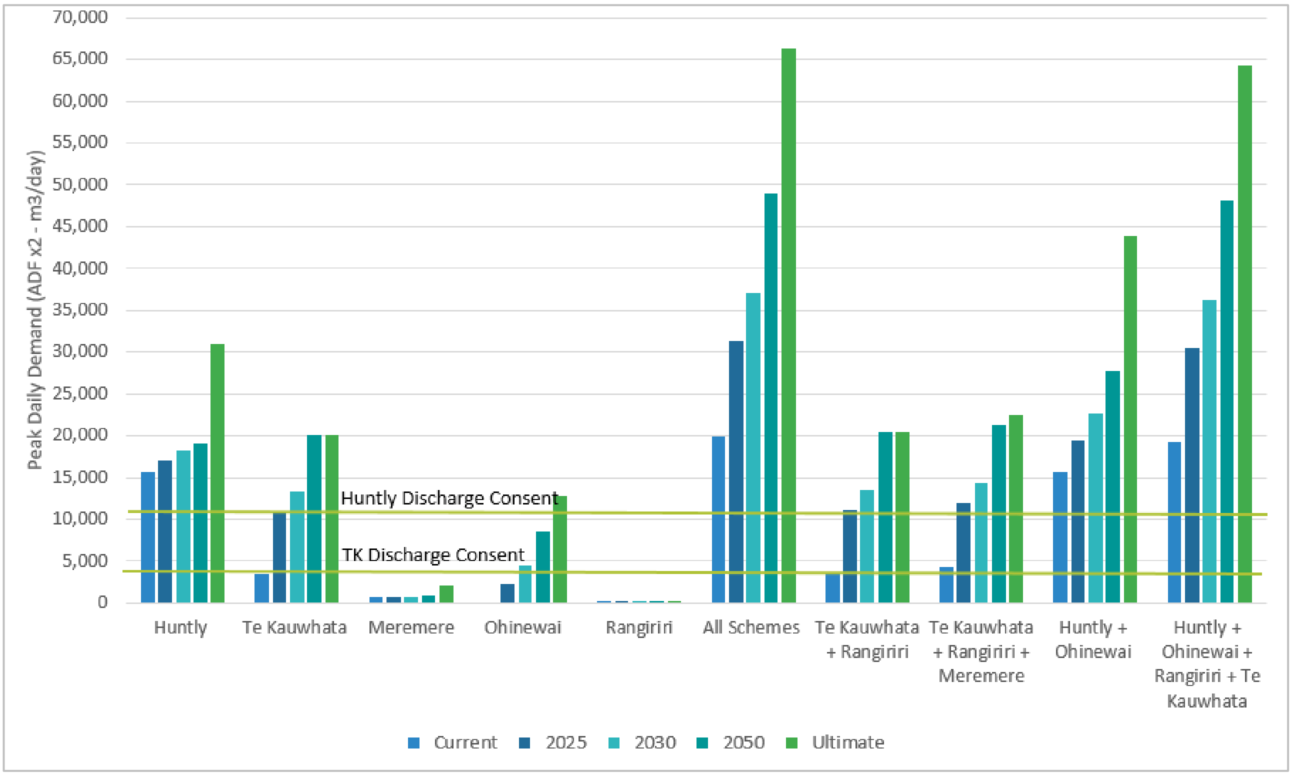


Figure 4-3 - Peak Wet Weather Flow vs. Existing Discharge to Water Consents



5 Loads calculation

Influent wastewater loads for all schemes have been calculated based on the population equivalent prediction.

Table 5-1: Huntly wastewater load calculations

Constituent	Range (g/capita/d)	Typical without ground up kitchen waste	Typical with ground up kitchen waste	Typical value*	Load (kg/d)				Concentration (mg/L)			
					2025	2030	2050	2060	2025	2030	2050	2060
BOD_5	50 - 120	80	100	85	839	886	930	2,441	244	242	243	317
COD	110 - 295	190	220	198	1,951	2,059	2,161	5,672	568	563	564	737
TSS	60 - 150	90	110	95	938	990	1,039	2,728	273	271	271	354
NH_3-N	5 - 12	7.6	8.4	7.8	77	81	85	224	22	22	22	29
Organic N	4 - 10	5.4	5.9	5.5	55	58	60	159	16	16	16	21
TKN	9 - 21.7	13	14.3	13.3	132	139	146	383	38	38	38	50
Organic P	0.9 - 1.8	1.2	1.3	1.2	12	13	13	35	4	3	3	5
Inorganic P	1.8 - 2.7	2	2.2	2.1	20	21	22	59	6	6	6	8
Total P	2.7 - 4.5	3.2	3.5	3.3	32	34	36	94	9	9	9	12
Oil and grease	10 - 40	30	34	31	306	323	339	890	89	88	89	116

Table 5-2: Te Kauwhata wastewater load calculations

Constituent	Range (g/capita/d)	Typical without ground up kitchen waste	Typical with ground up kitchen waste	Typical value*	Load (kg/d)				Concentration (mg/L)			
					2025	2030	2050	2060	2025	2030	2050	2060
BOD_5	50 - 120	80	100	85	895	1,071	1,628	1,623	325	321	322	322
COD	110 - 295	190	220	198	2,080	2,489	3,782	3,770	755	747	749	748
TSS	60 - 150	90	110	95	1,000	1,197	1,819	1,814	363	359	360	360
NH_3-N	5 - 12	7.6	8.4	7.8	82	98	149	149	30	29	30	30
Organic N	4 - 10	5.4	5.9	5.5	58	70	106	105	21	21	21	21
TKN	9 - 21.7	13	14.3	13.3	140	168	255	254	51	50	51	50
Organic P	0.9 - 1.8	1.2	1.3	1.2	13	15	23	23	5	5	5	5
Inorganic P	1.8 - 2.7	2	2.2	2.1	22	26	39	39	8	8	8	8
Total P	2.7 - 4.5	3.2	3.5	3.3	34	41	63	63	13	12	12	12
Oil and grease	10-40	30	34	31	326	391	594	592	118	117	118	117

Table 5-3: Meremere wastewater load calculations

Constituent	Range (g/capita/d)	Typical without ground up kitchen waste	Typical with ground up kitchen waste	Typical value*	Load (kg/d)				Concentration (mg/L)			
					2025	2030	2050	2060	2025	2030	2050	2060
BOD_5	50 - 120	80	100	85	58	60	70	118	74	329	329	268
COD	110 - 295	190	220	198	134	140	164	273	763	764	765	624
TSS	60 - 150	90	110	95	65	67	79	131	367	367	368	300
NH_3-N	5 - 12	7.6	8.4	7.8	5	6	6	11	30	30	30	25
Organic N	4 - 10	5.4	5.9	5.5	4	4	5	8	21	21	21	17
TKN	9 - 21.7	13	14.3	13.3	9	9	11	18	51	52	52	42
Organic P	0.9 - 1.8	1.2	1.3	1.2	1	1	1	2	5	5	5	4
Inorganic P	1.8 - 2.7	2	2.2	2.1	1	1	2	3	8	8	8	6
Total P	2.7 - 4.5	3.2	3.5	3.3	2	2	3	5	13	13	13	10
Oil and grease	10 - 40	30	34	31	21	22	26	43	120	120	120	98

Table 5-4: Ohinewai wastewater load calculations

Constituent	Range (g/capita/d)	Typical without ground up kitchen waste	Typical with ground up kitchen waste	Typical value*	Load (kg/d)				Concentration (mg/L)			
					2025	2030	2050	2060	2025	2030	2050	2060
BOD_5	50 - 120	80	100	85	167	334	454	575	311	311	208	168
COD	110 - 295	190	220	198	388	776	1,056	1,335	723	723	483	390
TSS	60 - 150	90	110	95	187	373	508	642	348	348	232	188
NH_3-N	5 - 12	7.6	8.4	7.8	15	31	42	53	29	29	19	15
Organic N	4 - 10	5.4	5.9	5.5	11	22	30	37	20	20	14	11
TKN	9 - 21.7	13	14.3	13.3	26	52	71	90	49	49	33	26
Organic P	0.9 - 1.8	1.2	1.3	1.2	2	5	7	8	4	4	3	2
Inorganic P	1.8 - 2.7	2	2.2	2.1	4	8	11	14	8	8	5	4
Total P	2.7 - 4.5	3.2	3.5	3.3	6	13	18	22	12	12	8	6
Oil and grease	10 - 40	30	34	31	61	122	166	210	113	113	76	61

Table 5-5: Rangiriri wastewater load calculations

Constituent	Range (g/capita/d)	Typical without ground up kitchen waste	Typical with ground up kitchen waste	Typical value *	Load (kg/d)				Concentration (mg/L)			
					2025	2030	2050	2060	2025	2030	2050	2060
BOD_5	50 - 120	80	100	85	8	8	12	13	272	274	280	281
COD	110 - 295	190	220	198	18	19	29	31	632	636	652	654
TSS	60 - 150	90	110	95	9	9	14	15	304	306	313	315
NH_3-N	5 - 12	7.6	8.4	7.8	1	1	1	1	25	25	26	26
Organic N	4 - 10	5.4	5.9	5.5	0	1	1	1	18	18	18	18
TKN	9 - 21.7	13	14.3	13.3	1	1	2	2	43	43	44	44
Organic P	0.9 - 1.8	1.2	1.3	1.2	0	0	0	0	4	4	4	4
Inorganic P	1.8 - 2.7	2	2.2	2.1	0	0	0	0	7	7	7	7
Total P	2.7 - 4.5	3.2	3.5	3.3	0	0	0	1	10	11	11	11
Oil and grease	10 - 40	30	34	31	3	3	5	5	99	100	102	103

* Typical value assumes 25% of homes have kitchen waste food grinders

6 Risks Identification

A high-level risk assessment was undertaken, including risks related to:

- Asset condition and ownership,
- Climate change and change in land use,
- Feasibility of option,
- Financial risk,
- Growth projection/demand,
- Land acquisition,
- Regulatory environment,
- Security of service.

Risks, consequences and potential mitigation measures are summarised in Table 6-1 below.

Table 6-1 - High-Level Risks Assessment

Category	Risk	Consequence	Mitigation	WS	WW	Scheme if specific
Asset condition and ownership	Unknown condition of some existing assets.	– Loss of service in case of asset failure. – Increased cost/time to repair existing assets. – Poor condition of assets affecting performance of WWTPs and WTPs.	For options assessment: – Consider impact of existing poor condition networks/assets, – Factor in the cost of replacing/repairing these assets, – Investigate options to undertake a regional asset condition assessment for all government and private owned assets, using a standardised matrix.	✓	✓	Huntly WW network & Meremere WW network known to be in poor condition with high I&I.
	Capacity of existing assets could be skewed due to high I&I (inflow and infiltration).	– Larger reticulation required to convey high peak flows or increased risk of overflow if pipes are undersized. – Larger pond volume required to provide storage and flow balancing during times of high flow. – Greater treatment capacity and operational costs during high flows, or else a larger proportion of flows must be bypassed and discharged without treatment, increasing risk of non-compliance with effluent quality consent limits. – Greater storage, land and irrigation infrastructure required to fully discharge wastewater to land. – Wasted capital.	– Options assessment to include measures for reducing I&I in wastewater networks. – Allow for storage to reduce unconsented overflows (potentially as an interim measure). – Allow for peak flow buffering to reduce size of treatment plant.		✓	Huntly & Meremere WWTP have issues with overflows in wet weather.
	TKWA private ownership of assets (intake, raw water pipeline, booster pump stations and reservoirs). Upgrades are needed for a number of assets (including a $100,000 upgrade required to the Te Kauwhata intake). The new drinking water standards may affect TKWA's operations.	– A reduction in water quality and quantity. – Non-compliance with water regulations and standards. – Potential issue with supplying raw water to the WTP and disrupting services. – Potential need for new infrastructure if TKWA is excluded from potable water supply market.	– An assessment of all water related assets (if this has not already been undertaken), – Register of all assets, their ownership status, approximated of years of service remaining and their current value, – Possibility of capital investment or purchase of water / wastewater assets - related to the supply of treated water to consumers.	✓		Te Kauwhata
	Responsibility of irrigation scheme reticulation area has not been assigned.	No one is responsible for maintenance or repairs.	Ensure that there is someone responsible or that has ownership of assets and has an asset maintenance/renewal programme in place.	✓		

Category	Risk	Consequence	Mitigation	WS	WW	Scheme if specific
Climate change and change in landuse	Multiple studies predict an overall reduction in average rainfall, but an increase in the frequency of intense rainfall events. Increased likelihood of prolonged periods with no rainfall (drought), diminishing reservoirs and affecting water supply - most critically to locations/consumers using water tanks.	– An impact on the patterns used for modelling, average flows may be lower but peak flows may be higher for a shorter duration. – Further influencing capital costs in future infrastructure investment. – Irrigation demand could increase. – Higher I&I events - impact on WW networks and potential contamination of the environment and waterways.	– Factor in climate change into future extraction rates, demand predictions and other WS or WW assessments. – Consider the impact of climate change on capital costs for upgrades, maintenance etc. – Irrigation water not provided for farmlands. Residential irrigation should be mitigated through communication. – Inform and educate consumers on sustainable water consumption and the impact that reduced rainfall will have on their water supply.	✓	✓	
	River water quality may be affected by climate change (lower flows, intense rain events, etc.) or change in landuse	– Increased turbidity, algae, farmland runoff, fluctuation of seasonal river level/flow seasons. – The WTP may not be able to treat lower quality water.	Commission a study into the impact that climate change and predicted change in landuse will have on water quality, within the relevant waterways. Provide sufficient redundancy and resilience in water supply assets (storage, ability to increase level of treatment) .	✓		
	Flooding may occur more frequently and to higher levels than previously experienced. Water and wastewater assets are located close to the river, in vulnerable locations. Higher I&I for wastewater networks; more frequent overflows.	Flooding of the WTP may result in loss of service and/or unpotable water being distributed in the system. Flooding of the WWTP may result in discharge of untreated wastewater in the river.	Consider locations less prone to flooding or increase flood protection measures (both hard and soft engineering methods).	✓	✓	
Feasibility of option	Poor stakeholder engagement (from both public and private stakeholders).	Lack of buy in from communities, leading to delayed or cancelled project.	Ensure good consultation and engagement with public. Make sure options are specific to the communities and convey this to the consumers. If they can relate to the benefits of a proposed project, they are more likely to buy into the project.	✓		✓
	Long retention times particularly during early years.	Septic sewage and odours. Increased age of water (and associated water quality issues	Staged development and chemical dosing may be feasible, future planning is essential.	✓	✓	
	A Centralised WWTP/WTP option would require great length of main, potentially along the Waikato River and the SH1.	Cost/technical feasibility and safety in design for proposed reticulation options.	Technical feasibility of getting reticulation to a centralised plant – to be considered in more detail when working on the long list of options.	✓		✓
Financial	Cost uncertainty.	Project cost overruns.	Consider geotechnical risk, confidence bounds of cost model, unusual or emerging construction methods, unusual topography, land use or geology.	✓		✓

Category	Risk	Consequence	Mitigation	WS	WW	Scheme if specific
	High capital cost options.	Option not being affordable to rate payers. Difficulty funding project.	Consider financial attributes in option scoring (Capex, Opex and Totex).	✓		✓
Growth projections/ demand	Existing demand not cross-checked or calibrated against SCADA data.	Existing demand may be under- or over-estimated; infrastructure may be incorrectly sized	Mitigate by communicating this risk to future designers; demand/design flows to be re-considered once an option is selected (i.e. at Preliminary Design Stage). Watercare Waikato have specified that no calibration of demands is to be completed at this stage.	✓		✓
	The calculated flows and loads are underestimated, due to uncertainty regarding residential, commercial and industrial growth across the entire region.	Capital investment allocation and Infrastructure under sizing.	Review existing information available on flows and concentrations. Where growth is uncertain, adopt flexible strategies that can be adapted or phased over time.	✓	✓	
	Calculated flows and loads over estimated due to uncertainty regarding growth or industry type.	Capital investment allocation and Infrastructure oversizing.		✓	✓	
	Area currently on restricted supply - assumed to be changing to on-demand supply.	Capital investment allocation and Infrastructure oversizing.		✓		
	Irrigation has not been included in the demand estimates.	Capital investment allocation and Infrastructure under sizing.	Investigate the irrigational demand relative to a zone and incorporate this into this study.	✓		
	Springhill Corrections Facility water use and wastewater generation changes from demand allowed for (eg due to facility expanding or closing).	High water use/trade waste source, could affect feasibility of options/infrastructure needs.	Springhill included in demand projections. Review Springhill demands during subsequent stages of project	✓	✓	
	Ohinewai existing population not included.	Infrastructure undersized if local residents excluded; potential for locals to be unhappy if they aren't given the option to connect to new reticulated infrastructure.	Include the local population in demand projections.	✓	✓	
	Sleepyhead development.	Significant new demand, infrastructure could be under-sized if not included.	Include in Ohinewai demand for year 2030.	✓	✓	
Land acquisition	Not being able to acquire land.	Inability to implement proposed routing or siting options.	Consider land ownership during routing and siting options.	✓	✓	
Regulatory	TKWA distributing untreated water to consumers, before being treated at the WTP.	Consumers will be supplied raw water, potentially leading to sickness.	– Investigate the feasibility and infrastructural investment needed to ultimately discontinue the supply on untreated water to consumers. – Prioritise capital investment to upgrade network to provide all consumers with a minimum level of service (further informed by drinking water standards). – Investigate interim options.	✓		

Category	Risk	Consequence	Mitigation	WS	WW	Scheme if specific
Regulatory	TKWA ability to continue to use water take consent, which expires in 2024 (they have never used their maximum allowable abstraction volume, it is likely to be reduced).	Inability to provide adequate level of service for an extended period of time. Increased rates for consumers (supply and demand). Impact on industrial, agricultural and commercial activity in areas.	– Investigate consenting options to mitigate risk (eg transfer of allocation, application lodged in required time prior to consent expiry) – Assess what is the maximum abstraction volume likely to be during the period of infrastructural upgrading and investment; any changes required depending on the extraction points and what other factors should be considered (e.g. climate change).	✓		Te Kauwahata
	New drinking water regulations will impact TKWA. Unknown as to who will be responsible for supplying water to the existing TKWA customers when the new drinking water regulations come into place. The new reticulation may not be required if the TWKA infrastructure becomes strictly for raw water only.	Increase cost of water supply affecting Te Kauwhata network (i.e. if new infrastructure required).	Assess cost of new intake structure and raw water pipeline if necessary; consult TKWA re: continued supply.	✓		Te Kauwahata
	Unknown discharge options for the future as Te Kauwhata WWTP must cease discharging to Lake Waikare by 2023.	Cost and time required for new consent application; cost of new infrastructure and land if a new discharge location is required.	Assess alternative options for Te Kauwhata WWTP discharge, including land-based options. Include the time and cost of consenting as part of the options evaluation.		✓	Te Kauwahata
	Existing non-compliant WW discharges – likely to cease or become more tightly regulated when new National Environmental Standards for WW discharges & overflows are released.	Cost and time for consents, new infrastructure to reduce/control overflows.	Assess the consent requirements, likely upgrade options required for existing overflows, new design overflow points (if necessary).		✓	Te Kauwhata, Huntly
	Health & safety risks in construction, operation, maintenance and decommissioning of new and existing assets.	Injuries, financial penalties, loss of reputation.	– Consider constructability, operability and maintainability of options. – Apply safety in design and standard H&S tools (HAZOP etc) during design phase.			Te Kauwhata
	Possibility of consent to take water from the river not being renewed or declined by council.	No raw water supply. Therefore, will not be able to supply treated water to consumers.	Assess consenting options to secure existing allocations (eg transfer allocations, “grand-parenting” municipal water supply consented allocations) Investigate other water sources.	✓		
	Unsustainable solution with high carbon footprint.	Not compliant with the zero-carbon bill which could lead to financial penalties (loss of funding), loss of reputation.	Consider low carbon options, encourage low carbon thinking.	✓	✓	

Category	Risk	Consequence	Mitigation	WS	WW	Scheme if specific
Regulatory environment	Resource consentability issues. Waikato Regional Council Plan change, encompassing restoring and protecting the health and wellbeing of the Waikato River.	Delay implementation of housing developments.	Consenting strategy. consentability and planning review. An outline consenting strategy is required to determine if the consenting authority and future regulator are likely to allow consenting of mass load limits, and to determine future proofed discharge preferences, noting that Iwi are likely to object to discharges directly to surface water bodies.	✓	✓	
	New water regulations will enforce more stringent drinking water and/or treated wastewater discharge quality criteria	Need for higher level of water or wastewater treatment and/or level of service Review of current discharge consents results in need for change (immediate or within a given timeframe).	Consenting strategy. consentability and planning review. Discharge options will need to be future proofed as far as possible to account for anticipated regulatory changes.		✓	
	Unconsented and consented wastewater overflow points (including uncontrolled network overflows) and requirements of new regulations.	Lack of control and understanding regarding the impact on the network or surrounding environment at overflow points.	Consolidating information regarding unconsented wastewater overflow points. Minimise controlled wastewater overflow points and discharge consents.		✓	
Security of service	Failure of water and wastewater assets following natural disasters (eg earthquake).	No security of service if assets not functioning.	Seismic review of existing water infrastructure and upgrades as required. Prepare earthquake response plan. Appropriate specifications for siting, resilience and redundancy for new infrastructure.	✓	✓	
	Drought or extreme low flows in Waikato river.	Reduced supply of raw water. limited supply to consumers and unable to meet peak demands.	Increase treated water storage or raw water storage.	✓		
	Reliability of services e.g. power, telecoms.	Lack of service/supply.	Consider sites with good access to reliable services and infrastructure (e.g. urban in preference to rural).	✓	✓	

There are also opportunities related to the Mid-Waikato water and wastewater servicing. A few examples are listed below, to be considered during the options investigation phase of work:

- Options to support greater population growth, which are not supported by the status quo,
- Benefits in considering water and wastewater servicing options simultaneously, including common pipeline corridors or construction contracts for work in a similar area may bring costs savings,
- Wastewater reuse for non-potable water demand can potentially reduce wastewater discharge and water take, treatment and conveyance.

7 Recommendations

The objective of this investigation is to develop a long-term water supply and wastewater servicing strategy to enable the predicted growth in Mid-Waikato while protecting water supplies and receiving environment. Programme is critical to this engagement and the timing of this study to link in with relevant LTPs and AMPs is paramount. For the purpose of expediency, this study was kept at a high-level assessment. The following is recommended for further investigation, prior to designing a selected option:

- There is an opportunity to refine the design flows in future based on actual measured flows, population growth projections and as more becomes known about the types of industry planned.
- I&I rehabilitation work should be assessed and compared to the potential saving generated by I&I reduction (i.e. additional treatment capacity).
- Obtain scientifically robust evidence on the assimilative capacity of the receiving environment at each WWTP location for key contaminants.
- Carry out high-level review of feasibility of land application of treated wastewater using existing information available about physiographic zones to confirm selected wastewater discharge options and support associated consent applications.

8 References

[1] Technical Memo 1: Literature and Growth Review, Mott MacDonald for Watercare, 27 Mar 2020.

[2] Strategic Zones

[3] Waikato Strategic Planning (Capacity)

[4] Draft Waikato 2070

[5] Regional Infrastructure Technical Specification – (RITS)

[6] Tuakau-Pokeno Industrial wastewater demand

C. Technical Memo 3

Mid Waikato W&WW Servicing Strategy

Technical Memo 3: Long List of Options

Project:	Mid Waikato W&WW Servicing Strategy		
Our reference:	415939 – Final	**Your reference:**	CT 6484-7035
Prepared by:	Atisha Daya, Kirsten Norquay, Alex Ross	**Date:**	30 June 2020
Approved by:	Nick Dempsey	**Checked by:**	Julie Plessis, David Hume
Subject:	Technical Memo 3: Long List of Options		

The purpose of this study is to develop a long-term water supply and wastewater strategy to enable the rapid growth predicted in the Mid-Waikato region, while protecting water supplies and receiving environments. Key to this will be understanding the anticipated growth, completing a high-level bulk supply and wastewater supply analysis to enable this growth; ultimately, determining a preferred set of solutions and staging.

1 Introduction

Building on previous option investigations, high-level solutions have been developed to address current and future supply issues to enable growth between Huntly and Meremere. The long list of options will be evaluated in a workshop with Watercare and screened to produce a shortlist for further development.

This technical memo will form part of a wider study setting out options for the long-term servicing strategy for the Mid-Waikato area. This is intended to include:

- Literature and data review (Technical Memo 1);,
- Supply/demand balance and key risks identification (Technical Memo 2),
- High level solution options – long list (this memo),
- Multicriteria assessment and options short list,
- Option analysis report.

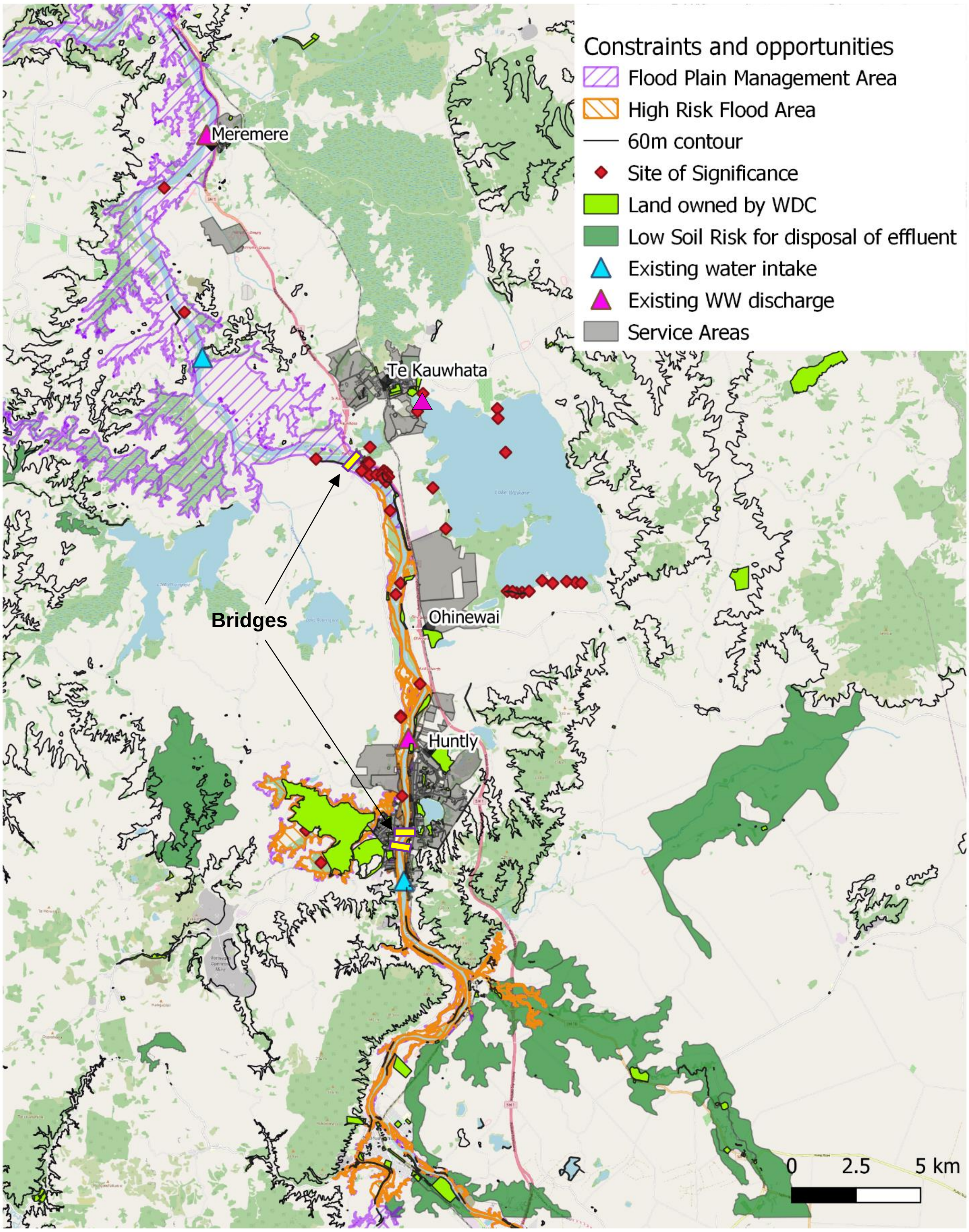
This memo is intended to provide an overview of the constraints in the study area, list high-level solutions for water and wastewater servicing in the Mid-Waikato region, and propose criteria for fatal flaws. The developed long-list options will undergo a fatal flaw assessment to produce a short-list of options. A Multi Criteria Analysis (MCA) will then be carried to narrow down the options to be developed in more detail.

2 Constraints

Figure 2-1 shows the following constraints and opportunities in the study area:

- **Flood plains:** Treatment plants and pump station to stay clear of these areas as much as possible.
- **Elevated areas**: Network route to avoid elevated areas.
- **Sites of significance**: Sites to be avoided.
- **Land ownership:** Land owned by the Council constitute potential treatment plants location.
- **Low soil risk for discharge of treated wastewater:** Areas of land potentially suitable for land application of treated wastewater.
- **Surface water bodies:** Waikato river and lakes. The Waikato river is the most likely source of drinking water for all options. Rivers and lakes are also potential discharge locations for treated wastewater. The Waikato River, and other waterways, represent a significant and costly obstacle for large scale transmission pipes.
- **Motorway, railway and bridges:** Only three bridges cross the Waikato River in the study area. A railway line runs along the majority of State Highway 1 between Te Kauwhata and Huntly. Construction along the State Highway 1 may cause significant disruption and will required traffic management and construction within the rail corridor requires additional approvals.
- **Existing water intake and treated wastewater discharge location:** The relative location of existing water intakes and treated wastewater discharge points should be taken into consideration for new water takes and treated wastewater discharges to the Waikato River.

Figure 2-1 - Constraints and Opportunities



3 Long List of options

The long list of options below consists of a summary of the options developed to date in previous studies and additional options not previously assessed. Any idea, no matter how progressive or challenging was included in the long list for consideration. At this initial stage, the focus is on high-level (generic) locations of treatment plants, and broad network solutions.

To facilitate the assessment process, the grouping of options was completed as follows:

- Wastewater options were grouped based on the discharge route for treated wastewater (to land, river, etc.),
- Water supply options were grouped depending on whether the treatment plants were centralised or decentralised around certain locations.

In these options we have considered the water intake, treated wastewater discharge, and treatment plant location options for the Huntly, Ohinewai, Te Kauwhata, Rangiriri and Meremere catchments for both centralised and decentralised servicing options.

3.1 Wastewater Options

The long list of wastewater options to the service area is summarised below. Costing available in previous reports are shown in the table.

Discharge route	No.	Site Location	WWTP options	Advantages/Opportunities	Disadvantages/Risks	Feasibility	Cost	Capacity/Consent/ Existing Assets	Fatal Flaws	Comments
Land (Irrigating treated wastewater to land)	1a	Huntly	Centralised - all WW from Meremere, Te Kauwhata, Rangiriri, Ohinewai and Huntly will be treated at Huntly.	Unlikely that Te Kauwhata will be re-consented to be able to discharge to Lake Waikare. Thus, treating WW in Huntly and discharging to the land would solve discharge issue at Te Kauwhata.	Very high CAPEX & OPEX; operating risk with long transfer pipe	Land area calculated based on ADF and a conservative infiltration rate. It is assumed there is insufficient land available to take peak wet weather flows all year round. Nitrogen and Phosphorous loading are yet to be considered. The land appears to be sufficient for discharge based on hydraulic loading. This would need to be investigated further in terms of soil types, future land use etc. This option assumes that flows higher than ADF would be stored with contingency discharges to Waikato River in winter.				Land Required: Conservative infiltration rate of 2mm/d used. Considering the Nitrogen standard would increase these areas. 2025: 451ha 2030: 538ha 2050: 736ha Ultimate: 1,082ha The criteria used to analyse the Soil Risk for FDE were assumed to be similar as the criteria required for suitable land for WW disposal. Thus, the Waikato GIS showing the soil risk for FDE was used to scan land around Huntly. Some sparse pieces of land appeared to be low risk, these would need to be investigated further in terms of future land use, etc. The land south of Huntly appears to be roughly 2,425ha (approx. 10km from Huntly) and 4,242ha, but the pipeline would need to cross the Hakarimata mountain range and the Mangawara Stream. Another potentially more suitable area of land west of Huntly is 1,212ha, but this would require the pipeline to cross the Waikato River.
	1b	Huntly	Centralised - all WW from Te Kauwhata, Rangiriri, Ohinewai and Huntly will be treated at Huntly. Meremere would have its own WWTP as it is set to be upgraded.	Shorter network route as Meremere not included. Removes Te Kauwhata discharge from Lake Waikare which has consentability issues.	Very high CAPEX & OPEX; operating risk with long transfer pipe.					Land Required: Conservative infiltration rate of 2mm/d used. Considering the Nitrogen standard would increase these areas. 2025: 439ha 2030: 526ha 2050: 722ha Ultimate: 1,054ha
	1c	Huntly	Centralised - WW from Huntly and Ohinewai to be treated at Huntly. Te Kauwhata (and Rangiriri) and Meremere will remain decentralised.	Extra consent for Ohinewai will not be required (as with above options). Reduced operating risk compared to other centralised options as the transfer pipe would be shorter.	High CAPEX and OPEX.					Land Required: Conservative infiltration rate of 2mm/d used. Considering the Nitrogen standard would increase these areas. 2025: 260ha 2030: 308ha 2050: 391ha Ultimate: 723ha
	1d	Huntly	Decentralised	Lower cost than centralised when compared over a 50-year period. Huntly does not require significant upgrades for growth until 2029 when consent expires.	Huntly will need an interim upgrade (Actiflo or equivalent) to meet TSS discharge requirements.			Treatment plant capacity not known (design ADWF is 2,100m³/day). Currently TSS and Ammonia discharge consents are not being met, overflowing issues due to high I/I.		Land Required: Conservative infiltration rate of 2mm/d used. Considering the Nitrogen standard would increase these areas. 2025: 224ha 2030: 238ha 2050: 249ha Ultimate: 501ha
	1e	Te Kauwhata	Decentralised						Yes. See comments.	Not feasible as there is no appropriate land available around Te Kauwhata.
	1f	Meremere	Decentralised						Yes. See comments.	Not feasible as there is no appropriate land available around Meremere.
	1g	Ohinewai	Decentralised						Yes. See comments.	Not feasible as there is no appropriate land available around Ohinewai. Not economic to transfer flows to 1,200ha west of Huntly with decentralised option.
River (Discharge of treated wastewater to the Waikato river)	2a	Huntly	Centralised- all WW from Meremere, Te Kauwhata, Rangiriri, Ohinewai and Huntly will be treated at Huntly.	Unlikely that Te Kauwhata will be re-consented to be able to discharge to Lake Waikare. Thus, treating WW in Huntly and discharging to the river would solve discharge issue at Te Kauwhata. Extra consent for Ohinewai will not be required.	Very high CAPEX & OPEX; operating risk with long transfer pipe.					

Discharge route	No.	Site Location	WWTP options	Advantages/Opportunities	Disadvantages/Risks	Feasibility	Cost	Capacity/Consent/ Existing Assets	Fatal Flaws	Comments
	2b	Huntly	Centralised - all WW from Te Kauwhata, Rangiriri, Ohinewai and Huntly will be treated at Huntly. Meremere would have its own WWTP as it is set to be upgraded.	Shorter network route as Meremere not included. Removes Te Kauwhata discharge from Lake Waikare which has consentability issues. Extra consent for Ohinewai will not be required.	Very high CAPEX & OPEX; operating risk with long transfer pipe.					
	2c	Huntly	Centralised - WW from Huntly and Ohinewai to be treated at Huntly. Te Kauwhata (and Rangiriri) and Meremere will remain decentralised.	Reduced operating risk compared to other centralised options as the transfer pipe would be shorter. Extra consent for Ohinewai will not be required.	High CAPEX and OPEX.					
	2d	Huntly	Decentralised - New WWTP.	Huntly WWTP currently has consent to discharge to the Waikato River. Lower cost than centralised when compared over a 50-year period. Huntly does not require significant upgrades for growth until 2029 when consent expires.	Cost, Consenting.	WW network upgrades would also be required.	Could be approx. $35 million, as it was $69 million for separate MBR construction at Huntly and Ngaruawahia (*Centralised and Decentralised Wastewater Treatment Investigation, Stantec, October 2017*).			
	2e	Huntly	Upgrade existing on-site WWTP.	Use existing WW network, WWTP and discharge point to river.	Existing high I&I in WW network in Huntly, affects WWTP capacity and performance during wet weather; Huntly WWTP will need an interim upgrade (Actiflo or equivalent) to meet TSS discharge requirements; treatment wetlands threatened by Waikato River floodwaters (may be increasingly vulnerable with climate change); increasingly tight restrictions on effluent quality due to river discharge; increasing restrictions likely on WW overflows. Consent conditions likely to become increasingly restrictive over time.	Upgrades to Huntly WWTP to solve compliance issues & future-proof; recommend WW network improvements to reduce I&I issues at the WWTP; consider increasing pump station emergency storage at 22 local pump stations.	$5million upgrade required for Actiflo, septage receival and wetlands upgrade; $3million upgrade for TN/TP and peak flows in 2028	Existing inlet screen, septage receival plant, primary oxidation pond with curtains and 5 aerators, secondary oxidation pond with aerator, UV disinfection, surface-flow wetlands and rock-lined channels. Discharge to river via multi-port diffuser on riverbed. Design ADWF = 2,500m³/d, design PWWF = 6,500m³/d. Consent until 2029 (upgrade required at this time). No capacity to receive flows from other centres. Huntly will not require MBR upgrades until 2028. The current plant has issues meeting TSS and Ammonia discharge consents. The oxidation ponds are known to overtop, and surcharging has been observed on the manholes on the outfall pipeline to the river.	Yes. See comments.	It is expected that this option will not achieve the expect tighter nutrient standards when consent is renewed in 2029. This will require a new high rate treatment plant.
	2f	Huntly	Do nothing - existing WWTP	Use existing WW network, WWTP and discharge point to river	Continue to not meet consents. Cannot meet future demands. Not consistent with vision and strategy for the Waikato River.	Upgrades to Huntly WWTP to solve compliance issues & future-proof; recommend WW network improvements to reduce I&I issues at the WWTP; consider increasing pump	$0	Existing inlet screen, septage receival plant, primary oxidation pond with curtains and 5 aerators, secondary oxidation pond with aerator, UV disinfection, surface-flow wetlands and rock-lined channels. Discharge to river via multi-port diffuser on	Yes. See comments.	It is expected that this option will not achieve the expect tighter nutrient standards when consent is renewed in 2029. This will require a new high rate treatment plant. Other issues: WWTP treatment wetlands threatened by Waikato River flooding. PWWF sometimes exceeds WWTP capacity.

Discharge route	No.	Site Location	WWTP options	Advantages/Opportunities	Disadvantages/Risks	Feasibility	Cost	Capacity/Consent/ Existing Assets	Fatal Flaws	Comments
						station emergency storage at 22 local pump stations		riverbed. Design ADWF = 2,500m³/d, design PWWF = 6,500m³/d. Consent until 2028 (upgrade required at this time). No capacity to receive flows from other centres. Huntly will not require MBR upgrades until 2028. The current plant has issues meeting TSS and Ammonia discharge consents. The oxidation ponds are known to overtop, and surcharging has been observed on the manholes on the outfall pipeline to the river.		
	2g	Te Kauwhata	Centralised - all WW from Meremere, Te Kauwhata, Rangiriri, Ohinewai and Huntly will be treated at Te Kauwhata.	Location would be roughly in the middle of Meremere and Huntly. This is a central location, which would facilitate potential future connections in the growth corridor.	New network required to transfer WW from Huntly, Ohinewai and Meremere. Location is distant from discharge point to river.		Transfer from Meremere WWTP to Te Kauwhata WWTP: $13.7million (3 x pump stations, chemical dosing) - unclear if this number includes Te Kauwhata WWTP upgrades.			
	2h	Te Kauwhata	Centralised - all WW from Te Kauwhata, Rangiriri, Ohinewai and Huntly will be treated at Te Kauwhata. Meremere would have its own WWTP.	Would not require a WW network between Meremere and Te Kauwhata.	New network required to transfer flows from Ohinewai and Huntly. Location is distant from discharge point to river.					
	2i	Te Kauwhata	Centralised - WW from Te Kauwhata, Rangiriri and Ohinewai to be treated at Te Kauwhata. Huntly and Meremere will remain decentralised.	Network would not need to handle large flows from Huntly and majority of the network between Te Kauwhata and Rangiriri would be existing.	New Network between Te Kauwhata and Ohinewai would be required. Location is distant from discharge point to river.					
	2j	Te Kauwhata	Decentralised- new WWTP.		Need to obtain a discharge consent for river discharge. High costs. Location is distant from discharge point to river.		HIF business case estimated new onsite WWTP (MBR) in Te Kauwhata and 5.3km rising main to land discharge point near SH1 and Waikato River $39.1 million.			
	2k	Meremere	Centralised - all WW from Meremere, Te Kauwhata, Rangiriri, Ohinewai and Huntly will be treated at Te Kauwhata.	The existing WWTP has a discharge consent to the river – it is possible that this could still be used. May need treated effluent storage to comply with discharge limits.						
	2l	Meremere	Decentralised-new WWTP.	Existing discharge consent to the Waikato River. New MBR plant would allow consented TN levels to be met.	High costs of new WWTP Consenting if new discharge point is required.					
	2m	Meremere	Upgrade existing on-site WWTP.	The existing WW network can be used with some upgrades.	Even with upgrades, unlikely to meet consent limits.	Consider WW network upgrades to reduce I&I and improve WWTP performance	Upgrades to WWTP (inflow balancing storage for PWWF; Actiflo unit; tertiary nitrification/denit	The current plant struggles to cope with high I&I during wet weather, causing discharge to the river that is out of consent.	Yes. See comments.	Not currently consented (expired 2018) capacity issues of existing WWTP; restrictions on discharge due to river use by Mercer Rowing Club.

Discharge route	No.	Site Location	WWTP options	Advantages/Opportunities	Disadvantages/Risks	Feasibility	Cost	Capacity/Consent/ Existing Assets	Fatal Flaws	Comments
						during wet weather.	rification or upgrade wetlands for TSS and TN control): $2million; Land irrigation scheme $3.5million (min).			
	2n	Meremere	Do nothing.	The existing WW network can be used.	Consents will continue to not be met. Cannot meet future demands and growth. Not consistent with vision and strategy for the Waikato River.			Single oxidation pond with DN175 HDPE rising main discharging to Waikato River. Capacity 480m³/day of treated WW, ADWF up to 160m³/day. Issues with consent compliance (effluent quality) and capacity of pond during rainfall. Peak wet weather discharges have exceeded consent limit by a factor of 3. Unlikely to have wet weather capacity for additional connections unless WWTP is upgraded.	Yes. See comments.	Not currently consented (expired 2018) capacity issues of existing WWTP; restrictions on discharge due to river use by Mercer Rowing Club
	2o	Ohinewai	Centralised - all WW from Meremere, Te Kauwhata, Rangiriri, Ohinewai and Huntly will be treated at Ohinewai.		Discharge consent will need to be obtained. New WW network will be required from Meremere to Huntly.	Better ground conditions (and more elevated) at Ohinewai compared with Huntly.				
	2p	Ohinewai	Centralised - all WW from Te Kauwhata, Rangiriri, Ohinewai and Huntly will be treated at Ohinewai. Meremere would have its own WWTP as it is set to be upgraded.	Reduced length of WW transfer pipeline as Meremere is no longer included.	Discharge consent will need to be obtained.					
	2q	Ohinewai	Decentralised.		Additional discharge consent will need to be obtained.					
	2r	Ohinewai	Centralised - WW from Huntly and Ohinewai to be treated at Ohinewai. Te Kauwhata (and Rangiriri) and Meremere will remain decentralised.	Reduced length of WW transfer pipeline as Meremere and Te Kauwhata is no longer included.						
	2s	Ohinewai	Centralised - WW from Te Kauwhata, Rangiriri and Ohinewai to be treated at Ohinewai. Huntly and Meremere remain decentralised.	- Simpler construction on a new greenfield site. - Economies of scales for WWTP construction. - Potential for reuse of treated effluent during dry periods. - Provides flexibility for additional growth areas and WWTP could be built in stages. i.e. Huntly specific capacity build could be deferred until 2029. - Discharge removed from Lake Waikare. - Less staff to operate one WWTP.	- Operational costs influences by pumping peak raw wastewater flows and odour control chemicals. - Takes longer to implement due to the requirement to consent a discharge to the Waikato river in a new location. - Complex to manage. - Ability to designate identified site needs to be confirmed.		Capex - $62.5 million; NPV - $ 163 million; *(Te Kauwhata WWTP Alternative Options Comparison – Beca, 2018).*			
	2t	Ohinewai	Individual WWTP's at Te Kauwhata and Huntly, and combined discharge at Ohinewai.	Potential for reuse of treated effluent during dry periods. Less discharge points to consent.	- Ohinewai not serviced with this option. - Requires more staff to operate two WWTPs.		Capex - $72.2 million; NPV – 168 million; *(Te Kauwhata WWTP Alternative*			

Discharge route	No.	Site Location	WWTP options	Advantages/Opportunities	Disadvantages/Risks	Feasibility	Cost	Capacity/Consent/ Existing Assets	Fatal Flaws	Comments
					- Higher capital and NPV cost due to two WWTPs to operate and two pipelines.		*Options Comparison – Beca, 2018).*			
Lake (discharge to Lake Waikare or other lakes in the vicinity)	3a	Te Kauwhata	Upgrade existing on-site WWTP.		- Te Kauwhata WWTP will require upgrades in 2020 including the construction of an outfall diffuser. - Discharge to Lake Waikare is to be stopped in the future. - WW needs to be treated to a high standard before discharging to the lake to possibly extend consent. - Cost to associated with additional treatment.			Te Kauwhata WWTP must cease discharging to Lake Waikare by 2023.	Yes. See comments.	Existing plant unable to be upgraded to meet growth and achieve tighter standards required without a new advanced WWTP.
	3b	Te Kauwhata	Do nothing.	WWTP has been compliant with consent conditions (however these are likely to become increasingly strict).	Cannot meet future demands. Not consistent with vision and strategy for the Waikato River. Consent to discharge to Lake Waikare is about to end. Te Kauwhata WWTP will require upgrades in 2020 including the construction of an outfall diffuser.	Upgrade likely to be required to reduce TN (to effectively zero) to allow discharge to river.		Existing WWTP serves Te Kauwhata, Rangiriri and Springhill Correction Facility. WWTP includes inlet screening, two aerated ponds in series with Aquamats, wetland, rock filter and a discharge to Lake Waikare. Coagulant dosing to reduce phosphorus. Design average flow of 1,020m³/day. Design PWWF not stated.	Yes. See comments.	Must cease discharging to Lake Waikare by 2023; consent expires 2028. Existing plant unable to be upgraded to meet growth and achieve tighter standards required without a new advanced WWTP.
	3c	Te Kauwhata	Centralised - all WW from Meremere, Te Kauwhata, Rangiriri, Ohinewai and Huntly will be treated at Te Kauwhata. Huntly and Meremere will remain decentralised.	Location would be roughly in the middle of Meremere and Huntly.	New network required to transfer WW from Huntly, Ohinewai and Meremere. Consent to discharge to Lake Waikare will cease in 2023.		Transfer from Meremere WWTP to Te Kauwhata WWTP: $13.7million (3 x pump stations, chemical dosing) - unclear if this number includes Te Kauwhata WWTP upgrades. *Meremere WWTP Upgrade Options Assessment, Beca July 2019*			
	3d	Te Kauwhata	Centralised - all WW from Te Kauwhata, Rangiriri, Ohinewai and Huntly will be treated at Te Kauwhata. Meremere would have its own WWTP.	Would not require a WW network between Meremere and Te Kauwhata	New network required to transfer flows from Ohinewai and Huntly. Consent to discharge to Lake Waikare will cease in 2023.					
	3e	Te Kauwhata	Centralised - WW from Te Kauwhata, Rangiriri and Ohinewai to be treated at Te Kauwhata. Huntly and Meremere remain decentralised.	Network would not need to handle large flows from Huntly and majority of the network between Te Kauwhata and Rangiriri would be existing.	New Network between Te Kauwhata and Ohinewai would be required. Consent to discharge to Lake Waikare will cease in 2023.					
	3f	Te Kauwhata	Decentralised - New WWTP.	New plant would be equipped to handle growth.	High costs. Location is distant from discharge point to river. Consent to discharge to Lake Waikare will cease in 2023.		New onsite WWTP (MBR) in Te Kauwhata and 5.3km rising main to land discharge point near SH1 and Waikato River $39.1 million.			

