Waitaki DISTRICT COUNCIL
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Ohau Village Water Supply

Option Evaluation Workshop

July 2019

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Ohau Village Water Supply
Option Evaluation Workshop

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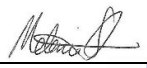
Project Manager:	Melanie Stevenson	
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Ohau Village Water Supply
Option Evaluation Workshop

1.0 Introduction

On Monday the 24th June 2019, the Waitaki District Council (WDC) held an option evaluation workshop to enable the ranking of preferred options for the Ohau Village Water Supply upgrade.

The meeting was attended by the following:

WDC:	Fluent Solutions:	Community Task Force:
Martin Pacey (MP)	Melanie Stevenson (MS)	Phil Driver (PD)
Michael Goldingham (MG)	Francesca Guthrie (FG)	Pip (Pip)
Caitlin Brand (CB)		
Warren Johnston (WJ)		
Oscar Smit (OS)		
Josh Rendell (JR)		

This report is a presentation of the evaluation criteria, assessments, notes and the results of the workshop and subsequent calibration and sensitivity analysis.

2.0 Basis of Assessment

2.1 Criteria

Fluent Solutions and WDC developed a set of criteria that were considered relevant to the water supply options. These were:

- Cost
- Water Safety
- Location
- Environment
- Future Proofing/Resilience

A set of questions were developed for each criterion. These questions are presented in Table 3.2 below.

Answers to each question were reported as a score from 1 to 5 with 1 being the least favourable and 5 being the most favourable.

The capital cost, Net Present Value (NPV) and rates impact were given scores based on the cost estimates. For each option the value was compared to the median and multiplied by a factor to give a score out of 5. With lower scores being more expensive than the median and vice versa. This is a standard procedure used for evaluating tenders.

Questions related to risk were based on a risk assessment using likelihood and consequence as detailed in Section 3.3.

Other questions that weren't considered a risk or a cost (for e.g. accessibility) were given a score based on experience and understanding of the issues.

Each criterion was given a weighting (agreed at the workshop as described in Section 3.2) to result in a final score out of 5 for each option.

2.2 Risk Assessment

The risk matrix shown below in Figure 2.1 was provided at the workshop and used to assign a risk score for each relevant question. This is frequently used by WDC in calculating risk as part of Water Safety Plans for various water supplies.

A "Very Low" risk was assigned a score of 5 and a "Very High" risk was assigned a score of 1.

The likelihood was assessed based on the description in Table 2.1.

Table 2.1: Risk Matrix

		Consequence				
		Insignificant	**Minor**	**Moderate**	**Major**	**Extreme**
Likelihood	**Almost Certain** - Occurs like clockwork - Occurs every week, month or season	Medium	Medium	High	Very High	Very High
	Likely - Has occurred more than once before - Expected to occur every year	Low	Medium	Medium	High	Very High
	Possible - Has occurred before - Expected to occur every 2-5years	Very Low	Low	Medium	High	High
	Unlikely - Has never occurred before, but expected to occur every 5-10years	Very Low	Very Low	Low	Medium	High
	Rare - has never occurred before, and expected to occur less than once every 10 years	Very Low	Very Low	Low	Medium	Medium

**The copy of the table handed out at the workshop incorrectly labelled 'almost certain' to occur with 'major' consequences and 'likely' to occur with 'extreme' consequences as a 'high' risk instead of a 'very high' risk. The excel spreadsheet used at the workshop had a small error and this was corrected during calibration.*

The consequence ratings were assessed based on a table developed for the workshop that gave examples of consequences related to each question. This consequence table is attached in Appendix 1.

3.0 Workshop Proceedings (24 June 2019)

3.1 Preliminary

The basis of assessment was presented and was agreed upon by all parties. It was agreed that PD and Pip could be active members of the discussion and were not solely there to observe.

It was agreed that the options being assessed in the workshop were for on demand supply with no chlorine treatment. This was the preference of the community based on the consultation survey.

More detailed notes taken at the workshop are presented in Section 3.4.

3.2 Criteria Weighting

Weightings were assigned to each criterion. This process involved averaging the scores given my members of the workshop group. All members agreed on the final weightings as presented in Table 3.1 below.

Table 3.1: Criteria Weightings as Agreed at the Workshop

	Criterion 1	Criterion 2	Criterion 3	Criterion 4	Criterion 5
Description	Cost	Water Safety	Location	Environment	Future Proofing / Resilience
Weighting	25%	45%	10%	10%	10%

3.3 Option Assessment

The following options were assessed:

- Option 2 (rev A) – new lakefront bores with treatment and storage within Lake Middleton Reserve. Pressure and flow to the network to be provided by reticulation pumps.
- Option 6 – new bores, treatment, and new storage within Don Edwards land. Storage will be elevated approximately 10m below existing storage. This option was presented to WDC by Don Edwards as an acceptable alternative to upgrades using his land.
- Option 8 – new bores, treatment and new storage directly behind village. This is the same process as Option 2 (Rev A), with a different location. Pressure and flow to the network to be provided by reticulation pumps.
- Option 9 – staged option to utilise existing source with treatment and new storage behind the village (same as Option 8). Stage 1 involves selective abstraction and maintaining intake, raw storage and supply pipelines. The second stage is to develop new bore to augment the supply. If the water is not adequate behind the village, then the treatment plant infrastructure is to be relocated to Lake Middleton reserve and new bores are to constructed adjacent the lake. This Option has been presented by the Task Force.

A more detailed outline of the options is attached in the appendices.

Each option was assessed against the questions as presented in Table 3.2.

Table 3.2: Option Assessment Questions

Criterion	Question	Assessment
Cost	Capital cost NPV Rates impact	Score (calculated)
	Risk of cost escalation Risk of escalating staff time	Risk
Water Safety	Source Risk of water source being unable to meet current on demand Risk of source water contamination Treatment Risk of water treatment not meeting DWSNZ Risk of water treatment process failure Reticulation Risk of pipe failure Risk of inadequate fire flow	Risk
Location	Construction accessibility Locality of infrastructure	Score
	Impact of water protection zone on landowners Risk of landowner legal action	Risk
Environment	Risk of exceeding consent limits Impact on the environment Visual / aesthetic risk	Risk
Future Proofing / Resilience	Risk of not meeting future demands Risk of climate change Risk of earthquake	Risk

The scores calculated for costs (as presented at the workshop) are displayed in Table 3.3 below. Note that these costs were subsequently updated as part of the calibration. This is discussed in Section 4.0.

