Technical Memo
Rangitoopuni Retirement Village

Water Supply Servicing Strategy
Rangitoopuni Developments LP

TO:	Rangitoopuni Developments LP	**REF:**	J6438-1
FROM:	GWE Consulting Ltd	**DATE:**	1 April 2025

The purpose of this memo is to outline the servicing recommendations for water supply at the Rangitoopuni Retirement Village. The options considered for each service are outlined in the sections below. Further design stages will confirm process unit sizing and equipment layout. The concept design is based on compliance with the Water Services Act 2021 and associated rules/acceptable solutions.

GWE note that the level of compliance monitoring and risk management required as outlined below for supplying drinking water within Rangitoopuni Retirement Village is on the surface onerous, this is a requirement of the Water Services Act 2021 and commonly applied throughout New Zealand.

1. WATER SUPPLY

1.1 Water Supply Philosophy and Supply Demand Balance Calculations

The water supply for the development is designed with a focus on self-sufficiency and independence. Given the development's unique typology and characteristics, groundwater and rainwater harvesting will serve as the exclusive sources of drinking water.

Water supply demand balance analysis shows a shortfall of 23 m^3/day of rainwater collection for both the Retirement Village and the Care Suit facilities, therefore supplementation with groundwater will be necessary. During summer, when there are no rainfall events, the bore will need to service and treat the entire development, ensuring a continuous drinking water supply. Therefore, the bore and treatment plant capacity must be designed to meet the maximum demand during this period.

Firefighting storage has not been considered as part of this scope. If required, an additional 24-hour storage capacity will be needed. This can be supplied from an additional treated water tank, or alternatively from an additional raw water tank if the firefighting supply is on a dedicated ring main.

Refer to Appendix A for the full water supply-demand balance calculations.

Table 1: Water Supply vs Demand Balance Summary

FACILITY	NO. OF PEOPLE	TOTAL ROOF AREA	FLOW ALLOWANCE	DEMAND	RAINFALL COLLETION
Retirement Villages	682 People	48,805 m^2 [1]	250 litres/person/day	170 m^3/day	159 m^3/day
Care Suits	57 Guests	2,871 m^2 [1]	250 litres/person/day	18 m^3/day	6.5 m^3/day
	50 Staff		80 litres/person/day		
Total	789 People	51,676 m^2		188.7 m^3/day	166 m^3/day

Notes:

1. *Measured from provided architectural drawings*

1.2 Water Treatment

Typical treatment for roof water sources is relatively simple, comprising of a two-stage cartridge filtration followed by UV disinfection. When a treatment system supplies treated water to several buildings through a reticulated network, depending on the specific site arrangement, ownership and number of people supplied, chlorination of treated water to maintain residual disinfection in the distribution network is also required.

2. TREATMENT PROCESS

The water supply for Rangitoopuni Retirement Village will consist of roof water and bore water. The location and specifications for the water supply bore are yet to be confirmed once the bore(s) has been drilled and tested. It is recommended that water be pumped from the bore to the treatment plant using a pump. The borehead should be classified as sanitary in accordance with the Drinking Water Quality Assurance Rules 2022 (DWQAR).

2.1 Raw Water Quality

Iron and manganese are naturally occurring in groundwater and are likely to be present at levels requiring treatment. Therefore, an iron and manganese treatment system has been incorporated into the proposed treatment process. Additionally, groundwater hardness is expected to be approximately 300 mg/L, which may necessitate a softening treatment process. Any other contaminants detected in the groundwater will require additional treatment barriers to ensure compliance with the DWQAR. A detailed assessment of the anticipated water quality based on the data from a nearby bore provided by *ENGEO Limited* has been included as Appendix C for reference, forming the basis of this concept. The key parameters above the Maximum Acceptable Values (MAV) are summarised in the following table:

Table 2: Key Groundwater Quality Parameters Exceeding MAV

PARAMETER	MEDIAN CONCENTRATION 1998-2005 (MG/L)	MEDIAN CONCENTRATION 2015-2019 (MG/L)	MAV (MG/L)	DWN-AV (MG/L)
Total Hardness (as $CaCO_3$)	308.9	-	-	100-200
Iron	1.230	1.1 (soluble)	-	≤ 0.3
Manganese	0.054	0.06 (soluble)	0.4	≤ 0.04

2.2 WTP PFD and Layout

Please refer to Appendix B for the full process flow diagram of the water treatment process of Rangitoopuni Retirement Village.