Discharge route	No.	Site Location	WWTP options	Advantages/Opportunities	Disadvantages/Risks	Feasibility	Cost	Capacity/Consent/ Existing Assets	Fatal Flaws	Comments
							Housing Infrastructure Fund- Te-Kauwhata Detailed Business Case, WDC, April 2018			
	3g	Huntly	Centralised - all WW from Meremere, Te Kauwhata, Rangiriri, Ohinewai and Huntly will be treated at Huntly.	Unlikely that Te Kauwhata will be re-consented to be able to discharge to Lake Waikare. Thus, treating WW in Huntly and discharging to the river would solve discharge issue at Te Kauwhata. Extra consent for Ohinewai will not be required.	Very high CAPEX & OPEX; operating risk with long transfer pipe					- The surrounding lakes are of poor quality, thus discharging to these would be unlikely or very costly if the WW is to be treated to a high standard before discharge. - Unlikely a new consent to discharge to the lakes will be given. In some cases, the iwi might prefer discharges to lakes.
	3h	Huntly	Centralised - all WW from Te Kauwhata, Rangiriri, Ohinewai and Huntly will be treated at Huntly. Meremere would have its own WWTP as it is set to be upgraded.	Shorter network route as Meremere not included. Removes Te Kauwhata discharge from Lake Waikare which has consentability issues. Extra consent for Ohinewai will not be required.	Very high CAPEX & OPEX; operating risk with long transfer pipe					- The surrounding lakes are of poor quality, thus discharging to these would be unlikely or very costly if the WW is to be treated to a high standard before discharge. - Unlikely a new consent to discharge to the lakes will be given. In some cases, the iwi might prefer discharges to lakes.
	3i	Huntly	Centralised - WW from Huntly and Ohinewai to be treated at Huntly. Te Kauwhata (and Rangiriri) and Meremere will remain decentralised.	Reduced operating risk compared to other centralised options as the transfer pipe would be shorter. Extra consent for Ohinewai will not be required.	High CAPEX and OPEX.					- The surrounding lakes are of poor quality, thus discharging to these would be unlikely or very costly if the WW is to be treated to a high standard before discharge. - Unlikely a new consent to discharge to the lakes will be given. In some cases, the iwi might prefer discharges to lakes.
	3j	Huntly	Decentralised - New WWTP	Huntly WWTP currently has consent to discharge to the Waikato River. Lower cost than centralised when compared over a 50-year period. Huntly does not require significant upgrades for growth until 2029 when consent expires.	Cost; Consenting.	WW network upgrades would also be required.				- The surrounding lakes are of poor quality, thus discharging to these would be unlikely or very costly if the WW is to be treated to a high standard before discharge. - Unlikely a new consent to discharge to the lakes will be given. In some cases, the iwi might prefer discharges to lakes.
	3k	Meremere	Centralised - all WW from Meremere, Te Kauwhata, Rangiriri, Ohinewai and Huntly will be treated at Meremere.	The existing WWTP has a discharge consent to the river - this could possibly still be used in emergency. May need treated effluent storage to comply with discharge limits.						- The surrounding lakes are of poor quality, thus discharging to these would be unlikely or very costly if the WW is to be treated to a high standard before discharge. - Unlikely a new consent to discharge to the lakes will be given. In some cases, the iwi might prefer discharges to lakes.
	3l	Meremere	Decentralised - New WWTP.	Existing discharge consent to the Waikato River. New MBR plant would allow consented TN levels to be met.	High costs of new WWTP Consenting if new discharge point is required.					- The surrounding lakes are of poor quality, thus discharging to these would be unlikely or very costly if the WW is to be treated to a high standard before discharge. - Unlikely a new consent to discharge to the lakes will be given. In some cases, the iwi might prefer discharges to lakes.
	3m	Ohinewai	Centralised - all WW from Meremere, Te Kauwhata, Rangiriri, Ohinewai and Huntly will be treated at Ohinewai.		Discharge consent will need to be obtained. New WW network will be required from Meremere to Huntly.					- The surrounding lakes are of poor quality, thus discharging to these would be unlikely or very costly if the WW is to be treated to a high standard before discharge. - Unlikely a new consent to discharge to the lakes will be given. In some cases, the iwi might prefer discharges to lakes.
	3n	Ohinewai	Centralised - all WW from Te Kauwhata, Rangiriri, Ohinewai and Huntly will be treated at Ohinewai. Meremere would have its own WWTP as it is set to be upgraded.	Reduced length of WW transfer pipeline as Meremere is no longer included.	Discharge consent will need to be obtained.					- The surrounding lakes are of poor quality, thus discharging to these would be unlikely or very costly if the WW is to be treated to a high standard before discharge. - Unlikely a new consent to discharge to the lakes will be given. In some cases, the iwi might prefer discharges to lakes.
	3o	Ohinewai	Decentralised.		Discharge consent will need to be obtained.					- The surrounding lakes are of poor quality, thus discharging to these would be unlikely or very costly

Discharge route	No.	Site Location	WWTP options	Advantages/Opportunities	Disadvantages/Risks	Feasibility	Cost	Capacity/Consent/ Existing Assets	Fatal Flaws	Comments
										if the WW is to be treated to a high standard before discharge. - Unlikely a new consent to discharge to the lakes will be given. In some cases, the iwi might prefer discharges to lakes.
	3p	Ohinewai	Centralised - WW from Huntly and Ohinewai to be treated at Huntly. Te Kauwhata (and Rangiriri) and Meremere will remain decentralised.	Shorter WW conveyance as Meremere is no longer included.						- The surrounding lakes are of poor quality, thus discharging to these would be unlikely or very costly if the WW is to be treated to a high standard before discharge. - Unlikely a new consent to discharge to the lakes will be given. In some cases, the iwi might prefer discharges to lakes.
	3q	Ohinewai	Centralised - WW from Te Kauwhata, Rangiriri and Ohinewai to be treated at Ohinewai.	- Simpler construction on a new greenfield site - Economies of scales for WWTP construction. - Potential for reuse of treated effluent during dry periods. - Provides flexibility for additional growth areas and WWTP could be built in stages. i.e. Huntly specific capacity build could be deferred until 2029. - Discharge removed from Lake Waikare. - Less staff to operate one WWTP.	- Operational costs influences by pumping peak raw wastewater flows and odour control chemicals. - Takes longer to implement due to the requirement to consent a discharge to the Waikato river in a new location. - Complex to manage. - Ability to designate identified site needs to be confirmed.					- The surrounding lakes are of poor quality, thus discharging to these would be unlikely or very costly if the WW is to be treated to a high standard before discharge. - Unlikely a new consent to discharge to the lakes will be given. In some cases, the iwi might prefer discharges to lakes.
Groundwater Recharge (Discharge to groundwater via deep injection well or aquifer recharge)	4a	Huntly			Treating the treated wastewater further to drinking water standards would increase the capital and operation costs significantly. - Potential risk of contaminating the aquifer. - Advanced treatment will result in waste stream that will need to be discharged.					
	4b	Te Kauwhata								
	4c	Meremere								
	4d	Ohinewai								
Out of region (Convey and discharge wastewater to a WWTP out of the region to be treated)	5a	Pokeno	Pipe untreated wastewater to Pokeno then combine with network to transfer to Pukekohe.	Consent for discharge to Waikato river, lakes or land would not need to be obtained. Upgrade of network from Pokeno to Pukekohe.	Not strategically aligned. Does not support growth pattern set out in NWIGBC, or Future Proof. Requires a 37km pipeline which engineering feasibility has confirmed will be technically challenging and Capex cost estimates are in the order of $53 million making this project unaffordable from WDC under current funding constraints.		$53 million - *Housing Infrastructure Fund- Te-Kauwhata Detailed Business Case, WDC, April 2018.*			
	5b	Pukekohe	Pipe untreated wastewater to the WWTP in Pukekohe.	Consent for discharge to Waikato river, lakes or land would not need to be obtained.	Would have a longer pipeline than 37km, which could make it more expensive than the Pokeno option.				Yes. See comments.	Pukekohe WWTP currently has no capacity.
	5c	Hamilton	Pipe untreated wastewater to the WWTP in Hamilton.	Consent for discharge to Waikato river, lakes or land would not need to be obtained.	The pipeline from Te Kauwhata to Hamilton would be about 45km.					
Sea (Discharge wastewater to sea via long sea outfall)	6								Yes. See comments.	Not feasible as the discharge point is a large distance away from the WWTP site locations and would also require a river crossing.
Direct Potable reuse	7									The location of WTP and WWTP would need to consider optimising the treatment and reticulation of treated wastewater.
Indirect Potable reuse	8									

Discharge route	No.	Site Location	WWTP options	Advantages/Opportunities	Disadvantages/Risks	Feasibility	Cost	Capacity/Consent/ Existing Assets	Fatal Flaws	Comments
Industrial, agricultural, forestry and horticultural reuse	9									The location of WTP and WWTP would need to consider optimising the treatment and reticulation of treated wastewater.
Recycle treated wastewater	10									
Offset discharge by providing environmental Impacts elsewhere	11									
Other Site locations										
	12	Lumsden Road (site 4)		Greenfield and better soils.	Flood risk from river scheme/land drainage scheme failure. Private ownership.					
	13	Tahuna Road (site 16)		Greenfield, elevated above floodable land, better soils and good access.	Adjacent significant natural areas around lake Ohinewai, possible conflict with reserve use and small size restricts future expansion.					
	14	Ralph Road (Site 18)		Greenfield, elevated above floodable land and better soils.	Increased pumping distance.					
	15	Frost Road (Site 19)		Greenfield, elevated above floodable land and better soils.	Increased pumping distance.					
	16	East Mine Road (site 36)		Area already designates, good access, existing resource consent for discharge to Waikato River, Availability of existing ponds for flow buffering and biosolids, land availability for future expansion.	Huntly subsidence zone, flood risk from local overland flow and river scheme stopbank failure (need to raise building platform and access) and uncertain ground conditions.					
	17	Rata Street (site 37)		Area already designated and availability of existing ponds for flow buffering.	Flood risk from local overland flow and Lake Waikare/river scheme, poor ground conditions, limited area available for future expansion, close to residential areas and distance from Waikato river.					

3.2 Water Supply Options

The long list of water supply options to the service area is summarised below. Costing available in previous reports are shown in the table, however they relate to the growth considered in the respective report (the report from which data is sourced is indicated in the last column).

No.	Option Name	Option Description	Site Location	Source / Site	Advantages/Opportunities	Disadvantages/Risks	Cost	Fatal Flaws	Previous Reports
1	**Decentralised – Status Quo ('do nothing')**	Existing WTPs at Te Kauwhata and Huntly (+ Ngaruawahia). Te Kauwhata services Meremere + Rangiriri. Huntly part of centralised Central Waikato scheme, which services Taupiri, Hopuhopu and Ngaruawahia. Unreticulated at Ohinewai.	Huntly & Te Kauwhata.	Existing intakes & WTPs.	- Maximise use of existing assets.	- Ohinewai unreticulated (low level of service). - Whangamarino WTP at capacity now, expansion planned from 3MLD to 4.5MLD. Another expansion required before 2030. - Huntly WTP capacity adequate at present. 2MLD of 8MLD capacity currently allocated to Central Waikato scheme.	Nil	Did not meet DBC project objectives. Does not meet future demand.	TK DBC, WDC, 2018
2	**Decentralised – Huntly WTP stand alone**	As for Option 1 but revert to decentralised scheme for Huntly (ie. not servicing Taupiri and Ngaruawahia) and upgraded to accommodate future demand.	Huntly & Te Kauwhata.	Upgraded Whangamarino WTP. Revert to standalone Huntly WTP.	- Maximise use of existing assets.	- recently constructed centralised scheme to alleviate capacity issues at Ngaruawahia, Hopuhopu & Taupiri - not strategically aligned.	Nil	Reputational risk given recent installation of pipeline (Cost estimate of $16M in 2018 report). Not servicing Ngaruawahia is not an option.	MWH , 2014 Beca, 2018
3	**Decentralised – 3 WTPs ('do minimum' or 'base case')**	Standalone WTPs at Te Kauwhata, Ohinewai and Huntly (+ Ngaruawahia) sized to accommodate future demand. Te Kauwhata services Meremere + Rangiriri. Huntly part of centralised Central Waikato scheme (Taupiri, Hopuhopu, Ngaruawahia).	Huntly & Te Kauwhata & Ohinewai.	- Te Kauwhata: new / upgraded WTP, new/existing intake. - Huntly: existing WTP & intake (may require upgrade to accommodate Central Waikato growth). - Ohinewai: new WTP & intake.	- Maximise use of existing assets - Dependent on final option / site constraints - Ability to stage upgrades for growth rates and location of growth	- Dependent on final option / site constraints - requires additional land / willing buyer - requires consents (designation, water take, discharge of residuals) - time to obtain land and consents	Dependent on final option / site constraints.		See below
			Te Kauwhata WTP sub-options considered previously.	Existing intake, new 5.5MLD WTP at Hall Road, new PS, new reservoirs (2,000m^3) + existing reservoirs, uses existing rising main as far as possible.	- At time of DBC catered for 40 years growth (5.5 MLD), including TK Structure Plan area (additional 1,190 dwellings) & Lakeside Development (additional 1,600 dwellings). - Increase LOS to give 24-48h storage (Avg Day Demand) and <4 days water age. - Utilises existing consent for water take (surplus capacity). - New WTP and reservoirs may be designated. - WDC owns property with reservoirs, locate conveyance in road reserve . - HIF funding allocation. - NB: Alternative location (Wayside Road) described as "lower and more constrained" than Hall Road.	- Need to buy 8,000m^2 at intersection of Hall and Churchill East Road / requires willing buyer. - TKWA own intake & raw water pipeline. WDC operate it.	$19.3M DBC ($12.3M IBC).		TK DBC, WDC; GHD 2017
				Existing Intake, upgrade Whangamarino WTP to 9MLD.	- Single plant/site. - Utilises existing residual pond. - Similar geotechnical issues, although existing water retaining structures built without geotechnical issues. - Existing electrical & civil infrastructure largely in place.	- TKWA own intake & raw water pipeline. WDC operate it. - Requires additional land / willing buyer. - Requires alteration to designation. - Requires revision to discharge consent.	$7.9M		Beca, 2018

No.	Option Name	Option Description	Site Location	Source / Site	Advantages/Opportunities	Disadvantages/Risks	Cost	Fatal Flaws	Previous Reports
				Existing intake, new 6MLD WTP on new site (Hall Road) + existing Whangamarino WTP.	- Two plants provide resilience. - Utilises existing residual pond with new pipeline from new WTP. - No significant geotechnical differences across sites.	- TKWA own intake & raw water pipeline. Uncertainty around condition and construction of existing assets. - Requires additional land / willing buyer. - Requires new designation. - Requires revision to discharge consent.	$12.5M		Beca, 2018
				Existing intake, new 6MLD WTP on new site closer to TK (Wayside Road) + existing Whangamarino WTP.	- Two plants provide resilience. - Land may be publicly owned – to be verified. - No significant geotechnical differences across sites.	- TKWA own intake & raw water pipeline. Uncertainty around condition and construction of existing assets - Routine discharges to sewer, which may require upgrade to WWTP & sewer. - May take time to formalise use of public land. - Requires new designation. - Requires revision to WWTP discharge consent & consent for non-routine discharges.	$12.7M		Beca, 2018
				Existing intake, new 9MLD WTP on Wayside Road + existing Whangamarino WTP.	- Two plants provide resilience. - Land may be publicly owned – to be verified. - No significant geotechnical differences across sites.	- TKWA own intake & raw water pipeline. Uncertainty around condition and construction of existing assets - Routine discharges to sewer, which may require upgrade to WWTP & sewer. - Make take time to formalise use of public land. - Requires new designation. - Requires revision to WWTP discharge consent & consent for non-routine discharges.	$17.1M		Beca, 2018
			Te Kauwhata WTP additional sub-options	New intake, existing WTP upgraded.	- WDC own and operate intake & raw water pipeline. - May mean shorter raw water system. - Single plant/site. - Similar benefits as new WTP at Hall or Wayside Road but single plant/site.	- Similar disadvantages as new WTP At Hall or Wayside Road but single plant/site. - Requires new consents for new water take and raw water pipeline. - Plus site-specific constraints - Increased Capex for raw water pipeline.	Dependent on capacity (see above) + intake location.		
				new intake, new WTP site.	- own intake - shorter raw water system - single plant/site - similar benefits as new WTP at Hall or Wayside Road but single plant/site.	similar disadvantages as new WTP at Hall or Wayside Road but single plant/site requires new consents for new water take and raw water pipeline - plus site-specific constraints.	>$17.1M		
				New intake, new WTP + existing WTP.	Own intake. Shorter raw water system. Two plants provides resilience. Benefits of new WTP as per Hall or Wayside Road with existing WTP retained.	Similar disadvantages as new WTP at Hall or Wayside Road with existing WTP retained. Requires new consents for new water take and raw water pipeline. - Plus site-specific constraints.	>$12.7 or $17.1M depending on capacity		

No.	Option Name	Option Description	Site Location	Source / Site	Advantages/Opportunities	Disadvantages/Risks	Cost	Fatal Flaws	Previous Reports
4	**Centralised – Mid Waikato**	**Various number of WTPs and degree of centralisation**	Huntly & Te Kauwhata & Ohinewai.	- WTP in one or multiple locations (Te Kauwhata, Huntly and/or Ohinewai). - Conveyance pipeline interconnecting two or three towns.	- Resilience / operational flexibility with centralised scheme and more than one WTP (e.g. Huntly / Ngaruawahia). - Fewer WTPs typically provides operational efficiencies & improved systems quality control. - Maximise reuse of existing assets (depending on sub-option). - Ability to stage WTP upgrades / degree of centralisation, which smooths capital spend. - Possibility of "global consenting" for water takes (e.g. transfer allocations).	- Few WTPs means decommissioning & writing off existing assets. - Uncertainty with growth is a challenge when selecting WTP locations/balancing demand over centralised system (existing vs future demand). - Inability to stage conveyance pipelines – sized for future demand, so large upfront capital cost without certainty of growth. - Large, long conveyance pipelines result in long water age / network quality issues plus higher pumping costs. - Plus site specific constraints for pipeline & WTP.			
4a	Centralised – 3 WTPs	Centralised scheme for mid-Waikato. 3 WTPs – Te Kauwhata, Ohinewai and Huntly (+ Ngaruawahia).	Centralised – Mid Waikato sub options.	Expanded/new Te Kauwhata WTP, new Ohinewai WTP, existing Huntly WTP.	- Resilience with multiple WTPs and interconnected. - Greatest flexibility in supply.	- Likely high capital cost.	~$73M (based on Beca, 2018, centralised options).		
4b	Centralised – 2 WTP	Centralised scheme for mid-Waikato. 2 WTPs – Te Kauwhata and Huntly.		Expanded/new Te Kauwhata WTP and Huntly WTP.	- Resilience with multiple WTPs and interconnected. - 2 WTPs located at location of greatest demand in existing locations.		~$57M (based on Beca, 2018, centralised options).		
4c	Centralised – 1 WTP – Ohinewai	Centralised scheme for mid-Waikato. 1 WTP – Ohinewai.		New Ohinewai WTP, decommission existing WTPs at Te Kauwhata & Huntly.	- Single plant/site. - Most central location geographically.	- Greatest cost – all new plant and decommission existing assets.	~$88M (based on Beca, 2018, centralised options).		
4d	Centralised – 1 WTP – TK	Centralised scheme for mid-Waikato. 1 WTP – Te Kauwhata.		Expanded/new Te Kauwhata WTP, decommission Huntly WTP.	- Single plant/site. - Location of greatest forecast growth - Reuse existing assets. - See advantages for WTP at Te Kauwhata above.	- Requires upgrade/new WTP at Te Kauwhata and possibly upgrade of Ngaruawahia WTP.	Similar or less than 4c.		
4e	Centralised – 1 WTP – Huntly	Centralised scheme for mid-Waikato. 1 WTP – Huntly.		Expand Huntly, decommission existing WTP at Te Kauwhata.	- Single plant/site. - Reuse existing assets.	- Require upgrade at Huntly WTP.	Similar or less than 4c.		
4f	Part Centralised – 2 WTPs not interconnected	Te Kauwhata + Ohinewai WTP / Huntly WTP.		TK WTP supplies Ohinewai, no pipeline from Ohinewai to Huntly.	- No upgrade to Huntly required.		~$35M (based on Beca, 2018).		
4g	Part Centralised – 2 WTPs not interconnected	Te Kauwhata WTP / Ohinewai + Huntly WTP.		Huntly WTP supplies Ohinewai, no pipeline from Ohinewai to TK.	- Shorter pipeline route.	- Upgrade to Huntly WTP required.	In order of Option 4f.		
5	**Centralised – Mid & North Waikato**	**Various number of WTPs and degree of centralisation.**	Huntly & Te Kauwhata & Ohinewai & Pokeno.	- WTP in one or multiple locations (Te Kauwhata, Huntly and/or Ohinewai) plus supply from Pokeno/Watercare. - Conveyance pipeline interconnecting towns from Pokeno to Huntly (& Ngaruawahia).	- Similar to Option 4 – Centralised Mid Waikato. - Possibility of connecting other areas (e.g. Mercer).	- Similar to Option 4 – Centralised Mid Waikato except longer pipelines. - Reliance on supply via Pokeno / Watercare. - Route may be challenging from Pokeno / Waikato WTP to Te Kauwhata.		Available allocation from Pokeno/Watercare is uncertain Confirm hydraulic capacity of new pipeline between Huntly and Ngaruawahia.	
5a	Centralised – 4 water supplies	Centralised scheme for upper and mid Waikato. 4 existing supplies upgraded – Pokeno, Te Kauwhata, Huntly and Ngaruawahia	Centralised – Mid & North Waikato sub options identified previously.	Expand Pokeno take (to 20MLD), Te Kauwhata WTP (to 20MLD), Huntly WTP (to 10MLD) and new Ngaruawahia WTP + intake (to 10MLD).	- Resilience with multiple WTPs & interconnected. - Greatest reuse of existing assets.	- Reliance on supply via Pokeno/Watercare. - High cost as all plants require upgrade + pipeline.	$93M (excl. $16M for existing pipeline Huntly to Ngaruawahia).	Available allocation from Pokeno/Watercare is uncertain Confirm hydraulic capacity of new pipeline between Huntly & Ngaruawahia.	Beca, 2018
5b	Centralised – 3 water supplies	Centralised scheme for upper and mid Waikato. 3 existing supplies upgraded – Pokeno, Te Kauwhata, and Huntly.		Expand Pokeno take (to 20MLD), Te Kauwhata WTP (to 20MLD), Huntly WTP (to 20MLD), decommission Ngaruawahia.	- Resilience with multiple WTPs & interconnected.	- Reliance on supply via Pokeno / Watercare. - High cost as all plants require upgrade + pipeline.	$81M (excl. $16M for existing pipeline Huntly to Ngaruawahia).	Available allocation from Pokeno/Watercare is uncertain Confirm hydraulic capacity of new pipeline between Huntly & Ngaruawahia.	Beca, 2018

No.	Option Name	Option Description	Site Location	Source / Site	Advantages/Opportunities	Disadvantages/Risks	Cost	Fatal Flaws	Previous Reports
5c	Centralised – 2 water supplies	Centralised scheme for upper and mid Waikato. 2 supplies – Pokeno and Ohinewai.		Expand Pokeno take (to 20MLD), new intake & plant at Ohinewai (40MLD). Decommission Te Kauwhata, Huntly and Ngaruawahia.	- Fewer plants to maintain.	- Reliance on supply via Pokeno/Watercare. - Least reuse of existing assets. - Greatest cost (new WTP vs several upgrades) + pipeline.	$112M (excl. $16M for existing pipeline Huntly to Ngaruawahia).	Available allocation from Pokeno/Watercare is uncertain Confirm hydraulic capacity of new pipeline between Huntly & Ngaruawahia.	Beca, 2018
6	**Out-of-district supply**	**Pipe treated water from outside of district – Sole or Supplementary Supply.**	All / some schemes.		- Similar to Options 4 & 5 in some respects. - Potentially better fit with future model of less water service providers.	- Similar to Options 4 & 5 in some respects except longer pipelines. - Reliance on external supply. - Lack of certainty of cost to ratepayers.		Similar to Options 4 & 5.	
6a	"Southern" Supply		Waiora WTP, Hamilton.		- additional resilience to Huntly via Central Waikato scheme if supplementary supply.. - Potentially better fit with future model of less water service providers.	- Willingness of HCC - $30M upgrade planned & water restrictions currently in place. - Waiora WTP located on south side of Hamilton. - Lack of certainty of cost to ratepayers. - Long pipelines, long water age & large capital & inability to stage (i.e. build for future demand). - plus site-specific constraints. (	$24M for 24km pipeline to TK + $23M for 23km pipeline TK to Huntly.	Available allocation from HCC in required timeframe is uncertain.	Beca, 2018 for pipeline costs.
6b	"Northern" supply		Pokeno/Watercare network, Waikato WTP.		- Additional resilience to Te Kauwhata / mid Waikato if centralised scheme. - Waikato WTP located to south of Pokeno. - Potentially better fit with future model of less water service providers.	- Willingness of Watercare. Pokeno is high growth area. - Lack of certainty of cost to ratepayers. - Long pipelines, long water age & large capital & inability to stage (i.e. build for future demand). - Route may be challenging from Pokeno/Waikato WTP to Te Kauwhata. - Plus site-specific constraints.	$24M for 24km pipeline to TK + $23M for 23km pipeline TK to Huntly.	Available allocation from Watercare in required timeframe is uncertain and less likely given Auckland's constraints.	Beca, 2018 for pipeline costs.
7	**Other Options**	**Reduce WTP demand / alternative source or treatment.**	All schemes.		- Specific to sub-option.	- Specific to sub-option.			
7a	Increased Reservoir Storage	Increased Reservoir storage to cover peak daily demand.	All schemes.			- Add on option, not solution for managing high growth.			MWH, 2014
7b	UWM and/or loss reduction		All schemes.			- Add on option, not solution for managing high growth.			MWH, 2014
7c	Wastewater reuse- non potable		District-wide.		- Linkage with wastewater options.	- Plus site-specific constraints / suitable reuse options.			
7d	Wastewater reuse – potable		District-wide.		- Linkage with wastewater options.	- Plus site-specific constraints / suitable reuse options.		Acceptability to public, iwi, MoH is a risk.	
7e	Alternative Source		All schemes.	Groundwater.		- Lead time to identify, investigate, consent and buy land. - Plus site-specific constraints.		Timelines to consent & procure may exceed required timeframe.	TK DBC, WDC, 2018
7f	Treatment Process		All schemes with upgrades.	Conventional / membrane.	- Both suitable for Waikato River water to achieve DWSNZ. - Flexibility to consider both options at next stage.		Typically, similar order of costs.	Adopt conventional treatment for purpose of strategic options.	Beca, 2018

4 Fatal Flaw Assessment

4.1 Fatal Flaw Criteria

The long list of options was assessed against the following criteria for fatal flaws:

1. Failure to meet statutory requirements (listed below),
2. Inability to accommodate the anticipated growth,
3. Inability to be delivered within the timeframe required to support anticipated growth in the project horizon (e.g. obtaining consents, securing access to land),
4. Terrain, sustainability and adaptability.

Statutory requirements include:

- Legislation (Resource Management Act, Local Government Act, Health Act,etc.), e.g. compliance with existing consents and Drinking Water Standards,
- National, regional and local policy requirements and rules (National Environmental Standards, National Policy Statements, operative and proposed regional and district plans etc.), and
- Other guidelines or requirements (Treaty Settlements, Drinking Water and Food Safety standards etc.).

Terrain, sustainability and adaptability includes consideration of issues such as long pipeline distances and difficult terrain making options impractical or uneconomic, high pumping costs, difficult operation and maintenance, long rising mains with associated septicity and odour potentially resulting in high chemical consumption (for wastewater) or long water age and water quality issues (for water) or requirement for dual pipelines, etc.

Options which satisfy these criteria will be progressed further and considered in more detail in the MCA.

4.2 Assessment

A fatal flaw assessment was conducted on the long list of options. The results of the assessment of wastewater options are shown in Table 4-1; 10 of the 20 overall wastewater options were identified as being fatally flawed. The results of the assessment of water options is shown in Table 4-2; of the 11 overall options 5 were identified as fatally flawed. All options identified as fatally flawed were not considered further.

Table 4-1: Fatal Flaw Assessment of Wastewater Options

Option	Option No.	Assessment Reasoning/Conclusion	Fatal Flaw
Status quo- “Do nothing” options for Huntly, Te Kauwhata and Meremere.	2f, 2n & 3b	This option does not meet the criteria of accommodating anticipated growth and does not meet statutory requirements. Not considered in the short list of options.	Yes (1,2)
“Do minimum” – upgrades to the existing Huntly and Te Kauwhata plants.	2e & 3a	Huntly experiences significant growth after 2029 which an upgraded plant will not be able to handle. Te Kauwhata discharge consent to Lake Waikare will end in 2023. Not considered in the short list of options.	Yes (1,2)
“Do minimum” – upgrades to the existing Meremere plant.	2m	Added to the short list of options, though considered as part of all options shortlisted.	No
Centralise all 4 catchments (Huntly, Ohinewai, Te Kauwhata and Meremere) at 1 WWTP.	1a, 2a, 2g, 2k, 2o, 3e, 3g, 3m & 3k	Difficult terrain between Meremere and Te Kauwhata. Not likely to be able to be centralised within this project timeframe. Possibility in the future. Not considered in the short list of options.	Yes (3,4)

Option	Option No.	Assessment Reasoning/Conclusion	Fatal Flaw
Centralise Te Kauwhata, Ohinewai and Huntly at 1 WWTP at either of the three locations. Meremere would be decentralised.	1b, 2b, 2h, 2p, 3d, 3h & 3n	Added to the short list of options.	No
Centralise Huntly and Ohinewai. Te Kauwhata and Meremere would remain decentralised.	1c, 2c, 2r, 3i & 3p	Added to the short list of options.	No
Centralise Te Kauwhata and Ohinewai. Meremere and Huntly would remain decentralised.	2i, 2s, 3e & 3q	Added to the short list of options.	No
Decentralised – 4 WWTPs.	1d, 2d, 2j, 2l, 2q, 3f, 3j & 3o	Added to the short list of options.	No
New individual WWTPs at Huntly and Te Kauwhata, combined discharge to Waikato river at Ohinewai.	2t	Added to the short list of options.	No
Out of region – convey and discharge WW to a WWTP out of the region to be treated.	5a, 5b & 5c	Significant distance and difficult terrain between the locations. Not considered in the short list of options.	Yes (4)
Discharge to Land from Te Kauwhata, Ohinewai and Meremere.	1e, 1f & 1g	Not feasible as there are no suitable areas of land around Te Kauwhata, Meremere and Ohinewai.	Yes (1,2)
Discharge to Lake from Meremere.	3l	Difficult due to the distance and terrain between Meremere and lakes in the region. Not added to short list of options.	Yes (4)
Groundwater recharge (discharge to groundwater via deep injection well or aquifer recharge) at any of the four sites.	4a, 4b, 4c, 4d	No precedent in NZ. Significant investigative work required to demonstrate feasibility and public health risks will put meeting project timeframes at risk	Yes (3)
Discharge to sea.	6	Difficult terrain and long distance to the sea makes this unfeasible. Not added to short list of options.	Yes (4)
Direct Potable reuse.	7	No precedent in NZ. Significant investigative work required to demonstrate feasibility and public health risks will put meeting project timeframes at risk.	Yes (3)
Indirect potable reuse.	8	No precedent in NZ. Significant investigative work required to demonstrate feasibility and public health risks will put meeting project timeframes at risk.	Yes (3)
Industrial, agricultural, forestry and horticulture reuse.	9	Added to the short list of options as a sub option.	No
Recycle treated water.	10	Added to the short list of options as a sub option.	No
Offset discharge by providing environmental impacts elsewhere.	11	Added to the short list of options as a sub option.	No
Site locations between Te Kauwhata and Huntly.	12, 13, 14, 15, 16, & 17	Added to the short list of options.	No

Table 4-2: Fatal Flaw Assessment of Water Options

Option	Option No.	Assessment Reasoning/Conclusion	Fatal Flaw
Decentralised – Status Quo ('Do nothing').	1	Not feasible as Te Kauwhata is already at capacity, will not be able to accommodate the growth. Not included in the short list of options.	Yes (2)
Decentralised – Huntly WTP stand alone.	2	Huntly needs to continue supplying Ngaruawahia, thus this option is not feasible. There are also reputational risks associated. Not included in the short list of options.	Yes (2)

Option	Option No.	Assessment Reasoning/Conclusion	Fatal Flaw
Decentralised – 2-3 WTPs (‘do minimum or ‘base case’).	3a and 3b 3c	Added to the short list of options but amend this option to reflect “do-minimum’ based on workshop discussion.	No
Centralised 3 WTPs.	4a	Added to the short list of options at this stage.	No
Centralised 2 WTPs.	4b	Added to the short list of options at this stage.	No
Centralised 1 WTP.	4c,4d & 4e	Added to the short list of options at this stage.	No
Partially Centralised – 2 WTPs not interconnected.	4f & 4g	Equivalent to Options 3a and 3b.	No
Centralised – Mid & North Waikato.	5a, 5b & 5c	There is no capacity at the Waikato WTP to accommodate the projected growth. Not included in short list of options.	Yes (2,4)
Out-of-District Supply.	6a & 6b	Waikato and Hamilton WTP’s are almost at capacity and it is not desirable having 1 WTP from a resilience aspect.	Yes (2,4)
Other options – reservoir storage, demand management and wastewater reuse.	7a, 7b, 7c & 7d	Added to the short list of options as sub options. Linkage to wastewater options	No
Other options – alternative source and treatment.	7e & 7f	Groundwater limited in area. Adopt conventional treatment as default for strategy; not strategic differentiator based on previous studies.	Yes (3)

It may be challenging to obtain new resource consents (either for water takes or treated wastewater discharges), secure access to land and procure new facilities within the required timeframes for many of the long-list options. However, only long-list options with no precedent in New Zealand and/or would require significant investigative work have been considered fatally flawed due to inability to meet project timeframes (fatal flaw 3). That being said, some of these options could be reconsidered in the future. The selected option therefore could be developed so as not to preclude the addition of such options in future.

In addition, some options indicated by the comment “added to the short list of options as a sub option” can be considered as part of any final solution and therefore have not been taken forward as a specific option. Rather these will be considered as future opportunities.

5 High Level Evaluation of Options

5.1 Wastewater Options

As a result of the fatal flaw assessment, the list of options was refined to 6 overall options (23 sub-options). The feasibility of these options was assessed through the consideration of factors such as consenting, site locations, conveyance and pumping (Table 5-1). The high-level evaluation of the wastewater options resulted in a final refined short list of 4 overall options (8 sub-options) to be considered in the MCA assessment (Table 5-2).

Table 5-1: Evaluation of Wastewater Options

Options	Location	Disposal	Option No.	In MCA (Yes/No)	Reasoning
Do Minimum - upgrade existing plant	Meremere	Waikato River		No	The "Do minimum" option for all plants is not a viable final option (does not meet the growth needs) but an interim option. The "Do minimum" option for Meremere only is not an option in itself but is included in all options below, thus it was not included in the MCA as a standalone option.
1 Centralised Plant for Te Kauwhata, Ohinewai and Huntly. Separate plant for Meremere	Te Kauwhata	Waikato River		No	No suitable site locations around Te Kauwhata for a centralised plant. (Te Kauwhata WWTP - site selection assessment, Beca Sept 2019)
		Lake Waikare		No	
	Ohinewai	Waikato River		No	See below - best site located between Te Kauwhata and Ohinewai
		Land		No	
		Lake		No	No sense in putting an additional discharge in the lake when the Te Kauwhata discharge needs to be removed. The Te Kauwhata discharge agreement states alternative disposal locations for the disposal of treated wastewater shall be investigated within 2 years of the commencement of the consent. As a minimum the document states land disposal should be investigated. Thus, the lake disposal option was ruled out.
	Huntly	Combined land and river	1a	Yes	Existing infrastructure and space for expansion. Potential land for WW discharge available within 13-16km.
		Waikato River	1b	Yes	Existing infrastructure and consent to discharge to river.
		Lake		No	No sense in going from a river discharge to a lake, as river has greater mixing and flushing abilities. Also, the lake is not future proofed due to the agreement as stated above.
	Between TK and Ohinewai	River	1c	Yes	Out of the three possible site locations (Te Kauwhata, Huntly and Ohinewai), the best location would be between Te Kauwhata and Ohinewai (largest future flows are from TK, more easily stageable, available land). Location of Plot 4 identified by the Te Kauwhata WWTP - Site selection assessment would be ideal. Land disposal can be ruled out due to proximity to irrigation schemes and distance from potential land disposal areas. Thus, only river disposal is considered for this option.
1 Centralised plant for Huntly and Ohinewai.	Ohinewai	Waikato River		No	This option is covered by the shortlisted option.
		Lake		No	As stated above.

Options	Location	Disposal	Option No.	In MCA (Yes/No)	Reasoning
Separate plants for Te Kauwhata and Meremere.	Huntly	Combined land and river	2a	Yes	As Huntly is the bigger centre, this would be the better site location for a combined plant. Large flows will not have to be pumped to the WWTP. Plus, this option uses existing infrastructure (lower carbon footprint, stageability). As the possible land disposal areas are near Huntly, both River and Land Disposal are considered.
		Waikato River	2b	Yes	
		Lake		No	As stated above.
1 Centralised plant for Te Kauwhata and Ohinewai. Separate plants for Huntly and Meremere.	Te Kauwhata	Waikato River		No	No suitable site locations around Te Kauwhata for a centralised plant. (*Te Kauwhata WWTP - site selection assessment, Beca Sept 2019*).
		Lake Waikare		No	
	Ohinewai	Waikato River		No	See below - best site located between Te Kauwhata and Ohinewai.
		Lake		No	As stated above.
	Between TK and Ohinewai - as close to Te Kauwhata as possible	River	3	Yes	The best location for a combined WWTP would ideally be as close to Te Kauwhata as possible to avoid the pumping of large flows. Land disposal can be ruled out due to proximity to irrigation schemes. Thus, only river disposal is considered for this option.
Decentralised 4 WWTP's	Meremere, Te Kauwhata, Ohinewai and Huntly have individual plants and individual discharges	Waikato River	4a	Yes	Lake disposal was taken out as stated above, therefore, only river disposal is being consider for plants in Meremere, Te Kauwhata and Ohinewai. For Huntly land and river disposal will be considered.
		Waikato River Combined land and river	4b	Yes	
New individual WWTPs at Huntly and Te Kauwhata, combined discharge to Waikato river at Ohinewai.		Waikato River		No	This option was scored poorly in '*Te Kauwhata WWTP Alternative Options Comparison, Beca Sept 2018*' and it is similar enough to other options shortlisted. Therefore, this option was not shortlisted.

The short list of options that will be considered in the MCA is summarised below:

Table 5-2: Short list of Wastewater Options

Option No.	Option	Site Location	Disposal Option
1a	1 Centralised Plant for Te Kauwhata, Ohinewai and Huntly. Separate plant for Meremere	Huntly	Combined land and river
1b	1 Centralised Plant for Te Kauwhata, Ohinewai and Huntly. Separate plant for Meremere	Huntly	Waikato River
1c	1 Centralised Plant for Te Kauwhata, Ohinewai and Huntly. Separate plant for Meremere	Between Te Kauwhata and Ohinewai.	Waikato River
2a	1 Centralised plant for Huntly and Ohinewai. Separate plants for Te Kauwhata and Meremere.	Huntly	Combined land and river

Option No.	Option	Site Location	Disposal Option
2b	1 Centralised plant for Huntly and Ohinewai. Separate plants for Te Kauwhata and Meremere.	Huntly	Waikato River
3	1 Centralised plant for Te Kauwhata and Ohinewai. Separate plants for Huntly and Meremere.	Between TK and Ohinewai - as close to Te Kauwhata as possible.	Waikato River
4a	Decentralised 4 WWTPs	Meremere, Te Kauwhata, Ohinewai and Huntly have individual plants and individual discharges.	Waikato River
4b	Decentralised 4 WWTPs	Meremere, Te Kauwhata, Ohinewai and Huntly have individual plants and individual discharges.	Waikato River, combined Land & river

5.2 Water Supply Options

As a result of the fatal flaw assessment, the long list of water options was refined to a short list of 7 options (Table 5.3) for consideration in the MCA assessment. Options 4f and 4g were also short-listed but were similar in concept as 3a and 3b so they were not considered as part of the MCA.

Table 5-3: Short list of Water Options

Option No.	Option Concept	WTP Location	Description
3a	Decentralised – 2-3 WTPs ('do minimum or 'base case')	Te Kauwhata, Huntly	Te Kauwhata - Existing intake + upgraded WTP (<2025). Huntly - Existing intake + upgraded WTP (<2030, including <2MLD to Ngaruawahia) Ohinewai - network serviced by Huntly WTP.
3b	Decentralised – 2-3 WTPs ('do minimum or 'base case')	Te Kauwhata, Huntly	Te Kauwhata - Existing intake + new WTP (<2025). Huntly - Existing intake + WTP (if demand from Ngaruawahia can be managed to 2050; upgrade needed for ultimate). Ohinewai - network serviced by Te Kauwhata WTP.
3c	Decentralised – 2-3 WTPs ('do minimum or 'base case')	Te Kauwhata, Huntly, Ohinewai	Te Kauwhata - New intake + upgraded WTP (<2025). Huntly - Existing intake + WTP (if demand from Ngaruawahia can be managed to 2050; upgrade needed for ultimate). Ohinewai - New intake + WTP
4a	Centralised 3 WTPs	Te Kauwhata, Huntly, Ohinewai	3 WTPs (like Option 3c), trunk main from Te Kauwhata to Huntly. Te Kauwhata - New intake + upgraded WTP (<2025) Huntly - Existing intake + WTP (if demand from Ngaruawahia can be managed to 2050; upgrade needed for ultimate). Ohinewai - New intake + WTP
4b	Centralised 2 WTPs	Te Kauwhata, Huntly	2 WTPs (like Option 3c/4a), trunkmain from Te Kauwhata to Huntly. Te Kauwhata - New intake + upgraded WTP (<2025) Huntly - Existing intake + WTP (if demand from Ngaruawahia can be managed to 2050; upgrade needed for ultimate). Ohinewai - network serviced primarily by Te Kauwhata WTP.
4c	Centralised 1 WTP	Ohinewai	1 WTP at Ohinewai, trunkmain from Te Kauwhata to Huntly. Ohinewai - New intake and WTP Te Kauwhata & Huntly - existing plants decommissioned, network serviced by Ohinewai WTP (including <2MLD to Ngaruawahia)
4d	Centralised 1 WTP	Te Kauwhata	1 WTP at Te Kauwhata, trunkmain from Te Kauwhata to Huntly. Te Kauwhata - New intake + upgraded WTP (<2025)

Option No.	Option Concept	WTP Location	Description
			Huntly & Ohinewai - existing Huntly plant decommissioned; network serviced by Te Kauwhata WTP (including <2MLD to Ngaruawahia)
4e	Centralised 1 WTP	Huntly	1 WTP at Huntly, trunkmain from Te Kauwhata to Huntly. Huntly - New intake + upgraded WTP (<2025) Te Kauwhata & Ohinewai - existing Te Kauwhata plant decommissioned; network serviced by Huntly WTP (including <2MLD to Ngaruawahia)

6 Multi Criteria Analysis

The Multi-Criteria Analysis (MCA) is used in this project to provide an auditable and defensible evaluation of the short-listed options.

Decisions are guided by rating the options against a set of chosen criteria[1]. The criteria are a combination of cost and non-cost factors, taking into account the social, cultural and environmental benefits of the options.

Each of the criteria is assigned a weighting to represent what is important when considering the ideal option.

6.1 MCA Criteria

The MCA criteria applied to each of the wastewater and water supply options is described in the following sections. The same criteria categories have been used for both wastewater and water and, as far as possible, a similar description for each criteria category has also been used. For clarity, a complete description for each category has been provided for wastewater and water.