Table 3.3: Calculated Cost Scores

Item		Option			
		2	**6**	**8**	**9.1**
Capex	$	1,240,000	1,431,000	1,088,000	761,000
	Score	**3.0**	**2.2**	**3.6**	**4.9**
NPV	$	1,598,000	1,888,000	1,504,000	1,202,000
	Score	**3.0**	**2.1**	**3.3**	**4.2**
Rates	$	1,093	1,402	1,035	965
	Score	**3.0**	**1.6**	**3.3**	**3.6**

The overall cost scores also included an analysis of risk of cost and staff time escalation.

3.4 Workshop Notes

Notes from the workshop have been collated and are presented below.

Table 3.4: Workshop Notes and Actions

Topic	Comments / Discussion Notes	Action
Preliminary and General	▪ WDC is aware that not all landowners are up to date. MG to follow up. ▪ PD – option to meter the water and scale rates accordingly is very attractive to community. ▪ PD believes the community is concerned about developers / select few using more water than their share.	MG
Criteria Weighting	*Cost* ▪ PD noted that this weighting depends on wealth of community member as some don't care about the cost and willing to pay for a more expensive option whilst some can only afford the least expensive. *Water Safety* ▪ PD believed water safety should be 100% (shouldn't be a criterion as they all have to be safe). MG and MS explain that some options are "safer" than others – all agreed. *Location* ▪ Everyone in agreeance that the water treatment plant building is not to be in McKinnon Reserve as community have been planting for 30+ years. ▪ Discussion over WDC having the right to build here as there are no protections over it. *Environment* ▪ Agree on weighting of 10%. *Future Proofing Resilience* ▪ PD stated that the community do not think this is an important thing to be considered as they do not want to pay for the future inhabitants / developments. ▪ MP explained that developers would have to contribute for further upgrades. ▪ Task force has anecdotal evidence that an existing landowner thinking of developing. ▪ Legally (Local Government Act) WDC have to consider 30 years into the future therefore it was agreed that this criterion remains.	
Option 2	▪ WDC have not officially approached DoC but believe they are on board. ▪ The trees are Douglas Firs and scheduled to be removed in the next 10-15 years therefore the building will become visible from some houses in the village ▪ There will be test bores that confirm the level of treatment required (aren't going to over spec the treatment). ▪ There will be small cabinets for control / electrics at the bores but they will be appropriately coloured and shielded to minimise visual impact.	

Topic	Comments / Discussion Notes	Action
	▪ Discussion on fire service - Everyone in village agrees they want the hydrants & pipes remaining and fire fighting should be no less than currently available - Still able to refill from the lake. ▪ Location of bore heads (being close to the road) was discussed as potential contamination. Thought to be low due to depth and secure bore head. ▪ Risk of WTP failure – consequence should always be major (MS thinks that this should be option dependent based on contamination risk of source water). ▪ PD - concerned about pressure fluctuations in pipework by changing from gravity to pump system (WDC confirm that it has been fine in Otematata and that Hydrovar pump system ramps up and down slowly to provide constant pressure).	
Option 6	▪ PD believes cost of bores are low and has had a 6" bore drilled for ~$19,000. ▪ PD is unconvinced by the Hydrologist (Tom Heller) report on yield and water quality. ▪ Discussion regarding Don Edwards permission to access – MP confirms that WDC would still need a legal easement over access road. i.e.: Don Edwards cannot share his easement. ▪ Pip concerned over noise from pumps – WDC confirm that they are just bore pumps (underground) so noise is not going to be an issue at this site.	
Option 8	▪ Residents concerned over sewerage contamination. PD would like Aqualinc to perform detailed study on risk. ▪ PD believe likely and moderate for risk and consequence of contamination. ▪ Smaller site / footprint is more manageable from an operations perspective.	
Option 9	▪ PD believes that selective abstraction at source is best to efficiently utilise existing water storage. Discussion regarding solar powered actuated valve being feasible as it is not a major change to the existing infrastructure on private land. MS to update costs of this option to include this. ▪ PD believes it will be simple to add insulation and cladding on the outside of shipping container for visual amenity. MS said this will add cost to the option, cost to be updated. ▪ PD believes the creek does not run dirty for long periods of time as he has seen it visually return to clear a day after a storm event. ▪ MS stated that turbidities too high for cartridges may not be visual to the naked eye. ▪ There was discussion about that the existing source could not meet current demand (if change to on-demand supply). WDC say no, PD says yes.	MS MS
End of Meeting	It was acknowledged that due to time limits Fluent and WDC would need to do a sanity check on numbers to check that all questions were answered fairly and like for like options were scored similarly. Stage 2 of	MG/MS

Topic	Comments / Discussion Notes	Action
	Option 9 was also to be completed by Fluent and WDC outside of the meeting.	

3.5 Assessment Results

A summary of the weighted scores at the Workshop are presented in Table 3.5 below. Detailed raw results from the workshop are attached in the appendices.

Table 3.5: Workshop Assessment Results

	Criterion 1	Criterion 2	Criterion 3	Criterion 4	Criterion 5	Total Score/20	Weighted Score/5
	Cost	Water Safety	Location	Environment	Future Proofing / Resilience		
Criteria Weighting	**25%**	**45%**	**10%**	**10%**	**10%**	**100%**	-
Option 2 (rev A)	3.0	3.3	4.0	2.3	3.7	**16.33**	**3.25**
Option 6	2.0	2.5	2.0	3.3	2.7	**12.48**	**2.42**
Option 8	3.0	2.3	3.5	3.0	2.7	**14.53**	**2.73**
Option 9.1	3.4	2.5	2.9	3.0	2.3	**14.06**	**2.78**

Option 2 (rev A) had the highest weighted score followed by Stage1 of Option 9 and Option 8. Don Edwards option had the lowest weighted score.

4.0 Calibration and Sensitivity Analysis

Following the meeting, MG and MS revisited the scoring via an online meeting (25th June). This was to complete the scoring for Stage 2 of Option 9 (Option 9.2(i) and Option 9.2(ii)) and to compare scores across all of the options. Scores were amended in some instances to ensure scores fairly compared against each other.

A sensitivity analysis was also completed to account for PD's noted disagreement on the assessed scores.

Costs were updated subsequent to the meeting. This was mostly to reflect cost updates for Option 9 Stage 1 which was modified to having selective abstraction at source and the continued use of existing reservoirs. Further to this, Phil Driver reported (9th July) that it was the intention of the Task Force to retain the existing source for Option 9 Stage 2 options. Initially the WDC understood that the existing source and storage would be abandoned during Stage 2. The costs and assessment for Option 9.2 (i) have therefore been updated as part of this revision. Please note that Option 9.2 (ii) has remained unchanged as it was not considered feasible to maintain the existing source and new bores adjacent the lake.

The final costs used to calculate the cost scores are presented below in Table 4.1.