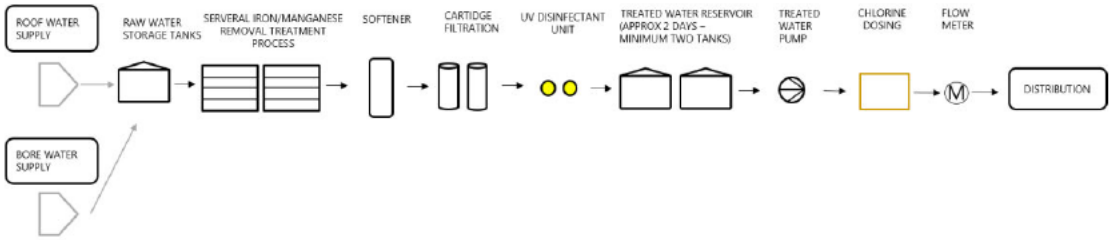

Figure 1: Schematic of Rangitoopuni Retirement Village Water Treatment Process

It is proposed to allocate space within the layout for approximately two 40-ft containers, along with two raw water tanks and two treated water tanks, ensuring redundancy and facilitating maintenance. Both raw and treated water tanks will provide a minimum of two days' storage, with final capacity to be confirmed once the bore yield is determined at a later stage. The bore is proposed to be located approximately north of the water treatment plant. The water treatment plant is planned to be located in the northwest section of the site, as illustrated in Figure 1 below.

Figure 2: Proposed Location of the Water Treatment Plant

3. WATER SUPPLY ARRANGEMENT RECOMMENDATION

3.1 Rangitoopuni Compliance Strategy

It is understood that the population at the Rangitoopuni Retirement Village is expected to be 789 people including the staff members at the care suits, and that the treatment system could potentially supply drinking water to neighbouring buildings through a reticulated network following further development stages.

Due to the number of people supplied (greater than 500), the only compliance pathway available for the site is to follow the Drinking Water Quality Assurance Rules 2022 (DWQAR) - Networked supply category – Large supply size.

This compliance pathway offers the possibility of providing drinking water by a centralised water treatment system to an unlimited number of buildings through a reticulated distribution network. By adopting this compliance pathway, the supply must demonstrate compliance against the General, Source S3, Treatment T3 and Distribution D3 rule modules of the DWQAR. In addition, the preparation of a Water Safety Plan (WSP) and Source Water Risk Management Plan (SWRM) will also be required. Note that, to comply with the Distribution D3 rule module, residual disinfection will be required, therefore chlorination of the treated water will be necessary.

Below is a summary of the reporting and monitoring requirements for Networked Large Supply.

3.1.1 Networked Supply – large Supply Reporting and Monitoring Requirements Summary

Table 3: Summary of Reporting Requirements

RULE MODULE	MONITORING/ASSURANCE RULES	REPORTING TIMEFRAME
S3 – Source Water	All relevant Monitoring Rules	Annually
	All relevant Assurance Rules	Annually
T3 – Treated Water	Monitoring Rule – UV dose	Daily
	All other relevant Monitoring Rules	Weekly to Annually
	All relevant Assurance Rules	Annually
D3 - Distribution	FAC, *E. coli* and total coliforms	FAC – Three times per week E.coli & Total Coliforms – Weekly
	All other relevant Monitoring Rules	Quarterly to Bi-annually
	All Assurance Rules	Annually

Table 4: Summary of Source S3 Water Compliance Monitoring Requirements

PARAMETER/DETERMINAND	FREQUENCY OF SAMPLING/TESTING
E. coli/total coliforms	Twice per month.
Colour	Monthly
Nitrate	Monthly
Iron	Monthly
Manganese	Monthly
Alkalinity	Annual
Antimony	Annual
Arsenic	Annual
Barium	Annual
Cadmium	Annual
Calcium	Annual
Chloride	Annual
Chromium	Annual
Copper	Annual
Lead	Annual
Magnesium	Annual
Mercury	Annual
Nickel	Annual
Sodium	Annual
Sulphate	Annual

Table 5: Summary of Treatment T3 Compliance Monitoring Requirements

PARAMETER/DETERMINAND	FREQUENCY OF SAMPLING/TESTING
Turbidity UVT (at the reactor) UVI or UV dose (at the reactor) Flow (at the reactor) FAC (in water leaving the treatment plant) pH (in water leaving the treatment plant)	Continuous
Other relevant determinands	Monthly