6.1.1 Wastewater Options

- Natural Environment Improvement Capability *(**environment**):*
  - Water and sediment quality – potential effects on freshwater and marine receiving environments,
  - Microbial contamination – Potential effects on the health of marine organisms,
  - Aquatic ecology – Potential effects on aquatic ecosystems,
  - Terrestrial ecology – Potential effects on terrestrial ecosystems and soils,
  - Coastal environment and resources – potential effects on significant marine areas, coastal processes and physical footprint within the coastal marine area,
  - Micropollutants/emerging contaminants – Potential effects in the receiving environment of micropollutants/ emerging contaminants in treated wastewater.
- Public Health Protection/ Statutory Compliance *(**social**):*
  - Microbiological quality of treated wastewater – risk of public exposure to waterborne pathogens,
  - Health effects from spray irrigation/aerosols – risk of public exposure to pathogens from aerosols and/or aeration equipment,
  - Treated wastewater re-use – risk of contamination from reclaimed water,
  - Nuisances – odour, dust, insect, vectors and/or noise nuisances.
  - Ability to meet statutory requirements.
- Cultural Benefits/Impacts and Maori cultural values *(**cultural**):*
  - Mauri – potential adverse effects on mauri of land, water and air,
  - Kai Awa – Potential adverse effects on Kai Awa,
  - Cultural values – Potential adverse effects on the relationship of Maori and their culture and traditions,
  - Food gathering – Project enhances or detracts from people's ability to collect wild food within the area.
- Social and Community *(**social**):*
  - Amnesty value and aesthetics – option enhances the natural and built environment and minimises adverse effects, including displacement and disruption of existing persons and activities,
  - Urban development – option enables residential and industrial development,

[1] Criteria derived from Watercare. (2016). *Southwest Sub-regional Wastewater Treatment Plant Discharge to the Waiuku Estuary. Volume One: Assessment of Environmental Effects.*

  - Recreation – enhances or detracts from local recreational activities and opportunities,
  - Negative perceptions – adverse perceptions against the location of infrastructure facilities and discharge locations,
  - Vibrant community – lake water quality/ potential to increase uses for the lake. Positive perceptions of town form and function, influence on visitor attractiveness.
- Flexibility/Scalability/Risk *(**technical**):*
  - Adaptable and flexible – adapt to changing conditions such as increased flows and loads, discharge quality requirements, etc.,
  - Able to be staged - accommodate uncertainty around population/business growth,
  - Engineering Resilience – Sufficiently resilient, adaptable to and have significant risks managed of natural hazards, climate change and operational failure.
- Sustainability
  - Reliable, proven and robust modern-day technology – to be sustainable, must be proven technology with adequate redundancy,
  - Opportunity for resource recovery – the provision of beneficial reuse of treated wastewater,
  - Provide opportunities for the implementation of sustainable practices and technologies,
  - Contribution toward carbon neutrality and energy neutrality,
  - Disposal reuse and flexibilities,
  - Ability to be delivered quickly by local contractors.
- Whole of life *(**economic**):*
  - Operational costs and whole of life costs including capex,
  - Implementation costs,
  - Future local investment impacts,
  - Council rates recovery – potential to recover portion of operational costs.
- Constructability *(**technical**):*
  - Geology, soil, groundwater conditions – must be suited to local environmental conditions,
  - Buildability – must be able to be constructed at proposed locations,
  - Land Availability – adequate and secure land must be available,
  - Existing Infrastructure – potential to maximise existing infrastructure,
  - Safety and design – whole of life safety in design considerations,
  - Electricity availability.

6.1.2 Water Supply Options

- Natural Environment Improvement Capability *(**environment**):*
  - Sustainable use of water resources/reuse of treated wastewater for non-potable use,
  - Water and sediment quality – potential effects on freshwater and marine receiving environments,
  - Microbial contamination – Potential effects on the health of marine organisms,
  - Aquatic ecology – Potential effects on aquatic ecosystems,
  - Terrestrial ecology – Potential effects on terrestrial ecosystems and soils,
  - Fresh water environment and resources,
  - Micropollutants/emerging contaminants – Potential effects in the receiving environment of micropollutants/ emerging contaminants in treated wastewater,

  - Consentability.
- Public Health Protection/ Statutory Compliance ***(social)***:
  - Ability to meet statutory requirements - DWSNZ, NES,
  - Compliance with all health-based parameters (Maximum Acceptable Values - MAVs),
  - Compliance with aesthetic parameters (Guideline Values - GVs),
  - Consideration of intake location and treatment processes relative to WW discharge and other land uses,
  - Raw water quality - Waikato River or reuse of treated wastewater.
- Cultural Benefits/Impacts and Maori cultural values ***(cultural)***:
  - Mauri – potential adverse effects on mauri of land, water and air,
  - Kai Awa – Potential adverse effects on Kai Awa,
  - Cultural values – Potential adverse effects on the relationship of Maori and their culture and traditions,
  - Food gathering – Project enhances or detracts from people's ability to collect wild food within the area.
- Social and Community ***(social)***:
  - Amnesty value and aesthetics – option enhances the natural and built environment and minimises adverse effects, including displacement and disruption of existing persons and activities,
  - Urban development – option enables residential and industrial development,
  - Recreation – enhances or detracts from local recreational activities and opportunities,
  - Negative perceptions – adverse perceptions against the location of infrastructure facilities and discharge locations,
  - Vibrant community – lake water quality/ potential to increase uses for the lake. Positive perceptions of town form and function, influence on visitor attractiveness.
- Flexibility/Scalability/Risk ***(technical)***:
  - Adaptable and flexible – adapt to changing conditions such as increased demands and uncertainty of growth location,
  - Able to be staged - accommodate uncertainty around population/business growth,
  - Engineering Resilience – Sufficiently resilient, adaptable to and have significant risks managed of natural hazards, climate change and operational failure,
  - Ability to meet forecasted demand over the next 5-10 years,
  - Council ownership or alternative mechanism to ensure long term security of supply.
- Sustainability
  - Reliable, proven and robust modern-day technology – to be sustainable, must be proven technology with adequate redundancy,
  - Opportunity for loss prevention and demand management,
  - Opportunity to limit treatment for non-potable use,
  - Provide opportunities for the implementation of sustainable practices and technologies,
  - Contribution toward carbon neutrality and energy neutrality,
  - Disposal reuse and flexibilities,
  - Ability to be delivered quickly by local contractors.
- Whole of life ***(economic)***:
  - Operational costs and whole of life costs including capex,
  - Implementation costs,

  - Future local investment impacts,
  - Council rates recovery/LTP budget allocation – potential to recover portion of operational costs,
  - Sunk costs of existing assets.
- Constructability *(**technical**):*
  - Geology, soil, groundwater conditions – must be suited to local environmental conditions,
  - Buildability – must be able to be constructed at proposed locations,
  - Land Availability – adequate and secure land must be available,
  - Existing Infrastructure – potential to maximise existing infrastructure,
  - Safety and design – whole of life safety in design considerations,
  - Electricity availability.

6.1.3 MCA Criteria Weighting

The weighting of the criteria were discussed in Workshop 2 on 30 March 2020 where Pearl McFall, Richard Pullar, Stephan Howard, Sharon Danks, Pranavan Kasipillai and Peter Crabb from Watercare, Taljit Singh-Sandhu from Waikato District Council and Nick Dempsey, Julie Plessis, David Hume and Atisha Daya from Mott MacDonald, Kirsten Norquay and Alex Ross from Stantec were in attendance. Watercare then discussed the weighting allocations further and provided the final weightings that were in line with previous studies. The MCA criteria for both wastewater and water supply have been assigned weightings as per Table 6-1 below:

Table 6-1 - MCA Criteria Weighting For Wastewater and Water Supply

Criteria	Weighting
Natural Environment Improvement Capability	10%
Public Health Protection/Statutory Compliance	10%
Cultural Benefits/Impacts and Maori Cultural Values	20%
Social and Community	5%
Flexibility/Scalability/Risk	10%
Sustainability	15%
Whole of Life	20%
Constructability	10%
Total	**100%**

6.2 Multi Criteria Analysis (MCA)

An MCA workshop was conducted with Watercare on 17 April 2020 (wastewater options) and 20 April 2020 (water supply options), with the participation of Waikato District Council. The MCA tool was prepared and prepopulated prior to the workshop. During the workshop, each option selected in the high-level evaluation phase was presented and scored as per criteria listed above. The final MCA output incorporating feedback for Watercare received during and following the MCA workshop is shown below.

The summary of the wastewater MCA results is presented in Table 6.3 and the results of the water supply MCA in Table 6.4. Only the option number is provided in these tables, however a brief description of the option is provided in Table 5-2 and Table 5-3. The individual option analysis, including option schematic, is provided in Appendix A.

Table 6.2: MCA Colour Key

1	Significant adverse impact
2	Moderate adverse impact
3	Minor improvement
4	Moderate improvement
5	Significant improvement

Table 6.3: Wastewater MCA Summary

Options		1a		1b		1c		2a		2b		3		4a		4b	
Criteria	Weighting	Score	Reasoning	Score	Reasoning	Score	Reasoning	Score	Reasoning	Score	Reasoning	Score	Reasoning	Score	Reasoning	Score	Reasoning
Natural Environment Improvement Capability	10%	4	• WW from Huntly removed from Waikato river and in winter more dilution reduces environmental impact of discharge. •Potential for lower level of treatment as only discharging to river in winter. •Water will eventually reach streams/lake through land disposal but loads and concentrations will be lower than direct river discharge. •Risk of potential adverse effects on surface water (could be mitigated through deficit irrigation and separation distances from surface water). •Use of land disposal contaminates soil, potentially limiting alternative future uses.	3	•High level treatment will minimise effect on water quality and microbial contamination. •Loads and Concentration discharged higher than land disposal. •Disposal to river will have a higher dilution and mixing than lakes. •Single discharge has less dispersion in river compared with multiple discharges for the same load.	3	•High level treatment will minimise effect on water quality and microbial contamination. •Loads and Concentration discharged higher than land disposal. •Disposal to river will have a higher dilution and mixing than lakes. •Single discharge has less dispersion in river compared with multiple discharges for the same load.	3.5	• WW from Huntly removed from Waikato river and in winter more dilution reduces environmental impact of discharge. •Potential for lower level of treatment as only discharging to river in winter. •Water will eventually reach streams/lake through land disposal but loads and concentrations will be lower than direct river discharge. •Risk of potential adverse effects on surface water (could be mitigated through deficit irrigation and separation distances from surface water). •Use of land disposal contaminates soil, potentially limiting alternative future uses. •New discharge from Te Kauwhata into Waikato river. •Disposal to river will have a higher dilution and mixing than lakes. (TK).	3	•High level treatment will minimise effect on water quality and microbial contamination. •Loads and Concentration discharged higher than land disposal. •Disposal to river will have a higher dilution and mixing than lakes. •Multiple discharges to the river, more dispersion of the load.	3	•High level treatment will minimise effect on water quality and microbial contamination. •Loads and Concentration discharged higher than land disposal. •Disposal to river will have a higher dilution and mixing than lakes. •Multiple discharges to the river, more dispersion of the load.	3	•High level treatment will minimise effect on water quality and microbial contamination. •Loads and Concentration discharged higher than land disposal. •Disposal to river will have a higher dilution and mixing than lakes. •Multiple discharges to the river, more dispersion of the load.	3	• WW from Huntly removed from Waikato river and in winter more dilution reduces environmental impact of discharge. •Potential for lower level of treatment as only discharging to river in winter. •Water will eventually reach streams/lake through land disposal but loads and concentrations will be lower than direct river discharge. •Risk of potential adverse effects on surface water (could be mitigated through deficit irrigation and separation distances from surface water). •Use of land disposal contaminates soil, potentially limiting alternative future uses. •New discharge from Te Kauwhata and Ohinewai into Waikato river. •Disposal to river will have a higher dilution and mixing than lakes. (TK).

Options		1a		1b		1c		2a		2b		3		4a		4b	
Public Health Protection/Statutory Compliance	10%	4	•Conveyance line to land disposal area is treated wastewater so minimal risk of waterborne pathogens • Surface irrigation - restricted public access required to reduce risk of exposure of pathogens (Subsurface irrigation may not be suitable at this scale) •risk of contamination of groundwater and surface flow, can be managed through deficit irrigation •Removes Te Kauwhata discharge to Lake Waikare •Lower effluent standard may be permissible for discharge to land	4	•High level treatment will minimise effect on water quality and microbial contamination •Removes Te Kauwhata discharge to Lake Waikare •Potentially not consistent with the Te Kauwhata Discharge agreement with Waikato - Tainui to discharge to land •Single discharge at existing discharge point - easier consenting	3.5	•High level treatment will minimise effect on water quality and microbial contamination •Removes Te Kauwhata discharge to Lake Waikare •Potentially not consistent with the Te Kauwhata Discharge agreement with Waikato - Tainui to discharge to land •Single discharge consent makes for easier consenting but new consent point harder to get than existing consent	4	•Conveyance line to land disposal area is treated wastewater so minimal risk of waterborne pathogens • Surface irrigation - restricted public access required to reduce risk of exposure of pathogens (Subsurface irrigation may not be suitable at this scale) •risk of contamination of groundwater and surface flow, can be managed through deficit irrigation •Removes Te Kauwhata discharge to Lake Waikare •New Te Kauwhata discharge is upstream of Te Kauwhata water intake •Additional consent required to discharge Te Kauwhata to the Waikato river and land disposal. •Lower effluent standard may be permissible for discharge to land	3.5	•High level treatment will minimise effect on water quality and microbial contamination •Removes Te Kauwhata discharge to Lake Waikare •Potentially not consistent with the Te Kauwhata Discharge agreement with Waikato - Tainui to discharge to land •New Te Kauwhata discharge is upstream of Te Kauwhata water intake •Additional consent required to discharge Te Kauwhata to the Waikato river.	3.5	•High level treatment will minimise effect on water quality and microbial contamination •Removes Te Kauwhata discharge to Lake Waikare •Potentially not consistent with the Te Kauwhata Discharge agreement with Waikato - Tainui to discharge to land •New discharge is upstream of Te Kauwhata water intake •Additional consent required to discharge from combined plant to the Waikato river.	3.5	•High level treatment will minimise effect on water quality and microbial contamination •Removes Te Kauwhata discharge to Lake Waikare •Potentially not consistent with the Te Kauwhata Discharge agreement with Waikato - Tainui to discharge to land •Two new discharges upstream of Te Kauwhata water intake •Additional consent required to discharge Te Kauwhata and Ohinewai to the Waikato river.	4	•Conveyance line to land disposal area is treated wastewater so minimal risk of waterborne pathogens • Surface irrigation - restricted public access required to reduce risk of exposure of pathogens (Subsurface irrigation may not be suitable at this scale) •risk of contamination of groundwater and surface flow, can be managed through deficit irrigation •Removes Te Kauwhata discharge to Lake Waikare •New Te Kauwhata and Ohinewai discharges are upstream of Te Kauwhata water intake •Additional consent required for land disposal and to discharge Te Kauwhata and Ohinewai to the Waikato river. •Lower effluent standard may be permissible for discharge to land
Cultural Benefits/ Impacts on Maori Cultural values	20%	3	Placeholder – Cultural Benefits/Impacts to be addressed later by iwi •Likely to have only low effect on kai awa •Cultural preference of iwi is to discharge to land •Reduction of nutrients in river is in line with the Vision and Strategy. •Discharge removed from Lake Waikare (site of significance)	2	Placeholder – Cultural Benefits/Impacts to be addressed later by iwi •Cultural preference of iwi is to discharge to land •Improved effluent quality is in line with the Vision and Strategy. •Discharge removed from Lake Waikare (site of significance)	2	Placeholder – Cultural Benefits/Impacts to be addressed later by iwi •Cultural preference of iwi is to discharge to land •Improved effluent quality is in line with the Vision and Strategy. •Discharge removed from Lake Waikare (site of significance)	3	Placeholder – Cultural Benefits/Impacts to be addressed later by iwi •Likely to have only low effect on kai awa •Cultural preference of iwi is to discharge to land •Reduction of nutrients in river is in line with the Vision and Strategy. •Discharge removed from Lake Waikare (site of significance)	2	Placeholder – Cultural Benefits/Impacts to be addressed later by iwi •Potential effects on kai awa •Cultural preference of iwi is to discharge to land •Improved effluent quality is in line with the Vision and Strategy.	2	Placeholder – Cultural Benefits/Impacts to be addressed later by iwi •Potential effects on kai awa •Cultural preference of iwi is to discharge to land •Improved effluent quality is in line with the Vision and Strategy.	2	Placeholder – Cultural Benefits/Impacts to be addressed later by iwi •Potential effects on kai awa •Cultural preference of iwi is to discharge to land •Improved effluent quality is in line with the Vision and Strategy.	3	Placeholder – Cultural Benefits/Impacts to be addressed later by iwi •Likely to have only low effect on kai awa •Cultural preference of iwi is to discharge to land •Reduction of nutrients in river is in line with the Vision and Strategy. •Discharge removed from Lake Waikare (site of significance)

Options		1a		1b		1c		2a		2b		3		4a		4b	
Social and Community	5%	3.5	•If route of thermal explorer highway is followed for land disposal, disruption would be minimised as a lot of the traffic would go through the new Waikato highway instead. •Land disposal means potentially significant disruption to existing land use •Amenity value of river increased by removing discharges	4	•Site would be at adjacent to exiting WWTP - minimises effects on urban development •Removal of Te Kauwhata discharge to Lake Waikare reduces impact on the lake quality and thus negative perceptions	3.5	•Pipe will be installed along a road parallel to SH1, limiting disruption to traffic and new WWTP site •Removal of Te Kauwhata discharge to Lake Waikare reduces impact on the lake quality and thus negative perceptions	3.5	•If route of thermal explorer highway is followed, disruption would be minimised as a lot of the traffic would go through the new Waikato highway instead. •Land disposal means potentially significant disruption to existing land use •New discharge may be viewed negatively by the community and iwi.	4	•Reduced disruption along SH1 as the transmission pipeline is much shorter. •New discharge may be viewed negatively by the community and iwi.	4	• Transmission pipeline can be built along a road adjacent SH1 - reduced disruption on SH1. •WWTP built in greenfield area - less disruption to community •New discharge may be viewed negatively by the community and iwi.	3.5	• No long transmission pipelines along motorway but additional construction at WWTP •New discharges may be viewed negatively by the community and iwi.	3	•If route of thermal explorer highway is followed, disruption would be minimised as a lot of the traffic would go through the new Waikato highway instead. •Land disposal means potentially significant disruption to existing land use •New discharges may be viewed negatively by the community and iwi.
Flexibility/Scalability/ Risk	10%	2.5	•Land area specified for disposal likely able to accommodate growth. •Treatment less easily staged as flows from Te Kauwhata and Ohinewai are to be accommodated ASAP (Huntly only needed in 2029 however interim upgrades may be required as Huntly is non-compliant). •Land available for expansion of WWTP at Huntly •Irrigation land available for expansion. •Disposal pipeline cannot be staged. •Changes in weather patterns could influence efficiency of irrigation •Dual discharge provides resilience in emergency if consented •Least resilient with only 1 WWTP and long transmission distances. • Less central location of treatment plant less easily facilitates future connections in the growth corridor	3.5	• Less central location of treatment plant less easily facilitates future connections in the growth corridor •Option less likely to be staged as plant would need to treat flows from Te Kauwhata and Ohinewai. Thus, wouldn't be able to leave Huntly upgrades for the future. •Least resilient with only 1 WWTP and long transmission distances. •Space on site for future expansion	4	• Central location of treatment plant more easily facilitates future connections in the growth corridor •Option allows the staged upgrade of Te Kauwhata and Ohinewai initially and Huntly in 2029. •Least resilient with only 1 WWTP and long transmission distances. •Space on site for future expansion	3	•Land area specified for disposal should be able to accommodate growth. •Treatment can be staged. Land available for expansion at Huntly and potentially irrigation. •Disposal pipeline cannot be staged. •Changes in weather patterns could influence efficiency of irrigation •Dual discharge provides resilience in emergency if consented •Resilience from having multiple WWTP plants and shorter transmission distance • Less central location of treatment plant less easily facilitates future connections in the growth corridor	4	•Treatment can be staged. Land available for expansion at Huntly. •Resilience from having multiple WWTP plants and shorter transmission distance • Less central location of treatment plant less easily facilitates future connections in the growth corridor	4.5	•Possible addition of Huntly in the future - pipe from Ohinewai to WWTP could be sized to allow for this •Resilience from having multiple WWTP plants and shorter transmission distance • Central location of treatment plant facilitates future connections in the growth corridor	2.5	•Treatment can be staged as opposed to pipelines that generally need to be sized for ultimate growth •decentralised option potentially makes it more difficult to connect future growth outside of the service area and to change to centralised scheme later (negative perception, sunk capital) •Resilience from having multiple WWTP's • Depending on site location, future expansions will be possible	2	•Land area specified for disposal should be able to accommodate growth. •Treatment can be staged. Land available for expansion at Huntly and potentially irrigation. •decentralised option potentially makes it more difficult to connect future growth outside of the service area and to change to centralised scheme later (negative perception, sunk capital) •Disposal pipeline cannot be staged. •Changes in weather patterns could influence efficiency of irrigation •Dual discharge provides resilience in emergency if consented •Resilience from having multiple WWTP's

Options		1a		1b		1c		2a		2b		3		4a		4b	
Sustainability	15%	3.5	•Requires additional land purchase and retains surface water discharge in winter •Land disposal is used in NZ but this is a large scheme for NZ. •WWTP can reuse some existing infrastructure at Huntly (reduced embodied carbon) •Long transmission pipeline (increased embodied carbon) •Potential lower effluent standard for land disposal with savings in treatment. •Significant civil works required, can be delivered by local contractors	3.5	•MBR technology provides future proofing •Some infrastructure at existing Huntly WWTP can be reused (capital carbon savings) •Long pipelines (embodied carbon) •High rate treatment (operational carbon) •Significant civil works which can be delivered by local contractors	3.5	•MBR technology provides future proofing •Long pipelines (embodied carbon) •High rate treatment (operational carbon) •Significant civil works which can be delivered locally.	4	•Requires additional land purchase and retains surface water discharge in winter •Land disposal is used in NZ but this a large scheme for NZ. •MBR technology provides future proofing •Te Kauwhata, Meremere and Huntly can reuse some existing infrastructure (reduced embodied carbon) •High rate treatment (operational carbon) •Potential lower effluent standard for land disposal with savings in treatment. •Significant civil works which can be delivered by local contractors	3.5	•MBR technology provides future proofing •Te Kauwhata, Meremere and Huntly can reuse some existing infrastructure (reduced embodied carbon) •High rate treatment (operational carbon) •Significant civil works which can be delivered by local contractors	3.5	•MBR technology provides future proofing •New centralised plant (high capital carbon) •High rate treatment (operational carbon) •Significant civil works which can be delivered by local contractors	3.5	•MBR technology provides future proofing •Reuse of existing infrastructure at Te Kauwhata, Meremere and Huntly (reduces embodied carbon) •High rate treatment (operational carbon) •Reduced civil works which would be delivered by local contractors, more process work likely delivered by contractors from outside the region	4	•Requires additional land purchase and retains surface water discharge in winter •Land disposal is used in NZ, but this a large scheme for NZ. •MBR technology provides future proofing •Te Kauwhata, Meremere and Huntly can reuse some existing infrastructure (reduced embodied carbon) •High rate treatment (operational carbon) •Potential lower effluent standard for land disposal with savings in treatment. •Significant civil works which can be delivered by local contractors
Whole of life	20%	1	•Capex highest due to irrigation land purchase and conveyance pipeline. •Centralised plant - higher capital costs than decentralised plants •Reduced Opex as only 1 plant to run (operators only have to look after one plant vs 3) •Opex associated with pumping distances •Potential revenue stream through crop sales (e.g. haylage for stock feed; Fonterra impose restrictions, but other markets are available) •Increased consenting effort/costs due to land and river discharges	3	•Only 1 WWTP operate and maintain hence lower O&M costs (operators only have to look after 1 plant vs 3) •Higher capex than decentralised option •Opex associated with pumping distances	3	•Only 1 WWTP operate and maintain hence lower O&M costs (reduces number of sites operators have to visit) •Higher capex than decentralised option •Opex costs associated with long pumping distances	1	•Capex higher due to irrigation land and treated WW conveyance pipeline. •Increased O&M costs as there is an additional plant to run •Potential revenue stream through crop sales (e.g. haylage for stock feed; Fonterra impose restrictions, but other markets are available) •Increased consenting effort/costs due to land and river discharges •Reduced Opex associated with long pumping distances	3	•Capex lower than other options as there is a decentralised plant and less conveyance pipework •Increased O&M costs as there is an additional plant to run •Reduced Opex associated with long pumping distances	3	•Capex likely lower than centralised options as there is a decentralised plant and less conveyance pipework •Increased O&M costs as there is an additional plant to run •Reduced Opex associated with long pumping distances	3	•Capex of conveyance is reduced significantly •Capex for new site for Ohinewai WWTP and major upgrades at existing plants •Increased Opex and effort as 4 plants to run • Reduced Opex associated with long pumping distances	1	•Capex high due to irrigation land, new site for Ohinewai WWTP and major upgrades at existing plants •Increased O&M costs as there are 4 separate plants to run •Potential revenue stream through crop sales (e.g. haylage for stock feed; Fonterra impose restrictions, but other markets are available) •Increased consenting effort/costs due to land and river discharges • Reduced Opex associated with long pumping distances

Options		1a		1b		1c		2a		2b		3		4a		4b	
Constructability	10%	2	•Need to investigate ground conditions at Huntly. Potential preloading required at site. •Land adjacent to Huntly WWTP is owned by the council/designated •Services such as electricity and potable water will be readily available •Large land area required for irrigation, availability/acquisition of land. •Ohinewai to Huntly section of conveyance follows SH1. Huntly to Land disposal conveyance follows Thermal explorer highway	3.5	•Land adjacent to Huntly WWTP is owned by the council/designated •Need to investigate ground conditions at Huntly. Potential preloading required at site. •Availability of electricity and potable water	3.5	•Potential site location is on privately owned land •Confirmed suitable ground conditions •Greenfield Site •No availability of electricity and potable water	2.5	•Need to investigate ground conditions at Huntly and Te Kauwhata. Potential preloading required at both sites •Land adjacent to Huntly WWTP is owned by the council/designated •Services such as electricity and potable water will be readily available •Large land area required for irrigation, availability/acquisition of land. •Ohinewai to Huntly conveyance follows SH1. Huntly to Land disposal conveyance follows Thermal explorer highway	3.5	•Need to investigate ground conditions at Huntly and Te Kauwhata. Potential preloading required at both sites •Land adjacent to Huntly WWTP is owned by the council/designated •Services such as electricity and potable water will be readily available •Existing ponds can be used to buffer the flows	3.5	•Potential site location is on privately owned land •Confirmed suitable ground conditions •Greenfield Site •No availability of electricity and potable water	2.5	•Need to investigate ground conditions at Huntly and Te Kauwhata. Potential preloading required at site locations •Greenfield site for new plant at Ohinewai •Availability of services such as electricity and potable water in Huntly and Te Kauwhata but none available at Ohinewai	2.5	•Need to investigate ground conditions at Huntly and Te Kauwhata. Potential preloading required at both sites •Land adjacent to Huntly WWTP is owned by the council/designated •Land for Ohinewai WWTP needs to be acquired •Services such as electricity and potable water will be readily available at existing sites. •Large land area required for irrigation, availability/acquisition of land. •Huntly to Land disposal conveyance follows Thermal explorer highway
Score		**2.75**		**3.13**		**3.10**		**2.88**		**3.13**		**3.18**		**2.85**		**2.70**	

Table 6.4: Water Supply MCA Summary

		Decentralised – 2-3 WTPs ('do minimum or 'base case')		Decentralised – 2-3 WTPs ('do minimum or 'base case')		Decentralised – 2-3 WTPs ('do minimum or 'base case')		Centralised 3 WTPs		Centralised 2 WTPs		Centralised 1 WTP		Centralised 1 WTP		Centralised 1 WTP	
Options		3a		3b		3c		4a		4b		4c		4d		4e	
Criteria	Weighting	Score	Reasoning	Score	Reasoning	Score	Reasoning	Score	Reasoning	Score	Reasoning	Score	Reasoning	Score	Reasoning	Score	Reasoning
Natural Environment Impact Improvement Capability	10%	3	• Using existing intakes minimises additional disturbance to riverbed • Additional extraction from Waikato River due to growth & reticulation of Ohinewai. • Maximum consented take for Huntly (7MLD) exceeded in <2025 with Ohinewai (& supplementing Ngaruawahia) • Previously maximum agreed take with TKIA for Te Kauwhata exceeded (agreement expired 2016) but within consent limits • Reconsenting existing intakes/sites may be easier than consenting a new additional intake location /sites • Utilise existing residuals handling and disposal route minimises environmental impacts	3	• Using existing intakes minimises additional disturbance to riverbed • Additional extraction from Waikato River due to growth & reticulation of Ohinewai. • Maximum consented take (7MLD) for Huntly may be sufficient to 2050, depending on Ngaruawahia) • Previously maximum agreed take with TKIA for Te Kauwhata exceeded (agreement expired 2016) but within consent limits • Consenting new additional intake (Ohinewai) and new WTP site (Te Kauwhata) may be harder than reconsenting existing intakes/sites • Utilise existing residuals handling and disposal route minimises environmental impacts; may require new residuals handling and disposal route for Te Kauwhata	2	• Requires new intake at Ohinewai & Te Kauwhata - additional disturbance to riverbed • Additional extraction from Waikato River due to growth & reticulation of Ohinewai. • Maximum consented take (7MLD) for Huntly may be sufficient to 2050, depending on Ngaruawahia) • Consenting new additional intakes (Ohinewai, Te Kauwhata) and new WTP site (Ohinewai) may be harder than reconsenting existing intakes/sites • Requires new residuals handling and disposal route for Ohinewai to minimise environmental impacts	2	• Requires new intake at Ohinewai & Te Kauwhata - additional disturbance to riverbed • Additional extraction from Waikato River due to growth & reticulation of Ohinewai. • Maximum consented take (7MLD) for Huntly may be sufficient to 2050, depending on Ngaruawahia) • Consenting new additional intakes (Ohinewai, Te Kauwhata) and new WTP site (Ohinewai) may be harder than reconsenting existing intakes/sites • Requires new residuals handling and disposal route for Ohinewai to minimise environmental impacts	3	• Requires new intake at Te Kauwhata - additional disturbance to riverbed • Additional extraction from Waikato River due to growth & reticulation of Ohinewai. • Maximum consented take (7MLD) for Huntly may be sufficient to 2050, depending on Ngaruawahia) • Consenting new additional intakes (Te Kauwhata) may be harder than reconsenting existing intakes/sites • Utilise existing residuals handling, and disposal route minimises environmental impacts	3	• Requires new intake at Ohinewai and decommissioning of existing intakes - additional disturbance to riverbed • Additional overall extraction from Waikato River due to growth & reticulation of Ohinewai. • Consenting new intake & WTP site may be harder than reconsenting existing intakes/sites • Requires new residuals handling and disposal route for Ohinewai to minimise environmental impacts	3	• Requires new intake at Te Kauwhata and decommissioning of existing intake at Huntly - additional disturbance to riverbed • Additional extraction from Waikato River due to growth & reticulation of Ohinewai. • Consenting new additional intakes (Te Kauwhata) may be harder than reconsenting existing intakes/sites • Utilise existing residuals handling, and disposal route minimises environmental impacts	3	• Requires new intake at Huntly and, possibly, decommissioning of existing intake at Huntly - additional disturbance to riverbed • Additional extraction from Waikato River due to growth & reticulation of Ohinewai. • Consenting new intakes (Huntly) may be harder than reconsenting existing intakes/sites • Utilise existing residuals handling, and disposal route minimises environmental impacts

		Decentralised – 2-3 WTPs (‘do minimum or ‘base case’)		Decentralised – 2-3 WTPs (‘do minimum or ‘base case’)		Decentralised – 2-3 WTPs (‘do minimum or ‘base case’)		Centralised 3 WTPs		Centralised 2 WTPs		Centralised 1 WTP		Centralised 1 WTP		Centralised 1 WTP	
Options		3a		3b		3c		4a		4b		4c		4d		4e	
Public Health Protection/Statutory Compliance	10%	4	• Provision of reticulated potable water mitigates public health risks associated with untreated household supplies • High level of treatment means water supplies comply with current legislative requirements • Tighter process controls / more stringent monitoring more cost-effective at larger plants. • Uncertainty of condition and construction of existing Te Kauwhata intake and raw water system poses risk • No change in separation distance between water intakes and WWTP discharges on Waikato River •Existing treatment process can accommodate variation in river water quality; upgrade needed if reuse wastewater	4	• Provision of reticulated potable water mitigates public health risks associated with untreated household supplies • High level of treatment means water supplies comply with current legislative requirements • Tighter process controls / more stringent monitoring more cost-effective at larger plants. • Uncertainty of condition and construction of existing Te Kauwhata intake and raw water system poses risk • No change in separation distance between water intakes and WWTP discharges on Waikato River •Existing treatment process can accommodate variation in river water quality; upgrade needed if reuse wastewater	4	• Provision of reticulated potable water mitigates public health risks associated with untreated household supplies • High level of treatment means water supplies comply with current legislative requirements • Tighter process controls / more stringent monitoring less cost-effective at smaller plants. • Replacement of existing Te Kauwhata intake and raw water system reduces risk • Less separation distance between water intakes and WWTP discharges on Waikato River (Ohinewai ~5km downstream of Huntly WWTP) •Existing / new treatment process can accommodate variation in river water quality; upgrade needed if reuse wastewater	4	• Provision of reticulated potable water mitigates public health risks associated with untreated household supplies • High level of treatment means water supplies comply with current legislative requirements • Tighter process controls / more stringent monitoring less cost-effective at smaller plants. • Replacement of existing Te Kauwhata intake and raw water system reduces risk • Less separation distance between water intakes and WWTP discharges on Waikato River (Ohinewai ~5km downstream of Huntly WWTP) •Existing / new treatment process can accommodate variation in river water quality; upgrade needed if reuse wastewater	4	• Provision of reticulated potable water mitigates public health risks associated with untreated household supplies • High level of treatment means water supplies comply with current legislative requirements • Tighter process controls / more stringent monitoring more cost-effective at larger plants. • Replacement of existing Te Kauwhata intake and raw water system reduces risk • No change in separation distance between water intakes and WWTP discharges on Waikato River •Existing / new treatment process can accommodate variation in river water quality; upgrade needed if reuse wastewater	4	• brand new plant Provision of reticulated potable water mitigates public health risks associated with untreated household supplies • High level of treatment means water supplies comply with current legislative requirements • Tighter process controls / more stringent monitoring more cost-effective at smaller plants. • New intake and raw water system reduces risk • Less separation distance between water intakes and WWTP discharges on Waikato River (Ohinewai ~5km downstream of Huntly WWTP) •Existing / new treatment process can accommodate variation in river water quality; upgrade needed if reuse wastewater	4	• Provision of reticulated potable water mitigates public health risks associated with untreated household supplies • High level of treatment means water supplies comply with current legislative requirements • Tighter process controls / more stringent monitoring more cost-effective at larger plants. • Replacement of existing Te Kauwhata intake and raw water system reduces risk • No change in separation distance between water intakes and WWTP discharges on Waikato River •Existing / new treatment process can accommodate variation in river water quality; upgrade needed if reuse wastewater	4	• Provision of reticulated potable water mitigates public health risks associated with untreated household supplies • High level of treatment means water supplies comply with current legislative requirements • Tighter process controls / more stringent monitoring more cost-effective at larger plants. • New intake and raw water system reduces risk • No change in separation distance between water intakes and WWTP discharges on Waikato River •Existing / new treatment process can accommodate variation in river water quality; upgrade needed if reuse wastewater
Cultural Benefits/ Impacts on Maori Cultural values	20%	3	Placeholder - Cultural Benefits/Impacts to be addressed later by iwi • similar between options. No marked change from status quo.	3	Placeholder - Cultural Benefits/Impacts to be addressed later by iwi • similar between options. No marked change from status quo. • recent CIA available	2.5	Placeholder - Cultural Benefits/Impacts to be addressed later by iwi • similar between options. No marked change from status quo.	2.5	Placeholder - Cultural Benefits/Impacts to be addressed later by iwi • similar between options. No marked change from status quo.	3	Placeholder - Cultural Benefits/Impacts to be addressed later by iwi • similar between options. No marked change from status quo.	3	Placeholder - Cultural Benefits/Impacts to be addressed later by iwi • similar between options. No marked change from status quo.	3	Placeholder - Cultural Benefits/Impacts to be addressed later by iwi • similar between options. No marked change from status quo.	3	Placeholder - Cultural Benefits/Impacts to be addressed later by iwi • similar between options. No marked change from status quo.

		Decentralised – 2-3 WTPs ('do minimum or 'base case')		Decentralised – 2-3 WTPs ('do minimum or 'base case')		Decentralised – 2-3 WTPs ('do minimum or 'base case')		Centralised 3 WTPs		Centralised 2 WTPs		Centralised 1 WTP		Centralised 1 WTP		Centralised 1 WTP	
Options		3a		3b		3c		4a		4b		4c		4d		4e	
			• recent CIA available for Waikato River water take.		for Waikato River water take.		• recent CIA available for Waikato River water take.		• recent CIA available for Waikato River water take.		• recent CIA available for Waikato River water take.		• recent CIA available for Waikato River water take.		• recent CIA available for Waikato River water take.		• recent CIA available for Waikato River water take.
Social and Community	5%	4	•Provision of water supply to Ohinewai encourages development •Potential for increased property rates in Ohinewai (initial scheme / ongoing costs) and thus negative perceptions	4	•Provision of water supply to Ohinewai encourages development •Potential for increased property rates in Ohinewai (initial scheme / ongoing costs) and thus negative perceptions	4	•Provision of water supply to Ohinewai encourages development •Potential for increased property rates in Ohinewai (initial scheme / ongoing costs) and thus negative perceptions •Local employment due to WTP operation	4	•Provision of water supply to Ohinewai encourages development •Potential for increased property rates in Ohinewai (initial scheme / ongoing costs) and thus negative perceptions •Local employment due to WTP operation	4	•Provision of water supply to Ohinewai encourages development •Potential for increased property rates in Ohinewai (initial scheme / ongoing costs) and thus negative perceptions	4	•Provision of water supply to Ohinewai encourages development •Potential for increased property rates in Ohinewai (initial scheme / ongoing costs) and thus negative perceptions •Local employment due to WTP operation (albeit relocated from existing WTPs)	4	•Provision of water supply to Ohinewai encourages development •Potential for increased property rates in Ohinewai (initial scheme / ongoing costs) and thus negative perceptions	4	•Provision of water supply to Ohinewai encourages development •Potential for increased property rates in Ohinewai (initial scheme / ongoing costs) and thus negative perceptions
Flexibility/Scalability/ Risk	10%	3	•WTP upgrades can be staged, however Huntly WTP upgrade required in near future to accommodate Ohinewai (<2030) unless Ngaruawahia demands managed (e.g. WTP upgrade) •Pipeline from Huntly to Ohinewai needs to be sized for future flows, which may mean low flows and long water age in early years. Could size to give flexibility for future centralised scheme •Least resilient with only 1 WTP/source servicing each scheme and relatively long conveyance distances.	3.5	•WTP upgrades can be staged; new Te Kauwhata WTP can be built to allow for growth • Investing in area where greatest growth predicted and gives flexibility for future centralised scheme • No requirement to upgrade Huntly WTP (if Ngaruawahia demand can be managed) •Pipeline from Te Kauwhata to Ohinewai needs to be sized for future flows, which may mean low flows and long water age in early years •Least resilient with only 1 WTP/source servicing each scheme and relatively long conveyance distances.	2.5	•WTP upgrades can be staged • No requirement to upgrade Huntly WTP (if Ngaruawahia demand can be managed) •No long conveyance pipelines •Least resilient with only 1 WTP/source servicing each scheme. •Potential available space for future expansion of Te Kauwhata WTP (but not owned/ designated).	4	•WTP upgrades can be staged, and could potentially accommodate growth in Ngaruawahia • No requirement to upgrade Huntly WTP (if Ngaruawahia demand can be managed) •Long conveyance pipelines that need to be sized for future flows, which may mean low flows and long water age in early years •Most resilient with 3 WTPs/sources able to service centralised scheme. •Potential available space for future expansion of Te Kauwhata WTP (but	4	•WTP upgrades can be staged, , and could potentially accommodate growth in Ngaruawahia • No requirement to upgrade Huntly WTP (if Ngaruawahia demand can be managed) •Long conveyance pipelines that need to be sized for future flows, which may mean low flows and long water age in early years •Resilience provided as 2 WTPs/sources able to service centralised scheme. •Potential available space for future expansion of Te Kauwhata WTP (but	3	•WTP upgrades can be staged; new Ohinewai WTP can be built to allow for growth, and could potentially accommodate growth in Ngaruawahia • Investing near area where greatest growth predicted and gives flexibility for future centralised scheme beyond Mid Waikato •Long conveyance pipelines that need to be sized for future flows, which may mean low flows and long water age in early years •Least resilient with only 1 WTP/source to service centralised scheme.	3	•WTP upgrades can be staged, and could potentially accommodate growth in Ngaruawahia • Investing in area where greatest growth predicted and gives flexibility for future operation of centralised scheme •Long conveyance pipelines that need to be sized for future flows, which may mean low flows and long water age in early years •Least resilient with only 1 WTP/source to service centralised scheme. •Potential available space for future expansion of Te	3	•WTP upgrades can be staged, and could potentially accommodate growth in Ngaruawahia • Huntly WTP is furthest from area where greatest growth predicted in Mid Waikato •Long conveyance pipelines that need to be sized for future flows, which may mean low flows and long water age in early years •Least resilient with only 1 WTP/source to service centralised scheme.