Table 4.1: Calculated Cost Scores (Calibrated)

Item		Option					
		2	**6**	**8**	**9.1**	**9.2(i) (RevA)**	**9.2(ii)**
Capex	$	1,240,000	1,431,000	1,088,000	821,000	1,038,000	1,510,000
	Score	**2.7**	**1.9**	**3.3**	**4.5**	**3.5**	**1.5**
NPV	$	1,603,000	1,892,000	1,509,000	1,262,000	1,466,000	1,684,000
	Score	**2.8**	**1.9**	**3.2**	**3.9**	**3.3**	**2.6**
Rates	$	1,099	1,408	1,041	1,155	1,313	1,324
	Score	**3.5**	**2.3**	**3.8**	**3.3**	**2.7**	**2.6**

The results of the sensitivity analysis and calibration are presented in Figure 4.1 below and Table 4.2 below.

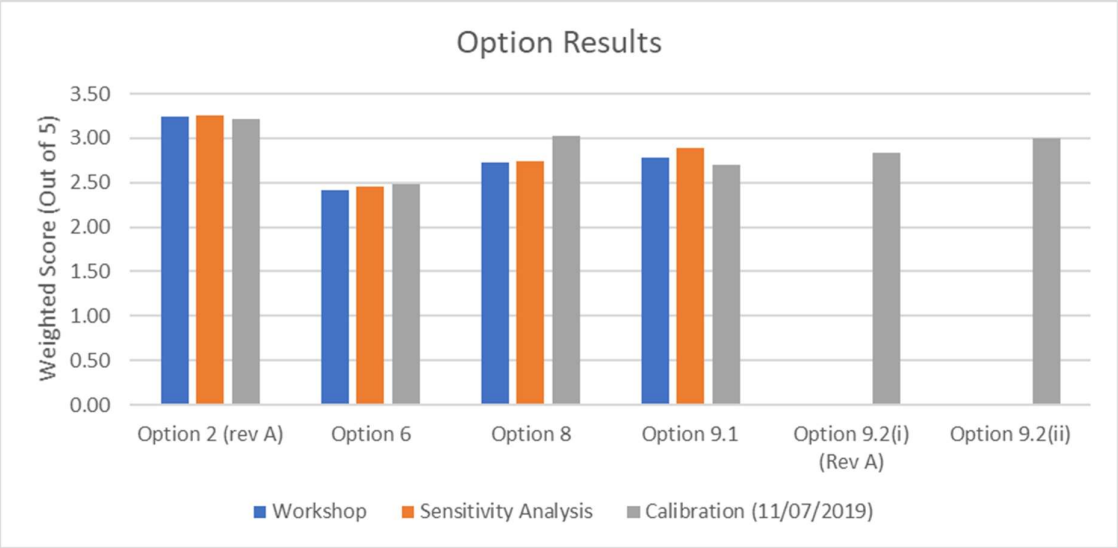


Figure 4.1: A comparison of Workshop, Sensitivity Analysis and Calibrated Results

Table 4.2 : Sensitivity Analysis / Calibrated Results (Ranked)

Option	Workshop		Sensitivity (PD Scoring)		Calibrated		Comments / Changes
	Weighted Score	Rank	Weighted Score	Rank	Weighted Score	Rank	
2 (rev A)	3.26	1	3.26	1	3.21	1	▪ This option is the highest ranked option and did not change position with calibration or sensitivity analysis. ▪ Risk of source water contamination changed to possible / minor (from likely/insignificant) due to lake water.
8	2.81	3	2.74	3	3.03	2	▪ Option 8 was ranked as 3rd ranked following workshop but became 2nd ranked following calibration. Amendments made were: ▪ Likelihood of water treatment not meeting DWSNZ changed to unlikely (from likely) to be same as other bore options. ▪ Likelihood of water treatment process failure changed to unlikely (from minor) to be same as other bore options. ▪ Consequence of landowner legal action changed to moderate (from minor) due to landowners not consulted on potential bore location change. ▪ Consequence of not meeting future demands changed to moderate (from minor) to be same as other bore options.
9.2(ii)	N/A	N/A	N/A	N/A	3.00	2+	▪ This essentially becomes option 2(rev A) however ranks lower due to higher costs in moving infrastructure and associated construction accessibility risks. e.g. untreated water will be supplied while transferring to new supply.
9.2(i)	N/A	N/A	N/A	N/A	2.97	2++	▪ This essentially is similar to Option 8 but retains the use of the existing source. It ranks lower due to costs associated with retaining existing infrastructure and dealing with multiple landowners.
9.1	2.84	2	2.89	2	2.70	3	▪ Option 9.1 was ranked as 2nd ranked following workshop but became 3rd ranked following calibration. Amendments made were: ▪ Update of costs to include selective abstraction and inability to fund job from abandoned assets (impact rates). ▪ Likelihood of escalating staff time changed to almost certain (from likely) due to potential landowner disputes. ▪ Likelihood of water source not being able to meet current on demand was **not changed** but WDC believe it is likely. ▪ Construction accessibility was changed to 3 (from 3.5) due to new access road. ▪ Locality of infrastructure changed to 1 (from 3) due to being scattered on private land. ▪ Impact of water protection zone on landowners was changed to likely / moderate (from rare / minor) due to surface water fencing requirements. ▪ Impact on the environment was **not changed** but WDC believe it is moderate due to intake works. ▪ Consequence of not meeting future demands changed to major (from moderate).
6	2.46	4	2.46	4	2.49	4	▪ Option 6 scores and ranking not significantly changed during calibration or sensitivity amendments. ▪ Consequence of pipe breakage changed to major (from moderate) due to no storage near village. ▪ Consequence of landowner legal action changed to major (from extreme) regarding access easement. ▪ Consequence of not meeting future demands changed to moderate (from minor) to be same as other bore options.

5.0 Conclusion

Option 2 (Rev A) consistently remained the highest ranked option in the workshop, including PD viewpoints on risk (sensitivity analysis) and following calibration.

Option 6; construction on new water supply infrastructure in Don Edwards land, was the lowest ranked option. This was consistent from the workshop, sensitivity and to calibration of the results.

Option 9.1 (the first stage of the Task Force Option – Option 9) was initially ranked second during the workshop but dropped a ranking following calibration. This was mostly due to allowance for selective abstraction (not considered in the costs presented at the workshop) and retaining of the existing storage, which impacts on the available funding for the upgrade. Risks were also modified to ensure assessments were fairly compared across all of the options.

Stage 2 alternatives of Option 9 were ranked slightly lower than options that were fully upgraded from the beginning (i.e.: Option 2 (Rev A) and Option 8). The lower ranking is mostly due to costs associated with the inability to fund the upgrade from depreciation and costs associated with relocating infrastructure (Option 9.2 (ii). It should be noted that the assessment of risks associated with Stage 2 did not consider the assessed risks of Stage 1. If Stage 1 risks were considered, the Stage 2 options would likely to score even lower.