Table 6: Summary of Distribution D3 Compliance Monitoring Requirements

PARAMETER/DETERMINAND	FREQUENCY OF SAMPLING/TESTING
FAC	Three times per week
E. coli/total coliforms	Weekly
Disinfection By-products: **Trihaltomethanes (THMs)**: chloroform, bromodichloromethane, dibromochloromethane, bromoform.	Quarterly

PARAMETER/DETERMINAND	FREQUENCY OF SAMPLING/TESTING
Haloacetic acids (HAAs): dichloroacetic acid, trichloroacetic acid.	
Plumbosolvent Metals (antimony, cadmium, chromium, copper, lead, mercury, nickel, zinc).	6 monthly

4. LIMITATIONS

This report has been prepared for the sole benefit of **Rangitoopuni Developments LP** as our Client, and their appointed representatives, according to their instructions, for the specific objectives described herein. This report is qualified in its entirety and should be considered in the light of our Terms of Engagement with the Client and the following:

a. Data or opinions contained within the report may not be used in other contexts or for any other purpose without our prior review and written agreement. Any reliance will be at the parties' sole risk.

b. No responsibility is assumed for inaccuracies in reporting by the information providers. In no event, regardless of whether GWE 's consent has been provided, does GWE accept any liability, whether directly or indirectly, for any liability or loss suffered or incurred by any third party to whom this report is disclosed placing any reliance on this report, in part or in full.

c. GWE has relied on information provided by the Client and by third parties to produce this document and arrive at its conclusions. GWE has not verified information provided (unless specifically noted otherwise) and we assume no responsibility and make no representations with respect to the adequacy, accuracy, or completeness of such information.

Prepared by:	**Reviewed by:**	**Approved by:**
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Graduate Engineer	Water Sector Lead	Technical Director

enc Appendix A: Water Supply-Demand Balance Calculation
Appendix B: Process Flow Diagram
Appendix C: Raw Groundwater Quality Table

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APPENDIX A:
WATER SUPPLY-DEMAND BALANCE CALCULATION

V1 GWE 20 March 2025

PROJECT TITLE: Rangitoopuni (Retirement Vilage)

OBJECTIVE: Determine the supply and demand balance based on the new development at the site

PROJECT ASSUMPTIONS AND INPUT DATA (Rainwater):

17.5% Rainwater Treatment Losses / collection inefficiencies (Evaporation, first flush diverter, Spillage) ***

1 metres Rainfall (incl distribution vs storage)

input data

Demand

Rainwater

REFERENCES

Source TP58 On-Site Wastewater Systems 2004 paper Fig 6.1

Water NZ Waterloss guidelines

BRANZ fact sheet

Table 1: Rainwater Harvesting and Development Capacity Check

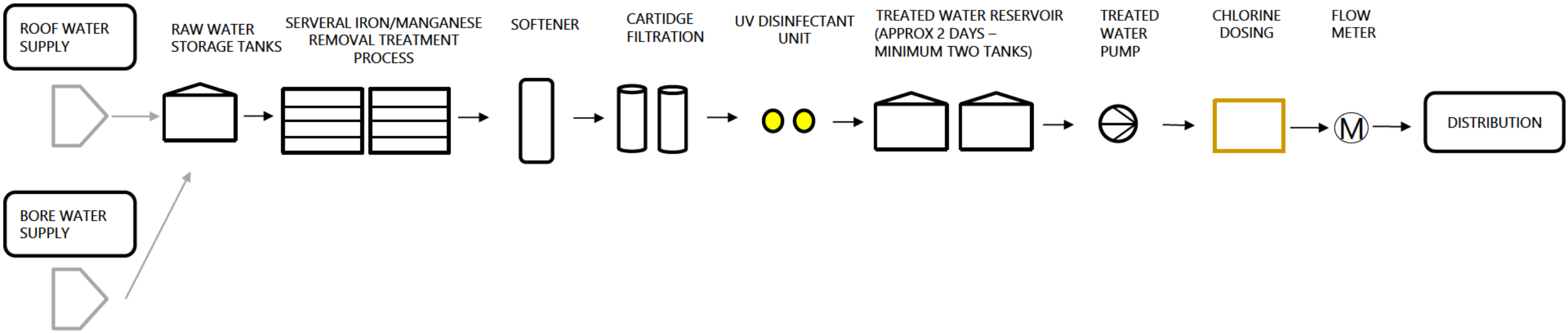
FACILITIES	COUNT	NO. OF PEOPLE	AV ROOF AREA m^2	FLOW ALLOWANCE (L/PERSON/DAY)	DEMAND (m^3/d) (Rainwater)	RAINFALL COLLECTION (m^3/d) LZ Sc.1	WATER RESERVOIR STORAGE (2 DAYS)	WATER RESERVOIR STORAGE (4 DAYS)	WATER RESERVOIR STORAGE (7 DAYS)
						82.5%			
TYPE 1 - 2.5 Bedroom Dwelling	103		192.85			44.90	39.0	77.9	136.3
Residents		2.5		250	64.38				
TYPE 2 - 3 Bedroom Dwelling	118		189.84			50.63	75.7	151.5	265.1
Residents		3		250	88.50				
TYPE 3 - 2 Bedroom Dwelling/Duplex	39		167.7			63.57	-92.0	-184.1	-322.1
Residents		1.8		250	17.55				
TYPE 4 - CARE SUITS	38		2871.42			6.49	23.5	47.0	82.3
Care Suites (Staffs)		50		80	4.00				
Care Suites (guests)		1.5		250	14.25				
TOTAL	298	788.7	3421.81		**188.675**	**165.59**	**46.2**	**92.4**	**161.6**
		681.7	48804.97		**170.43**	159			