		Decentralised – 2-3 WTPs (‘do minimum or ‘base case’)		Decentralised – 2-3 WTPs (‘do minimum or ‘base case’)		Decentralised – 2-3 WTPs (‘do minimum or ‘base case’)		Centralised 3 WTPs		Centralised 2 WTPs		Centralised 1 WTP		Centralised 1 WTP		Centralised 1 WTP	
Options		3a		3b		3c		4a		4b		4c		4d		4e	
			•Potential available space for future expansion of Te Kauwhata WTP (but not owned/ designated). Not for Huntly WTP		•Potential available space for future expansion of Te Kauwhata WTP (but not owned/designated).				not owned/designated).		not owned/designated).		•Need to procure/consent sufficient space for future expansion of new WTP		Kauwhata WTP (but not owned/designated).		
Sustainability	15%	4	•Treatment can be staged/upgraded for future proofing, but pipelines need to be sized for future flows •Infrastructure at existing Te Kauwhata WTP and Huntly WTP can be reused (capital carbon savings) •Long pipelines (embodied carbon) •High level of treatment (operational carbon)	3.5	•Treatment can be staged/upgraded for future proofing but pipelines need to be sized for future flows •Infrastructure at existing Te Kauwhata WTP abandoned ("sunk" capital carbon) •Infrastructure at existing Huntly WTP can be reused (capital carbon savings) •Long pipelines (embodied carbon) •High level of treatment (operational carbon)	3	•Treatment can be staged/upgraded for future proofing and no long conveyance pipelines •Infrastructure at existing Te Kauwhata WTP and Huntly WTP can be reused (capital carbon savings) •Existing water intake and possibly raw water main infrastructure retained by TKIA •New raw water supply main and additional WTP at Ohinewai but no long conveyance pipelines (embodied carbon) •High level of treatment (operational carbon)	2	•Treatment can be staged/upgraded for future proofing but pipelines need to be sized for future flows •Infrastructure at existing Te Kauwhata WTP and Huntly WTP can be reused (capital carbon savings) •Existing water intake and possibly raw water main infrastructure retained by TKIA •New raw water supply main, long conveyance pipelines and additional WTP at Ohinewai (embodied carbon) •High level of treatment (operational carbon)	3	•Treatment can be staged/upgraded for future proofing but pipelines need to be sized for future flows •Infrastructure at existing Te Kauwhata WTP and Huntly WTP can be reused (capital carbon savings) •Existing water intake and possibly raw water main infrastructure retained by TKIA •New raw water supply main and long conveyance pipelines (embodied carbon) •High level of treatment (operational carbon)	2	•Treatment can be staged/upgraded for future proofing but pipelines need to be sized for future flows •Infrastructure at existing Te Kauwhata WTP and Huntly WTP decommissioned ("sunk" capital carbon) •Existing water intake and possibly raw water main infrastructure retained by TKIA •Additional WTP at Ohinewai and long conveyance pipelines (embodied carbon) •High level of treatment (operational carbon)	2.5	•Treatment can be staged/upgraded for future proofing but pipelines need to be sized for future flows •Infrastructure at existing Te Kauwhata WTP can be reused (capital carbon savings) •Existing water intake and possibly raw water main infrastructure retained by TKIA •Infrastructure at existing Huntly WTP decommissioned ("sunk" capital carbon) •New raw water supply main and long conveyance pipelines (embodied carbon) •High level of treatment (operational carbon)	2.5	•Treatment can be staged/upgraded for future proofing but pipelines need to be sized for future flows •Infrastructure at existing Huntly could be reused (capital carbon savings) •Infrastructure at existing Te Kauwhata WTP decommissioned ("sunk" capital carbon) but TKIA retains intake & raw water main •Long conveyance pipelines (embodied carbon) •High level of treatment (operational carbon)

		Decentralised – 2-3 WTPs (‘do minimum or ‘base case’)		Decentralised – 2-3 WTPs (‘do minimum or ‘base case’)		Decentralised – 2-3 WTPs (‘do minimum or ‘base case’)		Centralised 3 WTPs		Centralised 2 WTPs		Centralised 1 WTP		Centralised 1 WTP		Centralised 1 WTP	
Options		3a		3b		3c		4a		4b		4c		4d		4e	
Whole of life	20%	4	•Only 2 WTPs to operate and maintain hence lower O&M costs • For servicing Ohinewai, pipeline from Huntly to Ohinewai may be lower capex than Option 3b (shorter pipeline); similar order to Option 3c but can't be staged (TBC). •Ongoing pumping costs, which are larger for Option 3a and 3b than Option 3c (TBC) •Greater rating base to cover capital upgrade costs	3.5	•Only 2 WTPs to operate and maintain hence lower O&M costs • For servicing Ohinewai, pipeline from Te Kauwhata to Ohinewai may be higher capex than Option 3a (longer pipeline); similar order to Option 3c but can't be staged (TBC). •Ongoing pumping costs, which are larger for Option 3a and 3b than Option 3c (TBC) •Greater rating base to cover capital upgrade costs	3	•3 WTPs to operate and maintain hence higher O&M costs • Similar order of costs to Option 3a & 3b but can be staged (TBC). •Greater rating base to cover capital upgrade costs	2	•3 WTPs to operate and maintain hence higher O&M costs • Greater order of costs to Options 3c, with greater upfront cost of trunk main (TBC). • Ongoing pumping costs •Greater rating base to cover capital upgrade costs	3	•Only 2 WTPs to operate and maintain hence lower O&M costs • Lower overall order of costs to Option 4a, but same upfront cost of trunkmain (TBC). • Ongoing pumping costs •Greater rating base to cover capital upgrade costs	2	•Only 1 WTP to operate and maintain hence some reduction in O&M costs • Likely to be higher overall order of costs to Option 4b as new WTP to service Mid Waikato and decommissioning of existing plants, but same upfront cost of trunkmain (TBC). • Ongoing pumping costs •Greater rating base to cover capital upgrade costs	2.5	•Only 1 WTP to operate and maintain hence some reduction in O&M costs • Likely to be higher overall order of costs to Option 4b as significant upgrade and decommissioning of assets, but same upfront cost of trunkmain (TBC). • Ongoing pumping costs •Greater rating base to cover capital upgrade costs	2.5	•Only 1 WTP to operate and maintain hence some reduction in O&M costs • Likely to be higher overall order of costs to Option 4b as significant upgrade and decommissioning of assets, but same upfront cost of trunkmain (TBC) • Ongoing pumping costs •Greater rating base to cover capital upgrade costs
Construct-ability	10%	3	•Additional land near existing Te Kauwhata WWTP needs to be procured by the council/designated but suitable ground conditions and availability of electricity •May be difficult to expand Huntly WTP? •Pipeline route within Huntly may be challenging (TBC) •No need to investigate/consent/ procure new site & intake at Ohinewai	3	•Land for new Te Kauwhata WWTP needs to be procured by the council/designated. Uncertainty with ground conditions and availability of electricity (site dependent, TBC) •No need to expand Huntly WTP (if demand from Ngaruawahia can be managed) •Pipeline route to Te Kauwhata may be challenging (TBC) •No need to investigate/consent/procure new site & intake at Ohinewai	2	•Additional land near existing Te Kauwhata WWTP needs to be procured by the council/designated but suitable ground conditions and availability of electricity •No need to expand Huntly WTP (if demand from Ngaruawahia can be managed) •Need to investigate/consent/ procure new site & intake at Ohinewai and new intake & raw water pipeline route at Te Kauwhata	2	•Additional land near existing Te Kauwhata WWTP needs to be procured by the council/designated but suitable ground conditions and availability of electricity •No need to expand Huntly WTP (if demand from Ngaruawahia can be managed) •Need to investigate/consent/ procure new site & intake at Ohinewai and new intake & raw water pipeline route at Te Kauwhata •Pipeline route from Te Kauwhata to	3	•Additional land near existing Te Kauwhata WWTP needs to be procured by the council/designated but suitable ground conditions and availability of electricity •No need to expand Huntly WTP (if demand from Ngaruawahia can be managed) •Need to investigate/consent/ procure new intake & raw water pipeline route at Te Kauwhata •Pipeline route from Te Kauwhata to Ohinewai and within	2	•Need to investigate/consent/ procure new site & intake at Ohinewai with unknown ground conditions, availability of electricity and access to residual disposal route	3	•Additional land near existing Te Kauwhata WWTP needs to be procured by the council/designated but suitable ground conditions and availability of electricity •Need to investigate/consent/ procure new intake & raw water pipeline route at Te Kauwhata •Pipeline route from Te Kauwhata to Ohinewai and within Huntly may be challenging (TBC)	2	•May be difficult to expand Huntly WTP to service Mid Waikato? Need to investigate/consent/ procure new intake & upgrade options (or new site?) •Pipeline route from Te Kauwhata to Ohinewai and within Huntly may be challenging (TBC)

		Decentralised – 2-3 WTPs (‘do minimum or ‘base case’)		Decentralised – 2-3 WTPs (‘do minimum or ‘base case’)		Decentralised – 2-3 WTPs (‘do minimum or ‘base case’)		Centralised 3 WTPs		Centralised 2 WTPs		Centralised 1 WTP		Centralised 1 WTP		Centralised 1 WTP	
Options		3a		3b		3c		4a		4b		4c		4d		4e	
									Ohinewai and within Huntly may be challenging (TBC)		Huntly may be challenging (TBC)						
Score		**3.5**		**3.4**		**2.8**		**2.6**		**3.3**		**2.7**		**3**		**2.9**	

7 Next Steps

As a result of the MCA, the following wastewater options scored the highest and were short-listed:

- 1b – Centralised treatment plant for 3 catchments (Huntly, Te Kauwhata, Ohinewai) located at Huntly and separate MBR at Meremere, both discharging to the Waikato River,
- 1c – Centralised treatment plant for 3 catchments (Huntly, Te Kauwhata, Ohinewai) located between Ohinewai and Te Kauwhata, and separate MBR at Meremere, both discharging to the Waikato River,
- 2b – Centralised treatment plant for 2 catchments (Huntly, Ohinewai) located at Huntly and separate MBRs at Te Kauwhata and Meremere, all discharging to the Waikato River,
- 3 – Centralised treatment plant for 2 catchments (Te Kauwhata, Ohinewai) located between Te Kauwhata and Ohinewai, and separate MBRs at Huntly and Meremere, all discharging to the Waikato River.

The three highest scoring water supply options were Option 3a, 3b and 4b. Of the three options, Option 4b provides the most resilience as it involves creating a centralised scheme for Mid Waikato, with a WTP located at each end of Mid Waikato (namely Te Kauwhata to the north and Huntly to the south) that can service Ohinewai and supplement water demand as required via a centralised pipeline. Whereas Options 3a and 3b can be considered as essentially stages of Option 4b. Hence, rather than short-listing Options 3a, 3b and 4b, it was agreed with Watercare to investigate sub-options and staging of Option 4b and develop a few short-list water supply options for further analysis.

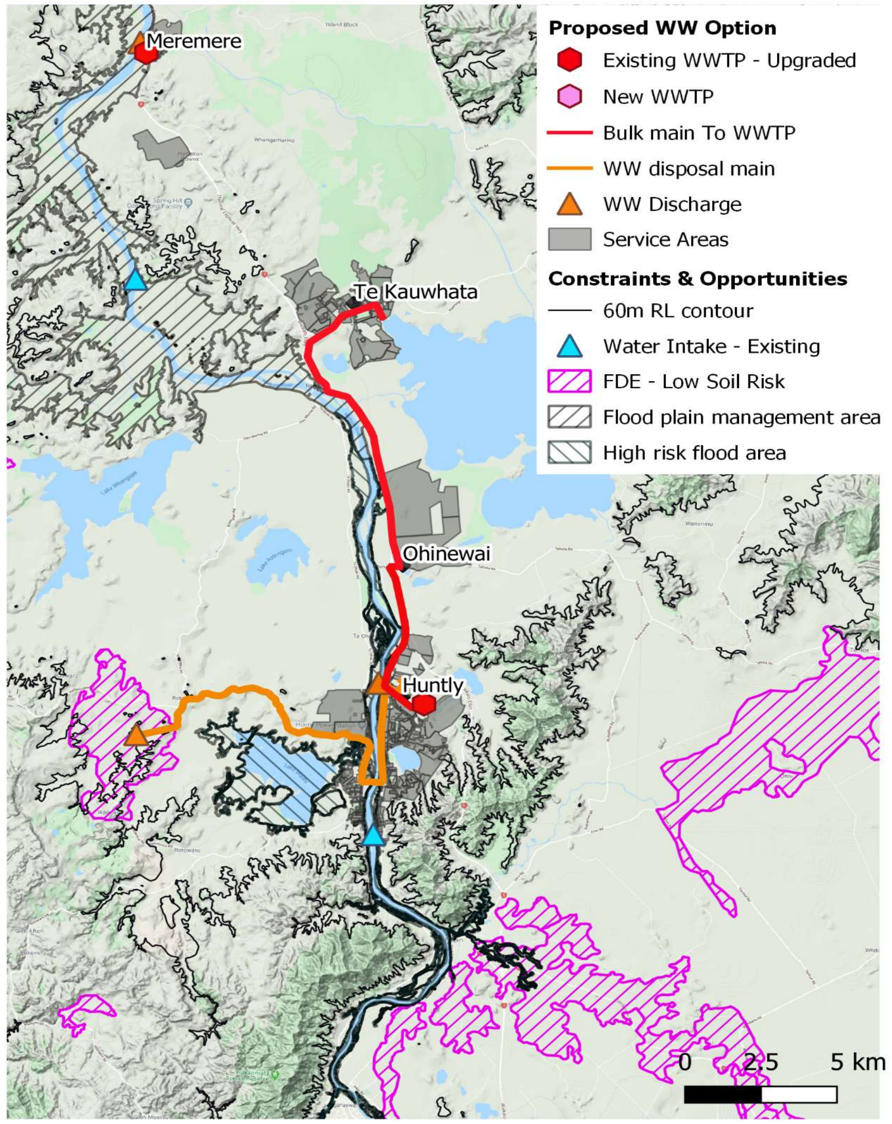
It was agreed to develop the short-listed options (Options 1b, 1c, 2b and 3 for wastewater and variations on Option 4b for water) in more detail, prepare high-level cost estimates and carry out a MCA for the purpose of developing a long-term wastewater and water supply strategy to enable rapid growth predicted in the Mid-Waikato.

As mentioned above, long-list options were discarded in the fatal flaw assessment due to inability to meet project timeframes, as it may be challenging to obtain new resource consents, secure access to land and procure new facilities within the required timeframes for many of the long-list options. However, some of these options could be reconsidered in the future. The selected option therefore could be developed so as not to preclude the addition of such options in future.

In addition, some “sub options” can be considered as part of any final solution and therefore have not been taken forward as a specific option. Rather these will be considered as future opportunities.

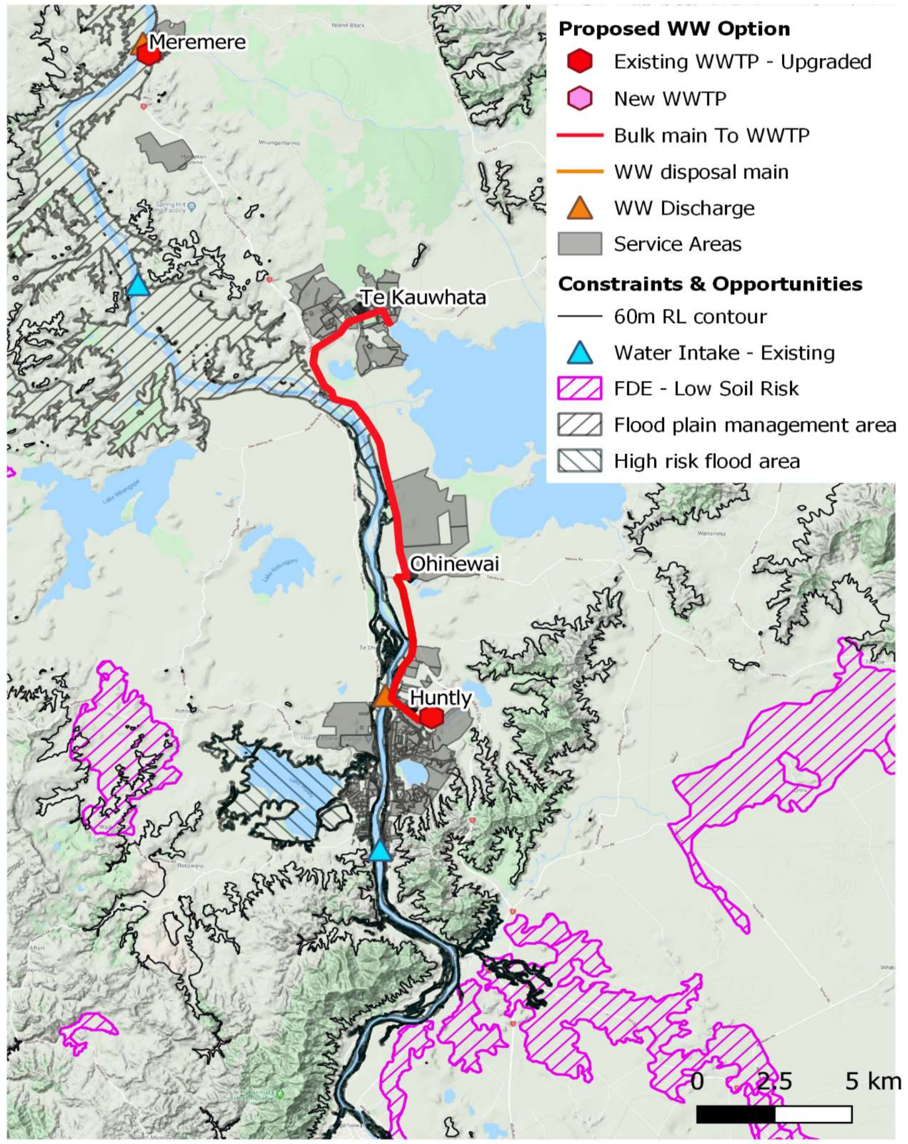
A. Options Analysis

WASTEWATER OPTIONS



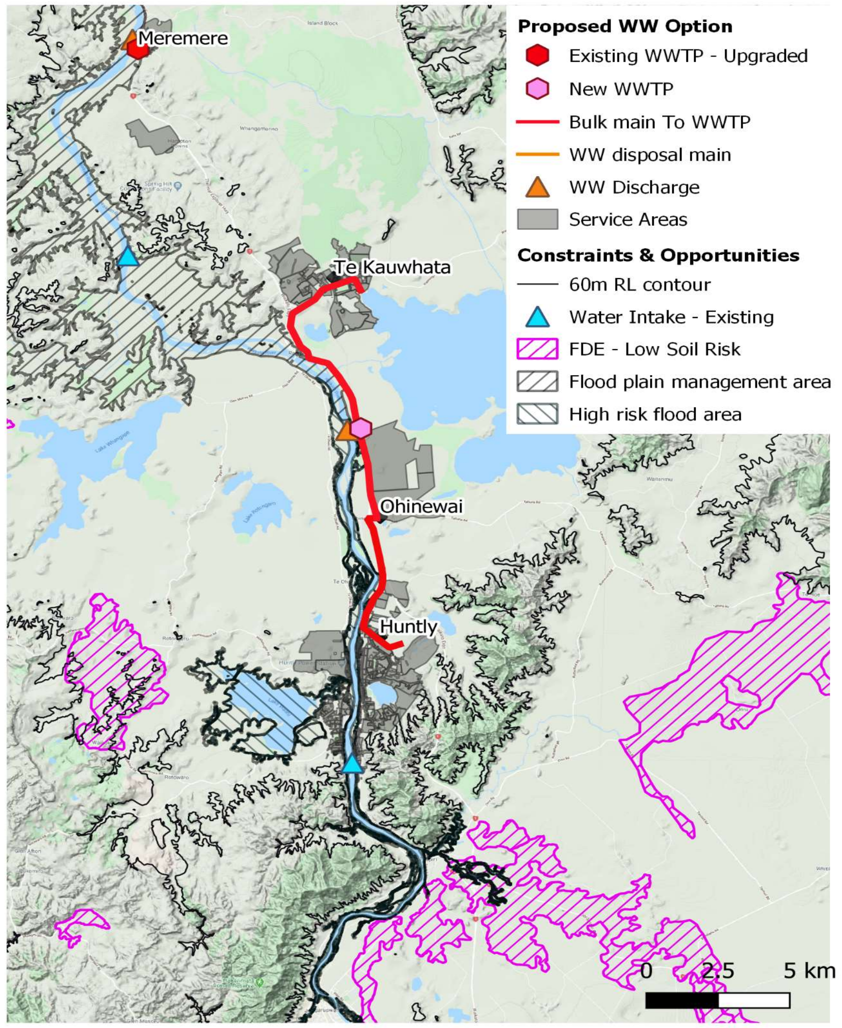
Option 1a			Centralised - 1 WWTP for Huntly, Ohienewai and Te Kauwhata catchments and separate plant for Meremere	
Criteria	Description/ Key Aspects of Criteria	Weighting	High rate treatment plant such as MBR located at Huntly, discharging to land (deficit irrigation) in summer and some discharges to river in winter. Individual MBR at Meremere discharging to the Waikato river.	
			Score	Reasoning
Natural Environment Improvement Capability	•Water and sediment quality •Microbial Contamination •Aquatic ecology •Terrestrial Ecology •Coastal Environment and resources •Micropollutants/emerging contaminants	10%	4	• WW from Huntly removed from Waikato river and in winter more dilution reduces environmental impact of discharge. •Potential for lower level of treatment as only discharging to river in winter •Water will eventually reach streams/lake through land disposal but loads and concentrations will be lower than direct river discharge. •Risk of potential adverse effects on surface water (could be mitigated through deficit irrigation and separation distances from surface water) •Use of land disposal contaminates soil, potentially limiting alternative future uses.
Public Health Protection / Statutory Compliance	•Microbiological quality of treated wastewater •Health effects from sprays irrigation/aerosols •Treated wastewater re-use •Nuisances •Ability to meet statutory requirements	10%	4	•Conveyance line to land disposal area is treated wastewater so minimal risk of waterborne pathogens • Surface irrigation - restricted public access required to reduce risk of exposure of pathogens (Subsurface irrigation may not be suitable at this scale) •risk of contamination of groundwater and surface flow, can be managed through deficit irrigation •Removes Te Kauwhata discharge to Lake Waikare •Lower effluent standard may be permissible for discharge to land
Cultural Benefits/ Impacts on Maori Cultural values	•Mauri •Kai Awa •Cultural Values •Food gathering	20%	3	•Likely to have only low effect on kai awa •Cultural preference of iwi is to discharge to land •Reduction of nutrients in river is in line with the Vision and Strategy. •Discharge removed from Lake Waikare (site of significance)
Social and Community	•Amenity value and aesthetics •Urban development •Recreation •Negative perceptions •Vibrant community	5%	3.5	•If route of thermal explorer highway is followed for land disposal, disruption would be minimised as a lot of the traffic would go through the new Waikato highway instead. •Land disposal means potentially significant disruption to existing land use •Amenity value of river increased by removing discharges
Flexibility/Scalability / Risk	•Adaptable and flexible •Able to be staged •Engineering resilience	10%	2.5	•Land area specified for disposal should be able to accommodate growth. •Treatment less easily staged as flows from Te Kauwhata and Ohinewai are to be accommodated ASAP (Huntly only needed in 2029 however interim upgrades may be required as Huntly is non-compliant). •Land available for expansion of WWTP at Huntly •Irrigation land available for expansion. •Disposal pipeline cannot be staged. •Changes in weather patterns could influence efficiency of irrigation •Dual discharge provides resilience in emergency if consented •Least resilient with only 1 WWTP and long transmission distances. • Less central location of treatment plant less easily facilitates future connections in the growth corridor
Sustainability	•Reliable, proven and robust modern-day technology •Opportunity for resource recovery •Opportunities for implementation of sustainable practices and technologies •Carbon and energy neutrality •Disposal reuse and flexibilities •Ability to be delivered quickly by local contractors	15%	3.5	•Requires additional land purchase and retains surface water discharge in winter •Land disposal is used in NZ but this is a large scheme for NZ. •WWTP can reuse some existing infrastructure at Huntly (reduced embodied carbon) •Long transmission pipeline (increased embodied carbon) •Potential lower effluent standard for land disposal with savings in treatment. •Significant civil works required, can be delivered by local contractors
Whole of life	•Operational costs and whole of life costs including capex •Implementation costs •Future local investment impacts •Council rates recovery	20%	1	•Capex highest due to irrigation land purchase and conveyance pipeline. •Centralised plant - higher capital costs than decentralised plants •Reduced Opex as only 1 plant to run (operators only have to look after one plant vs 3) •Opex associated with pumping distances •Potential revenue stream through crop sales (e.g. haylage for stock feed; Fonterra impose restrictions, but other markets are available) •Increased consenting effort/costs due to land and river discharges
Constructability	•Geology, soil, groundwater conditions •Buildability •Land Availability •Existing Infrastructure •Safety and Design •Electricity Availability	10%	2	•Need to investigate ground conditions at Huntly. Potential preloading required at site. •Land adjacent to Huntly WWTP is owned by the council/designated •Services such as electricity and potable water will be readily available •Large land area required for irrigation, availability/acquisition of land. •Ohinewai to Huntly section of conveyance follows SH1. Huntly to Land disposal conveyance follows Thermal explorer highway
Score			**2.75**	

WASTEWATER OPTIONS



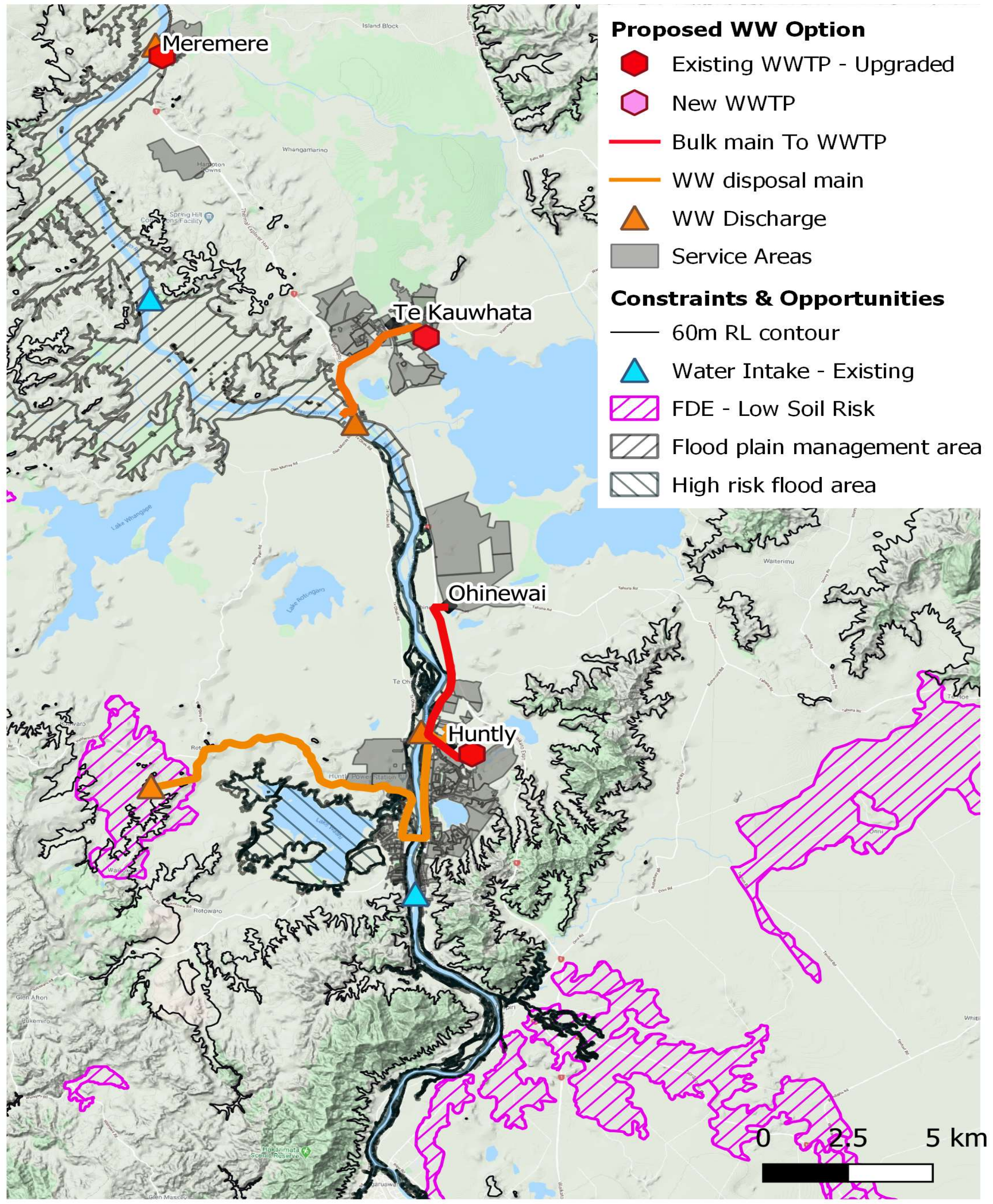
Option 1b			Centralised - 1 WWTP for Huntly, Ohienewai and Te Kauwhata catchments and separate plant for Meremere	
Criteria	Description/ Key Aspects of Criteria	Weighting	High rate treatment plant such as MBR located at Huntly, discharging to the Waikato river. Individual MBR at Meremere discharging to the Waikato river.	
			Score	Reasoning
Natural Environment Improvement Capability	•Water and sediment quality •Microbial Contamination •Aquatic ecology •Terrestrial Ecology •Coastal Environment and resources •Micropollutants/emerging contaminants	10%	3	•High level treatment will minimise effect on water quality and microbial contamination •Loads and Concentration discharged higher than land disposal •Disposal to river will have a higher dilution and mixing than lakes. •Single discharge has less dispersion in river compared with multiple discharges for the same load
Public Health Protection / Statutory Compliance	•Microbiological quality of treated wastewater •Health effects from sprays irrigation/aerosols •Treated wastewater re-use •Nuisances •Ability to meet statutory requirements	10%	4	•High level treatment will minimise effect on water quality and microbial contamination •Removes Te Kauwhata discharge to Lake Waikare •Potentially not consistent with the Te Kauwhata Discharge agreement with Waikato - Tainui to discharge to land •Single discharge at existing discharge point - easier consenting
Cultural Benefits/ Impacts on Maori Cultural values	•Mauri •Kai Awa •Cultural Values •Food gathering	20%	2	•Cultural preference of iwi is to discharge to land •Improved effluent quality is in line with the Vision and Strategy. •Discharge removed from Lake Waikare (site of significance)
Social and Community	•Amenity value and aesthetics •Urban development •Recreation •Negative perceptions •Vibrant community	5%	4	•Site would be at adjacent to exiting WWTP - minimises effects on urban development •Removal of Te Kauwhata discharge to Lake Waikare reduces impact on the lake quality and thus negative perceptions
Flexibility/Scalability/ Risk	•Adaptable and flexible •Able to be staged •Engineering resilience	10%	3.5	• Less central location of treatment plant less easily facilitates future connections in the growth corridor •Option less likely to be staged as plant would need to treat flows from Te Kauwhata and Ohinewai. Thus, wouldn't be able to leave Huntly upgrades for the future. •Least resilient with only 1 WWTP and long transmission distances. •Space on site for future expansion
Sustainability	•Reliable, proven and robust modern-day technology •Opportunity for resource recovery •Opportunities for implementation of sustainable practices and technologies •Carbon and energy neutrality •Disposal reuse and flexibilities •Ability to be delivered quickly by local contractors	15%	3.5	•MBR technology provides future proofing •Some infrastructure at existing Huntly WWTP can be reused (capital carbon savings) •Long pipelines (embodied carbon) •High rate treatment (operational carbon) •Significant civil works which can be delivered by local contractors
Whole of life	•Operational costs and whole of life costs including capex •Implementation costs •Future local investment impacts •Council rates recovery	20%	3	•Only 1 WWTP operate and maintain hence lower O&M costs (operators only have to look after 1 plant vs 3) •Higher capex than decentralised option •Opex associated with pumping distances
Constructability	•Geology, soil, groundwater conditions •Buildability •Land Availability •Existing Infrastructure •Safety and Design •Electricity Availability	10%	3.5	•Land adjacent to Huntly WWTP is owned by the council/designated •Need to investigate ground conditions at Huntly. Potential preloading required at site. •Availability of electricity and potable water
Score			**3.125**	

WASTEWATER OPTIONS



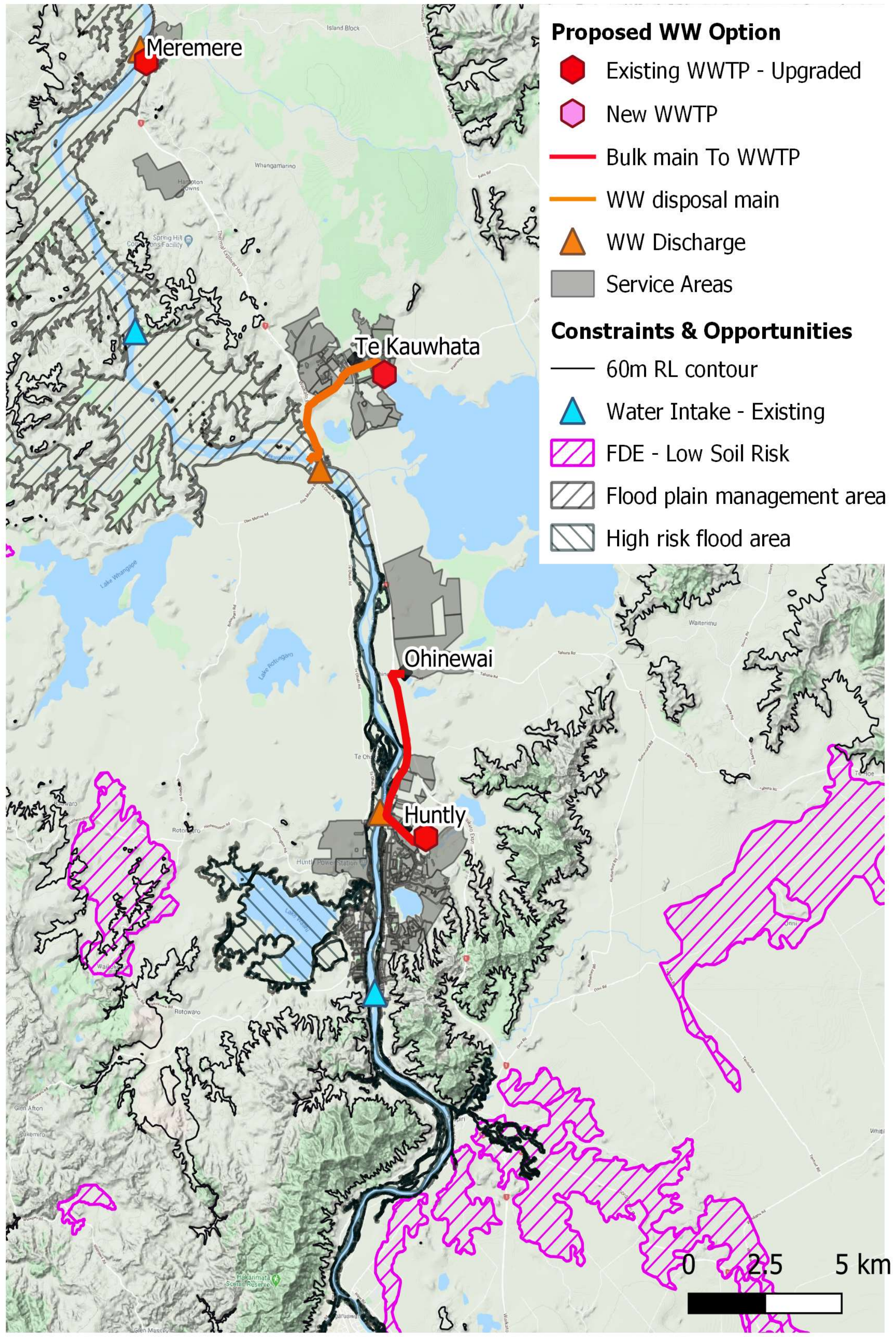
Option 1c			Centralised - 1 WWTP for Huntly, Ohienewai and Te Kauwhata catchments and separate plant for Meremere	
Criteria	Description/ Key Aspects of Criteria	Weighting	High rate treatment plant such as MBR located between Te Kauwhata and Ohinewai discharging to the Waikato river. Meremere MBR discharging to Waikato river.	
			Score	Reasoning
Natural Environment Improvement Capability	•Water and sediment quality •Microbial Contamination •Aquatic ecology •Terrestrial Ecology •Coastal Environment and resources •Micropollutants/emerging contaminants	10%	3	•High level treatment will minimise effect on water quality and microbial contamination •Loads and Concentration discharged higher than land disposal •Disposal to river will have a higher dilution and mixing than lakes. •Single discharge has less dispersion in river compared with multiple discharges for the same load
Public Health Protection / Statutory Compliance	•Microbiological quality of treated wastewater •Health effects from sprays irrigation/aerosols •Treated wastewater re-use •Nuisances •Ability to meet statutory requirements	10%	3.5	•High level treatment will minimise effect on water quality and microbial contamination •Removes Te Kauwhata discharge to Lake Waikare •Potentially not consistent with the Te Kauwhata Discharge agreement with Waikato - Tainui to discharge to land •Single discharge consent makes for easier consenting but new consent point harder to get than existing consent
Cultural Benefits/ Impacts on Maori Cultural values	•Mauri •Kai Awa •Cultural Values •Food gathering	20%	2	•Cultural preference of iwi is to discharge to land •Improved effluent quality is in line with the Vision and Strategy. •Discharge removed from Lake Waikare (site of significance)
Social and Community	•Amenity value and aesthetics •Urban development •Recreation •Negative perceptions •Vibrant community	5%	3.5	•Pipe will be installed along a road parallel to SH1, limiting disruption to traffic and new WWTP site •Removal of Te Kauwhata discharge to Lake Waikare reduces impact on the lake quality and thus negative perceptions
Flexibility/Scalability/ Risk	•Adaptable and flexible •Able to be staged •Engineering resilience	10%	4	corridor •Option allows the staged upgrade of Te Kauwhata and Ohinewai initially and Huntly in 2029. •Least resilient with only 1 WWTP and long transmission distances. •Space on site for future expansion
Sustainability	•Reliable, proven and robust modern-day technology •Opportunity for resource recovery •Opportunities for implementation of sustainable practices and technologies •Carbon and energy neutrality •Disposal reuse and flexibilities •Ability to be delivered quickly by local contractors	15%	3.5	•MBR technology provides future proofing •Long pipelines (embodied carbon) •High rate treatment (operational carbon) •Significant civil works which can be delivered locally.
Whole of life	•Operational costs and whole of life costs including capex •Implementation costs •Future local investment impacts •Council rates recovery	20%	3	•Only 1 WWTP operate and maintain hence lower O&M costs (reduces number of sites operators have to visit) •Higher capex than decentralised option •Opex costs associated with long pumping distances
Constructability	•Geology, soil, groundwater conditions •Buildability •Land Availability •Existing Infrastructure •Safety and Design •Electricity Availability	10%	3.5	•Potential site location is on privately owned land •Confirmed suitable ground conditions •Greenfield Site •No availability of electricity and potable water
Score			**3.1**	

WASTEWATER OPTIONS



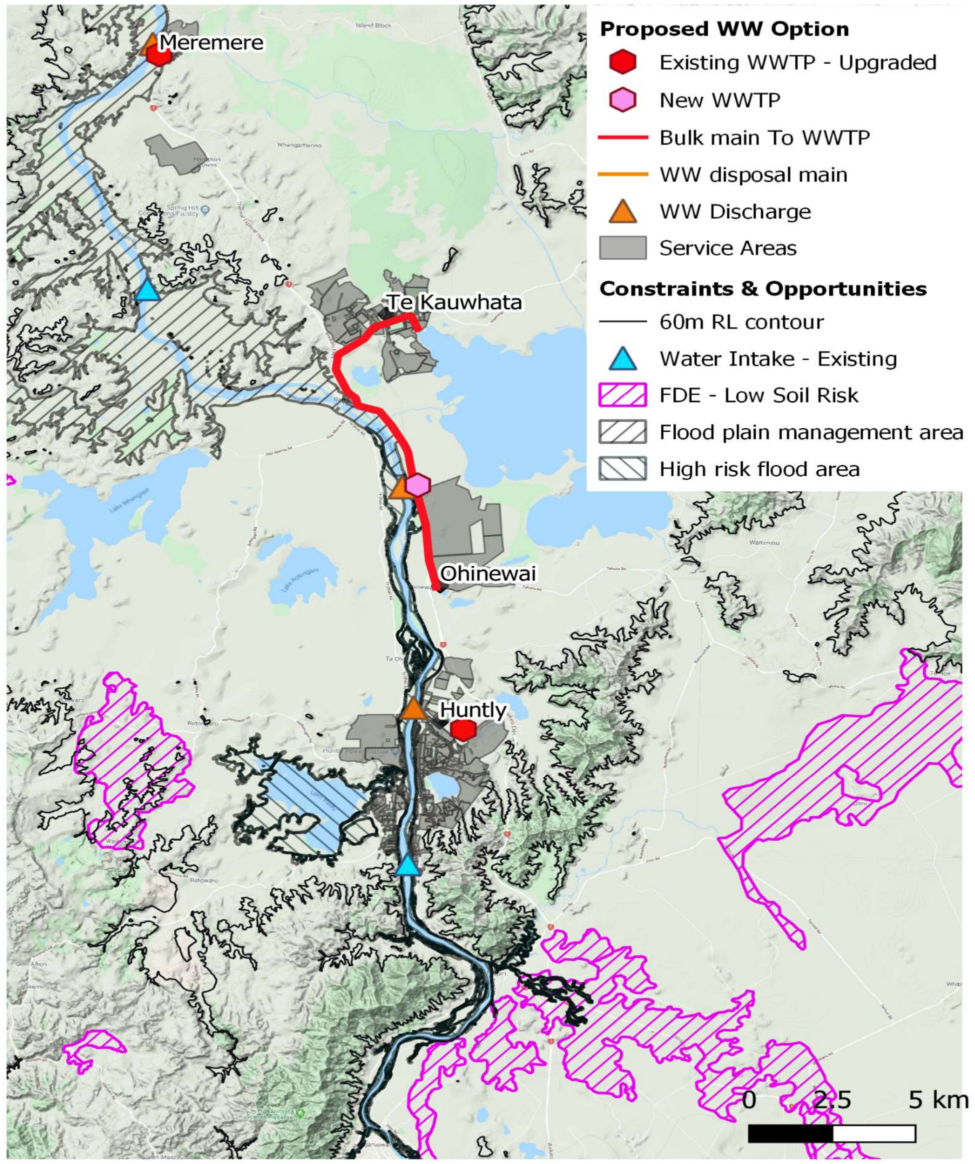
Option 2a			Centralised - 1 WWTP for Ohienewai and Huntly catchments. Separate plant for Te Kauwhata and Meremere	
Criteria	Description/ Key Aspects of Criteria	Weighting	High rate treatment plant such as MBR located at Huntly to treat Huntly and Ohinewai with a land disposal (deficit irrigation) in summer and some discharges to river in winter. It is assumed existing ponds at Huntly WWTP will be used for peak flow storage. Individual MBR's at Meremere and Te Kauwhata discharging to the Waikato River.	
			Score	Reasoning
Natural Environment Improvement Capability	•Water and sediment quality •Microbial Contamination •Aquatic ecology •Terrestrial Ecology •Coastal Environment and resources •Micropollutants/emerging contaminants	10%	3.5	discharge. •Potential for lower level of treatment as only discharging to river in winter •Water will eventually reach streams/lake through land disposal but loads and concentrations will be lower than direct river discharge. •Risk of potential adverse effects on surface water (could be mitigated through deficit irrigation and separation distances from surface water) •Use of land disposal contaminates soil, potentially limiting alternative future uses. •New discharge from Te Kauwhata into Waikato river •Disposal to river will have a higher dilution and mixing than lakes. (TK)
Public Health Protection/Statutory Compliance	•Microbiological quality of treated wastewater •Health effects from sprays irrigation/aerosols •Treated wastewater re-use •Nuisances •Ability to meet statutory requirements	10%	4	•Conveyance line to land disposal area is treated wastewater so minimal risk of waterborne pathogens • Surface irrigation - restricted public access required to reduce risk of exposure of pathogens (Subsurface irrigation may not be suitable at this scale) •risk of contamination of groundwater and surface flow, can be managed through deficit irrigation •Removes Te Kauwhata discharge to Lake Waikare •New Te Kauwhata discharge is upstream of Te Kauwhata water intake •Additional consent required to discharge Te Kauwhata to the Waikato river and land disposal. •Lower effluent standard may be permissible for discharge to land
Cultural Benefits/ Impacts on Maori Cultural values	•Mauri •Kai awa •Cultural Values •Food gathering	20%	3	•Likely to have only low effect on kai awa •Cultural preference of iwi is to discharge to land •Reduction of nutrients in river is in line with the Vision and Strategy. •Discharge removed from Lake Waikare (site of significance)
Social and Community	•Amenity value and aesthetics •Urban development •Recreation •Negative perceptions •Vibrant community	5%	3.5	•If route of thermal explorer highway is followed, disruption would be minimised as a lot of the traffic would go through the new Waikato highway instead. •Land disposal means potentially significant disruption to existing land use •New discharge may be viewed negatively by the community and iwi.
Flexibility/Scalability/ Risk	•Adaptable and flexible •Able to be staged •Engineering resilience	10%	3	•Land area specified for disposal should be able to accommodate growth. •Treatment can be staged. Land available for expansion at Huntly and potentially irrigation. •Disposal pipeline cannot be staged. •Changes in weather patterns could influence efficiency of irrigation •Dual discharge provides resilience in emergency if consented •Resilience from having multiple WWTP plants and shorter transmission distance • Less central location of treatment plant less easily facilitates future connections in the growth corridor
Sustainability	•Reliable, proven and robust modern-day technology •Opportunity for resource recovery •Opportunities for implementation of sustainable practices and technologies •Carbon and energy neutrality •Disposal reuse and flexibilities •Ability to be delivered quickly by local contractors	15%	4	•Requires additional land purchase and retains surface water discharge in winter •Land disposal is used in NZ but this a large scheme for NZ. •MBR technology provides future proofing •Te Kauwhata, Meremere and Huntly can reuse some existing infrastructure (reduced embodied carbon) •High rate treatment (operational carbon) •Potential lower effluent standard for land disposal with savings in treatment. •Significant civil works which can be delivered by local contractors
Whole of life	•Operational costs and whole of life costs including capex •Implementation costs •Future local investment impacts •Council rates recovery	20%	1	•Capex higher due to irrigation land and treated WW conveyance pipeline. •Increased O&M costs as there is an additional plant to run •Potential revenue stream through crop sales (e.g. haylage for stock feed; Fonterra impose restrictions, but other markets are available) •Increased consenting effort/costs due to land and river discharges •Reduced Opex associated with long pumping distances
Constructability	•Geology, soil, groundwater conditions •Buildability •Land Availability •Existing Infrastructure •Safety and Design •Electricity Availability	10%	2.5	•Need to investigate ground conditions at Huntly and Te Kauwhata. Potential preloading required at both sites •Land adjacent to Huntly WWTP is owned by the council/designated •Services such as electricity and potable water will be readily available •Large land area required for irrigation, availability/acquisition of land. •Ohinewai to Huntly conveyance follows SH1. Huntly to Land disposal conveyance follows Thermal explorer highway
Score			**2.875**	