APPENDIX 1

Consequence Table
June 2019

Criterion	Question	Consequence				
	Risk Table Score	**Insignificant**	**Minor**	**Moderate**	**Major**	**Extreme**
		1	**2**	**5**	**20**	**30**
Cost	Risk of cost escalation	Only minor upgrades required within 20 years costing <$25,000		Moderate upgrades required within 20 years costing <$100,000		Only minor upgrades required within 20 years costing <$500,000
	Risk of escalating staff time	Requires no extra WDC staff hours per month	Requires 10 extra WDC staff hours per month	Requires 20 extra WDC staff hours per month	Requires 40 extra WDC staff hours per month	Requires 80 extra WDC staff hours per month
Water Safety	Source	-	-	-	-	-
	Risk of water source being unable to meet current on demand	No water shortages		Some water shortages		Major water shortages
	Risk of source water contamination	No illness expected in the community	Very few of the community ill	Some of the community ill	Most of the community ill	All of the community ill. Anticipate some deaths
	Treatment					
	Risk of water treatment not meeting DWSNZ	No action taken by DWA		DWA requests upgrades to WTP		DWA takes WDC to court
	Risk of water treatment process failure	No illness expected in the community	Very few of the community ill	Some of the community ill	Most of the community ill	All of the community ill. Anticipate some deaths
	Reticulation	-	-	-	-	-
	Risk of pipe failure	Only non-critical pipelines impaired (repaired within several hours)		Main pipeline breakage but easily accessed (repaired within a week)		Main pipeline breakage & not easily accessed (repairs take longer than a month)
	Risk of inadequate fire flow	No damage to buildings		Several buildings building damaged		Multiple buildings destroyed
Location	Construction accessability	No extra time		Extra half hour		Extra hour
	Locality of infrastructure	No extra time		Extra half hour		Extra hour
	Impact of water protection zone on landowners	No landowner effected		Several landowners effected		Many landowners effected
	Risk of landowner legal action	No infrastructure on private land	Landowner requires financial compensation (<$25k)	Landowner requires financial compensation ($50k)	Landowner requires financial compensation (>$100k)	Landowner takes Council to court
Environment	Risk of exceeding consent limits	No resource consent breaches		Fined for minor exceedance		Taken to court for major/consistent exceedances
	Impact on the environment	Only brief, non-hazardous impact on the localised natural environment	Minor damage including temporary pollution /contamination of localised natural environment	Widespread damage to the local natural environment taking several years to recover	Long term and significant damage to natural environments taking over five years to recover	Irreversible and extensive damage to regionally significant natural environments
	Visual/aesthetic risk	Not visible from the village		Visible from the village but consistent with neighbouring aesthetic		Highly visible from the village
Future Proofing/ Resilience	Risk of not meeting future demand	No water shortages		Some water shortages		Major water shortages
	Risk of climate change	Only minor damage that would take less than four hours to fix	Some damage that would take less than a day to fix	Moderate damage that would take a week to fix	Extensive damage that would take two to four weeks to fix	Major damage that would take over a month to fix
	Risk of earthquake	Only minor damage that would take less than four hours to fix	Some damage that would take less than a day to fix	Moderate damage that would take a week to fix	Extensive damage that would take two to four weeks to fix	Major damage that would take over a month to fix

APPENDIX 2

Option Selection Information (Revision B)
July 2019

Introduction

The information presented is a summary of the Options that have been assessed at the Ohau Village Water Supply Option Evaluation workshop. The information has been garnered from a series of memorandums previously provided by Fluent.

1.0 Option 2 (rev A): New Bores plus Treatment, New Storage and Reticulation Pumps that Pump Directly to Reticulation

1.1 Description

This option is for the construction of 2 new bores, a new treatment plant and new storage tanks connected to reticulation pumps that pump directly into the Village reticulation. The bore pumps would be located adjacent to the lake edge and the water treatment plant and storage would be located in the trees behind the campground.

The bores will pump water through the treatment process directly into storage tanks. The storage tanks will feed reticulation pumps that are controlled to maintain a set pressure in the village reticulation. The size of the pumps and the pressure set point would depend upon whether the flow scenario is for restricted or on-demand connections.

The storage tanks will be of capacity to provide flow for operational demand, emergency storage, and fire storage. The level in the storage tanks control the operation of the bore pumps.

The proposed treatment system to meet DWSNZ 2005(revised 2008) is a 1um cartridge filter with UV reactors with the possibility of installing a chlorine dosing system for disinfection.

This option has been revised since the Issues and Options Report (August 2018) with the WTP being located behind the campground instead of on the lakefront.

An overall site plan for Option 2 is shown in Figure 1.1 below and a process flow diagram for Option 2 and detailed cost estimate is attached.

Figure 1.1: Schematic of Proposed Option 2 (rev A)

1.2 Cost Estimate

Table 1.1: Cost Summary for Proposed Option 2 (rev A)

Description	Option 2 (rev A)
Source	187,000
Treatment	388,000
Reticulation	140,000
Storage	75,000
Fire Protection	71,000
Generator	26,000
P&G, Design and Contingency	354,000
Capital cost	**1,240,000**
Annual Cost	**37,000**
NPV 20 years at 8%	**1,603,000**

1.3 Pros and Cons

Pros and Cons for Option 2 are:

Pros

- The water bores, water treatment plant and storage will be in WDC reserve land with easy access.
- The water intake, storage and associated pipework can be abandoned.
- The private land owner is able to utilise land around intake and storage.
- It is easier to upgrade this option to include chlorine disinfection in the future (if and when required).
- Fire protection is provided with an in-line fire pump, storage and generator.

Cons

- Storage is lower than the village and will require reticulation pumps to meet demand. A generator is required to provide supply during power outage.
- Landscaping and screening will be required to hide water treatment plant and storage adjacent lake. The storage requirements are significant for on-demand flows but these could be reduced by increasing the capacity of the bores and treatment.

2.0 Option 6: New Bores, WTP and Storage on Don Edwards Property

2.1 Description

This option has been identified by landowner, Don Edwards, as a potential option to maintain water infrastructure on his land.

This option includes the development of new bore/s and a new water treatment plant located near the eastern boundary of Don Edwards property. Treated water would then be pumped into the existing supply pipeline and fed into the village and/or up to a new reservoir on elevated land near the main power lines. The reservoir would act as a balance tank and provide for emergency and fire storage. A location drawing for the proposed option is presented in Figure 2.1.