Table 2: Supply-Demand Summary

Total Demand (m3/day)		**188.68**
Rainwater available (m3/day)		**165.59**
Shortfall/Surplus (m3/day)		**-23.09** **To be supplemented by Bore Supply**

APPENDIX B:
PROCESS FLOW DIAGRAM

PROCESS FLOW DIAGRAM – RANGITOOPUNI RETIREMENT VILLAGE



APPENDIX C:
RAW GROUNDWATER QUALITY TABLE

PARAMETER	MEDIAN CONCENTRATION 1998-2005[1] (MG/L)	MEDIAN CONCENTRATION 2015-2019[2] (MG/L)	MEDIAN CONCENTRATION 1996-2024[3] (MG/L)	DRINKING WATER STANDARD – MAXIMUM ACCEPTABLE VALUE (DWS-MAV)[4] (MG/L)	DRINKING WATER NOTICE – AESTHETIC VALUE (DWN-AV)[5] (MG/L)
pH	7.6	7.5	-	-	7.0-8.5
Temperature (°C)	18.9	-	-	-	≤ 15°C
TDS	435	-	-	-	≤ 1,000
Turbidity (NTU)	11	-	-	-	≤ 5 NTU
Faecal Coliforms (cfu/100mL)	< 1	-	-	-	-
E. coli (cfu/100mL)	< 1	-	< 1	-	-
Total Alkalinity as $CaCO_3$	282.8	-	-	-	-
Total Hardness as $CaCO_3$	308.9	-	-	-	100-200
Ammonia	-	0.3	-	-	≤ 1.5
Ammoniacal-N	0.270	-	-	-	-
Nitrate-N	<0.002	0.01	11.3	-	-
Calcium	76.4	-	-	-	-
Magnesium	28.3	-	-	-	-
Sodium	35.4	36	-	-	≤ 200
Potassium	1.7	-	-	-	-
Chloride	74.6	71	-	-	≤ 250
Sulphate	0.02	0.03	-	-	≤ 250
Aluminium	< 0.003	-	< 0.02[6]	1	≤ 0.1
Antimony	-	-	< 0.001[6]	0.02	-

Arsenic	< 0.0005	-	-	0.01	-
Barium	-	-	0.03[6]	1.5	-
Boron	0.016	-	-	2.4	-
Bromate	-	-	-	0.01	-
Bromide	-	-	-	-	-
Cadmium	-	-	< 0.001[6]	0.004	-
Chromium (Total)	< 0.005	-	-	0.05	-
Copper	0.002	-	-	2	≤ 1
Fluoride	0.050	-	-	1.5	-
Iron	1.230	1.1	-	-	≤ 0.3
Lead	0.0001	-	-	0.01	-
Lithium	0.0300	-	0.03[6]	-	-
Manganese	0.054	0.06 (soluble)	-	0.4	≤ 0.04
Mercury	-	-	-	0.007	-
Nickel	< 0.005	-	< 0.001[6]	0.08	-
Zinc	0.010	-	0.002[6]	-	≤ 1.5