WASTEWATER OPTIONS



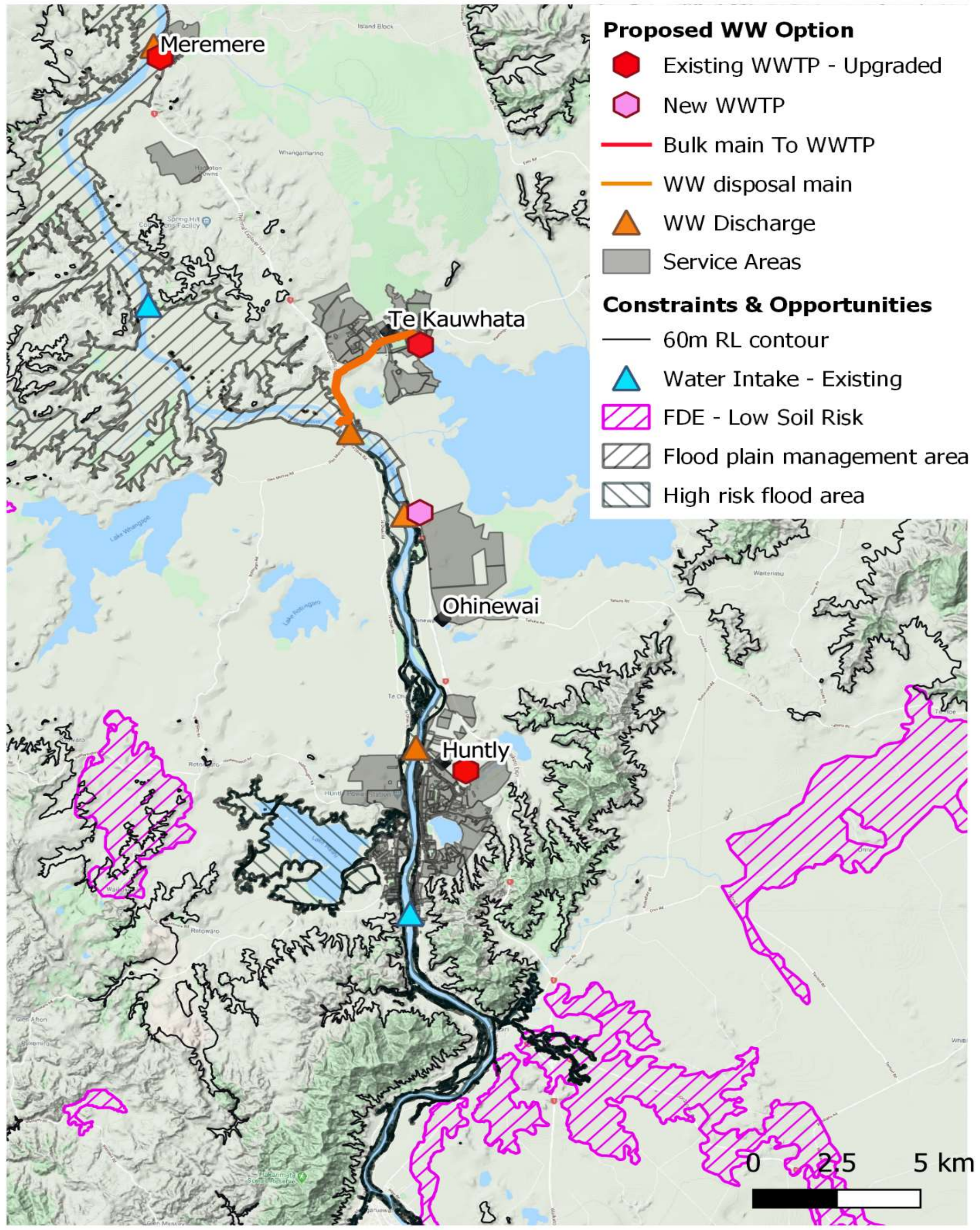
Option 2b			Centralised - 1 WWTP for Ohienewai and Huntly catchments. Separate plant for Te Kauwhata and Meremere	
Criteria	Description/ Key Aspects of Criteria	Weighting	High rate treatment plant such as MBR located at Huntly to treat Huntly and Ohinewai with a River disposal. Individual MBR's at Meremere and Te Kauwhata discharging to the Waikato River.	
			Score	Reasoning
Natural Environment Improvement Capability	•Water and sediment quality •Microbial Contamination •Aquatic ecology •Terrestrial Ecology •Coastal Environment and resources •Micropollutants/emerging contaminants	10%	3	•High level treatment will minimise effect on water quality and microbial contamination •Loads and Concentration discharged higher than land disposal •Disposal to river will have a higher dilution and mixing than lakes. •Multiple discharges to the river, more dispersion of the load
Public Health Protection/Statutory Compliance	•Microbiological quality of treated wastewater •Health effects from sprays irrigation/aerosols •Treated wastewater re-use •Nuisances •Ability to meet statutory requirements	10%	3.5	•High level treatment will minimise effect on water quality and microbial contamination •Removes Te Kauwhata discharge to Lake Waikare •Potentially not consistent with the Te Kauwhata Discharge agreement with Waikato - Tainui to discharge to land •New Te Kauwhata discharge is upstream of Te Kauwhata water intake •Additional consent required to discharge Te Kauwhata to the Waikato river.
Cultural Benefits/ Impacts on Maori Cultural values	•Mauri •Kai awa •Cultural Values •Food gathering	20%	2	•Potential effects on kai awa •Cultural preference of iwi is to discharge to land •Improved effluent quality is in line with the Vision and Strategy.
Social and Community	•Amenity value and aesthetics •Urban development •Recreation •Negative perceptions •Vibrant community	5%	4	•Reduced disruption along SH1 as the transmission pipeline is much shorter. •New discharge may be viewed negatively by the community and iwi.
Flexibility/Scalability/ Risk	•Adaptable and flexible •Able to be staged •Engineering resilience	10%	4	•Treatment can be staged. Land available for expansion at Huntly. •Resilience from having multiple WWTP plants and shorter transmission distance • Less central location of treatment plant less easily facilitates future connections in the growth corridor
Sustainability	•Reliable, proven and robust modern-day technology •Opportunity for resource recovery •Opportunities for implementation of sustainable practices and technologies •Carbon and energy neutrality •Disposal reuse and flexibilities •Ability to be delivered quickly by local contractors	15%	3.5	•MBR technology provides future proofing •Te Kauwhata, Meremere and Huntly can reuse some existing infrastructure (reduced embodied carbon) •High rate treatment (operational carbon) •Significant civil works which can be delivered by local contractors
Whole of life	•Operational costs and whole of life costs including capex •Implementation costs •Future local investment impacts •Council rates recovery	20%	3	•Capex lower than other options as there is a decentralised plant and less conveyance pipework •Increased O&M costs as there is an additional plant to run •Reduced Opex associated with long pumping distances
Constructability	•Geology, soil, groundwater conditions •Buildability •Land Availability •Existing Infrastructure •Safety and Design •Electricity Availability	10%	3.5	•Need to investigate ground conditions at Huntly and Te Kauwhata. Potential preloading required at both sites •Land adjacent to Huntly WWTP is owned by the council/designated •Services such as electricity and potable water will be readily available •Existing ponds can be used to buffer the flows
Score			3.125	

WASTEWATER OPTIONS



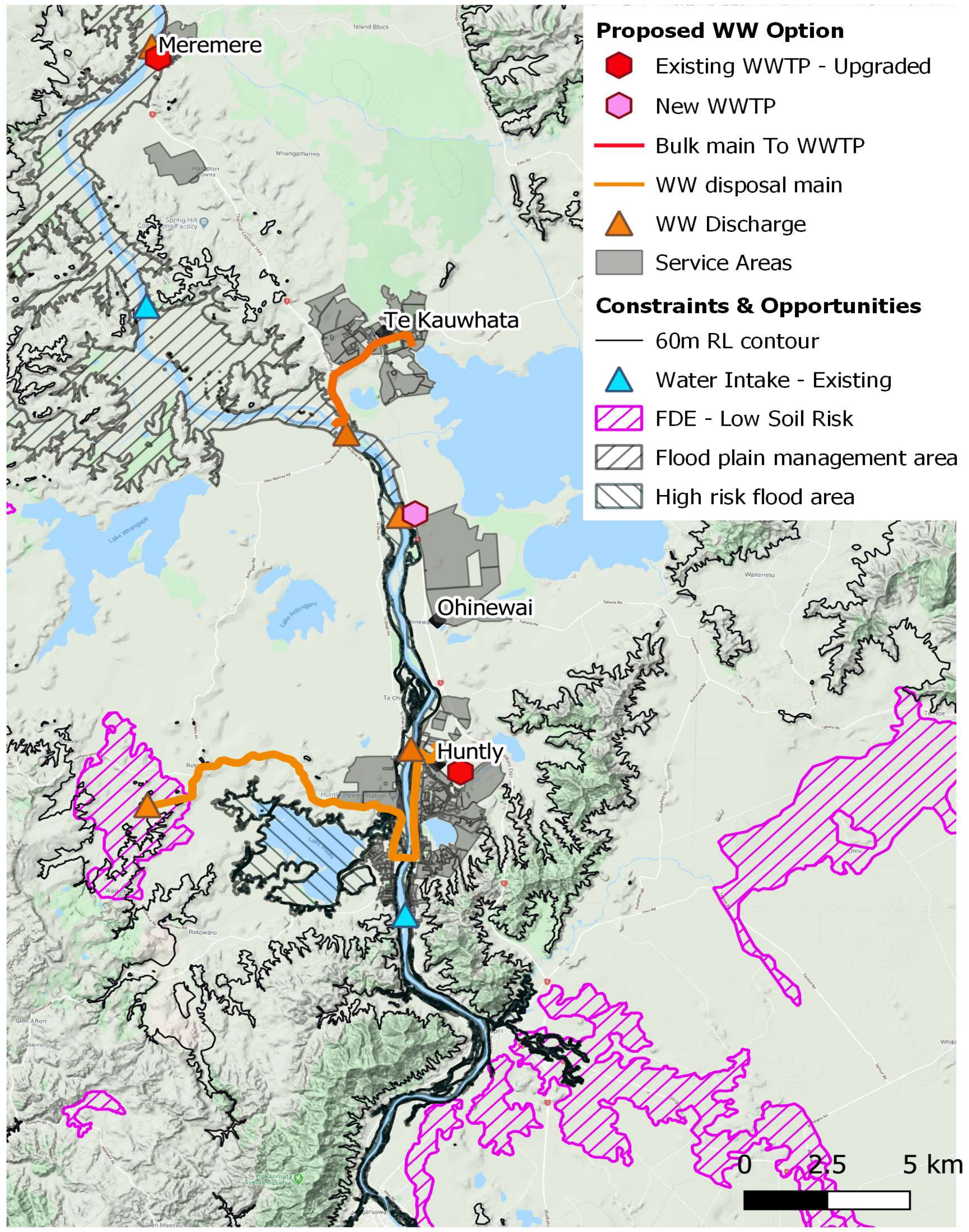
Option 3			Centralised - 1 WWTP for Ohienewai and Te Kauwhata catchments. Separate plant for Huntly and Meremere	
Criteria	Description/ Key Aspects of Criteria	Weighting	High rate treatment plant between Te Kauwhata and Ohinewai (as close to Te Kauwhata as possible) discharging to Waikato River. Individual MBR's at Meremere and Huntly discharging to the Waikato River.	
			Score	Reasoning
Natural Environment Improvement Capability	•Water and sediment quality •Microbial Contamination •Aquatic ecology •Terrestrial Ecology •Coastal Environment and resources •Micropollutants/emerging contaminants	10%	3	•High level treatment will minimise effect on water quality and microbial contamination •Loads and Concentration discharged higher than land disposal •Disposal to river will have a higher dilution and mixing than lakes. •Multiple discharges to the river, more dispersion of the load
Public Health Protection/Statutory Compliance	•Microbiological quality of treated wastewater •Health effects from sprays irrigation/aerosols •Treated wastewater re-use •Nuisances •Ability to meet statutory requirements	10%	3.5	•High level treatment will minimise effect on water quality and microbial contamination •Removes Te Kauwhata discharge to Lake Waikare •Potentially not consistent with the Te Kauwhata Discharge agreement with Waikato - Tainui to discharge to land •New discharge is upstream of Te Kauwhata water intake •Additional consent required to discharge from combined plant to the Waikato river.
Cultural Benefits/ Impacts on Maori Cultural values	•Mauri •Kai awa •Cultural Values •Food gathering	20%	2	•Potential effects on kai awa •Cultural preference of iwi is to discharge to land •Improved effluent quality is in line with the Vision and Strategy.
Social and Community	•Amenity value and aesthetics •Urban development •Recreation •Negative perceptions •Vibrant community	5%	4	• Transmission pipeline can be built along a road adjacent SH1 - reduced disruption on SH1. •WWTP built in greenfield area - less disruption to community •New discharge may be viewed negatively by the community and iwi.
Flexibility/Scalability/ Risk	•Adaptable and flexible •Able to be staged •Engineering resilience	10%	4.5	•Possible addition of Huntly in the future - pipe from Ohinewai to WWTP could be sized to allow for this •Resilience from having multiple WWTP plants and shorter transmission distance • Central location of treatment plant facilitates future connections in the growth corridor
Sustainability	•Reliable, proven and robust modern-day technology •Opportunity for resource recovery •Opportunities for implementation of sustainable practices and technologies •Carbon and energy neutrality •Disposal reuse and flexibilities •Ability to be delivered quickly by local contractors	15%	3.5	•MBR technology provides future proofing •New centralised plant (high capital carbon) •High rate treatment (operational carbon) •Significant civil works which can be delivered by local contractors
Whole of life	•Operational costs and whole of life costs including capex •Implementation costs •Future local investment impacts •Council rates recovery	20%	3	•Capex likely lower than centralised options as there is a decentralised plant and less conveyance pipework •Increased O&M costs as there is an additional plant to run •Reduced Opex associated with long pumping distances
Constructability	•Geology, soil, groundwater conditions •Buildability •Land Availability •Existing Infrastructure •Safety and Design •Electricity Availability	10%	3.5	•Potential site location is on privately owned land •Confirmed suitable ground conditions •Greenfield Site •No availability of electricity and potable water
Score			**3.175**	

WASTEWATER OPTIONS



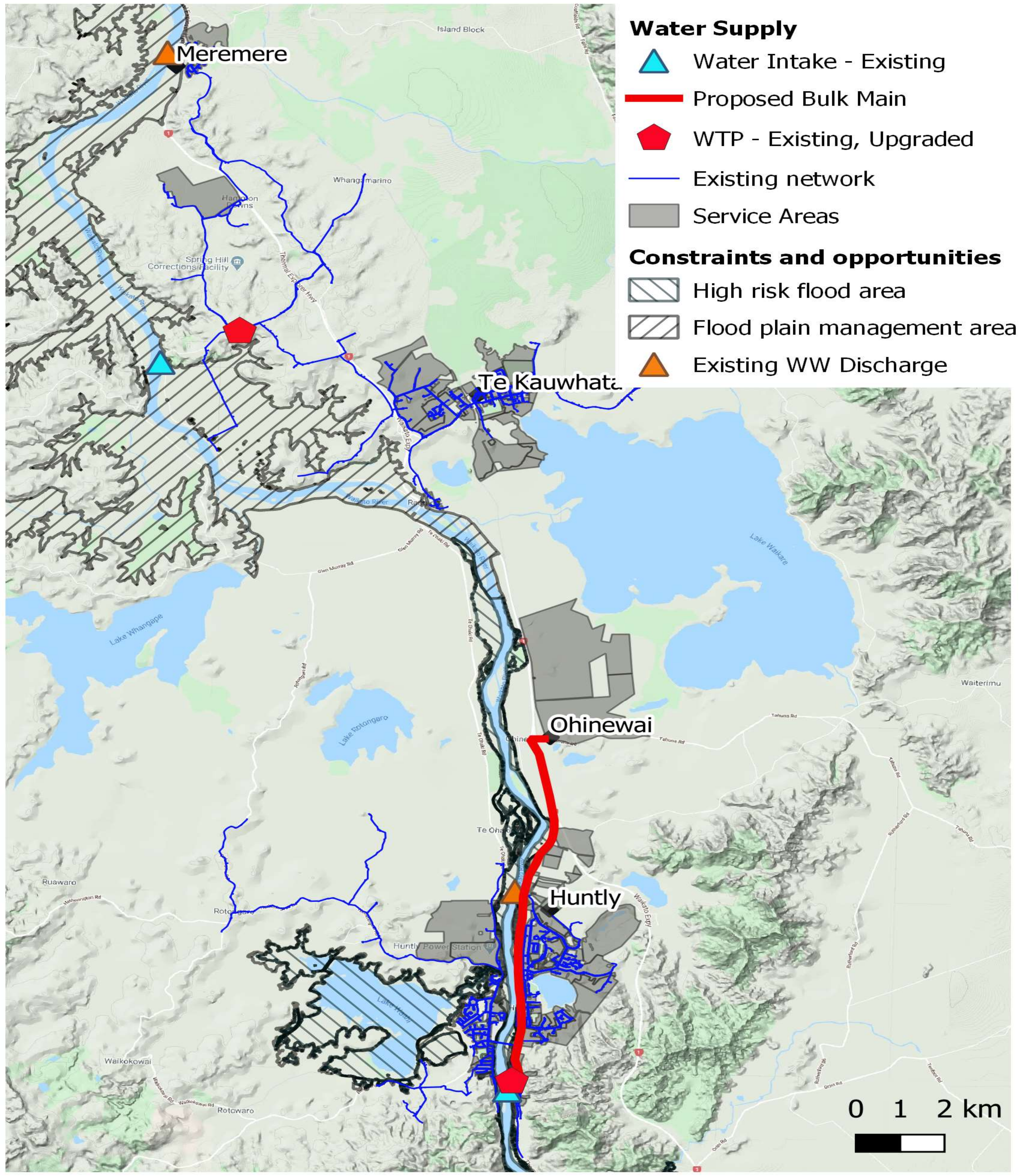
Option 4a			Decentralised - 4 WWTP's	
Criteria	Description/ Key Aspects of Criteria	Weighting	Individual high rate treatment plants at Huntly, Te Kauwhata, Ohinewai and Meremere. All 4 plants discharging to the Waikato River.	
			Score	Reasoning
Natural Environment Improvement Capability	•Water and sediment quality •Microbial Contamination •Aquatic ecology •Terrestrial Ecology •Coastal Environment and resources •Micropollutants/emerging contaminants	10%	3	•High level treatment will minimise effect on water quality and microbial contamination •Loads and Concentration discharged higher than land disposal •Disposal to river will have a higher dilution and mixing than lakes. •Multiple discharges to the river, more dispersion of the load
Public Health Protection/Statutory Compliance	•Microbiological quality of treated wastewater •Health effects from sprays irrigation/aerosols •Treated wastewater re-use •Nuisances •Ability to meet statutory requirements	10%	3.5	•High level treatment will minimise effect on water quality and microbial contamination •Removes Te Kauwhata discharge to Lake Waikare •Potentially not consistent with the Te Kauwhata Discharge agreement with Waikato - Tainui to discharge to land •Two new discharges upstream of Te Kauwhata water intake •Additional consent required to discharge Te Kauwhata and Ohinewai to the Waikato river.
Cultural Benefits/ Impacts on Maori Cultural values	•Mauri •Kai awa •Cultural Values •Food gathering	20%	2	•Potential effects on kai awa •Cultural preference of iwi is to discharge to land •Improved effluent quality is in line with the Vision and Strategy.
Social and Community	•Amenity value and aesthetics •Urban development •Recreation •Negative perceptions •Vibrant community	5%	3.5	• No long transmission pipelines along motorway but additional construction at WWTP •New discharges may be viewed negatively by the community and iwi.
Flexibility/Scalability/ Risk	•Adaptable and flexible •Able to be staged •Engineering resilience	10%	2.5	•Treatment can be staged as opposed to pipelines that generally need to be sized for ultimate growth •decentralised option potentially makes it more difficult to connect future growth outside of the service area and to change to centralised scheme later (negative perception, sunk capital) •Resilience from having multiple WWTP's • Depending on site location, future expansions will be possible
Sustainability	•Reliable, proven and robust modern-day technology •Opportunity for resource recovery •Opportunities for implementation of sustainable practices and technologies •Carbon and energy neutrality •Disposal reuse and flexibilities •Ability to be delivered quickly by local contractors	15%	3.5	•MBR technology provides future proofing •Reuse of existing infrastructure at Te Kauwhata, Meremere and Huntly (reduces embodied carbon) •High rate treatment (operational carbon) •Reduced civil works which would be delivered by local contractors, more process work likely delivered by contractors from outside the region
Whole of life	•Operational costs and whole of life costs including capex •Implementation costs •Future local investment impacts •Council rates recovery	20%	3	•Capex of conveyance is reduced significantly •Capex for new site for Ohinewai WWTP and major upgrades at existing plants •Increased Opex and effort as 4 plants to run • Reduced Opex associated with long pumping distances
Constructability	•Geology, soil, groundwater conditions •Buildability •Land Availability •Existing Infrastructure •Safety and Design •Electricity Availability	10%	2.5	•Need to investigate ground conditions at Huntly and Te Kauwhata. Potential preloading required at site locations •Greenfield site for new plant at Ohinewai •Availability of services such as electricity and potable water in Huntly and Te Kauwhata but none available at Ohinewai
Score			**2.85**	

WASTEWATER OPTIONS



Option 4b			Decentralised - 4 WWTP's	
Criteria	Description/ Key Aspects of Criteria	Weighting	Individual high rate treatment plants at Huntly, Te Kauwhata, Ohinewai and Meremere. Meremere, Te Kauwhata and Ohinewai plants discharging to the Waikato River, Huntly plant partly discharges to land.	
			Score	Reasoning
Natural Environment Improvement Capability	•Water and sediment quality •Microbial Contamination •Aquatic ecology •Terrestrial Ecology •Coastal Environment and resources •Micropollutants/emerging contaminants	10%	3	• WW from Huntly removed from Waikato river and in winter more dilution reduces environmental impact of discharge. •Potential for lower level of treatment as only discharging to river in winter •Water will eventually reach streams/lake through land disposal but loads and concentrations will be lower than direct river discharge. •Risk of potential adverse effects on surface water (could be mitigated through deficit irrigation and separation distances from surface water) •Use of land disposal contaminates soil, potentially limiting alternative future uses. •New discharge from Te Kauwhata and Ohinewai into Waikato river •Disposal to river will have a higher dilution and mixing than lakes. (TK)
Public Health Protection/Statutory Compliance	•Microbiological quality of treated wastewater •Health effects from sprays irrigation/aerosols •Treated wastewater re-use •Nuisances •Ability to meet statutory requirements	10%	4	•Conveyance line to land disposal area is treated wastewater so minimal risk of waterborne pathogens • Surface irrigation - restricted public access required to reduce risk of exposure of pathogens (Subsurface irrigation may not be suitable at this scale) •risk of contamination of groundwater and surface flow, can be managed through deficit irrigation •Removes Te Kauwhata discharge to Lake Waikare •New Te Kauwhata and Ohinewai discharges are upstream of Te Kauwhata water intake •Additional consent required for land disposal and to discharge Te Kauwhata and Ohinewai to the Waikato river. •Lower effluent standard may be permissible for discharge to land
Cultural Benefits/ Impacts on Maori Cultural values	•Mauri •Kai awa •Cultural Values •Food gathering	20%	3	•Likely to have only low effect on kai awa •Cultural preference of iwi is to discharge to land •Reduction of nutrients in river is in line with the Vision and Strategy. •Discharge removed from Lake Waikare (site of significance)
Social and Community	•Amenity value and aesthetics •Urban development •Recreation •Negative perceptions •Vibrant community	5%	3	•If route of thermal explorer highway is followed, disruption would be minimised as a lot of the traffic would go through the new Waikato highway instead. •Land disposal means potentially significant disruption to existing land use •New discharges may be viewed negatively by the community and iwi.
Flexibility/Scalability/ Risk	•Adaptable and flexible •Able to be staged •Engineering resilience	10%	2	•Land area specified for disposal should be able to accommodate growth. •Treatment can be staged. Land available for expansion at Huntly and potentially irrigation. •decentralised option potentially makes it more difficult to connect future growth outside of the service area and to change to centralised scheme later (negative perception, sunk capital) •Disposal pipeline cannot be staged. •Changes in weather patterns could influence efficiency of irrigation •Dual discharge provides resilience in emergency if consented •Resilience from having multiple WWTP's
Sustainability	•Reliable, proven and robust modern-day technology •Opportunity for resource recovery •Opportunities for implementation of sustainable practices and technologies •Carbon and energy neutrality •Disposal reuse and flexibilities •Ability to be delivered quickly by local contractors	15%	4	•Requires additional land purchase and retains surface water discharge in winter •Land disposal is used in NZ, but this a large scheme for NZ. •MBR technology provides future proofing •Te Kauwhata, Meremere and Huntly can reuse some existing infrastructure (reduced embodied carbon) •High rate treatment (operational carbon) •Potential lower effluent standard for land disposal with savings in treatment. •Significant civil works which can be delivered by local contractors
Whole of life	•Operational costs and whole of life costs including capex •Implementation costs •Future local investment impacts •Council rates recovery	20%	1	•Capex high due to irrigation land, new site for Ohinewai WWTP and major upgrades at existing plants •Increased O&M costs as there are 4 separate plants to run •Potential revenue stream through crop sales (e.g. haylage for stock feed; Fonterra impose restrictions, but other markets are available) •Increased consenting effort/costs due to land and river discharges • Reduced Opex associated with long pumping distances
Constructability	•Geology, soil, groundwater conditions •Buildability •Land Availability •Existing Infrastructure •Safety and Design •Electricity Availability	10%	2.5	•Need to investigate ground conditions at Huntly and Te Kauwhata. Potential preloading required at both sites •Land adjacent to Huntly WWTP is owned by the council/designated •Land for Ohinewai WWTP needs to be acquired •Services such as electricity and potable water will be readily available at existing sites. •Large land area required for irrigation, availability/acquisition of land. •Huntly to Land disposal conveyance follows Thermal explorer highway
Score			**2.7**	

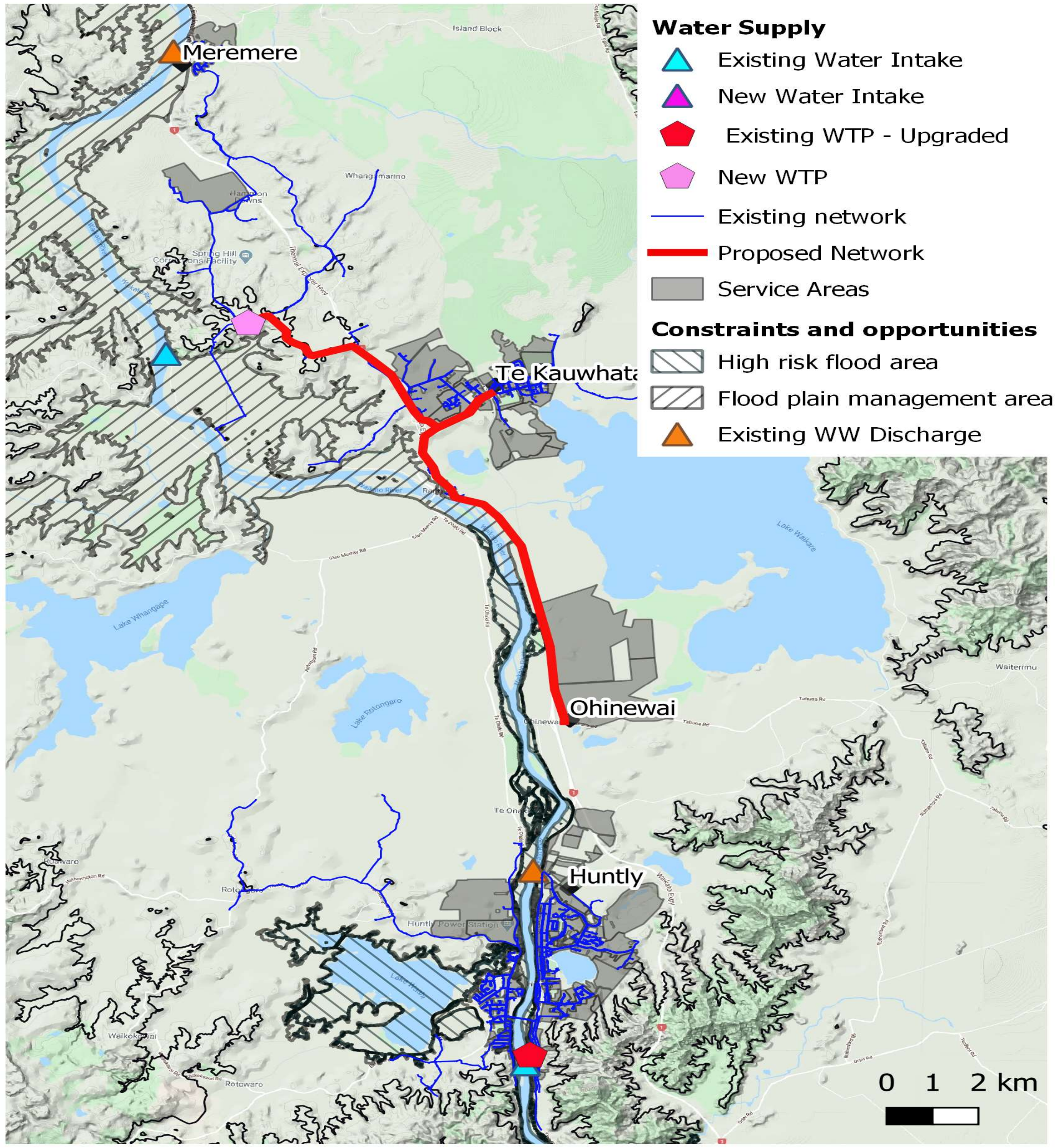
WATER SUPPLY OPTIONS



Option 3a

Criteria	Weighting	Score	Reasoning
		Decentralised – 2-3 WTPs ('do minimum or 'base case')	
		Te Kauwhata - New intake + upgraded WTP (<2025). Huntly - Existing intake + upgraded WTP (<2030, including <2MLD to Ngaruawahia) Ohinewai - network serviced by Huntly WTP. (OR NO SERVICE?)	
		Score	Reasoning
Natural Environment Impact	10%	3	• Using existing intakes minimises additional disturbance to river bed • Additional extraction from Waikato River due to growth & reticulation of Ohinewai. • Maximum consented take for Huntly (7MLD) exceeded in <2025 with Ohinewai (& supplementing Ngaruawahia) • Previously maximum agreed take with TKIA for Te Kauwhata exceeded (agreement expired 2016) but within consent limits • Reconsenting existing intakes/sites may be easier than consenting a new additional intake location /sites • Utilise existing residuals handling and disposal route minimises environmental impacts
Public Health Protection/Statutory Compliance	10%	4	• Provision of reticulated potable water mitigates public health risks associated with untreated household supplies • High level of treatment means water supplies comply with current legislative requirements • Tighter process controls / more stringent monitoring more cost-effective at larger plants. • Lack of ownership /control of Te Kauwhata intake and raw water system poses risk • No change in separation distance between water intakes and WWTP discharges on Waikato River •Existing treatment process can accommodate variation in river water quality; upgrade needed if reuse wastewater
Cultural Benefits/ Impacts on Maori Cultural values	20%	3	• *similar between options? No marked change from status quo?* • *recent CIA available for Waikato River water take?*
Social and Community	5%	4	•Provision of water supply to Ohinewai encourages development •Potential for increased property rates in Ohinewai (initial scheme / ongoing costs) and thus negative perceptions
Flexibility/Scalability / Risk	10%	3	•WTP upgrades can be staged, however Huntly WTP upgrade required in near future to accommodate Ohinewai (<2030) unless Ngaruawahia demands managed (e.g. WTP upgrade) •Pipeline from Huntly to Ohinewai needs to be sized for future flows, which may mean low flows and long water age in early years. Could size to give flexibility for future centralised scheme •Least resilient with only 1 WTP/source servicing each scheme and relatively long conveyance distances. •Potential available space for future expansion of Te Kauwhata WTP (but not owned/designated). Not for Huntly WTP
Sustainability	15%	4	•Treatment can be staged/upgraded for future proofing but pipelines need to be sized for future flows •Infrastructure at existing Te Kauwhata WTP and Huntly WTP can be reused (capital carbon savings) •Long pipelines (embodied carbon) •High level of treatment (operational carbon)
Whole of life	20%	4	•Only 2 WTPs to operate and maintain hence lower O&M costs • For servicing Ohinewai, pipeline from Huntly to Ohinewai may be lower capex than Option 3b (shorter pipeline); similar order to Option 3c but can't be staged (TBC). •Ongoing pumping costs, which are larger for Option 3a and 3b than Option 3c (TBC) •Greater rating base to cover capital upgrade costs
Constructability	10%	3	•Additional land near existing Te Kauwhata WWTP needs to be procured by the council/designated but suitable ground conditions and availability of electricity •May be difficult to expand Huntly WTP? •Pipeline route within Huntly may be challenging (TBC) •No need to investigate/consent/procure new site & intake at Ohinewai
Score		**3.5**	

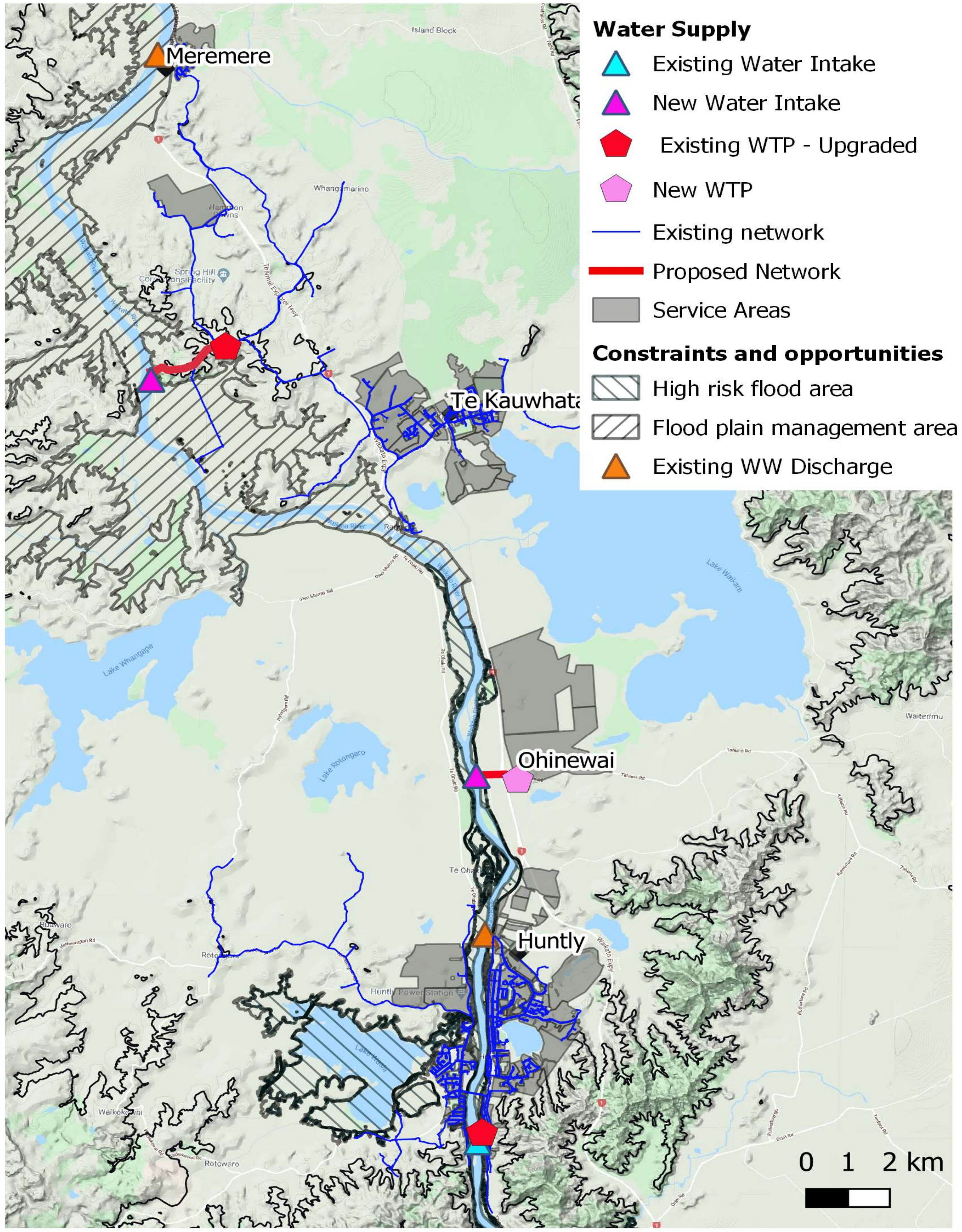
WATER SUPPLY OPTIONS



Option 3b

Criteria	Weighting	Decentralised – 2-3 WTPs ('do minimum or 'base case')	
		Te Kauwhata - New intake + new WTP (<2025). Huntly - Existing intake + WTP (if demand from Ngaruawahia can be managed to 2050; upgrade needed for ultimate). Ohinewai - network serviced by Te Kauwhata WTP. (OR NO SERVICE?)	
		Score	Reasoning
Natural Environment Impact	10%	3	• Using existing intakes minimises additional disturbance to river bed • Additional extraction from Waikato River due to growth & reticulation of Ohinewai. • Maximum consented take (7MLD) for Huntly may be sufficient to 2050, depending on Ngaruawahia) • Previously maximum agreed take with TKIA for Te Kauwhata exceeded (agreement expired 2016) but within consent limits • Consenting new additional intake (Ohinewai) and new WTP site (Te Kauwhata) may be harder than reconsenting existing intakes/sites • Utilise existing residuals handling and disposal route minimises environmental impacts; may require new residuals handling and disposal route for Te Kauwhata
Public Health Protection/Statutory Compliance	10%	4	• Provision of reticulated potable water mitigates public health risks associated with untreated household supplies • High level of treatment means water supplies comply with current legislative requirements • Tighter process controls / more stringent monitoring more cost-effective at larger plants. • Lack of ownership /control of Te Kauwhata intake and raw water system poses risk • No change in separation distance between water intakes and WWTP discharges on Waikato River •Existing treatment process can accommodate variation in river water quality; upgrade needed if reuse wastewater
Cultural Benefits/ Impacts on Maori Cultural values	20%	3	• *similar between options? No marked change from status quo?* • *recent CIA available for Waikato River water take?*
Social and Community	5%	4	•Provision of water supply to Ohinewai encourages development •Potential for increased property rates in Ohinewai (initial scheme / ongoing costs) and thus negative perceptions
Flexibility/Scalability / Risk	10%	3.5	•WTP upgrades can be staged; new Te Kauwhata WTP can be built to allow for growth • Investing in area where greatest growth predicted and gives flexibility for future centralised scheme • No requirement to upgrade Huntly WTP (if Ngaruawahia demand can be managed) •Pipeline from Te Kauwhata to Ohinewai needs to be sized for future flows, which may mean low flows and long water age in early years •Least resilient with only 1 WTP/source servicing each scheme and relatively long conveyance distances. •Potential available space for future expansion of Te Kauwhata WTP (but not owned/designated).
Sustainability	15%	3.5	•Treatment can be staged/upgraded for future proofing but pipelines need to be sized for future flows •Infrastructure at existing Te Kauwhata WTP abandoned ("sunk" capital carbon) •Infrastructure at existing Huntly WTP can be reused (capital carbon savings) •Long pipelines (embodied carbon) •High level of treatment (operational carbon)
Whole of life	20%	3.5	•Only 2 WTPs to operate and maintain hence lower O&M costs • For servicing Ohinewai, pipeline from Te Kauwhata to Ohinewai may be higher capex than Option 3a (longer pipeline); similar order to Option 3c but can't be staged (TBC). •Ongoing pumping costs, which are larger for Option 3a and 3b than Option 3c (TBC) •Greater rating base to cover capital upgrade costs
Constructability	10%	3	•Land for new Te Kauwhata WWTP needs to be procured by the council/designated. Uncertainty with ground conditions and availability of electricity (site dependent, TBC) •No need to expand Huntly WTP (if demand from Ngaruawahia can be managed) •Pipeline route to Te Kauwhata may be challenging (TBC) •No need to investigate/consent/procure new site & intake at Ohinewai
Score		**3.375**	

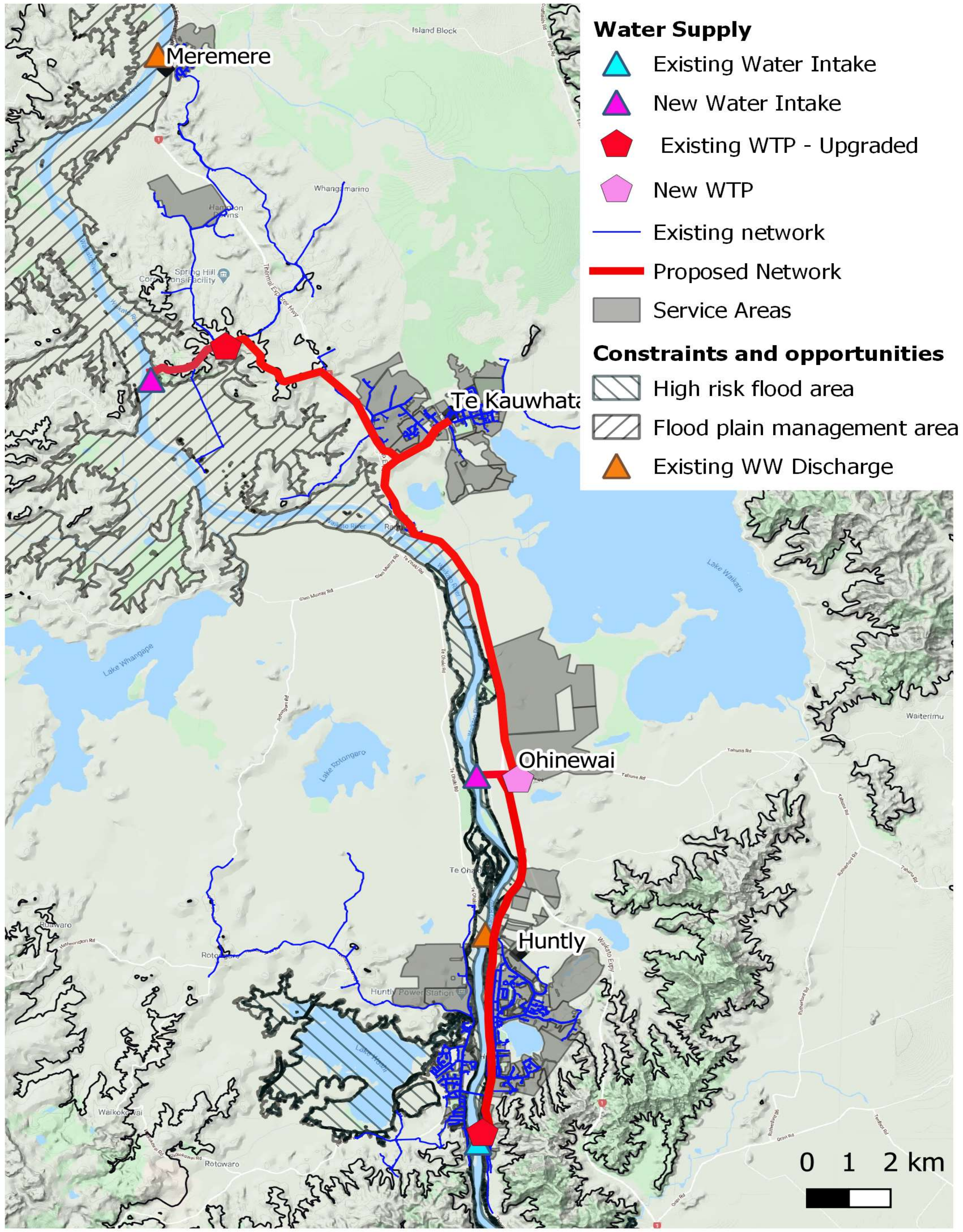
WATER SUPPLY OPTIONS



Option 3c

Criteria	Weighting	Score	Reasoning
		Decentralised – 2-3 WTPs ('do minimum or 'base case')	
Criteria	Weighting	Te Kauwhata - New intake + upgraded WTP (<2025). Huntly - Existing intake + WTP (if demand from Ngaruawahia can be managed to 2050; upgrade needed for ultimate). Ohinewai - New intake + WTP (OR NO SERVICE?)	
		Score	Reasoning
Natural Environment Impact	10%	2	• Requires new intake at Ohinewai & Te Kauwhata - additional disturbance to river bed • Additional extraction from Waikato River due to growth & reticulation of Ohinewai. • Maximum consented take (7MLD) for Huntly may be sufficient to 2050, depending on Ngaruawahia) • Consenting new additional intakes (Ohinewai, Te Kauwhata) and new WTP site (Ohinewai) may be harder than reconsenting existing intakes/sites • Requires new residuals handling and disposal route for Ohinewai to minimise environmental impacts
Public Health Protection/Statutory Compliance	10%	4	• Provision of reticulated potable water mitigates public health risks associated with untreated household supplies • High level of treatment means water supplies comply with current legislative requirements • Tighter process controls / more stringent monitoring less cost-effective at smaller plants. • Ownership /control of new Te Kauwhata intake and shorter raw water system reduces risk • Less separation distance between water intakes and WWTP discharges on Waikato River (Ohinewai ~5km downstream of Huntly WWTP) •Existing / new treatment process can accommodate variation in river water quality; upgrade needed if reuse wastewater
Cultural Benefits/ Impacts on Maori Cultural values	20%	2.5	• *similar between options? No marked change from status quo?* • *recent CIA available for Waikato River water take?*
Social and Community	5%	4	•Provision of water supply to Ohinewai encourages development •Potential for increased property rates in Ohinewai (initial scheme / ongoing costs) and thus negative perceptions •Local employment due to WTP operation
Flexibility/Scalability / Risk	10%	2.5	•WTP upgrades can be staged • No requirement to upgrade Huntly WTP (if Ngaruawahia demand can be managed) •No long conveyance pipelines •Least resilient with only 1 WTP/source servicing each scheme. •Potential available space for future expansion of Te Kauwhata WTP (but not owned/designated).
Sustainability	15%	3	•Treatment can be staged/upgraded for future proofing and no long conveyance pipelines •Infrastructure at existing Te Kauwhata WTP and Huntly WTP can be reused (capital carbon savings) •Existing water intake and possibly raw water main infrastructure retained by TKIA •New raw water supply main and additional WTP at Ohinewai but no long conveyance pipelines (embodied carbon) •High level of treatment (operational carbon)
Whole of life	20%	3	•3 WTPs to operate and maintain hence higher O&M costs • Similar order of costs to Option 3a & 3b but can be staged (TBC). •Greater rating base to cover capital upgrade costs
Constructability	10%	2	•Additional land near existing Te Kauwhata WWTP needs to be procured by the council/designated but suitable ground conditions and availability of electricity •No need to expand Huntly WTP (if demand from Ngaruawahia can be managed) •Need to investigate/consent/procure new site & intake at Ohinewai and new intake & raw water pipeline route at Te Kauwhata
Score		**2.8**	