Works required are:

- New bore/s near property boundary.
- Build new access road to provide all weather access to new bores and plant. This could be up through a right of way on the north boundary of 1789/1 property and then through pine trees to the reservoir site.
- New transformer and power to site – there are several options with the most cost effective being an overhead line from the supply behind the village. Any power within Don Edwards property will need to be underground which may also be the case for property 1789/1.
- Fencing around bores and WTP to protect area from any livestock.
- New WTP with cartridge filtration and UV and allowance for chlorine.
- New 350m^3 storage tank to store treated water for buffering flows, providing emergency and fire storage. Don Edwards has requested that this be a single tank rather than a tank farm.

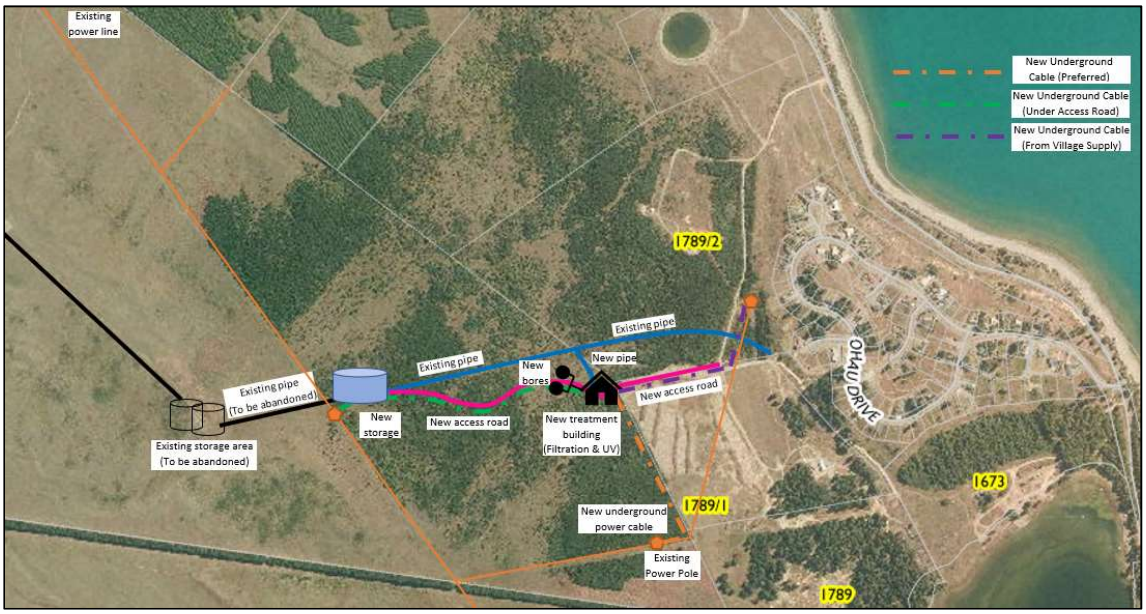


Figure 2.1: Schematic of Proposed Option 6

2.2 Cost Estimate

Table 2.1: Cost Summary for Proposed Option 6

Description	Option 6
Source	297,000
Treatment	470,000
Reticulation	41,000
Storage	214,000
P&G, Design and Contingency	409,000
Capital cost	**1,431,000**
Annual Cost	**43,000**
NPV 20 years at 8%	**1,892,000**

2.3 Pros and Cons

Pros and Cons for Option 6 are:

Pros

- Elevated storage provides supply during power outage without the need for a generator.
- The WTP cannot be seen from the village.
- Bore supply is often cleaner and more consistent resulting in less complex treatment systems.
- Don Edwards is agreeable to this option.
- Location is upgradient of potential contamination from wastewater oxidation pond and septic tanks.

Cons

- This is a change to infrastructure on private land and will require landowner permissions, and compensation to the owner.
- The WTP and storage is on a remote site so there will be additional operational cost with travel time to site and ensuring adequate notice is given.
- The identified location for the storage is 10m below the existing storage. This will reduce the pressure at village to 25-30m.
- There remains a high risk that the quantity of water required at this site is not available. Drilling exploratory bores is costly and there is no guarantee of finding water. For this site, a well formed access road will need to be constructed to bring in a drilling rig.
- Locating the bores in this location will require deeper bores at added expense.
- There is some concern over the potential damage from the trees that have grown over the existing water supply pipeline between the storage and reticulation. Removing these trees and keeping the pipeline clear will add to the costs of this option.

3.0 Option 8: New Bores, WTP and Storage behind Ohau Village with On-line Reticulation Pumps

3.1 Description

This option is the development of new bore/s and a new water treatment plant located behind the village. Treated water would then be pumped into the existing supply pipeline and fed into the village and/or up to a new tank farm located behind the village. The tank farm would sit below the village requiring reticulation pumps and a backup generator to provide water and fire flows in case of emergencies. A location drawing for the proposed option is presented in Figure 3.1.

Works required are:

- New bore/s located behind the town.
- New transformer and overhead power to site.
- Fencing around bores and WTP to protect area from any livestock.
- New WTP with cartridge filtration and UV and allowance for chlorine.
- New tank farm located at water treatment site to provide fire and buffer storage.
- Generator provided for emergencies.

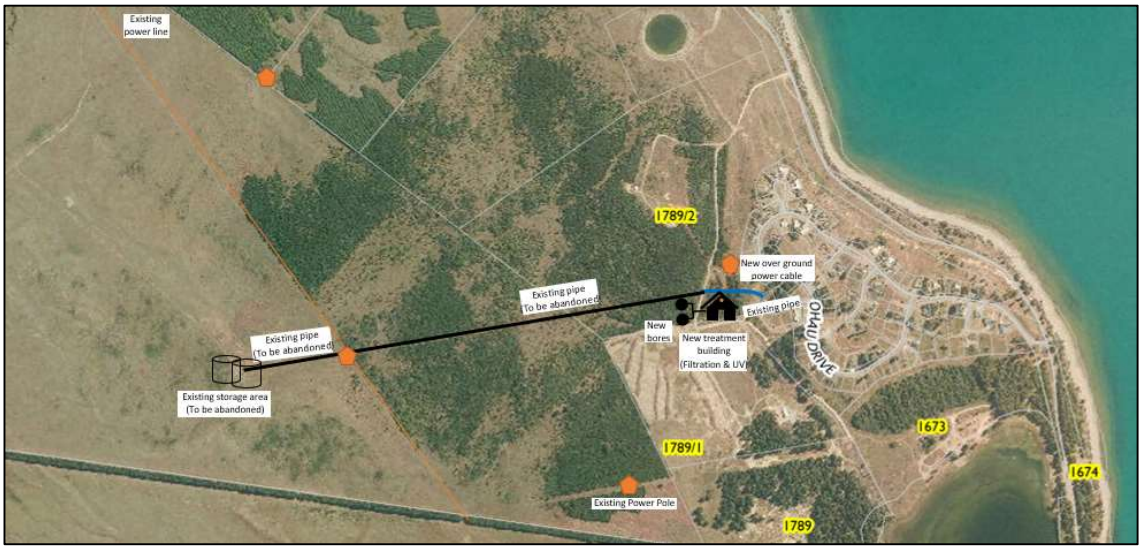


Figure 3.1: Schematic of Proposed Option 8

3.2 Cost Estimate

Table 3.1: Cost Summary for Proposed Option 8

Description	Option 8
Source	210,000
Treatment	323,000
Reticulation	53,000
Storage	94,000
Fire Protection	71,000
Generator	26,000
P&G, Design and Contingency	311,000
Capital cost	**1,088,000**
Annual Cost	**43,000**
NPV 20 years at 8%	**1,509,000**