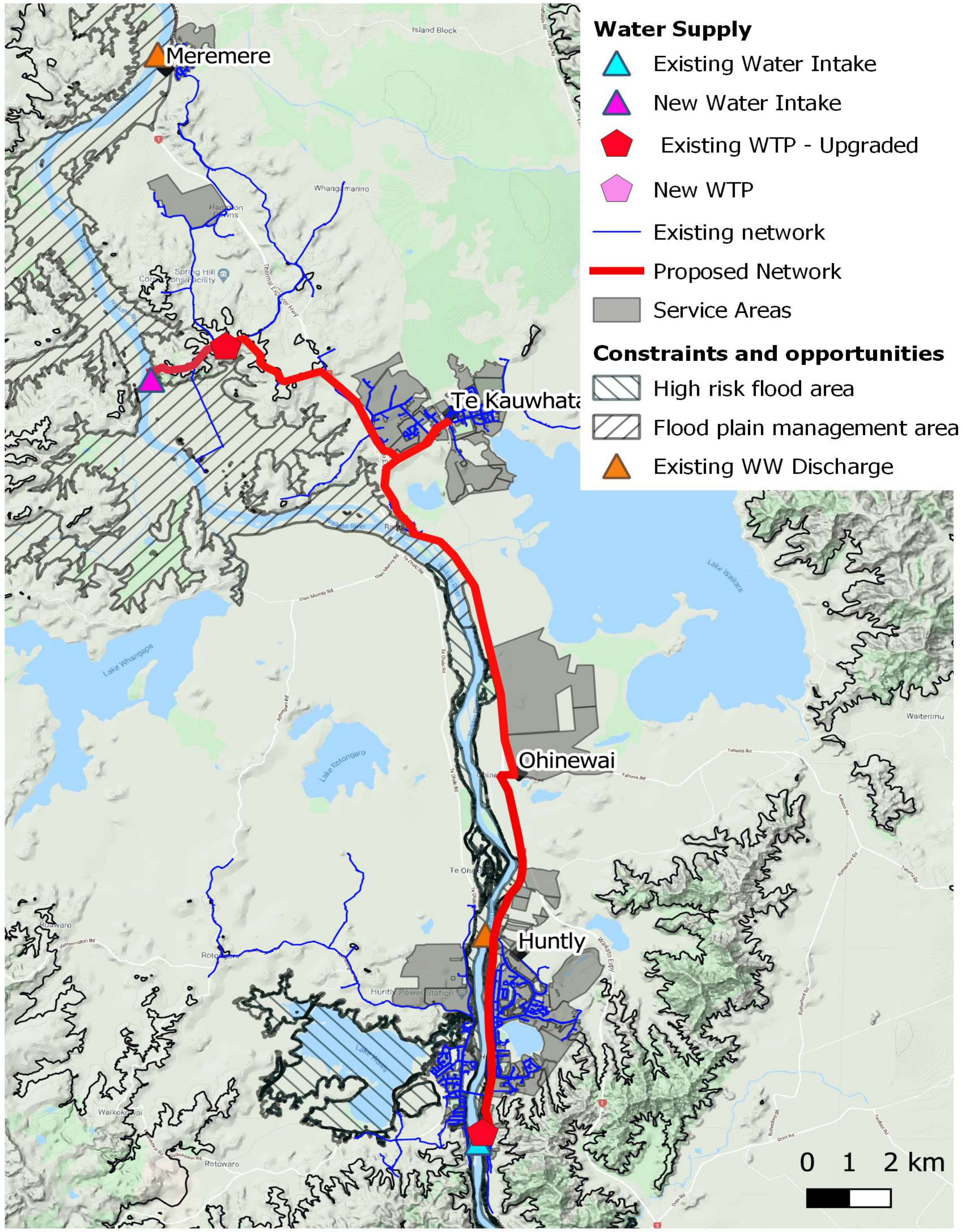
WATER SUPPLY OPTIONS



Option 4a

Criteria	Weighting	Score	Reasoning
		Centralised 3 WTPs	
		3 WTPs (like Option 3c), trunk main from Te Kauwhata to Huntly. Te Kauwhata - New intake + upgraded WTP (<2025) Huntly - Existing intake + WTP (if demand from Ngaruawahia can be managed to 2050; upgrade needed for ultimate). Ohinewai - New intake + WTP	
		Score	Reasoning
Natural Environment Impact	10%	2	• Requires new intake at Ohinewai & Te Kauwhata - additional disturbance to river bed • Additional extraction from Waikato River due to growth & reticulation of Ohinewai. • Maximum consented take (7MLD) for Huntly may be sufficient to 2050, depending on Ngaruawahia) • Consenting new additional intakes (Ohinewai, Te Kauwhata) and new WTP site (Ohinewai) may be harder than reconsenting existing intakes/sites • Requires new residuals handling and disposal route for Ohinewai to minimise environmental impacts
Public Health Protection/Statutory Compliance	10%	4	• Provision of reticulated potable water mitigates public health risks associated with untreated household supplies • High level of treatment means water supplies comply with current legislative requirements • Tighter process controls / more stringent monitoring less cost-effective at smaller plants. • Ownership /control of new Te Kauwhata intake and shorter raw water system reduces risk • Less separation distance between water intakes and WWTP discharges on Waikato River (Ohinewai ~5km downstream of Huntly WWTP) •Existing / new treatment process can accommodate variation in river water quality; upgrade needed if reuse wastewater
Cultural Benefits/ Impacts on Maori Cultural values	20%	2.5	• *similar between options? No marked change from status quo?* • *recent CIA available for Waikato River water take?*
Social and Community	5%	4	•Provision of water supply to Ohinewai encourages development •Potential for increased property rates in Ohinewai (initial scheme / ongoing costs) and thus negative perceptions •Local employment due to WTP operation
Flexibility/Scalability / Risk	10%	4	•WTP upgrades can be staged, and could potentially accommodate growth in Ngaruawahia • No requirement to upgrade Huntly WTP (if Ngaruawahia demand can be managed) •Long conveyance pipelines that need to be sized for future flows, which may mean low flows and long water age in early years •Most resilient with 3 WTPs/sources able to service centralised scheme. •Potential available space for future expansion of Te Kauwhata WTP (but not owned/designated).
Sustainability	15%	2	•Treatment can be staged/upgraded for future proofing but pipelines need to be sized for future flows •Infrastructure at existing Te Kauwhata WTP and Huntly WTP can be reused (capital carbon savings) •Existing water intake and possibly raw water main infrastructure retained by TKIA •New raw water supply main, long conveyance pipelines and additional WTP at Ohinewai (embodied carbon) •High level of treatment (operational carbon)
Whole of life	20%	2	•3 WTPs to operate and maintain hence higher O&M costs • Greater order of costs to Options 3c, with greater upfront cost of trunk main (TBC). • Ongoing pumping costs •Greater rating base to cover capital upgrade costs
Constructability	10%	2	•Additional land near existing Te Kauwhata WWTP needs to be procured by the council/designated but suitable ground conditions and availability of electricity •No need to expand Huntly WTP (if demand from Ngaruawahia can be managed) •Need to investigate/consent/procure new site & intake at Ohinewai and new intake & raw water pipeline route at Te Kauwhata •Pipeline route from Te Kauwhata to Ohinewai and within Huntly may be challenging (TBC)
Score		**2.6**	

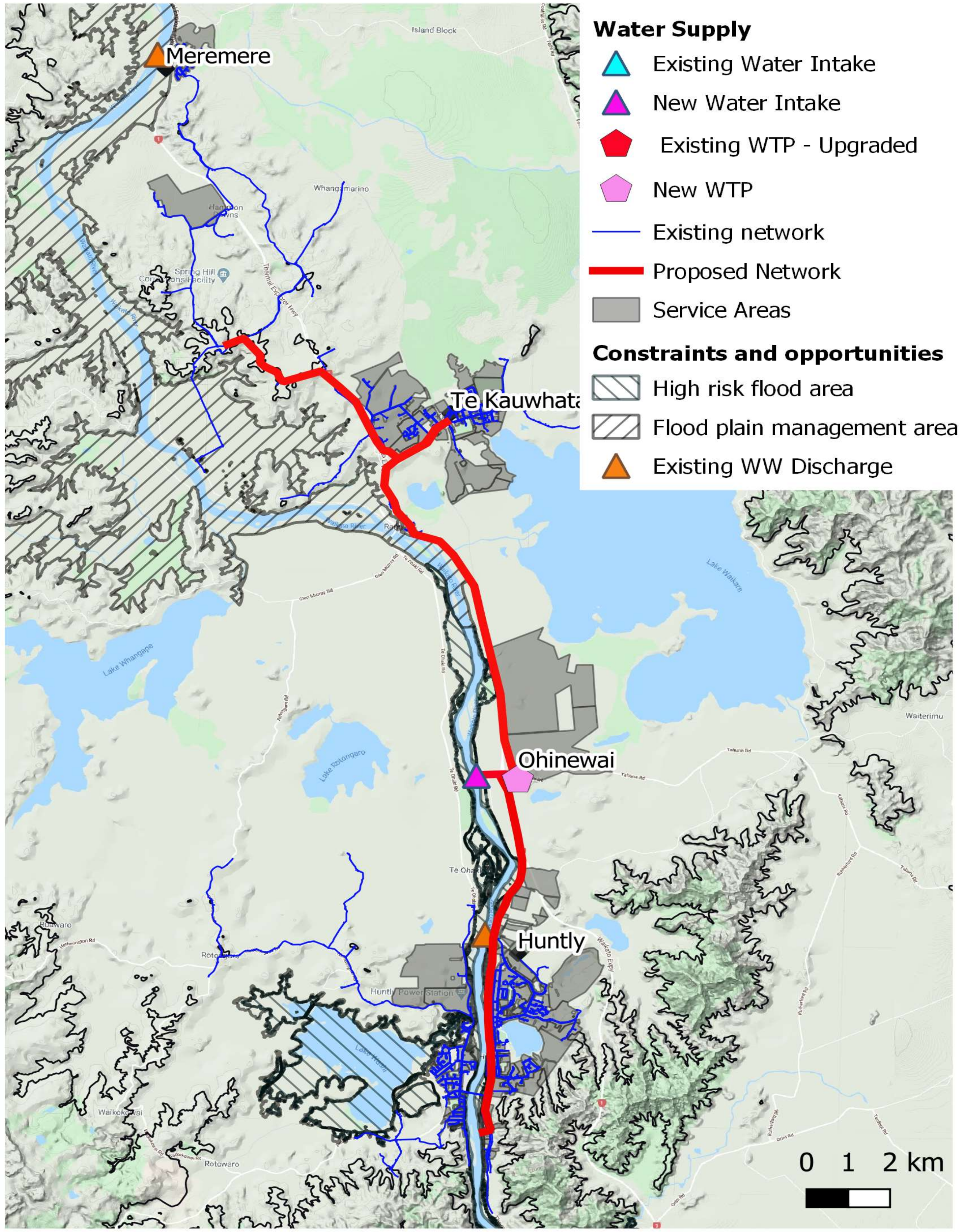
WATER SUPPLY OPTIONS



Option 4b

		Centralised 2 WTPs	
Criteria	Weighting	2 WTPs (like Option 3c/4a), trunkmain from Te Kauwhata to Huntly. Te Kauwhata - New intake + upgraded WTP (<2025) Huntly - Existing intake + WTP (if demand from Ngaruawahia can be managed to 2050; upgrade needed for ultimate). Ohinewai - network serviced primarily by Te Kauwhata WTP.	
		Score	Reasoning
Natural Environment Impact	10%	3	• Requires new intake at Te Kauwhata - additional disturbance to river bed • Additional extraction from Waikato River due to growth & reticulation of Ohinewai. • Maximum consented take (7MLD) for Huntly may be sufficient to 2050, depending on Ngaruawahia) • Consenting new additional intakes (Te Kauwhata) may be harder than reconsenting existing intakes/sites • Utilise existing residuals handling and disposal route minimises environmental impacts
Public Health Protection/Statutory Compliance	10%	4	• Provision of reticulated potable water mitigates public health risks associated with untreated household supplies • High level of treatment means water supplies comply with current legislative requirements • Tighter process controls / more stringent monitoring more cost-effective at larger plants. • Ownership /control of new Te Kauwhata intake and shorter raw water system reduces risk • No change in separation distance between water intakes and WWTP discharges on Waikato River •Existing / new treatment process can accommodate variation in river water quality; upgrade needed if reuse wastewater
Cultural Benefits/ Impacts on Maori Cultural values	20%	3	• *similar between options? No marked change from status quo?* • *recent CIA available for Waikato River water take?*
Social and Community	5%	4	•Provision of water supply to Ohinewai encourages development •Potential for increased property rates in Ohinewai (initial scheme / ongoing costs) and thus negative perceptions
Flexibility/Scalability / Risk	10%	4	•WTP upgrades can be staged, , and could potentially accommodate growth in Ngaruawahia • No requirement to upgrade Huntly WTP (if Ngaruawahia demand can be managed) •Long conveyance pipelines that need to be sized for future flows, which may mean low flows and long water age in early years •Resilience provided as 2 WTPs/sources able to service centralised scheme. •Potential available space for future expansion of Te Kauwhata WTP (but not owned/designated).
Sustainability	15%	3	•Treatment can be staged/upgraded for future proofing but pipelines need to be sized for future flows •Infrastructure at existing Te Kauwhata WTP and Huntly WTP can be reused (capital carbon savings) •Existing water intake and possibly raw water main infrastructure retained by TKIA •New raw water supply main and long conveyance pipelines (embodied carbon) •High level of treatment (operational carbon)
Whole of life	20%	3	•Only 2 WTPs to operate and maintain hence lower O&M costs • Lower overall order of costs to Option 4a, but same upfront cost of trunkmain (TBC). • Ongoing pumping costs •Greater rating base to cover capital upgrade costs
Constructability	10%	3	•Additional land near existing Te Kauwhata WWTP needs to be procured by the council/designated but suitable ground conditions and availability of electricity •No need to expand Huntly WTP (if demand from Ngaruawahia can be managed) •Need to investigate/consent/procure new intake & raw water pipeline route at Te Kauwhata •Pipeline route from Te Kauwhata to Ohinewai and within Huntly may be challenging (TBC)
Score		**3.25**	

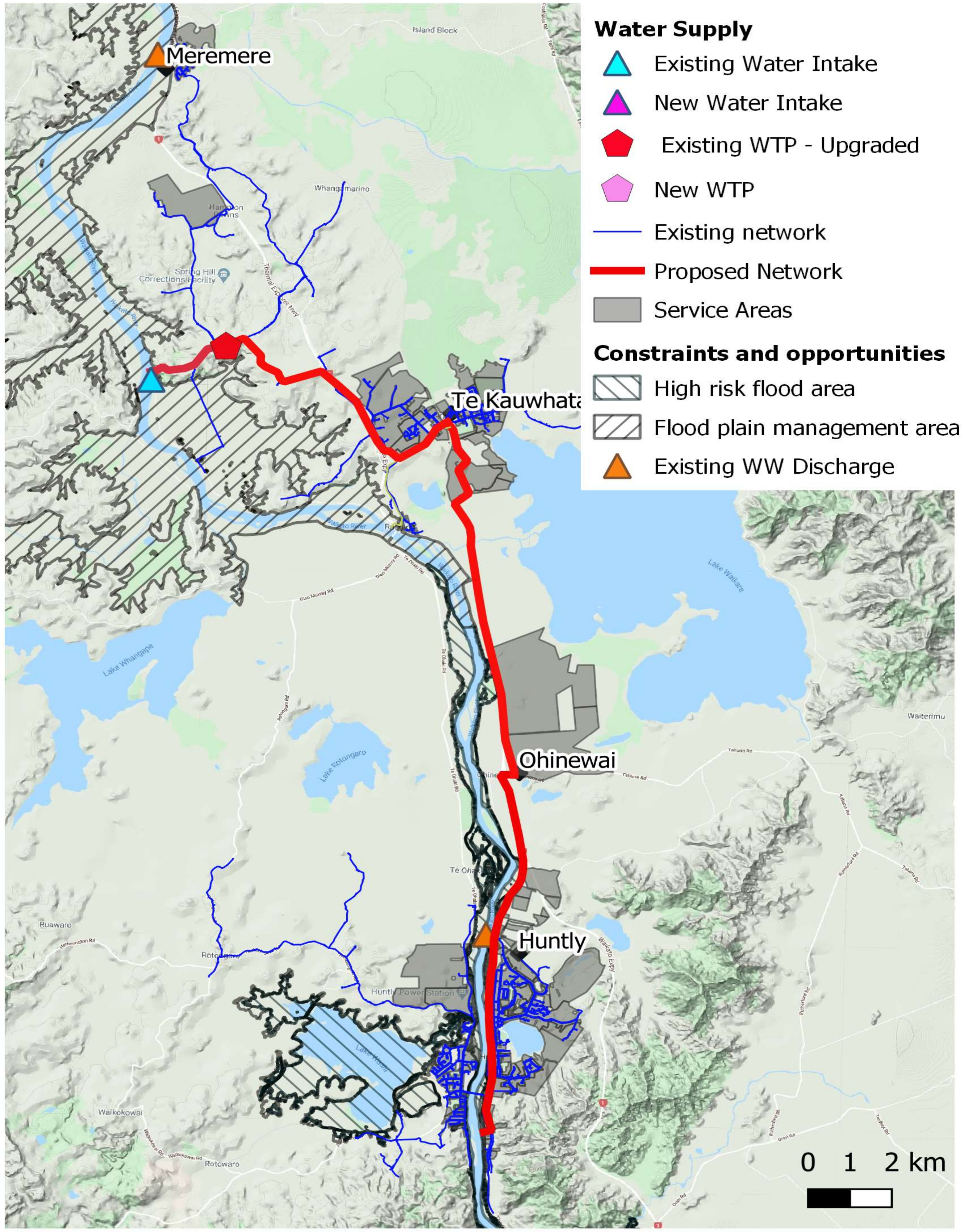
WATER SUPPLY OPTIONS



Option 4c

Criteria	Weighting	Centralised 1 WTP 1 WTP at Ohinewai, trunkmain from Te Kauwhata to Huntly. Ohinewai - New intake and WTP Te Kauwhata & Huntly - existing plants decommissioned, network serviced by Ohinewai WTP (including <2MLD to Ngaruawahia)	
		Score	Reasoning
Natural Environment Impact	10%	3	• Requires new intake at Ohinewai and decommissioning of existing intakes - additional disturbance to river bed • Additional overall extraction from Waikato River due to growth & reticulation of Ohinewai. • Consenting new intake & WTP site may be harder than reconsenting existing intakes/sites • Requires new residuals handling and disposal route for Ohinewai to minimise environmental impacts
Public Health Protection/Statutory Compliance	10%	4	• brand new plant Provision of reticulated potable water mitigates public health risks associated with untreated household supplies • High level of treatment means water supplies comply with current legislative requirements • Tighter process controls / more stringent monitoring more cost-effective at smaller plants. • Ownership/control of system reduces risk • Less separation distance between water intakes and WWTP discharges on Waikato River (Ohinewai ~5km downstream of Huntly WWTP) •Existing / new treatment process can accommodate variation in river water quality; upgrade needed if reuse wastewater
Cultural Benefits/ Impacts on Maori Cultural values	20%	3	• *similar between options? No marked change from status quo?* • *recent CIA available for Waikato River water take?*
Social and Community	5%	4	•Provision of water supply to Ohinewai encourages development •Potential for increased property rates in Ohinewai (initial scheme / ongoing costs) and thus negative perceptions •Local employment due to WTP operation (albeit relocated from existing WTPs)
Flexibility/Scalability / Risk	10%	3	•WTP upgrades can be staged; new Ohinewai WTP can be built to allow for growth, and could potentially accommodate growth in Ngaruawahia • Investing near area where greatest growth predicted and gives flexibility for future centralised scheme beyond Mid Waikato •Long conveyance pipelines that need to be sized for future flows, which may mean low flows and long water age in early years •Least resilient with only 1 WTP/source to service centralised scheme. •Need to procure/consent sufficient space for future expansion of new WTP
Sustainability	15%	2	•Treatment can be staged/upgraded for future proofing but pipelines need to be sized for future flows •Infrastructure at existing Te Kauwhata WTP and Huntly WTP decommissioned ("sunk" capital carbon) •Existing water intake and possibly raw water main infrastructure retained by TKIA •Additional WTP at Ohinewai and long conveyance pipelines (embodied carbon) •High level of treatment (operational carbon)
Whole of life	20%	2	•Only 1 WTP to operate and maintain hence some reduction in O&M costs • Likely to be higher overall order of costs to Option 4b as new WTP to service Mid Waikato and decommissioning of existing plants, but same upfront cost of trunkmain (TBC). • Ongoing pumping costs •Greater rating base to cover capital upgrade costs
Constructability	10%	2	•Need to investigate/consent/procure new site & intake at Ohinewai with unknown ground conditions, availability of electricity and access to residual disposal route
Score		**2.7**	

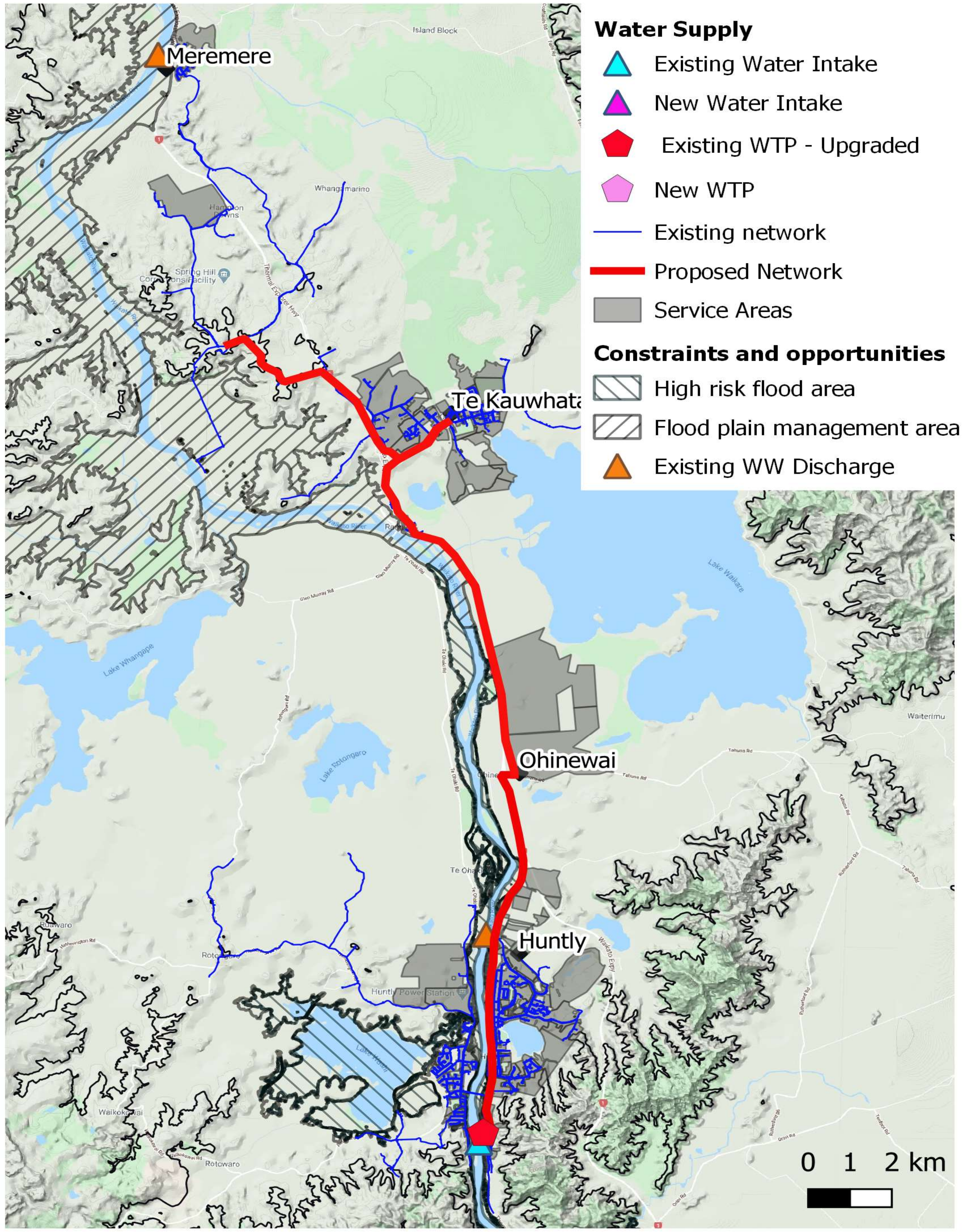
WATER SUPPLY OPTIONS



Option 4d

Criteria	Weighting	Centralised 1 WTP	
		1 WTP at Te Kauwhata, trunkmain from Te Kauwhata to Huntly. Te Kauwhata - New intake + upgraded WTP (<2025) Huntly & Ohinewai - existing Huntly plant decommissioned, network serviced by Te Kauwhata WTP (including <2MLD to Ngaruawahia)	
		Score	Reasoning
Natural Environment Impact	10%	3	• Requires new intake at Te Kauwhata and decommissioning of existing intake at Huntly - additional disturbance to river bed • Additional extraction from Waikato River due to growth & reticulation of Ohinewai. • Consenting new additional intakes (Te Kauwhata) may be harder than reconsenting existing intakes/sites • Utilise existing residuals handling and disposal route minimises environmental impacts
Public Health Protection / Statutory Compliance	10%	4	• Provision of reticulated potable water mitigates public health risks associated with untreated household supplies • High level of treatment means water supplies comply with current legislative requirements • Tighter process controls / more stringent monitoring more cost-effective at larger plants. • Ownership /control of new Te Kauwhata intake and shorter raw water system reduces risk • No change in separation distance between water intakes and WWTP discharges on Waikato River •Existing / new treatment process can accommodate variation in river water quality; upgrade needed if reuse wastewater
Cultural Benefits/ Impacts on Maori Cultural values	20%	3	• *similar between options? No marked change from status quo?* • *recent CIA available for Waikato River water take?*
Social and Community	5%	4	•Provision of water supply to Ohinewai encourages development •Potential for increased property rates in Ohinewai (initial scheme / ongoing costs) and thus negative perceptions
Flexibility/Scalability / Risk	10%	3	•WTP upgrades can be staged, and could potentially accommodate growth in Ngaruawahia • Investing in area where greatest growth predicted and gives flexibility for future operation of centralised scheme •Long conveyance pipelines that need to be sized for future flows, which may mean low flows and long water age in early years •Least resilient with only 1 WTP/source to service centralised scheme. •Potential available space for future expansion of Te Kauwhata WTP (but not owned/designated).
Sustainability	15%	2.5	•Treatment can be staged/upgraded for future proofing but pipelines need to be sized for future flows •Infrastructure at existing Te Kauwhata WTP can be reused (capital carbon savings) •Existing water intake and possibly raw water main infrastructure retained by TKIA •Infrastructure at existing Huntly WTP decommissioned ("sunk" capital carbon) •New raw water supply main and long conveyance pipelines (embodied carbon) •High level of treatment (operational carbon)
Whole of life	20%	2.5	•Only 1 WTP to operate and maintain hence some reduction in O&M costs • Likely to be higher overall order of costs to Option 4b as significant upgrade and decommissioning of assets, but same upfront cost of trunkmain (TBC). • Ongoing pumping costs •Greater rating base to cover capital upgrade costs
Constructability	10%	3	•Additional land near existing Te Kauwhata WWTP needs to be procured by the council/designated but suitable ground conditions and availability of electricity •Need to investigate/consent/procure new intake & raw water pipeline route at Te Kauwhata •Pipeline route from Te Kauwhata to Ohinewai and within Huntly may be challenging (TBC)
Score		**2.975**	

WAETR SUPPLY OPTIONS



Option 4e

Criteria	Weighting	Centralised 1 WTP 1 WTP at Huntly, trunkmain from Te Kauwhata to Huntly. Huntly - New intake + upgraded WTP (<2025) Te Kauwhata & Ohinewai - existing Te Kauwhata plant decommissioned, network serviced by Huntly WTP (including <2MLD to Ngaruawahia)	
		Score	Reasoning
Natural Environment Impact	10%	3	• Requires new intake at Huntly and, possibly, decommissioning of existing intake at Huntly - additional disturbance to river bed • Additional extraction from Waikato River due to growth & reticulation of Ohinewai. • Consenting new intakes (Huntly) may be harder than reconsenting existing intakes/sites • Utilise existing residuals handling and disposal route minimises environmental impacts
Public Health Protection/Statutory Compliance	10%	4	• Provision of reticulated potable water mitigates public health risks associated with untreated household supplies • High level of treatment means water supplies comply with current legislative requirements • Tighter process controls / more stringent monitoring more cost-effective at larger plants. • Ownership/control of system reduces risk • No change in separation distance between water intakes and WWTP discharges on Waikato River •Existing / new treatment process can accommodate variation in river water quality; upgrade needed if reuse wastewater
Cultural Benefits/ Impacts on Maori Cultural values	20%	3	• *similar between options? No marked change from status quo?* • *recent CIA available for Waikato River water take?*
Social and Community	5%	4	•Provision of water supply to Ohinewai encourages development •Potential for increased property rates in Ohinewai (initial scheme / ongoing costs) and thus negative perceptions
Flexibility/Scalability / Risk	10%	3	•WTP upgrades can be staged, and could potentially accommodate growth in Ngaruawahia • Huntly WTP is furthest from area where greatest growth predicted in Mid Waikato •Long conveyance pipelines that need to be sized for future flows, which may mean low flows and long water age in early years •Least resilient with only 1 WTP/source to service centralised scheme.
Sustainability	15%	2.5	•Treatment can be staged/upgraded for future proofing but pipelines need to be sized for future flows •Infrastructure at existing Huntly could be reused (capital carbon savings) •Infrastructure at existing Te Kauwhata WTP decommissioned ("sunk" capital carbon) but TKIA retains intake & raw water main •Long conveyance pipelines (embodied carbon) •High level of treatment (operational carbon)
Whole of life	20%	2.5	•Only 1 WTP to operate and maintain hence some reduction in O&M costs • Likely to be higher overall order of costs to Option 4b as significant upgrade and decommissioning of assets, but same upfront cost of trunkmain (TBC) • Ongoing pumping costs •Greater rating base to cover capital upgrade costs
Constructability	10%	2	•May be difficult to expand Huntly WTP to service Mid Waikato? Need to investigate/consent/procure new intake & upgrade options (or new site?) •Pipeline route from Te Kauwhata to Ohinewai and within Huntly may be challenging (TBC)
Score		**2.875**	

D. Potential Te Kauwhata WTP Locations

A desktop assessment of the area was undertaken to evaluate the suitability of the area with regards to location, natural hazards and general topography for the installation of a new water treatment plant (WTP). Watercare identified three possible locations for a new WTP, shown below, however it should be noted that these are not the final locations, and further in-depth work is required to determine a final location.

The following table has been produced to provide a comparative assessment of each potential site using a traffic light assessment method. It should be noted that a red dot does not necessarily mean 'bad' or 'stop' but that it is relatively 'least preferred' based on each option.

Criteria	Site/Option		
	Site 1	Site 2	Site 3
● (green) = most preferred/best site; ● (amber) = median site; ● (red) = least preferred site			
Site Physical Characteristics			
Outside identified flood risk zone	● (green)	● (green)	● (green)
Ground Stability Classification – Susceptibility risk	● (red)	● (amber)	● (amber)
Site Slope Grade	● (red)	● (green)	● (green)
Elevation	● (amber)	● (amber)	● (green)
Distance from new intake	● (green)	● (green)	● (amber)
Distance to Te Kauwhata network	● (green)	● (amber)	● (green)
Land Available for Purchase	● (red)	● (red)	● (red)
Single Land Title	● (green)	● (red)	● (green)
Qualitative Ranking			
Overall Ranking	3	2	1
Notes: 1. The land available for purchase has been ranked as least preferred for all sites as any new site regardless of location will require discussions and agreement with land owners for land purchase, this item poses a big risk to the project.			

The table shows that there is suitable land located within 2km radius of the Waikato River for a new water treatment plant servicing Te Kauwhata. The highest ranked site (Site 1) was adopted for the purpose of developing high-level cost for the water supply options.

Figure D1- Potential WTP sites

E. Option Assumptions and Schematics

E.1 Options Assumptions

E. 1.1 Water

The following assumptions were agreed with Watercare:

Demand:

- Forecasted demand based on the Huntly township forecasts for 2050 rather than the ultimate (equates to a required WTP design capacity of 5,760 m^3/day rather than 15,000 m^3/day), This is considered a more realistic scenario for the purpose of informing the 2020 LTP.
- An ultimate allocation of 2 MLD from Huntly WTP to Ngaruawahia. It is understood Ngaruawahia currently uses 1MLD of this allocation. It was assumed this increases to 1.5MLD in 2035 and to 2 MLD in 2045.

Treatment:

- Treatment plant design capacity based on peak flow of 2x average daily flow, with upgrades planned in stages to match forecasted demand;
- Treatment plant upgrades on the basis of conventional treatment, consistent with existing processes (see Technical Memo 1).

Conveyance:

- Reservoirs sized on basis of 24 hours average day demand. Whether or not this is sufficient to buffer peak demand needs to be confirmed based on actual demand pattern;
- Huntly Water network assumed to have 1ML spare capacity to service Ohinewai.

E.1.1 Wastewater

Treatment

- The existing WWTPs at Te Kauwhata and Huntly do not have the capacity to handle the predicted flows. Thus, all WWTPs in the options are new WWTPs and the existing WWTPs are not being utilised. Opportunities for reusing existing equipment can be investigated further in the future design stages;
- All the new WWTPs are sized on peak daily flows (PDFs) of the appropriate catchments in the ultimate design horizon. The exception is Huntly, where PDFs from 2050 were used, as agreed with Watercare;
- No overflow/wet weather storage is provided at the plant as this storage is provided for at the source through underground storage. Existing WWTP ponds may be re-purposed for storage of peak wet weather flows and as sludge monofills, and this opportunity can be considered in the next stages.

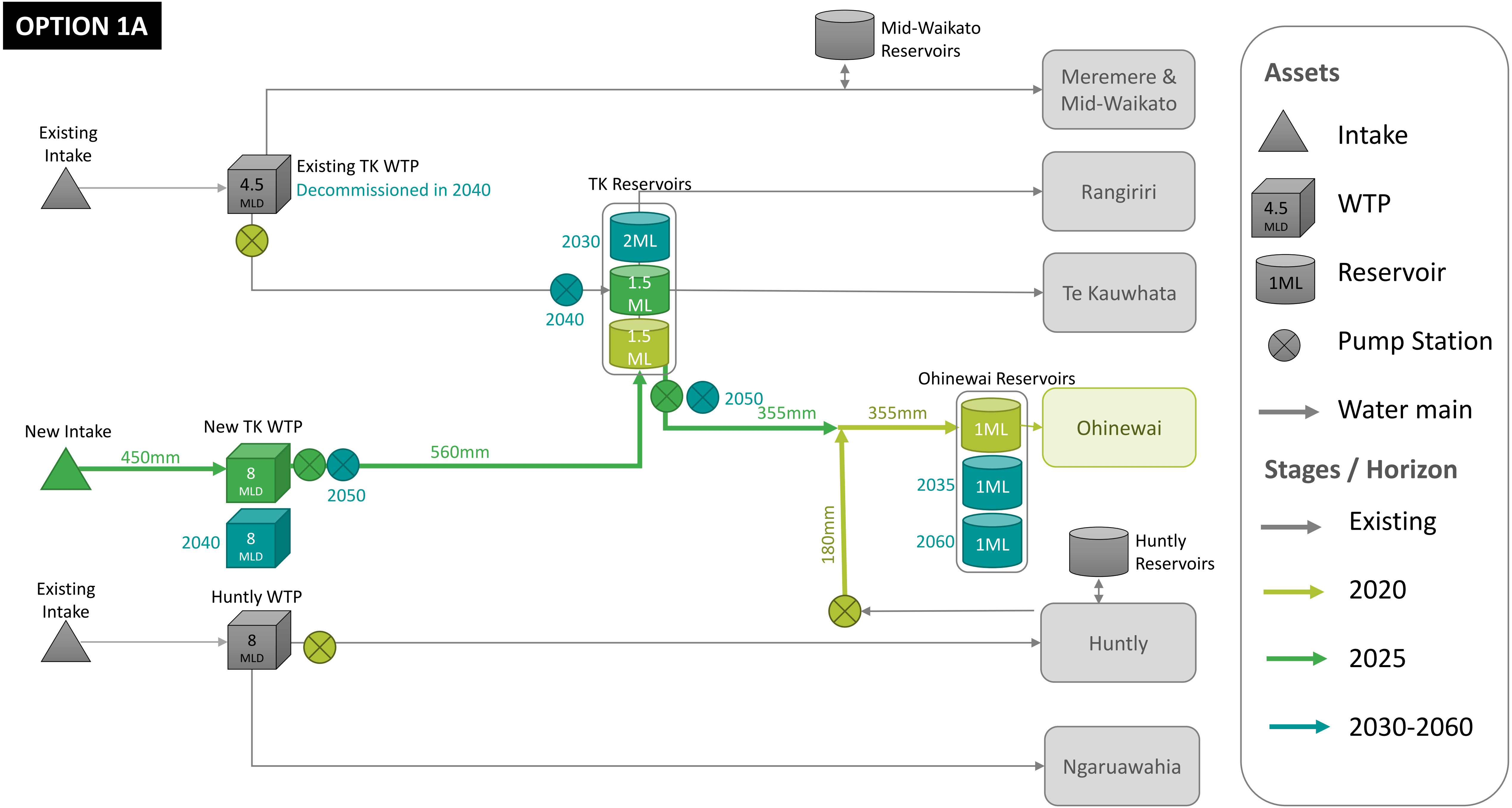
Conveyance, pumping and storage

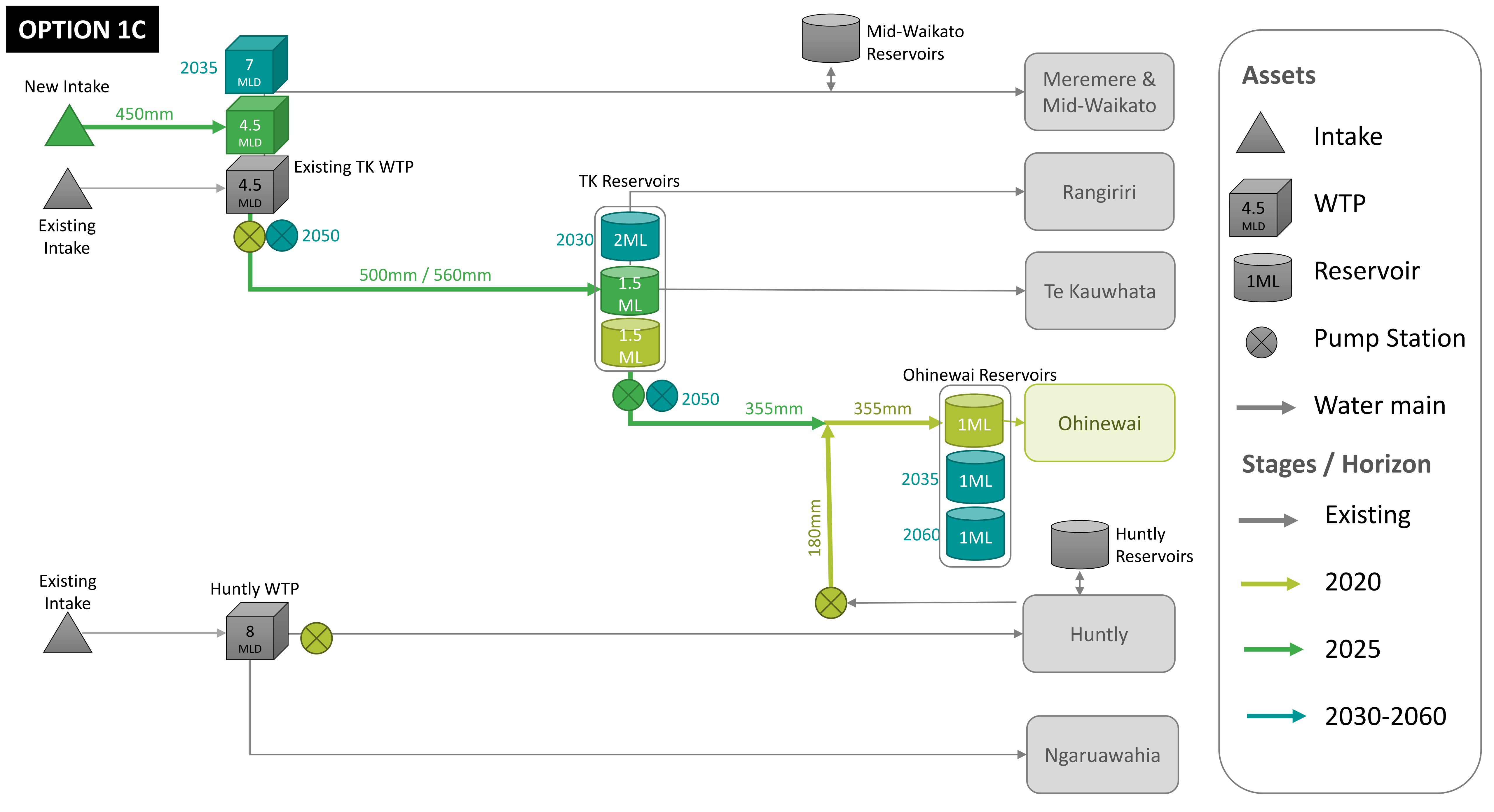
- All conveyance mains are sized for peak daily flow;
- Our strategy for conveyance main sizing has been to size mains for the ultimate flow where possible, allowing for flushing in early stages to mitigate low flows. In some instances where

growth is significantly increasing over the design horizon, we have recommended pipe duplication;

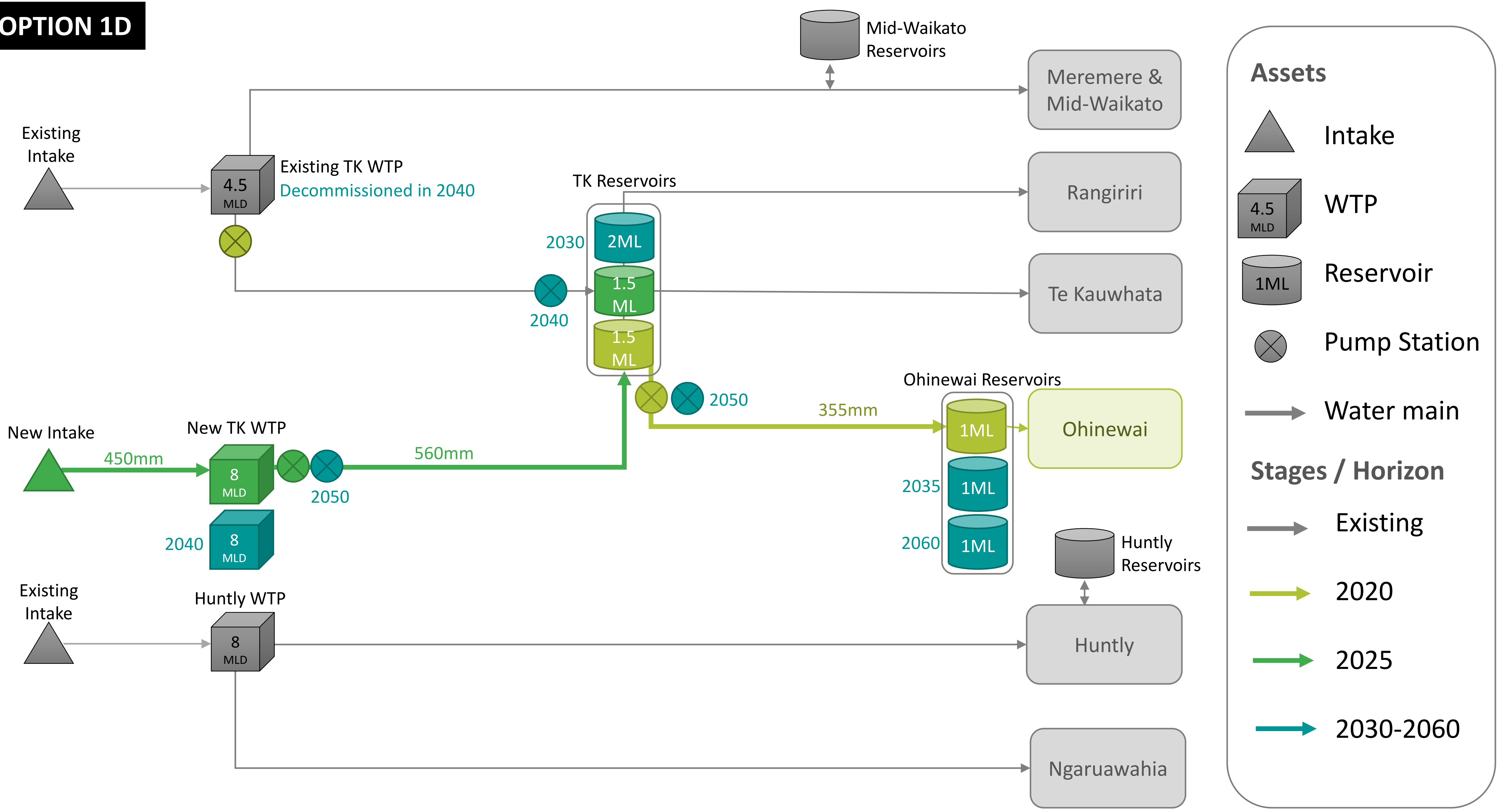
- All parameters (pump head, conveyance main length, etc) are indicative only until WWTP and pump station sites are confirmed;
- Where existing rising mains are retained in the option, we have assumed that these are in good condition and have enough remaining asset life for the design horizon;
- Where existing pump stations are retained in the option, we have assumed that these are in good condition, have enough remaining asset life for the design horizon and are able to be re-purposed for the new pump duty points and incoming flows;
- We have assumed that peak wet weather storage will be provided at each urban centre (Te Kauwhata, Huntly, Ohinewai). Peak wet weather storage has been costed as an underground storage tank sized for 12 hours at Average Daily Flow;
- We note that a cost-effective alternative (to underground storage tanks) would be to re-purpose existing WWTP ponds to provide storage of peak wet weather flows. This has not been costed but could be considered in later stages of design;
- We also note that for Ohinewai, any new developments could include distributed storage (for example, through private low-pressure pump station units), which would reduce the up-front cost of peak wet weather storage;
- We have relied on contour data from the Waikato Regional Council for estimating static head for pump stations;
- We have assumed that the Te Kauwhata rising main will be divided into a rising main and a falling main section, due to the hills on the outskirts of Te Kauwhata. We have assumed that the elevation difference between the crest of these hills and the ultimate discharge point (which varies for each option) will provide additional driving head to mitigate the static head losses in the falling main;
- We have sized conveyance mains using the design parameters in the Standard for Transmission Wastewater Pumping Stations (BP-13, ver 0.3, June 2018, Watercare);
- Where the minimum flow velocity of 0.9m/s is not met in a conveyance main (based on peak daily flow), we have included additional Opex for pipe flushing;
- We have sized conveyance mains and/or added booster pump stations in order to limit total pump head to 60m or less;
- For Huntly, design accommodates the population growth only to year 2050 (i.e. not the ultimate design horizon);
- Infrastructure for all other urban centres includes population growth up to the ultimate design horizon;
- The wastewater options costs do not include the Meremere scheme, which was excluded from all centralised or partially centralised options. We have estimated that the existing Meremere discharge pipe (175 OD HDPE) has adequate capacity for the forecast population growth;
- As previously indicated, we have considered only the cost and feasibility of long-distance wastewater conveyance mains and associated pump stations and storage. This project has not considered local reticulation networks within each urban centre, although we note that these may require upgrades/expansion to cater for the forecast population growth.