3.3 Pros and Cons

Pros

- The WTP is at the back of the village and less prominent from view.
- Bore supply is often cleaner and more consistent resulting in less complex treatment systems.
- In principal, landowners are agreeable to this option, however further consultation is required.
- The location of the bores is more accessible, making test drilling more cost effective than on Don Edwards property.
- The location is close to the existing power supply.
- Location is upgradient of potential contamination from wastewater oxidation pond however, care needs to be taken to ensure there are no septic tanks upgradient of bores. This requires further investigation into the groundwater flows and location of septic tanks in the vicinity.
- The supply pipeline connecting the existing storage to the village reticulation can be abandoned, eliminating the potential for costs associated with clearing trees growing over the pipeline.
- Pressures in the village can be adjusted through pressure settings of the pumps.
- Fire flows can be met through provision of adequate fire pump capacity.

Cons

- This involves a change to infrastructure on private land and will require landowner permissions, and compensation to the owners.
- It is easier to upgrade this option to include chlorine disinfection in the future (if and when required).
- A generator is required to provide supply during power outage.
- There remains a high risk that the quantity of water required at this site is not available and that more than 2 bores are required to get adequate flow to meet the village demand.

4.0 Option 9: Community Task Force Option

4.1 Description of Stage 1 (Option 9.1)

Utilise existing source and tanks as raw water storage and install an actuated valve and turbidimeter at source, to allow for selective abstraction. This allows the source to be shut down when turbidity exceeds a set value. Water would then be treated with bag filtration, cartridge filtration and UV disinfection housed within a transportable shipping container. Treated water storage would be constructed adjacent the treatment plant with reticulation pumps to provide back up on-demand flow and fire flows when there is a drop in pressure in the reticulation. A generator would be required.

A location drawing for the proposed option is presented in Figure 4.1.

The proposed design is to run off the existing storage and provide gravity head to drive water through the filters and to the village. When the source water becomes dirty, the system will operate on the stored raw water and /or treated water storage until that runs out. This could take 2 to 4 days depending on demand.

It is unknown how long it takes for the source water to return to low turbidity (about <2 NTU) that would be treatable by the proposed system.

When the source water clears up, the system will return to running off the source and through the raw water storage.

Works required are:

Source

- Turbidimeter (solar powered) to be installed at source.
- Actuated valve, at source, controlled by turbidimeter.
- Fencing around existing intake and water protection zone to protect area from any livestock – this area needs to be such that livestock cannot enter waterways in the 142 Ha water protection zone. Cut off drains may also be required to minimise any surface runoff into the protection zone.

Raw Water Storage

- Level transducer, solar power and RTU for control and monitoring.

WTP

- New transformer and overhead power to site.
- Fencing around WTP to protect area from any livestock.
- New transportable containerised WTP with sound proofing and cladding with cartridge filtration and UV and allowance for chlorine.
- New tank farm located at water treatment site to provide fire and buffer storage.
- Generator provided for emergencies.

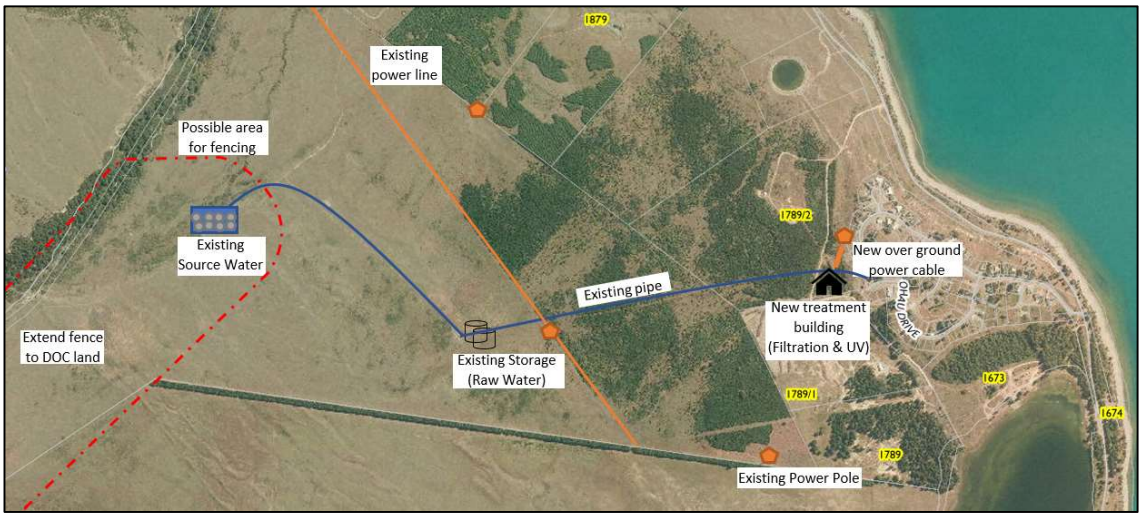


Figure 4.1: Schematic of Proposed Option 9.1

4.2 Description of Stage 2 (Option 9.2 (i) and 9.2 (ii))

Stage 2 is to develop a new water source, to meet future on-demand flows and improve quality of the water with a more consistent bore source. This stage is broken down into 2 alternative versions based on whether water is available near the water treatment plant constructed in Stage 1.

- Option 9.2(i)– Subject to a test bore confirming adequate water supply, install 1 x new bore near the water treatment plant. The new bore is to augment the existing supply to meet higher demands and provide source water when the existing source is dirty.
- Option 9.2(ii) – If the test bore in 9.2(ii) confirms inadequate water then find a new source. Most likely this will be adjacent the lake. This second stage will then require the development of new bores by the lake, relocating WTP, treated water storage, reticulation pumps and generator to nearer bores. It is not cost effective to maintain the use of the existing source with this option due to separation of the two source water types and thus it is assumed that the existing source, falling main and raw water storage be abandoned.

4.2.1 Option 9.2 (i)

A location drawing for this proposed option is presented in Figure 4.2.