E.2 Water Option Schematics

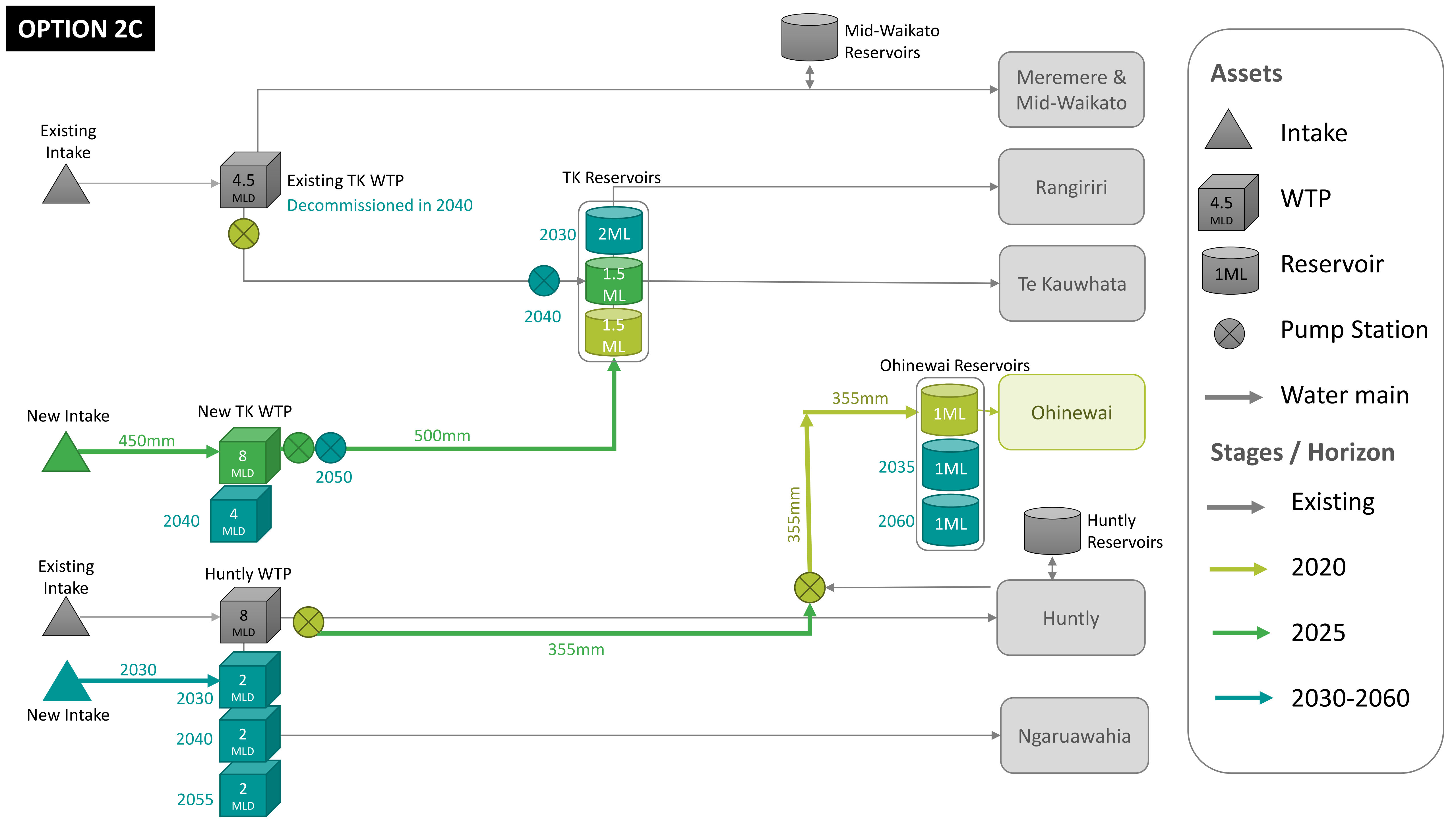

OPTION 1A
Mid-Waikato Reservoirs
Meremere & Mid-Waikato
Existing Intake
4.5 MLD
Existing TK WTP
Decommissioned in 2040
TK Reservoirs
Rangiriri
2030
2ML
1.5 ML
1.5 ML
2040
Te Kauwhata
2050
355mm
355mm
Ohinewai Reservoirs
1ML
Ohinewai
New Intake
450mm
New TK WTP
8 MLD
560mm
2050
2040
8 MLD
2035
1ML
2060
1ML
180mm
Huntly Reservoirs
Existing Intake
Huntly WTP
8 MLD
Huntly
Ngaruawahia
Assets
Intake
WTP
4.5 MLD
Reservoir
1ML
Pump Station
Water main
Stages / Horizon
Existing
2020
2025
2030-2060


OPTION 1C
New Intake
450mm
2035
7 MLD
4.5 MLD
Existing TK WTP
4.5 MLD
Existing Intake
2050
500mm / 560mm
TK Reservoirs
2030
2ML
1.5 ML
1.5 ML
2050
355mm
355mm
180mm
Mid-Waikato Reservoirs
Meremere & Mid-Waikato
Rangiriri
Te Kauwhata
Ohinewai Reservoirs
1ML
2035
1ML
2060
1ML
Ohinewai
Huntly Reservoirs
Existing Intake
Huntly WTP
8 MLD
Huntly
Ngaruawahia
Assets
Intake
4.5 MLD
WTP
1ML
Reservoir
Pump Station
Water main
Stages / Horizon
Existing
2020
2025
2030-2060

OPTION 1D

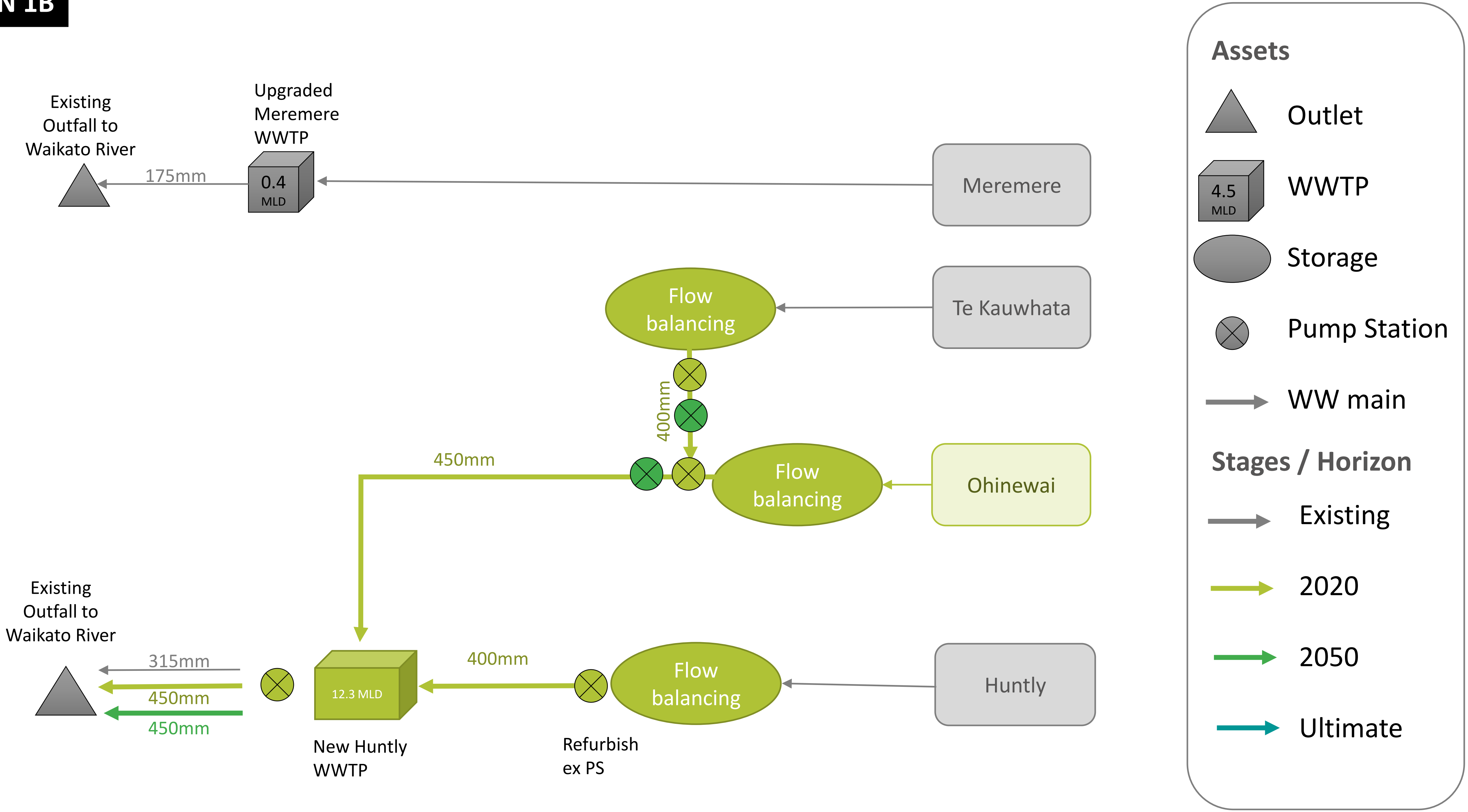


Mid-Waikato Reservoirs
Meremere & Mid-Waikato
Existing Intake
4.5 MLD
Existing TK WTP
Decommissioned in 2040
TK Reservoirs
Rangiriri
2030
2ML
1.5 ML
1.5 ML
2040
Te Kauwhata
2050
Ohinewai Reservoirs
355mm
1ML
Ohinewai
New Intake
New TK WTP
450mm
8 MLD
560mm
2050
2040
8 MLD
2035
1ML
2060
1ML
Huntly Reservoirs
Existing Intake
Huntly WTP
8 MLD
Huntly
Ngaruawahia
Assets
Intake
4.5 MLD
WTP
1ML
Reservoir
Pump Station
Water main
Stages / Horizon
Existing
2020
2025
2030-2060

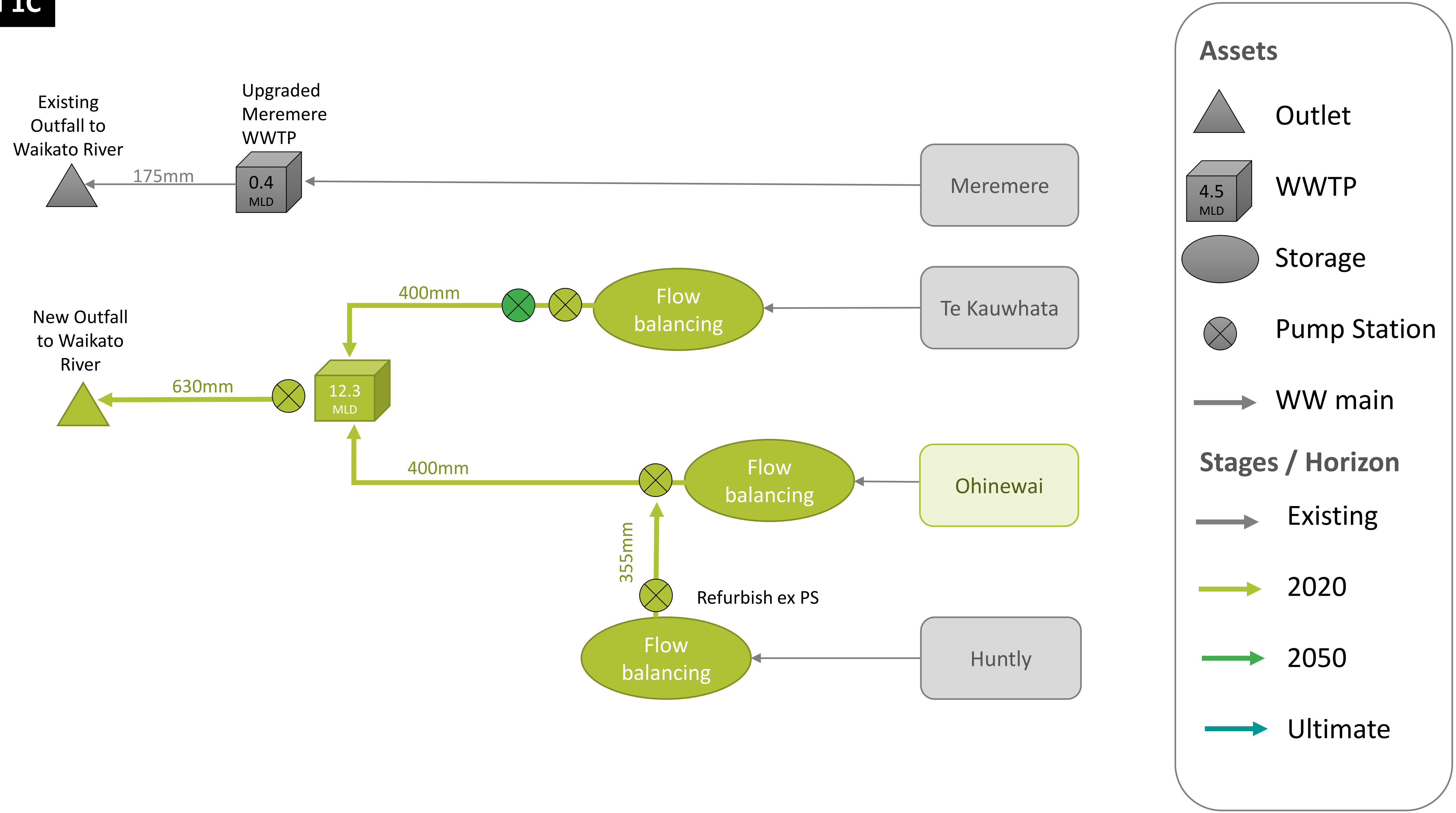

OPTION 2C
Mid-Waikato Reservoirs
Meremere & Mid-Waikato
Existing Intake
4.5 MLD
Existing TK WTP
Decommissioned in 2040
TK Reservoirs
Rangiriri
2030
2ML
1.5 ML
1.5 ML
2040
Te Kauwhata
Ohinewai Reservoirs
355mm
1ML
Ohinewai
New Intake
New TK WTP
450mm
8 MLD
500mm
2050
2035
1ML
2040
4 MLD
355mm
2060
1ML
Huntly Reservoirs
Existing Intake
Huntly WTP
8 MLD
Huntly
355mm
2030
2 MLD
New Intake
2030
2040
2 MLD
Ngaruawahia
2055
2 MLD
Assets
Intake
4.5 MLD
WTP
1ML
Reservoir
Pump Station
Water main
Stages / Horizon
Existing
2020
2025
2030-2060

E.3 Wastewater Option Schematics

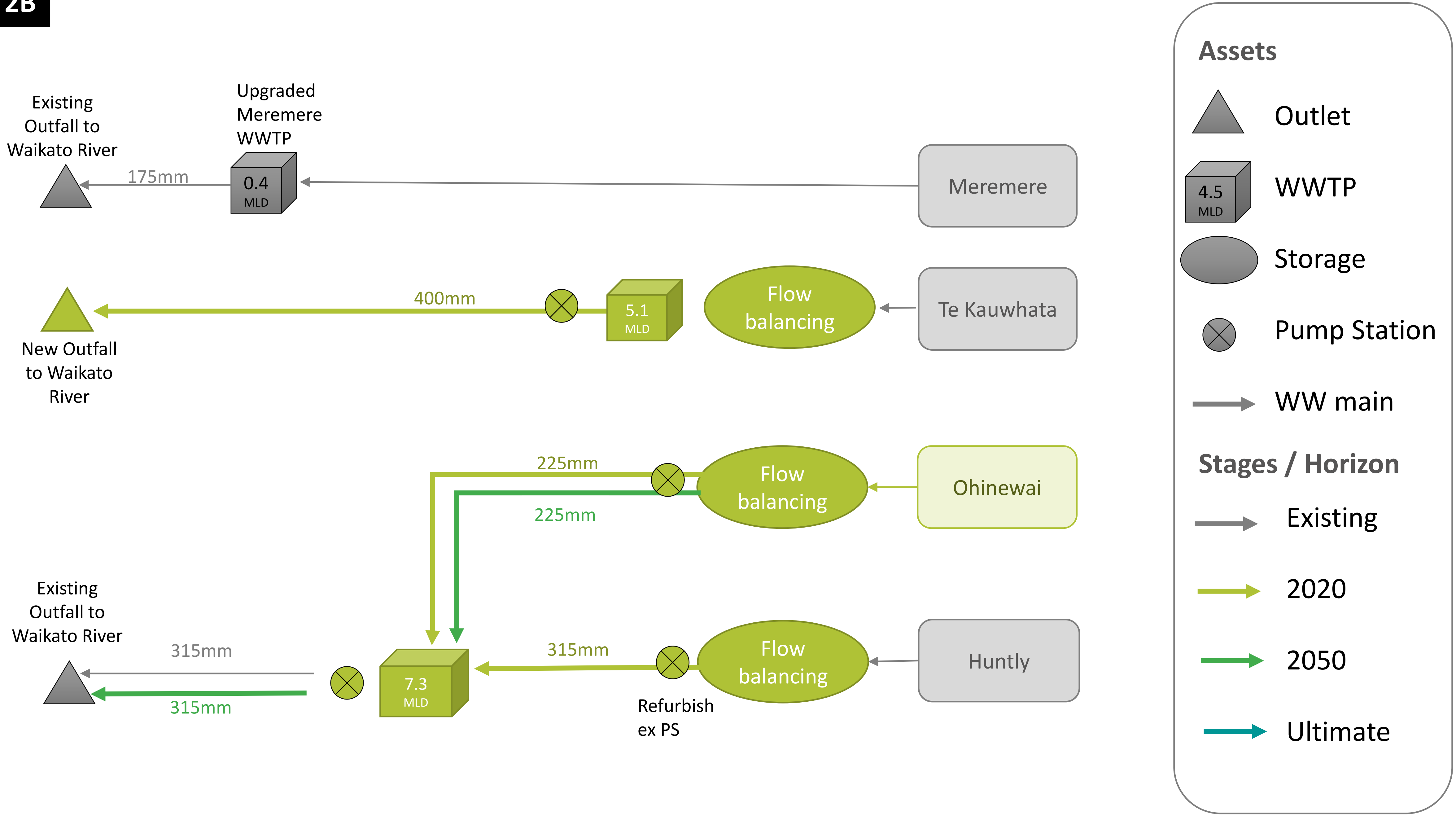
OPTION 1B


Existing
Outfall to
Waikato River
Upgraded
Meremere
WWTP
175mm
0.4
MLD
Meremere
Flow
balancing
Te Kauwhata
400mm
450mm
Flow
balancing
Ohinewai
Existing
Outfall to
Waikato River
315mm
450mm
450mm
12.3 MLD
New Huntly
WWTP
400mm
Flow
balancing
Huntly
Refurbish
ex PS
Assets
Outlet
4.5
MLD
WWTP
Storage
Pump Station
WW main
Stages / Horizon
Existing
2020
2050
Ultimate

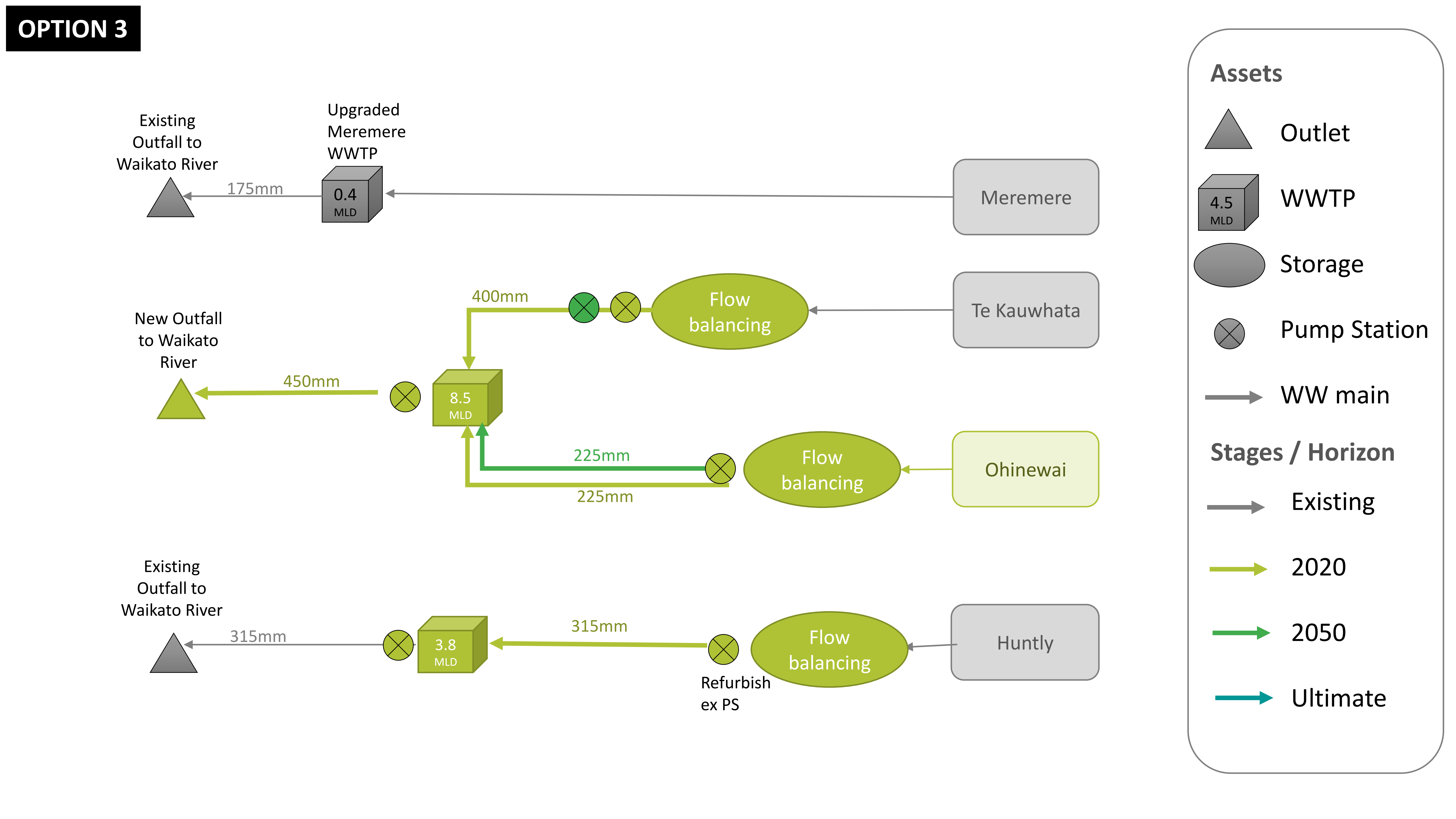
OPTION 1C


Existing Outfall to Waikato River
175mm
Upgraded Meremere WWTP
0.4 MLD
Meremere
New Outfall to Waikato River
630mm
12.3 MLD
400mm
Flow balancing
Te Kauwhata
400mm
Flow balancing
Ohinewai
355mm
Refurbish ex PS
Flow balancing
Huntly
Assets
Outlet
4.5 MLD
WWTP
Storage
Pump Station
WW main
Stages / Horizon
Existing
2020
2050
Ultimate

OPTION 2B



Existing Outfall to Waikato River
Upgraded Meremere WWTP
175mm
0.4 MLD
Meremere
400mm
5.1 MLD
Flow balancing
Te Kauwhata
New Outfall to Waikato River
225mm
Flow balancing
Ohinewai
225mm
Existing Outfall to Waikato River
315mm
315mm
7.3 MLD
315mm
Flow balancing
Huntly
Refurbish ex PS
Assets
Outlet
4.5 MLD
WWTP
Storage
Pump Station
WW main
Stages / Horizon
Existing
2020
2050
Ultimate


OPTION 3
Existing Outfall to Waikato River
Upgraded Meremere WWTP
175mm
0.4 MLD
Meremere
400mm
Flow balancing
Te Kauwhata
New Outfall to Waikato River
450mm
8.5 MLD
225mm
Flow balancing
Ohinewai
225mm
Existing Outfall to Waikato River
315mm
3.8 MLD
315mm
Flow balancing
Huntly
Refurbish ex PS
Assets
Outlet
4.5 MLD
WWTP
Storage
Pump Station
WW main
Stages / Horizon
Existing
2020
2050
Ultimate

F. Cost Assumptions and NPV

F.1 Cost Assumptions

F.1.1 Water Supply

High-level cost estimates of bulk supply assets have been prepared for each of the options, including:

- River intake works and conveyance of raw water to the WTPs, including intake structure, inlet screening, pump stations and conveyance mains;
- New or upgrades to WTPs;
- Additional pump stations, reservoirs and bulk treated water mains; and
- Operational expenses.

The costs do not include GST and are a best estimate at the time of pricing. All costs are estimates based on a level of design appropriate for strategic planning for options comparison purposes only, and as a result have a wide margin of error (level of accuracy is assumed to be approximately ±50% at this stage). Further development and more detailed costing of preferred solution(s) is recommended before any commercial decisions are made. In addition, the strategic options investigation only includes bulk supply assets, however significant network assets will be required to service the growth (e.g. reticulation of Ohinewai).

Key assumptions for capital cost estimates are:

- Base costs as follows:
  - Pump stations and reservoirs: Unit rates have been adapted from the 2011 AECOM report (Update of Unit Rate Cost Models, report prepared for Watercare Services Ltd by AECOM, July 2011), with an allowance for inflation from 2011 to 2020 and, where applicable discounts for greenfield sites, large construction works and construction in rural areas;
  - Pipelines: Unit rates have been developed from Stantec/MWH legacy data for comparable watermain /rising main projects, cross-referenced against the New South Wales Guidance manual and the 2011 AECOM report;
  - Intake works and WTPs: Rates have been developed from Stantec/MWH legacy data for comparable projects, cross-referenced against the New South Wales Guidance manual and previous reports prepared for WDC. Conventional water treatment processes, similar to existing Mid-Waikato WTPs, have been adopted for the purpose of developing costs;
  - Land cost is $100,000 per hectare.
- 15% allowance for preliminary & general;
- 30% allowance for contingency;
- 30% allowance for professional and non-works costs, including consenting, design, client project management, tendering, construction phase management, process commissioning and final documentation;
- No allowance for geotechnical investigations, surveying, feasibility studies or fast tracking.

Key assumptions for operating cost estimates are:

- Power cost is $0.13 per kWh;

- Maintenance for civil works is 0.25% of CAPEX per year;
- Maintenance for mechanical and electrical works is 2% of CAPEX per year;
- WTP operations and maintenance is $200/ML.

Watercare's NPV spreadsheet was used for the NPV calculation. Key assumptions are:

- Time period is 2020 to 2060;
- Inflation 2% inflation;
- Actual discount rate is 8.0%.

F.1.2 Wastewater

- WWTP CAPEX assumptions:
  - Assumed 5 hectares of land is required for a centralised plant of 3 catchments and 3 hectares for a centralised plant of 2 catchments for future proofing;
  - Assumed land cost is $100,000 per hectare;
  - Preliminary & General is 15% of works costs;
  - Contingency is 30%, an additional 5% has been added to allow for poor ground conditions at specific locations;
  - Professional and Non-works costs is 30% including consenting, design, client project management, tendering, construction phase management, process commissioning and final documentation.
- Conveyance CAPEX assumptions:
  - Pipe unit rates for conveyance mains, pump station costs and underground storage tank costs have been adapted from the 2011 AECOM report (Update of Unit Rate Cost Models, report prepared for Watercare Services Ltd by AECOM, July 2011);
  - We note that the AECOM rates were prepared for projects in urban areas. We have therefore included the following modifications to the AECOM rates:
    - Adjustment for inflation from 2011 to 2020 (+13%);
    - Discount for large contract with long pipe runs (90% of standard rate);
    - Discount for greenfields (48% of standard urban rate);
  - We have cross-checked the conveyance, pump station and underground storage rates against Stantec/MWH legacy data for similar projects and found the adjusted AECOM rates to be consistent with our rates;
  - We have allowed for extra costs ($250,000) associated with air valves, chemical dosing and odour facilities at the high point on the Te Kauwhata pipeline, which is divided into rising main and falling main sections. This cost also includes measures to maintain the falling main in a full condition.
- WWTP OPEX assumptions:
  - Assumed aeration power is 60% of total site power;
  - Power per unit = $0.13 per kWh;
  - Landfill Price = $130/m^3;
  - Operator labour = $35 per hour;
  - Lab cost = $15,000 per WWTP;
  - Chemicals:
    - Hypo (12.5%) = $1.10/L;

    - Ethanol (100%) = $1.25/L;
    - Polymer (100%) = $7.90/kg;
    - Alum (47%) = $0.65/L;
    - Citric Acid (50%) = $2.00/L;
    - Poly consumption 5kg/tDS (thickening) and 10kg/tDS (dewatering).
- Conveyance OPEX assumptions:
  - Power per unit = $0.13 per kWh;
  - Cost of water for flushing = $1.517/m^3 (Watercare rate);
  - Flushing has been included where peak daily flow results in less than 0.9m/s in the pipeline (i.e. early in the design life of the pipeline);
  - Flushing water volume is calculated as the pipeline volume, flushed once weekly;
  - Cost of chemical dosing = $75/ML;
  - Chemical dosing volume is calculated as the annual discharge volume for the pipeline in ML;
  - Chemical dosing has only been included for long pipelines conveying raw wastewater, and is assumed to be a permanent requirement for these pipelines;
  - Underground storage annual OPEX (general maintenance activities): 1% of CAPEX per year;
  - Pipelines annual OPEX (general maintenance activities): 0.25% of CAPEX per year;
  - Pump stations OPEX (general maintenance activities): 2% of CAPEX per year.
- Net Present Value (NPV) Calculation assumptions:
  - Operational costs are based on the ultimate 2060 design horizon;
  - NPV and Future Costs are summed from a 35-year period;
  - Year of project commencement is 2025;
  - 2% inflation was used;
  - Nominal discount rate is 11.2%;
  - Actual discount rate is 8.0%.

F.2 Water Supply NPV Calculations

Mid Waikato Water Supply Options

Prepared by: Stantec / Mott McDonald
Last revised: 29-May-20
Printed: 29-May-20

Net Present Value Calculation

ASSUMPTIONS

1 Operational costs are based on the ultimate 2040 design horizon
2 NPV and Future Costs are summed from a 25 year period
3 Year of project commencement 2020
4 Inflation 2.0%
5 Nominal Discount Rate 11.2%
6 Actual Discount Rate 8.0%

Option 1A - Retain old TK until 2035, Construct new TK 2025 at new site, double new TK at 2040, Ohinewai supplied by Huntly at 2020 then supplied by TK at 2025, no upgrades to Huntly

Costings (NPV)	Total	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039
Year from Project Commencement		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Capital Costs	$ 64,968,000	$ 7,700,000					$ 34,868,000					$ 2,100,000					$ 1,400,000				
Operational Costs	$ 864,643	$ 333,865	$ 333,865	$ 333,865	$ 333,865	$ 333,865	$ 663,248	$ 663,248	$ 663,248	$ 663,248	$ 663,248	$ 796,400	$ 796,400	$ 796,400	$ 796,400	$ 796,400	$ 881,493	$ 881,493	$ 881,493	$ 881,493	$ 881,493
Pumping Station OPEX	$ 75,883	$ 9,560	$ 14,864	$ 20,168	$ 25,472	$ 30,776	$ 34,974	$ 36,965	$ 39,796	$ 42,627	$ 45,458	$ 48,289	$ 53,683	$ 59,077	$ 64,471	$ 69,865	$ 62,701	$ 63,833	$ 65,385	$ 66,938	$ 68,490
Sum (Todays Cost)		$ 8,043,425	$ 348,729	$ 354,033	$ 359,337	$ 364,641	$ 35,566,223	$ 700,214	$ 703,044	$ 705,875	$ 708,706	$ 2,944,689	$ 850,083	$ 855,477	$ 860,871	$ 866,265	$ 2,344,194	$ 945,326	$ 946,878	$ 948,430	$ 949,982
Future Cost (at 2.0% inflation)	**$ 142,890,606**	$ 8,043,425	$ 355,704	$ 368,336	$ 381,331	$ 394,699	$ 39,267,984	$ 788,554	$ 807,577	$ 827,045	$ 846,970	$ 3,589,559	$ 1,056,971	$ 1,084,952	$ 1,113,629	$ 1,143,019	$ 3,154,976	$ 1,297,730	$ 1,325,858	$ 1,354,592	$ 1,383,945
NPV (at 8.0%)	**$ 53,572,000**	$ 8,043,425	$ 329,355	$ 315,789	$ 302,713	$ 290,116	$ 26,725,130	$ 496,923	$ 471,213	$ 446,827	$ 423,696	$ 1,662,660	$ 453,317	$ 430,849	$ 409,479	$ 389,153	$ 994,580	$ 378,795	$ 358,338	$ 338,985	$ 320,677

Costings (NPV)	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060
Year from Project Commencement	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Capital Costs	$ 15,700,000					$ -					$ 2,100,000					$ -					$ 1,100,000
Operational Costs	$ 941,880	$ 941,880	$ 941,880	$ 941,880	$ 941,880	$ 1,018,347	$ 1,018,347	$ 1,018,347	$ 1,018,347	$ 1,018,347	$ 1,073,984	$ 1,073,984	$ 1,073,984	$ 1,073,984	$ 1,073,984	$ 1,143,123	$ 1,143,123	$ 1,143,123	$ 1,143,123	$ 1,143,123	$ 1,188,678
Pumping Station OPEX	$ 70,042	$ 71,594	$ 73,146	$ 74,698	$ 76,250	$ 77,803	$ 79,355	$ 80,907	$ 82,459	$ 84,011	$ 85,563	$ 117,983	$ 121,365	$ 124,746	$ 128,127	$ 131,509	$ 134,890	$ 138,271	$ 141,653	$ 145,034	$ 148,415
Sum (Todays Cost)	$ 16,711,922	$ 1,013,474	$ 1,015,026	$ 1,016,578	$ 1,018,130	$ 1,096,150	$ 1,097,702	$ 1,099,254	$ 1,100,806	$ 1,102,358	$ 3,259,548	$ 1,191,967	$ 1,195,349	$ 1,198,730	$ 1,202,111	$ 1,274,632	$ 1,278,013	$ 1,281,394	$ 1,284,776	$ 1,288,157	$ 2,437,094
Future Cost (at 2.0% inflation)	$ 24,833,036	$ 1,536,088	$ 1,569,209	$ 1,603,041	$ 1,637,598	$ 1,798,350	$ 1,836,914	$ 1,876,302	$ 1,916,530	$ 1,957,617	$ 5,904,219	$ 2,202,265	$ 2,252,683	$ 2,304,237	$ 2,356,951	$ 2,549,122	$ 2,607,002	$ 2,666,178	$ 2,726,678	$ 2,788,531	$ 5,381,200
NPV (at 8.0%)	$ 5,327,883	$ 305,153	$ 288,641	$ 273,022	$ 258,248	$ 262,591	$ 248,354	$ 234,888	$ 222,152	$ 210,106	$ 586,746	$ 202,644	$ 191,929	$ 181,779	$ 172,164	$ 172,409	$ 163,262	$ 154,600	$ 146,397	$ 138,627	$ 247,702

Option 1C - Retain old TK, upgrade old TK to 8MLD and new intake at 2025, upgrade old TK to 16MLD at 2035, Ohinewai supplied by Huntly at 2020 then supplied by TK at 2025, no upgrades to Huntly

Costings (NPV)	Total	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039
Year from Project Commencement		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Capital Costs	$ 61,384,000	$ 7,900,000					$ 32,884,000					$ 2,100,000					$ 15,600,000				
Operational Costs	$ 876,396	$ 364,115	$ 364,115	$ 364,115	$ 364,115	$ 364,115	$ 703,123	$ 703,123	$ 703,123	$ 703,123	$ 703,123	$ 804,400	$ 804,400	$ 804,400	$ 804,400	$ 804,400	$ 885,618	$ 885,618	$ 885,618	$ 885,618	$ 885,618
Pumping Station OPEX	$ 54,944	$ 7,464	$ 12,975	$ 18,486	$ 23,996	$ 29,507	$ 22,943	$ 24,824	$ 27,546	$ 30,268	$ 32,990	$ 35,711	$ 36,830	$ 37,949	$ 39,068	$ 40,187	$ 41,306	$ 42,424	$ 43,543	$ 44,662	$ 45,781
Sum (Todays Cost)		$ 8,271,579	$ 377,089	$ 382,600	$ 388,111	$ 393,622	$ 33,610,066	$ 727,948	$ 730,670	$ 733,391	$ 736,113	$ 2,940,111	$ 841,230	$ 842,349	$ 843,468	$ 844,587	$ 16,526,923	$ 928,042	$ 929,161	$ 930,280	$ 931,399
Future Cost (at 2.0% inflation)	**$ 135,309,181**	$ 8,271,579	$ 384,631	$ 398,057	$ 411,867	$ 426,069	$ 37,108,229	$ 819,788	$ 839,310	$ 859,285	$ 879,723	$ 3,583,979	$ 1,045,964	$ 1,068,302	$ 1,091,116	$ 1,114,415	$ 22,243,062	$ 1,274,003	$ 1,301,049	$ 1,328,668	$ 1,356,872
NPV (at 8.0%)	**$ 53,307,000**	$ 8,271,579	$ 356,140	$ 341,270	$ 326,953	$ 313,174	$ 25,255,237	$ 516,605	$ 489,729	$ 464,245	$ 440,081	$ 1,660,076	$ 448,596	$ 424,238	$ 401,201	$ 379,415	$ 7,011,941	$ 371,869	$ 351,633	$ 332,498	$ 314,404

Costings (NPV)	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060
Year from Project Commencement	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Capital Costs	$ -					$ -					$ 1,800,000					$ -					$ 1,100,000
Operational Costs	$ 941,255	$ 941,255	$ 941,255	$ 941,255	$ 941,255	$ 1,017,722	$ 1,017,722	$ 1,017,722	$ 1,017,722	$ 1,017,722	$ 1,093,609	$ 1,093,609	$ 1,093,609	$ 1,093,609	$ 1,093,609	$ 1,139,123	$ 1,139,123	$ 1,139,123	$ 1,139,123	$ 1,139,123	$ 1,187,428
Pumping Station OPEX	$ 46,900	$ 48,019	$ 49,138	$ 50,256	$ 51,375	$ 52,494	$ 53,613	$ 54,732	$ 55,851	$ 56,970	$ 58,089	$ 90,983	$ 93,805	$ 96,627	$ 99,449	$ 102,270	$ 105,092	$ 107,914	$ 110,736	$ 113,558	$ 116,380
Sum (Todays Cost)	$ 988,155	$ 989,273	$ 990,392	$ 991,511	$ 992,630	$ 1,070,216	$ 1,071,335	$ 1,072,454	$ 1,073,573	$ 1,074,692	$ 2,951,698	$ 1,184,592	$ 1,187,414	$ 1,190,236	$ 1,193,058	$ 1,241,393	$ 1,244,215	$ 1,247,037	$ 1,249,859	$ 1,252,681	$ 2,403,808
Future Cost (at 2.0% inflation)	$ 1,468,346	$ 1,499,408	$ 1,531,126	$ 1,563,513	$ 1,596,583	$ 1,755,803	$ 1,792,791	$ 1,830,557	$ 1,869,116	$ 1,908,485	$ 5,346,592	$ 2,188,639	$ 2,237,730	$ 2,287,909	$ 2,339,200	$ 2,482,650	$ 2,538,059	$ 2,594,692	$ 2,652,574	$ 2,711,734	$ 5,307,704
NPV (at 8.0%)	$ 315,031	$ 297,866	$ 281,636	$ 266,290	$ 251,780	$ 256,379	$ 242,389	$ 229,162	$ 216,656	$ 204,833	$ 531,330	$ 201,390	$ 190,655	$ 180,491	$ 170,868	$ 167,913	$ 158,945	$ 150,455	$ 142,418	$ 134,810	$ 244,319

Option 1D - Retain old TK until 2035, construct new TK at 2025, double new TK at 2040, Ohinewai supplied by TK at 2020, no upgrades to Huntly

Costings (NPV)	Total	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039
Year from Project Commencement		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Capital Costs	$ 66,468,000	$ 15,300,000					$ 28,768,000					$ 2,100,000					$ 1,400,000				
Operational Costs	$ 857,543	$ 333,865	$ 333,865	$ 333,865	$ 333,865	$ 333,865	$ 670,998	$ 670,998	$ 670,998	$ 670,998	$ 670,998	$ 785,400	$ 785,400	$ 785,400	$ 785,400	$ 785,400	$ 867,118	$ 867,118	$ 867,118	$ 867,118	$ 867,118
Pumping Station OPEX	$ 74,854	$ 7,880	$ 10,769	$ 13,658	$ 16,547	$ 19,436	$ 33,294	$ 36,125	$ 38,956	$ 41,787	$ 44,618	$ 47,449	$ 52,843	$ 58,237	$ 63,631	$ 69,025	$ 62,281	$ 63,833	$ 65,385	$ 66,938	$ 68,490
Sum (Todays Cost)		$ 15,641,745	$ 344,634	$ 347,523	$ 350,412	$ 353,301	$ 29,472,293	$ 707,124	$ 709,954	$ 712,785	$ 715,616	$ 2,932,849	$ 838,243	$ 843,637	$ 849,031	$ 854,425	$ 2,329,399	$ 930,951	$ 932,503	$ 934,055	$ 935,607
Future Cost (at 2.0% inflation)	**$ 143,221,169**	$ 15,641,745	$ 351,527	$ 361,563	$ 371,860	$ 382,424	$ 32,539,793	$ 796,336	$ 815,514	$ 835,142	$ 855,228	$ 3,575,126	$ 1,042,250	$ 1,069,936	$ 1,098,312	$ 1,127,396	$ 3,135,064	$ 1,277,996	$ 1,305,729	$ 1,334,061	$ 1,363,003
NPV (at 8.0%)	**$ 56,485,000**	$ 15,641,745	$ 325,488	$ 309,982	$ 295,194	$ 281,093	$ 22,146,036	$ 501,827	$ 475,845	$ 451,201	$ 427,827	$ 1,655,975	$ 447,003	$ 424,886	$ 403,847	$ 383,834	$ 988,303	$ 373,035	$ 352,898	$ 333,847	$ 315,824

Costings (NPV)	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060
Year from Project Commencement	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Capital Costs	$ 15,700,000					$ -					$ 2,100,000					$ -					$ 1,100,000
Operational Costs	$ 930,880	$ 930,880	$ 930,880	$ 930,880	$ 930,880	$ 1,007,347	$ 1,007,347	$ 1,007,347	$ 1,007,347	$ 1,007,347	$ 1,062,984	$ 1,062,984	$ 1,062,984	$ 1,062,984	$ 1,062,984	$ 1,132,123	$ 1,139,123	$ 1,139,123	$ 1,139,123	$ 1,139,123	$ 1,177,678
Pumping Station OPEX	$ 70,042	$ 71,594	$ 73,146	$ 74,698	$ 76,250	$ 77,803	$ 79,355	$ 80,907	$ 82,459	$ 84,011	$ 85,563	$ 117,983	$ 121,365	$ 124,746	$ 128,127	$ 131,509	$ 134,890	$ 138,271	$ 141,653	$ 145,034	$ 148,415
Sum (Todays Cost)	$ 16,700,922	$ 1,002,474	$ 1,004,026	$ 1,005,578	$ 1,007,130	$ 1,085,150	$ 1,086,702	$ 1,088,254	$ 1,089,806	$ 1,091,358	$ 3,248,548	$ 1,180,967	$ 1,184,349	$ 1,187,730	$ 1,191,111	$ 1,263,632	$ 1,274,013	$ 1,277,394	$ 1,280,776	$ 1,284,157	$ 2,426,094
Future Cost (at 2.0% inflation)	$ 24,816,691	$ 1,519,416	$ 1,552,204	$ 1,585,695	$ 1,619,906	$ 1,780,303	$ 1,818,506	$ 1,857,526	$ 1,897,379	$ 1,938,083	$ 5,884,294	$ 2,181,942	$ 2,231,953	$ 2,283,092	$ 2,335,384	$ 2,527,123	$ 2,598,843	$ 2,657,855	$ 2,718,189	$ 2,779,872	$ 5,356,911
NPV (at 8.0%)	$ 5,324,377	$ 301,841	$ 285,513	$ 270,068	$ 255,458	$ 259,956	$ 245,865	$ 232,538	$ 219,932	$ 208,010	$ 584,765	$ 200,774	$ 190,163	$ 180,111	$ 170,589	$ 170,921	$ 162,751	$ 154,118	$ 145,941	$ 138,197	$ 246,584

Option 2C - Retain old TK until 2040, construct new TK at 2025 to 8 MLD, upgrade new TK at 2040 to 12 MLD, Ohinewai supplied by Huntly only, upgrade Huntly to 10 MLD at 2030, 12 MLD at 2040, 14 MLD at 2055

Costings (NPV)	Total	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039
Year from Project Commencement		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Capital Costs	$ 82,252,000	$ 9,800,000					$ 32,268,000					$ 12,684,000					$ 1,100,000				
Operational Costs	$ 906,963	$ 370,615	$ 370,615	$ 370,615	$ 370,615	$ 370,615	$ 689,248	$ 689,248	$ 689,248	$ 689,248	$ 689,248	$ 853,525	$ 853,525	$ 853,525	$ 853,525	$ 853,525	$ 932,743	$ 932,743	$ 932,743	$ 932,743	$ 932,743
Pumping Station OPEX	$ 82,737	$ 8,031	$ 12,135	$ 16,240	$ 20,344	$ 24,449	$ 35,741	$ 39,412	$ 43,082	$ 46,752	$ 50,422	$ 54,092	$ 55,978	$ 57,863	$ 59,748	$ 61,634	$ 63,519	$ 61,525	$ 59,531	$ 57,537	$ 55,543
Sum (Todays Cost)		$ 10,178,646	$ 382,750	$ 386,855	$ 390,959	$ 395,063	$ 32,992,990	$ 728,660	$ 732,330	$ 736,000	$ 739,671	$ 13,591,617	$ 909,503	$ 911,388	$ 913,274	$ 915,159	$ 2,096,262	$ 994,268	$ 992,273	$ 990,279	$ 988,285
Future Cost (at 2.0% inflation)	**$ 170,848,366**	$ 10,178,646	$ 390,405	$ 402,483	$ 414,889	$ 427,629	$ 36,426,927	$ 820,590	$ 841,217	$ 862,342	$ 883,975	$ 16,568,106	$ 1,130,852	$ 1,155,861	$ 1,181,417	$ 1,207,533	$ 2,821,292	$ 1,364,916	$ 1,389,422	$ 1,414,363	$ 1,439,745
NPV (at 8.0%)	**$ 61,992,000**	$ 10,178,646	$ 361,486	$ 345,065	$ 329,352	$ 314,320	$ 24,791,554	$ 517,111	$ 490,842	$ 465,896	$ 442,207	$ 7,674,239	$ 485,003	$ 459,008	$ 434,404	$ 411,118	$ 889,389	$ 398,406	$ 375,518	$ 353,943	$ 333,606