Works required are:

- New resource consent to take water
- Test drill and installation of 1x new bore
- Fencing around bore
- Connection of bore to WTP

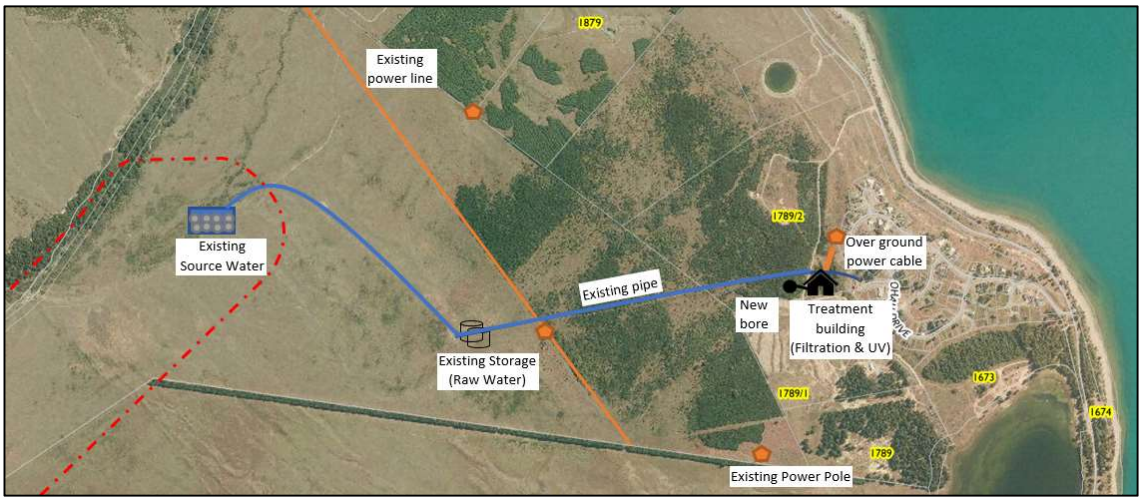


Figure 4.2: Schematic of Proposed Option 9.2(i)

4.2.2 Option 9.2 (ii)

A location drawing for this proposed option is presented in Figure 4.3.

Works required are:

- New resource consent to take water
- Test drill and installation of 2 x new bores
- Fencing around bores
- Connection of bore to WTP
- Relocation of WTP infrastructure to Lake Middleton Reserve
- New power connection
- Abandon existing source infrastructure

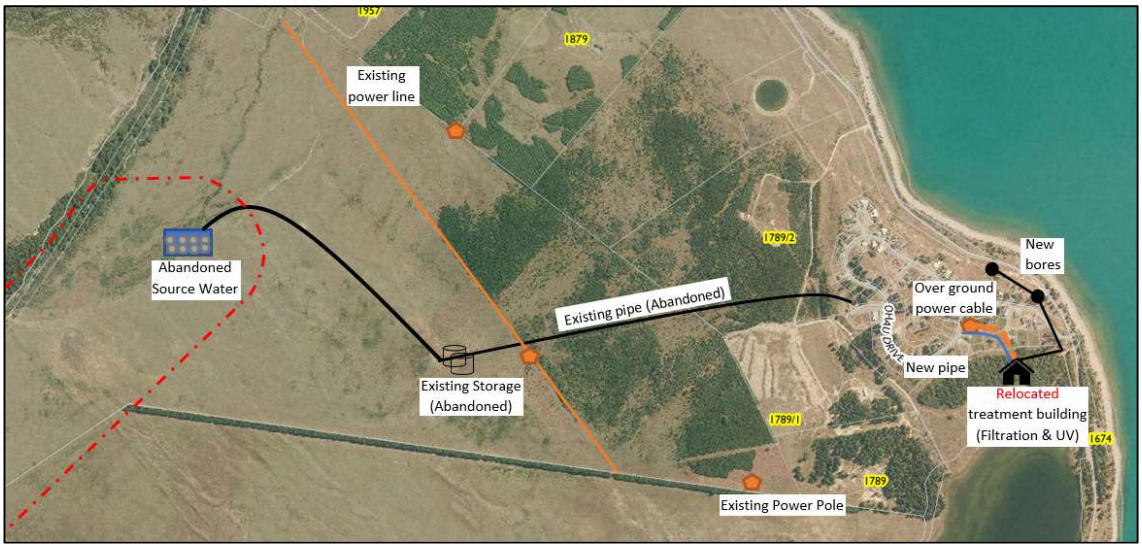


Figure 4.3: Schematic of Proposed Option 9.2(ii)

4.3 Cost Estimate

Table 4.1: Cost Summary for Stage 1 of Proposed Option 9

Description	Stage One	Stage Two: New bore behind village		Stage Two: New bores on lakefront	
	Option 9.1 a - OD	9.2(i) (add)	9.1 + 9.2(i)	9.2(ii) (add)	9.1 + 9.2(ii)
Source	132,000	120,750	252,800	213,000	345,000
Treatment	236,000	15,625	251,000	123,000	359,000
Reticulation	35,000	18,750	53,000	128,000	162,000
Storage	113,000	-	113000	19,000	131,000
Fire Protection	46,000	-	46,000	5,000	51,000
Generator	26,000	-	26000	5,000	31,000
P&G, Design and Contingency	235,000	82,750	317,000	197,000	431,000
Capital cost	**821,000**	**217,200**	**1,038,000**	**689,000**	**1,510,000**
Annual Cost	**45,000**		**43,000**		**37,000**
NPV 20 years at 8%	**1,262,000**		**1,466,500[1]**		**1,684,000**

4.4 Pros and Cons

Pros and Cons for this option are discussed below:

Pros

- The initial location of the WTP is close to the existing power supply.
- The cost of a modified shipping container is low compared with a bespoke and sympathetically designed WTP.
- Fire flows can be met through provision of adequate fire pump capacity and storage at the WTP.
- This option utilises the existing source which has support by Task Force community group.

Cons

- The landowners are not in favour of infrastructure or continued use of the water source located on their land. Therefore, upgrading and maintaining any part of the water supply on the land would be very difficult.
- The existing source is anecdotally subject to drought conditions and at higher risk of running out of water compared with sources near the lake. Water restrictions are more likely with Stage 1 of this option.
- The resource consent and probable yield of the existing source is for 2.2 L/sec and this option is only likely to be adequate to meet current demands and not a fully on-demand system (as preferred by the community).
- Selective abstraction requires construction works at the existing intake and continued operations resulting in added costs for communication and access. All work associated with the intake will be sunk costs if Option 9.2 (ii) is developed.

[1] The NPV allows for a renewal of the existing consent at 2035 and replacement of the existing tanks after 10 years.