Costings (NPV)	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060
Year from Project Commencement	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Capital Costs	$ 19,600,000					$ -					$ 1,800,000					$ 3,900,000					$ 1,100,000
Operational Costs	$ 990,380	$ 990,380	$ 990,380	$ 990,380	$ 990,380	$ 1,066,847	$ 1,066,847	$ 1,066,847	$ 1,066,847	$ 1,066,847	$ 1,122,484	$ 1,122,484	$ 1,122,484	$ 1,122,484	$ 1,122,484	$ 1,167,998	$ 1,167,998	$ 1,167,998	$ 1,167,998	$ 1,167,998	$ 1,216,303
Pumping Station OPEX	$ 93,798	$ 81,472	$ 82,484	$ 83,497	$ 84,509	$ 85,522	$ 88,116	$ 90,711	$ 93,306	$ 95,901	$ 98,495	$ 133,979	$ 138,225	$ 142,470	$ 146,715	$ 150,960	$ 155,205	$ 159,451	$ 163,696	$ 167,941	$ 172,186
Sum (Todays Cost)	$ 20,684,178	$ 1,071,852	$ 1,072,864	$ 1,073,876	$ 1,074,889	$ 1,152,369	$ 1,154,963	$ 1,157,558	$ 1,160,153	$ 1,162,748	$ 3,020,979	$ 1,256,464	$ 1,260,709	$ 1,264,954	$ 1,269,199	$ 5,218,958	$ 1,323,203	$ 1,327,448	$ 1,331,694	$ 1,335,939	$ 2,488,489
Future Cost (at 2.0% inflation)	$ 30,735,600	$ 1,624,569	$ 1,658,626	$ 1,693,395	$ 1,728,891	$ 1,890,583	$ 1,932,737	$ 1,975,820	$ 2,019,854	$ 2,064,859	$ 5,472,086	$ 2,321,428	$ 2,375,857	$ 2,431,534	$ 2,488,488	$10,437,340	$ 2,699,186	$ 2,762,002	$ 2,826,252	$ 2,891,966	$ 5,494,683
NPV (at 8.0%)	$ 6,594,268	$ 322,730	$ 305,088	$ 288,411	$ 272,645	$ 276,059	$ 261,309	$ 247,347	$ 234,129	$ 221,616	$ 543,801	$ 213,609	$ 202,423	$ 191,821	$ 181,772	$ 705,925	$ 169,035	$ 160,157	$ 151,743	$ 143,770	$ 252,925

F.3 Wastewater NPV Calculations

Mid Waikato Wastewater Options

Project #: 415939
Last revised: 12-Jun-20
Printed: 12-Jun-20

Net Present Value Calculation

ASSUMPTIONS

1 Operational costs are based on the ultimate 2060 design horizon
2 NPV and Future Costs are summed from a 45 year period
3 Year of project commencement 2025
4 Inflation 2.0%
5 Nominal Discount Rate 11.2%
6 Actual Discount Rate 8.0%

Option 1b - Centralised Plant at Huntly

Costings (NPV)	Total	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060
Year from Project Commencement		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
Capital Cost	$ 115,200,000	$ 107,700,000																									$ 7,500,000										
Operational Costs	$ 2,200,000	$ 1,573,675	$ 1,615,294	$ 1,735,343	$ 1,776,963	$ 1,818,582	$ 1,716,234	$ 1,759,438	$ 1,790,102	$ 1,820,765	$ 1,851,429	$ 1,882,092	$ 1,925,297	$ 1,955,960	$ 1,986,623	$ 2,017,287	$ 2,047,950	$ 2,091,155	$ 2,121,818	$ 2,152,482	$ 2,183,145	$ 2,209,861	$ 2,252,779	$ 2,283,510	$ 2,314,242	$ 2,344,974	$ 2,492,904	$ 2,518,529	$ 2,534,148	$ 2,549,768	$ 2,565,388	$ 2,589,849	$ 2,624,424	$ 2,649,061	$ 2,673,785	$ 2,698,594	$ 2,723,490
Sum (Todays Cost)		$ 109,273,675	$ 1,615,294	$ 1,735,343	$ 1,776,963	$ 1,818,582	$ 1,716,234	$ 1,759,438	$ 1,790,102	$ 1,820,765	$ 1,851,429	$ 1,882,092	$ 1,925,297	$ 1,955,960	$ 1,986,623	$ 2,017,287	$ 2,047,950	$ 2,091,155	$ 2,121,818	$ 2,152,482	$ 2,183,145	$ 2,209,861	$ 2,252,779	$ 2,283,510	$ 2,314,242	$ 2,344,974	$ 9,992,904	$ 2,518,529	$ 2,534,148	$ 2,549,768	$ 2,565,388	$ 2,589,849	$ 2,624,424	$ 2,649,061	$ 2,673,785	$ 2,698,594	$ 2,723,490
NPV (at 8.0%)	**$ 133,200,000**	$ 109,273,675	$ 1,495,643	$ 1,487,777	$ 1,410,610	$ 1,336,712	$ 1,168,040	$ 1,108,745	$ 1,044,507	$ 983,703	$ 926,175	$ 871,773	$ 825,727	$ 776,739	$ 730,477	$ 686,808	$ 645,599	$ 610,388	$ 573,462	$ 538,656	$ 505,861	$ 474,122	$ 447,527	$ 420,030	$ 394,151	$ 369,801	$ 1,459,143	$ 340,510	$ 317,242	$ 295,553	$ 275,337	$ 257,372	$ 241,489	$ 225,700	$ 210,932	$ 197,120	$ 184,202

Option 1c - Centralised Plant at Ohinewai

Costings (NPV)	Total	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060
Year from Project Commencement		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
Capital Costs	$ 105,200,000	$ 102,700,000																									$ 2,500,000										
Operational Costs	$ 2,200,000	$ 1,590,856	$ 1,632,419	$ 1,752,412	$ 1,793,975	$ 1,835,538	$ 1,815,633	$ 1,853,112	$ 1,878,050	$ 1,902,988	$ 1,927,925	$ 1,952,863	$ 1,990,343	$ 2,015,280	$ 2,040,218	$ 2,065,156	$ 2,090,094	$ 2,127,573	$ 2,152,511	$ 2,177,449	$ 2,202,387	$ 2,223,377	$ 2,260,569	$ 2,285,575	$ 2,310,581	$ 2,335,587	$ 2,409,184	$ 2,432,702	$ 2,446,217	$ 2,459,731	$ 2,473,245	$ 2,495,601	$ 2,528,070	$ 2,550,602	$ 2,573,220	$ 2,595,925	$ 2,618,715
Sum (Todays Cost)		$ 104,290,856	$ 1,632,419	$ 1,752,412	$ 1,793,975	$ 1,835,538	$ 1,815,633	$ 1,853,112	$ 1,878,050	$ 1,902,988	$ 1,927,925	$ 1,952,863	$ 1,990,343	$ 2,015,280	$ 2,040,218	$ 2,065,156	$ 2,090,094	$ 2,127,573	$ 2,152,511	$ 2,177,449	$ 2,202,387	$ 2,223,377	$ 2,260,569	$ 2,285,575	$ 2,310,581	$ 2,335,587	$ 4,909,184	$ 2,432,702	$ 2,446,217	$ 2,459,731	$ 2,473,245	$ 2,495,601	$ 2,528,070	$ 2,550,602	$ 2,573,220	$ 2,595,925	$ 2,618,715
NPV (at 8.0%)	**$ 127,800,000**	$ 104,290,856	$ 1,511,499	$ 1,502,411	$ 1,424,115	$ 1,349,175	$ 1,235,689	$ 1,167,775	$ 1,095,824	$ 1,028,125	$ 964,443	$ 904,554	$ 853,624	$ 800,296	$ 750,184	$ 703,105	$ 658,885	$ 621,018	$ 581,757	$ 544,904	$ 510,320	$ 477,022	$ 449,075	$ 420,410	$ 393,527	$ 368,321	$ 716,829	$ 328,906	$ 306,234	$ 285,117	$ 265,447	$ 248,006	$ 232,623	$ 217,311	$ 202,999	$ 189,620	$ 177,116

Option 2b - Centralised Plant at Huntly and Individual Plant at TK

Costings (NPV)	Total	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060
Year from Project Commencement		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
Capital Costs	$ 113,400,000	$ 110,000,000																									$ 3,400,000										
Operational Costs	$ 2,100,000	$ 1,441,181	$ 1,484,422	$ 1,606,103	$ 1,649,344	$ 1,692,585	$ 1,692,153	$ 1,726,623	$ 1,748,557	$ 1,770,490	$ 1,792,423	$ 1,814,356	$ 1,848,827	$ 1,870,760	$ 1,892,693	$ 1,914,627	$ 1,936,560	$ 1,971,031	$ 1,992,964	$ 2,014,897	$ 2,036,830	$ 2,054,816	$ 2,121,790	$ 2,144,391	$ 2,166,992	$ 2,191,686	$ 2,235,580	$ 2,260,972	$ 2,276,360	$ 2,291,748	$ 2,307,135	$ 2,317,070	$ 2,352,039	$ 2,377,072	$ 2,402,190	$ 2,427,394	$ 2,452,683
Sum (Todays Cost)		$ 111,441,181	$ 1,484,422	$ 1,606,103	$ 1,649,344	$ 1,692,585	$ 1,692,153	$ 1,726,623	$ 1,748,557	$ 1,770,490	$ 1,792,423	$ 1,814,356	$ 1,848,827	$ 1,870,760	$ 1,892,693	$ 1,914,627	$ 1,936,560	$ 1,971,031	$ 1,992,964	$ 2,014,897	$ 2,036,830	$ 2,054,816	$ 2,121,790	$ 2,144,391	$ 2,166,992	$ 2,191,686	$ 5,635,580	$ 2,260,972	$ 2,276,360	$ 2,291,748	$ 2,307,135	$ 2,317,070	$ 2,352,039	$ 2,377,072	$ 2,402,190	$ 2,427,394	$ 2,452,683
NPV (at 8.0%)	**$ 133,400,000**	$ 111,441,181	$ 1,374,465	$ 1,376,974	$ 1,309,302	$ 1,244,101	$ 1,151,651	$ 1,088,066	$ 1,020,266	$ 956,541	$ 896,658	$ 840,398	$ 792,930	$ 742,905	$ 695,939	$ 651,856	$ 610,484	$ 575,325	$ 538,636	$ 504,226	$ 471,958	$ 440,857	$ 421,506	$ 394,440	$ 369,072	$ 345,627	$ 822,896	$ 305,687	$ 284,970	$ 265,645	$ 247,619	$ 230,264	$ 216,425	$ 202,527	$ 189,506	$ 177,310	$ 165,886

Option 3- Centralised Plant between TK & Ohinewai and Individual Plant at Huntly

Costings (NPV)	Total	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060
Year from Project Commencement		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
Capital Costs	$ 118,500,000	$ 113,900,000																									$ 4,600,000										
Operational Costs	$ 2,400,000	$ 1,636,899	$ 1,689,790	$ 1,821,111	$ 1,874,001	$ 1,926,892	$ 1,906,181	$ 1,950,241	$ 1,981,760	$ 2,013,279	$ 2,044,798	$ 2,076,317	$ 2,120,377	$ 2,151,896	$ 2,183,415	$ 2,214,934	$ 2,246,452	$ 2,290,513	$ 2,322,032	$ 2,353,551	$ 2,385,069	$ 2,412,641	$ 2,456,414	$ 2,488,002	$ 2,519,590	$ 2,434,854	$ 2,650,899	$ 2,674,616	$ 2,688,336	$ 2,702,056	$ 2,715,776	$ 2,727,471	$ 2,763,658	$ 2,790,003	$ 2,816,519	$ 2,843,209	$ 2,870,071
Sum (Todays Cost)		$ 115,536,899	$ 1,689,790	$ 1,821,111	$ 1,874,001	$ 1,926,892	$ 1,906,181	$ 1,950,241	$ 1,981,760	$ 2,013,279	$ 2,044,798	$ 2,076,317	$ 2,120,377	$ 2,151,896	$ 2,183,415	$ 2,214,934	$ 2,246,452	$ 2,290,513	$ 2,322,032	$ 2,353,551	$ 2,385,069	$ 2,412,641	$ 2,456,414	$ 2,488,002	$ 2,519,590	$ 2,434,854	$ 7,250,899	$ 2,674,616	$ 2,688,336	$ 2,702,056	$ 2,715,776	$ 2,727,471	$ 2,763,658	$ 2,790,003	$ 2,816,519	$ 2,843,209	$ 2,870,071
NPV (at 8.0%)	**$ 140,900,000**	$ 115,536,899	$ 1,564,620	$ 1,561,309	$ 1,487,642	$ 1,416,323	$ 1,297,315	$ 1,228,983	$ 1,156,338	$ 1,087,712	$ 1,022,908	$ 961,736	$ 909,393	$ 854,547	$ 802,837	$ 754,099	$ 708,176	$ 668,579	$ 627,573	$ 588,974	$ 552,649	$ 517,628	$ 487,981	$ 457,644	$ 429,125	$ 383,975	$ 1,058,761	$ 361,613	$ 336,544	$ 313,205	$ 291,478	$ 271,049	$ 254,301	$ 237,708	$ 222,192	$ 207,683	$ 194,116

G. Carbon Assumptions

G.1 Water Supply

The following key assumptions have been made across the four options:

- Meremere was not included in the scope as it is similar across all options;
- The flocculation and sedimentation processes are covered by the clarifier process model;
- Where there is a sedimentation basin without a flocculation basin, the sedimentation process is modelled through a concrete tank, clarifier sludge pumps and a scraper;
- A GRP tank was used instead of steel for treated water reservoir, as there was no steel reservoir model;
- A valve chamber has been assumed for every km of water main;
- Assumed the polymer make system is like a Polyrex0.6 or equivalent for all options thus mixing and storage tanks are the same size. The mixing and storage tanks are the main components of this system which have been included. The pump and mixer have been excluded;
- The final upgrades of pump stations and reservoirs have been included, this does not account for any inefficiencies during phasing;
- A 15% contingency based on contingencies associated with projects in pre-feasibility and feasibility phase in the Watercare Carbon baseline.

G.2 Wastewater

The following key assumptions have been made across the four options:

- The tanks of the potable water and recycled water systems have been included but no additional pipework has been included;
- Assumed a fuel tank will not be required;
- All contributions from the installation of power lines at the new treatment plants have been excluded;
- Allowed for 1 air valve and scour point per 500m and one isolation valve every 2km;
- A 15% contingency based on contingencies associated with projects in pre-feasibility and feasibility phase in the Watercare Carbon baseline.

H. Multi Criteria Analysis

H.1 Description of criteria

Tables F1 and F2 give more detail about the evaluation criteria used in the options analysis for water supply and wastewater.

Table F1 - Description of criteria used in options analysis of water supply options

Criteria	Description of criteria	Weighting
Natural Environment Impact	• Sustainable use of water resources / reuse of treated wastewater for non-potable use • Water and sediment quality • Microbial Contamination • Aquatic ecology • Terrestrial ecology • Fresh water environment and resources • Micropollutants/emerging contaminants Ability to gain consent for the option	10%
Public Health Protection/Statutory Compliance	• Ability to meet statutory requirements - DWSNZ, NES • Compliance with all health-based parameters (MAVs) • Compliance with aesthetic parameters (GVs) • Consideration of intake location and treatment processes relative to WW discharge and other land uses Raw water quality - Waikato River or reuse of treated wastewater	10%
Cultural Benefits/ Impacts on Maori Cultural values	To be confirmed by iwi representatives during consultation phase	20%
Social and Community	• Amenity value and aesthetics • Urban development • Recreation • Negative perceptions Vibrant community	5%
Flexibility/ Scalability/Risk	• Adaptable and resilient - adapt to changing conditions such as increased demands and uncertainty of growth location • Able to be staged - accommodate uncertainty around growth, pipeline route aligned to future expansion plans • Engineering Resilience – sufficiently resilient, adaptable to and have significant risks managed of natural hazards, climate change and operational failure. • Ability to meet forecasted demand over the next 5-10 years. Council ownership / or alternative mechanism to ensure long term security of supply	10%
Sustainability	• Reliable, proven and robust modern-day technology • Opportunity for loss prevention and demand management • Opportunity to limit treatment for non-potable use • Opportunities for implementation of sustainable practices and technologies • Carbon and energy neutrality • Disposal reuse and flexibilities Ability to be delivered quickly by local contractors	15%

Criteria	Description of criteria	Weighting
Whole of life cost	• Operational costs and whole of life costs including capex • Implementation costs • Future local investment impacts • Council rates recovery / LTP budget allocation Sunk costs of existing assets	20%
Constructability	• Geology, soil, groundwater, geotech and seismic conditions • Buildability • Land Availability • Existing Infrastructure • Safety and Design Electricity Availability	10%

Table F2 - Description of criteria used in options analysis of wastewater options

Criteria	Description of criteria	Weighting
Natural Environment Impact	• Potential effects on freshwater and marine receiving environments • Potential effects on the health of marine organisms • Potential effects on aquatic ecosystems • Potential effects on terrestrial ecosystems and soils • Potential effects on significant marine areas, coastal processes and physical footprint within the coastal marine area • Potential effects in the receiving environment of micropollutants/ emerging contaminants in treated wastewater	10%
Public Health Protection/Statutory Compliance	• Risk of public exposure to waterborne pathogens • Risk of public exposure to pathogens from aerosols and/or aeration equipment • Risk of contamination from reclaimed water • Odour, dust, insect, vectors and/or noise nuisances.	10%
Cultural Benefits/ Impacts on Maori Cultural values	• To be confirmed by iwi representatives during consultation phase	20%
Social and Community	• Option enhances the natural and built environment and minimises adverse effects, including displacement and disruption of existing persons and activities • Option enables residential and industrial development • Enhances or detracts from local recreational activities and opportunities • Adverse perceptions against the location of infrastructure facilities and discharge locations • Lake water quality/ potential to increase uses for the lake. Positive perceptions of town form and function, influence on visitor attractiveness	5%
Flexibility/ Scalability/Risk	• Adapt to changing conditions such as increased flows and loads, discharge quality requirements, etc. • Accommodate uncertainty around population/business growth • Sufficiently resilient, adaptable to and have significant risks managed of natural hazards, climate change and operational failure	10%
Sustainability	• To be sustainable, must be proven technology with adequate redundancy • The provision of beneficial reuse of treated wastewater	15%
Whole of life cost	• Potential to recover portion of operational costs	20%
Constructability	• **Must be suited to local environmental conditions** • **Must be able to be constructed at proposed locations** • **Adequate and secure land must be available** • **Potential to maximise existing infrastructure** • **Whole of life safety in design considerations**	**10%**

H.2 Water Supply MCA tables

The tables below show the detailed multi-criteria analysis completed for each of the shortlisted water supply options.

H.2.1.1 WS Option 1a MCA

Criteria	Weighting	Score	Reasoning
Natural Environment Impact	10%	3	• Maximum consented take (7MLD) for Huntly may be exceeded with Ohinewai (to 2025) otherwise may be sufficient to consent expiry (2046) depending on Ngaruawahia) • Need EW confirmation consented take for Huntly enables use by other towns • Requires extension of duration of existing consented take for Te Kauwhata (expires 2024) • Requires new intake at Te Kauwhata - additional disturbance to riverbed • Consenting new additional intake (Te Kauwhata) may take longer / be harder than reconsenting existing intakes/sites • Additional extraction from Waikato River due to growth & reticulation of Ohinewai. • Utilise existing residuals handling and disposal route minimises environmental impacts & will require new residuals handling and disposal route for Te Kauwhata (and consents)
Public Health Protection/Statutory Compliance	10%	4	• Provision of reticulated potable water mitigates public health risks associated with untreated household supplies • High level of treatment means water supplies comply with current legislative requirements • Tighter process controls / more stringent monitoring more cost-effective at larger plants. • Replacement of existing Te Kauwhata intake and raw water system reduces risk associated with uncertainty of condition and construction of existing assets (NB: two intakes and WTPs from 2025 to 2040) • More than 10km separation between water intakes and existing WWTP discharges on Waikato River • Existing / new treatment process can accommodate variation in river water quality; upgrade needed if reuse wastewater • Staged storage will allow reduced water age in the system
Cultural Benefits/ Impacts on Maori Cultural values	20%	TBC	• Placeholder - Cultural Benefits/Impacts to be addressed later by iwi
Social and Community	5%	4	• Provision of water supply to Ohinewai encourages staged development. • Limited to 1MLD (peak) from Huntly until 2025 when Te Kauwhata WTP constructed • Potential for increased property rates in Ohinewai (initial scheme / ongoing costs) and thus negative perceptions
Flexibility/ Scalability/Risk	10%	4	• Supply to Ohinewai staged, which reduces implementation time • WTP upgrades and reservoir cells staged to accommodate actual growth. • Centralised scheme could potentially accommodate growth in Ngaruawahia • No requirement to upgrade Huntly WTP (if Ngaruawahia demand can be managed) • Long conveyance pipelines that need to be sized for future flows, which may mean low flows and long water age in early years • Resilience provided as 2 WTPs/sources able to service centralised scheme. • Can seek to procure and consent sufficient space to enable future expansion of Te Kauwhata WTP.
Sustainability	15%	3.5	• Treatment can be staged/upgraded for future proofing but pipelines need to be sized for future flows • Infrastructure at existing Huntly WTP and some at Te Kauwhata WTP reused (capital carbon savings) • Existing water intake and possibly raw water main infrastructure retained by TKWA • New raw water intake & main (Te Kauwhata) and long conveyance pipelines (embodied carbon) • High level of treatment (operational carbon) • Significant civil work which can be delivered by local contractor
Whole of life cost	20%	4	• Initially 3 intakes and WTPs to operate and maintain, reduces to 2 WTPs in 2040 • Supply from Huntly WTP only until 2025 enables supply of Ohinewai from northern end of Huntly network rather than from Huntly WTP (capital cost of $7.7M vs $9.8M), but limited to 1MLD • Retention of existing Te Kauwhata WTP defers capital expenditure. • Supply from new Te Kauwhata WTP from 2025 mitigates need to upgrade bulk main from existing WTP (capital cost savings of ~$6M) • Greater rating base to cover capital upgrade costs
Constructability	10%	4	• No need to expand Huntly WTP (if demand from Ngaruawahia can be managed) • Need to investigate/consent/procure new intake, raw water pipeline and WTP site at Te Kauwhata. Possible WTP sites within 2km of river with pipeline along road corridors to south west of Te Kauwhata, with suitable elevation and access to electricity. • Pipeline route from Te Kauwhata to Ohinewai challenging but may be feasible largely within road/rail corridor or open country • Need to investigate/consent/procure new reservoir and pipeline at Ohinewai. Possible elevated site to south east with pipeline along road corridor or through open country. • Avoids challenging pipeline route through Huntly township
	Total score	**3.03**	

H.2.1.2 WS Option 1c MCA

Criteria	Weighting	Score	Reasoning
Natural Environment Impact	10%	3	• Maximum consented take (7MLD) for Huntly may be exceeded with Ohinewai (to 2025) otherwise may be sufficient to consent expiry (2046) depending on Ngaruawahia • Need EW confirmation consented take for Huntly enables use by other towns • May require short extension of duration of existing consented take for Te Kauwhata (expires 2024, new intake proposed in 2025) • Requires new intake & consents at Te Kauwhata but near existing intake - minimises area of disturbance to river bed and may be easier to reconsent • Additional extraction from Waikato River due to growth & reticulation of Ohinewai. • Utilise existing residuals handling and disposal route minimises environmental impacts but requires upgrade at Te Kauwhata (and consents)
Public Health Protection/Statutory Compliance	10%	4	• Provision of reticulated potable water mitigates public health risks associated with untreated household supplies • High level of treatment means water supplies comply with current legislative requirements • Tighter process controls / more stringent monitoring more cost-effective at larger plants. • Replacement of existing Te Kauwhata intake and raw water system reduces risk associated with uncertainty of condition and construction of existing assets (NB: two intakes and WTPs from 2025 to 2040) • Existing/new TK intake further downstream from existing Huntly WWTP than Option 1a, but more than 10km separation for both Options • Existing / new treatment process can accommodate variation in river water quality; upgrade needed if reuse wastewater • Staged storage will allow reduced water age in the system
Cultural Benefits/ Impacts on Maori Cultural values	20%	TBC	• Placeholder - Cultural Benefits/Impacts to be addressed later by iwi
Social and Community	5%	4	• Provision of water supply to Ohinewai encourages staged development. • Limited to 1MLD (peak) from Huntly until 2025 when Te Kauwhata WTP constructed • Potential for increased property rates in Ohinewai (initial scheme / ongoing costs) and thus negative perceptions
Flexibility/ Scalability/Risk	10%	3.5	• Supply to Ohinewai staged, which reduces implementation time • WTP upgrades and reservoir cells staged to accommodate actual growth. • Centralised scheme could potentially accommodate growth in Ngaruawahia • No requirement to upgrade Huntly WTP (if Ngaruawahia demand can be managed) • Long conveyance pipelines that need to be sized for future flows, which may mean low flows and long water age in early years • Resilience provided as 2 WTPs/sources able to service centralised scheme. • Building on existing infrastructure, previously upgraded multiple time may be challenging. • Potential available space for future expansion of Te Kauwhata WTP (but not owned/designated).
Sustainability	15%	4	• Treatment can be staged/upgraded for future proofing but pipelines need to be sized for future flows • Infrastructure at existing Huntly WTP and Te Kauwhata WTP reused (capital carbon savings) • Existing water intake and possibly raw water main infrastructure retained by TKWA • New raw water supply intake & main (Te Kauwhata) and long conveyance pipelines (embodied carbon) • High level of treatment (operational carbon) • Significant civil work which can be delivered by local contractor
Whole of life cost	20%	4	• Only 2 intakes and WTPs to operate and maintain (vs 3 for Option 1a until 2040) • Supply from Huntly WTP only until 2025 enables supply of Ohinewai from northern end of Huntly network rather than from Huntly WTP (capital cost of $7.7M vs $9.8M), but limited to 1MLD • Upgrading existing Te Kauwhata WTP has similar overall expenditure (NPV of $53.3M for Option 1c vs $54.6M for Option 1a if develop new WTP site) but less capital costs within first 10 years (~$2M less) • Greater rating base to cover capital upgrade costs • Lower OPEX associated with pumping due to the elevation of the existing Te Kauwhata WTP
Constructability	10%	3	• No need to expand Huntly WTP (if demand from Ngaruawahia can be managed) • Need to investigate/consent/procure new intake and raw water pipeline and expand existing WTP site at Te Kauwhata. Existing route feasible and studies have looked at expanding existing WTP. • Pipeline route from Te Kauwhata to Ohinewai challenging but may be feasible largely within road/rail corridor or open country • Need to investigate/consent/procure new reservoir and pipeline at Ohinewai. Possible elevated site to south east with pipeline along road corridor or through open country. • Avoids challenging pipeline route through Huntly township
	Total score	**2.95**	

H.2.1.3 WS Option 1d MCA

Criteria	Weighting	Score	Reasoning
Natural Environment Impact	10%	3	• Maximum consented take (7MLD) for Huntly may be sufficient to consent expiry (2046) depending on Ngaruawahia) • Need EW confirmation consented take for Huntly enables use by other towns • Requires extension of duration of existing consented take for Te Kauwhata (expires 2024) • Requires new intake at Te Kauwhata - additional disturbance to riverbed • Consenting new additional intake (Te Kauwhata) may take longer / be harder than reconsenting existing intakes/sites • Additional extraction from Waikato River due to growth & reticulation of Ohinewai. • Utilise existing residuals handling, and disposal route minimises environmental impacts & will require new residuals handling and disposal route for Te Kauwhata (and consents)
Public Health Protection/Statutory Compliance	10%	4	• Provision of reticulated potable water mitigates public health risks associated with untreated household supplies • High level of treatment means water supplies comply with current legislative requirements • Tighter process controls / more stringent monitoring more cost-effective at larger plants. • Replacement of existing Te Kauwhata intake and raw water system reduces risk associated with uncertainty of condition and construction of existing assets (NB: two intakes and WTPs from 2025 to 2040) • More than 10km separation between water intakes and existing WWTP discharges on Waikato River • Existing / new treatment process can accommodate variation in river water quality; upgrade needed if reuse wastewater • Staged storage will allow reduced water age in the system
Cultural Benefits/ Impacts on Maori Cultural values	20%	TBC	• Placeholder - Cultural Benefits/Impacts to be addressed later by iwi
Social and Community	5%	4	• Provision of water supply to Ohinewai from 2020 is only limited by capacity of Te Kauwhata WTPs • Potential for increased property rates in Ohinewai (initial scheme / ongoing costs) and thus negative perceptions
Flexibility/ Scalability/Risk	10%	2	• Supply to Ohinewai from Te Kauwhata from 2020. Risk to supply if new Te Kauwhata intake & WTP delayed. • WTP upgrades and reservoir cells staged to accommodate actual growth. • Part centralised scheme not able to accommodate growth in Ngaruawahia • No requirement to upgrade Huntly WTP (if Ngaruawahia demand can be managed) • Long conveyance pipelines that need to be sized for future flows, which may mean low flows and long water age in early years • Can seek to procure and consent sufficient space to enable future expansion of Te Kauwhata WTP.
Sustainability	15%	3.5	• Treatment can be staged/upgraded for future proofing, but pipelines need to be sized for future flows • Infrastructure at existing Huntly WTP and some at Te Kauwhata WTP reused (capital carbon savings) • Existing water intake and possibly raw water main infrastructure retained by TKWA • New raw water supply intake & main (Te Kauwhata) and long conveyance pipelines, less bulk main than Option 1a & 1c (embodied carbon) • High level of treatment (operational carbon) • Significant civil work which can be delivered by local contractor
Whole of life cost	20%	3	• Higher overall expenditure than Option 1a and 1c (NPV of $56.5M, 6% more than Option 1c) and greater initial capital costs (~$7M more in 2020) as constructing pipeline to Ohinewai from Te Kauwhata in 2020. • Retention of existing Te Kauwhata WTP defers capital expenditure. • Supply from new Te Kauwhata WTP from 2020 mitigates need to upgrade bulk main from existing WTP (capital cost savings of ~$6M) • Initially 3 intakes and WTPs to operate and maintain, reduces to 2 WTPs in 2040 • Greater rating base to cover capital upgrade costs
Constructability	10%	3	• No need to expand Huntly WTP (if demand from Ngaruawahia can be managed) • Need to investigate/consent/procure new intake, raw water pipeline and WTP site at Te Kauwhata. Possible WTP sites within 2km of river with pipeline along road corridors to south west of Te Kauwhata, with suitable elevation and access to electricity. • Pipeline route from Te Kauwhata to Ohinewai challenging but may be feasible largely within road/rail corridor or open country • Need to investigate/consent/procure new reservoir and pipeline at Ohinewai. Possible elevated site to south east with pipeline along road corridor or through open country. • Avoids pipeline from Huntly to Ohinewai
	Total score	**2.5**	

H.2.1.4 WS Option 2c MCA

Criteria	Weighting	Score	Reasoning
Natural Environment Impact	10%	2.5	• Maximum consented take (7MLD) for Huntly exceeded 2025, depending on Ngaruawahia). New consent required. • Need EW confirmation consented take for Huntly enables use by other towns • Requires extension of duration of existing consented take for Te Kauwhata (expires 2024) • Requires new intake at Te Kauwhata and Huntly - additional disturbance to river bed • Consenting new additional intakes may take longer / be harder than reconsenting existing intakes/sites • Additional extraction from Waikato River due to growth & reticulation of Ohinewai. • Utilise existing residuals handling and disposal route minimises environmental impacts & will require new residuals handling and disposal route for Te Kauwhata (and consents)
Public Health Protection/Statutory Compliance	10%	4	• Provision of reticulated potable water mitigates public health risks associated with untreated household supplies • High level of treatment means water supplies comply with current legislative requirements • Tighter process controls / more stringent monitoring more cost-effective at larger plants. • Replacement of existing Te Kauwhata intake and raw water system reduces risk associated with uncertainty of condition and construction of existing assets (NB: two intakes and WTPs from 2025 to 2040) • More than 10km separation between water intakes and existing WWTP discharges on Waikato River • Existing / new treatment process can accommodate variation in river water quality; upgrade needed if reuse wastewater • Staged storage will allow reduced water age in the system
Cultural Benefits/ Impacts on Maori Cultural values	20%	TBC	• Placeholder - Cultural Benefits/Impacts to be addressed later by iwi
Social and Community	5%	4	• Provision of water supply to Ohinewai from 2020 is only limited by capacity of Huntly • Potential for increased property rates in Ohinewai (initial scheme / ongoing costs) and thus negative perceptions
Flexibility/ Scalability/Risk	10%	2	• Supply to Ohinewai from Huntly from 2020. Risk to supply if Huntly intake & WTP upgrade delayed. • WTP upgrades and reservoir cells staged to accommodate actual growth. Multiple upgrades at Huntly to minimise risk of unrealised growth • Part centralised scheme able to accommodate growth in Ngaruawahia • Long conveyance pipelines that need to be sized for future flows, which may mean low flows and long water age in early years • Can seek to procure and consent sufficient space to enable future expansion of Te Kauwhata WTP.
Sustainability	15%	3	• Treatment can be staged/upgraded for future proofing but pipelines need to be sized for future flows • Infrastructure at existing Huntly WTP and some at Te Kauwhata WTP reused (capital carbon savings) • Existing water intake and possibly raw water main infrastructure retained by TKWA • New raw water supply intake & main (Te Kauwhata and Huntly) and long conveyance pipelines, less bulk main than Option 1a & 1c (embodied carbon • High level of treatment (operational carbon) • Significant civil work which can be delivered by local contractor
Whole of life cost	20%	2	• Highest expenditure out of 4 options (NPV of $62.0M, 16% more than Option 1c) as also upgrading Huntly intake and WTP. Significantly greater total capital cost ($21M more than Option 1c), however deferred so not reflected in NPV. • Retention of existing Te Kauwhata WTP defers capital expenditure. • Initially 3 intakes and WTPs to operate and maintain, reduces to 2 WTPs in 2040 • Greater rating base to cover capital upgrade costs
Constructability	10%	2	• Need to investigate/consent/procure new intake, raw water pipeline and WTP site at Te Kauwhata and Huntly. Possible WTP sites within 2km of river with pipeline along road corridors to south west of Te Kauwhata, with suitable elevation and access to electricity. Possible expansion to Huntly near existing site. • Challenging pipeline route through Huntly township to end of network, remainder along road corridor or through open country. • Need to investigate/consent/procure new reservoir and pipeline at Ohinewai. Possible elevated site to south east with pipeline along road corridor or through open country.
	Total score	**2.1**	

H.3 Wastewater MCA tables

The tables below show the detailed multi-criteria analysis completed for each of the shortlisted water supply options.

H.3.1.1 WW Option 1b MCA

Criteria	Weighting	Score	Reasoning
Natural Environment Impact	10%	3	• High level treatment will minimise effect on water quality and microbial contamination • Loads and Concentration discharged higher than land disposal • Disposal to river will have a higher dilution and mixing than lakes. • Single discharge has less dispersion in river compared with multiple discharges for the same load
Public Health Protection/Statutory Compliance	10%	3	• High level treatment will minimise effect on water quality and microbial contamination • Removes Te Kauwhata discharge to Lake Waikare • Potentially not consistent with the Te Kauwhata Discharge agreement with Waikato - Tainui to discharge to land • Single discharge at existing discharge point - easier consenting • More storage integrated into the network (peak wet weather storage at each location) - fewer overflows, better compliance with upcoming regulation changes
Cultural Benefits/ Impacts on Maori Cultural values	20%	TBC	• Placeholder - Cultural Benefits/Impacts to be addressed later by iwi
Social and Community	5%	3.5	• Site would be at adjacent to exiting WWTP - minimises effects on urban development • Removal of Te Kauwhata discharge to Lake Waikare reduces impact on the lake quality and thus negative perceptions • Location of underground storage tanks (or repurposed WWTP ponds) near residential areas - could get community push-back
Flexibility/ Scalability/Risk	10%	3	• Less central location of treatment plant less easily facilitates future connections in the growth corridor • Option less likely to be staged as plant would need to treat flows from Te Kauwhata and Ohinewai. Thus, wouldn't be able to leave Huntly upgrades for the future. • Least resilient with only 1 WWTP and long transmission distances. • Space on site for future expansion • Risk to communities reliant on long-distance conveyance of wastewater, especially where a single rising main is used • Existing WWTPs could be repurposed for temporary storage to improve flexibility and staging
Sustainability	15%	3	• MBR technology provides future proofing • Some infrastructure at existing Huntly WWTP can be reused (capital carbon savings) • Long pipelines (embodied carbon) • High rate treatment (operational carbon) • Significant civil works which can be delivered by local contractors
Whole of life cost	20%	3	• Only 1 WWTP operate and maintain hence lower O&M costs (operators only have to look after 1 plant vs 3) • Higher capex than decentralised option • Opex associated with pumping distances
Constructability	10%	3.5	• Land adjacent to Huntly WWTP is owned by the council/designated • Need to investigate ground conditions at Huntly. Potential preloading required at site. • Availability of electricity and potable water • Long rising mains
	Total score	**2.48**	

H.3.1.2 WW Option 1c MCA

Criteria	Weighting	Score	Reasoning
Natural Environment Impact	10%	3	• High level treatment will minimise effect on water quality and microbial contamination • Loads and Concentration discharged higher than land disposal • Disposal to river will have a higher dilution and mixing than lakes. • Single discharge has less dispersion in river compared with multiple discharges for the same load
Public Health Protection/Statutory Compliance	10%	3	• High level treatment will minimise effect on water quality and microbial contamination • Removes Te Kauwhata discharge to Lake Waikare • Potentially not consistent with the Te Kauwhata Discharge agreement with Waikato - Tainui to discharge to land • Single discharge at existing discharge point - easier consenting • More storage integrated into the network (peak wet weather storage at each location) - fewer overflows, better compliance with upcoming regulation changes
Cultural Benefits/ Impacts on Maori Cultural values	20%	TBC	• Placeholder - Cultural Benefits/Impacts to be addressed later by iwi
Social and Community	5%	3.5	• Pipe will be installed along a road parallel to SH1, limiting disruption to traffic and new WWTP site • Removal of Te Kauwhata discharge to Lake Waikare reduces impact on the lake quality and thus negative perceptions • Location of underground storage tanks (or repurposed WWTP ponds) near residential areas - could get community push-back
Flexibility/ Scalability/Risk	10%	3	• Central location of treatment plant more easily facilitates future connections in the growth corridor • Option allows the staged upgrade of Te Kauwhata and Ohinewai initially and Huntly in 2029. • Least resilient with only 1 WWTP and long transmission distances. • Space on site for future expansion. Risk to communities reliant on long-distance conveyance of wastewater, especially where a single rising main is used • Existing WWTPs could be repurposed for temporary storage to improve flexibility and staging
Sustainability	15%	3	• MBR technology provides future proofing • Long pipelines (embodied carbon) • High rate treatment (operational carbon) • Significant civil works which can be delivered locally.
Whole of life cost	20%	3.5	• Only 1 WWTP operate and maintain hence lower O&M costs (reduces number of sites operators have to visit) • Higher capex than decentralised option • Opex costs associated with long pumping distances
Constructability	10%	3.5	• Potential site location is on privately owned land • Confirmed suitable ground conditions • Greenfield Site • No availability of electricity and potable water
	Total score	**2.58**	

H.3.1.3 WW Option 2b MCA

Criteria	Weighting	Score	Reasoning
Natural Environment Impact	10%	3	• High level treatment will minimise effect on water quality and microbial contamination • Loads and Concentration discharged higher than land disposal • Disposal to river will have a higher dilution and mixing than lakes. • Multiple discharges to the river, more dispersion of the load
Public Health Protection/Statutory Compliance	10%	4	• High level treatment will minimise effect on water quality and microbial contamination • Removes Te Kauwhata discharge to Lake Waikare • Potentially not consistent with the Te Kauwhata Discharge agreement with Waikato - Tainui to discharge to land • New Te Kauwhata discharge is upstream of Te Kauwhata water intake • Additional consent required to discharge Te Kauwhata to the Waikato river. • More storage integrated into the network (peak wet weather storage at each location) - fewer overflows, better compliance with upcoming regulation changes
Cultural Benefits/ Impacts on Maori Cultural values	20%	TBC	• Placeholder - Cultural Benefits/Impacts to be addressed later by iwi
Social and Community	5%	4	• Reduced disruption along SH1 as the transmission pipeline is much shorter. • New discharge may be viewed negatively by the community and iwi. • Location of underground storage tanks (or repurposed WWTP ponds) near residential areas - could get community push-back
Flexibility/ Scalability/Risk	10%	4.5	• Treatment can be staged. Land available for expansion at Huntly. • Resilience from having multiple WWTP plants and shorter transmission distance • Less central location of treatment plant less easily facilitates future connections in the growth corridor • ability to build plant upgrade and main to river in different stages • ability to choose later whether to discharge in lake or river • Ohinewai conveyance main staged (duplication occurs in year 2050) • This option has the shortest distance of new transmission mains
Sustainability	15%	4.5	• MBR technology provides future proofing • Te Kauwhata, Meremere and Huntly can reuse some existing infrastructure (reduced embodied carbon) • High rate treatment (operational carbon) • Significant civil works which can be delivered by local contractors
Whole of life cost	20%	3	• Capex lower than other options as there is a decentralised plant and less conveyance pipework • Increased O&M costs as there is an additional plant to run • Reduced Opex associated with long pumping distances
Constructability	10%	4	• Land adjacent to Huntly WWTP is owned by the council/designated • Need to investigate ground conditions at Huntly. Potential preloading required at site. • Availability of electricity and potable water • Long rising mains
	Total score	**3.03**	

H.3.1.4 WW Option 3 MCA

Criteria	Weighting	Score	Reasoning
Natural Environment Impact	10%	3	• High level treatment will minimise effect on water quality and microbial contamination • Loads and Concentration discharged higher than land disposal • Disposal to river will have a higher dilution and mixing than lakes. • Multiple discharges to the river, more dispersion of the load
Public Health Protection/Statutory Compliance	10%	3.5	• High level treatment will minimise effect on water quality and microbial contamination • Removes Te Kauwhata discharge to Lake Waikare • Potentially not consistent with the Te Kauwhata Discharge agreement with Waikato - Tainui to discharge to land • New discharge is upstream of Te Kauwhata water intake • Additional consent required to discharge from combined plant to the Waikato river. • More storage integrated into the network (peak wet weather storage at each location) - fewer overflows, better compliance with upcoming regulation changes
Cultural Benefits/ Impacts on Maori Cultural values	20%	TBC	• Placeholder - Cultural Benefits/Impacts to be addressed later by iwi
Social and Community	5%	4	• Transmission pipeline can be built along a road adjacent SH1 - reduced disruption on SH1. • WWTP built in greenfield area - less disruption to community • New discharge may be viewed negatively by the community and iwi. • Location of underground storage tanks (or repurposed WWTP ponds) near residential areas - could get community push-back
Flexibility/ Scalability/Risk	10%	4.5	• Resilience from having multiple WWTP plants and shorter transmission distance • Central location of treatment plant facilitates future connections in the growth corridor • Long conveyance mains can be staged (in some instances) • This option has the 2nd shortest distance of new transmission mains
Sustainability	15%	4	• MBR technology provides future proofing • New centralised plant (high capital carbon) • High rate treatment (operational carbon) • Significant civil works which can be delivered by local contractors
Whole of life cost	20%	2.5	• Capex likely lower than centralised options as there is a decentralised plant and less conveyance pipework • Increased O&M costs as there is an additional plant to run • Reduced Opex associated with long pumping distances
Constructability	10%	3.5	• Potential site location is on privately owned land • Confirmed suitable ground conditions • Greenfield Site • No availability of electricity and potable water • Complexity of constructing new river outfall
	Total score	**2.75**	

I. Workshop Dates and Attendees

Pre-Start Meeting

Date: 23/01/2020

Purpose: Discuss the committed projects, agree on programme for the project, discuss growth, option analysis and requests for information.

Attendees:

- Watercare:
  - Pearl McFall
  - Richard Pullar
  - Stephen Howard
  - Sharon Danks
  - Pranavan Kasipillai
- Stantec:
  - Sarah Davies
- Mott MacDonald:
  - Julie Plessis
  - Douglas Bale
  - Atisha Daya

Workshop 1: Growth and Literature Review

Date: 14/02/2020

Purpose: Discuss the literature review, agree on growth and demand and discharge calculation methods.

Attendees:

- Watercare:
  - Richard Pullar
  - Stephen Howard
  - Sharon Danks
  - Pranavan Kasipillai
- Waikato District Council:
  - Marc Davey
- Stantec:
  - Sarah Davies
  - Kirsten Norquay (Skype)
  - Alex Ross (Skype)
- Mott MacDonald:
  - Julie Plessis

  - Nick Dempsey
  - David Hume (Skype)

Workshop 2: Long-List of Options

Date: 30/03/2020

Purpose: Discuss growth assumptions, constraints and opportunities, fatal flaw and MCA criteria, present long-list of options and agreed which options to remove.

Attendees:

- Watercare:
  - Pearl McFall
  - Richard Pullar
  - Stephen Howard
  - Sharon Danks
  - Pranavan Kasipillai
  - Peter Crabb
- Waikato District Council:
  - Taljit Singh-Sandhu
- Stantec:
  - Kirsten Norquay
  - Alex Ross
- Mott MacDonald:
  - Julie Plessis
  - David Hume
  - Atisha Daya

Workshop 3: MCA

Date: 17/04/2020

Purpose: Narrow down wastewater options through an MCA to produce the shortlist options

Attendees:

- Watercare:
  - Pearl McFall
  - Richard Pullar
  - Stephen Howard
  - Sharon Danks
  - Pranavan Kasipillai
  - Peter Crabb
- Waikato District Council:
  - Taljit Singh-Sandhu
- Stantec:
  - Kirsten Norquay

  - Alex Ross
- Mott MacDonald:
  - Nick Dempsey
  - Julie Plessis
  - David Hume
  - Atisha Daya

Workshop 4: MCA Continued

Date: 20/04/2020

Purpose: Narrow down water supply options through an MCA to produce the shortlist options

Attendees:

- Watercare:
  - Pearl McFall
  - Richard Pullar
  - Stephen Howard
  - Sharon Danks
  - Pranavan Kasipillai
  - Peter Crabb
- Waikato District Council:
  - Taljit Singh-Sandhu
- Stantec:
  - Kirsten Norquay
  - Alex Ross
- Mott MacDonald:
  - Nick Dempsey
  - Julie Plessis
  - David Hume
  - Atisha Daya

Workshop 5: MCA

Date: 20/05/2020

Purpose: MCA carried out on shortlisted options to choose the preferred option for both wastewater and water supply.

Attendees:

- Watercare:
  - Pearl McFall
  - Richard Pullar
  - Stephen Howard
  - Sharon Danks
  - Pranavan Kasipillai

  - Peter Crabb
- Waikato District Council:
  - Taljit Singh-Sandhu
- Stantec:
  - Kirsten Norquay
  - Alex Ross
  - Sarah Davies
- Mott MacDonald:
  - Nick Dempsey
  - Julie Plessis
  - Atisha Daya

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