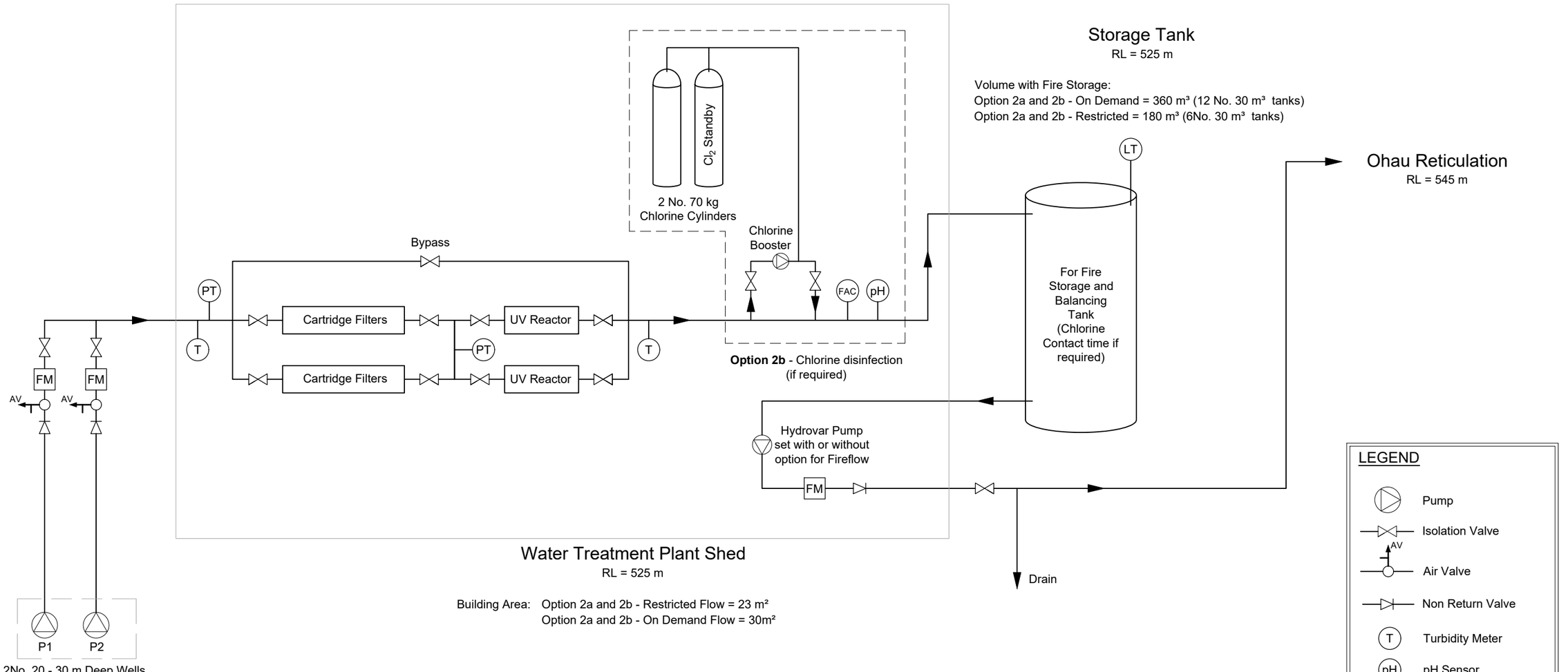
- Turbidity data collected from the existing supply indicates that the supply is subject to variability of quality. This is typical behaviour of a run of the river source. The treatment system as proposed is not suitable for treating high turbidity water. While there is back up storage, filters will block quickly and will not reduce turbidity enough to meet DWS, if exposed to dirty water.
- Having 'back up' treated water storage at the WTP introduces issues in that this water needs to be turned over regularly. Best practice is to turn water over every 24 hours to prevent it from becoming stagnant. To turn this water over would require either running this system or discharging to ground (which is wasteful).
- Maintaining the raw water storage and infrastructure takes away the opportunity to use the value of the depreciated assets for funding the upgrade. **The rates impact of this option is actually more expensive than most of the full upgrade options.**
- Option 9.2(i) proposes to retain the existing intake and storage.
    - The storage tanks will need replacement in the future as it is considered to be in poor condition. The NPV analysis assumes this will occur in 10 years time for option 9.2(i). This replacement is not included in the capital spend reported.
    - The raw water consent will need to be renewed in 2035. The NPV analysis assumes this will occur in 16 years time for option 9.2(i). This is not included in the capital spend reported.
- With a direct online system (raw water storage – treatment – consumer), the WTP would need to be sized for instantaneous peak flows (current peak flows up to 12 L/sec). If the treatment system is as proposed there will be potential pressure fluctuations in the network. To combat this, the treated water storage and pumps would need to switch on automatically with a drop in pressure. This adds complexities to the system and potential operational issues.
- There will be a drop in the normal operating pressures due to headloss through the filters (up to 240kPa). This could result in a reticulation pressure of 100kPa which is well below the Waitaki District Council Standards (250kPa for on-demand connections). This also requires the treated water storage and pumps to switch on automatically with a drop in pressure. This again adds complexities to the system and potential operational issues.
- There is no chlorine contact time when operating as a direct on-line system. If adding chlorine the system will need to pumped from the treated water storage.
- The Task Force have suggested that the WTP is constructed behind the village in a container. It is proposed that in the future, bores could be developed nearby. The feasibility of this option relies on water being found in this location. If an acceptable yield of water cannot be found at this location then the containerised WTP will need to be shifted. This will require significant re work including, new access, approvals, power supply and pipework. There is significant risk that costs will escalate for this option, making it one of more expensive options.

5.0 Summary

Table 5.1: Summary of Options Assessed

	Option					
	Option 2	**Option 6**	**Option 8**	**Option 9.1**	**Option 9.2(i) (Rev A)**	**Option 9.2(ii)**
Source (Type, Location)	Bores located on lakefront	Bores located on Don Edwards property	Bores located behind the village	Existing intake on Don Edwards property	Existing intake plus new bore located behind the village	Bores located on lakefront
Treatment (Type, Location)	Cartridge & UV located in a 25m^2 building behind the campground	Cartridge & UV located in a 25m^2 building on Don Edwards property	Cartridge & UV located in a 25m^2 building behind the village	Bag & Cartridge & UV located in a 40ft container behind the village	Bag & Cartridge & UV located in a 40ft container behind the village	Bag & Cartridge & UV located in a 40ft container behind the campground
Storage (Size, Location)	Treated water tanks behind the campground requiring retic pumps	Treated water reservoir on Don Edwards property	Treated water tanks behind the village requiring retic pumps	Raw water (existing) and treated water tanks behind the village requiring retic pumps	Raw water (existing) and treated water tanks behind the village requiring retic pumps	Treated water tanks behind the campground requiring retic pumps
Capital Cost	$1,240,000	$1,431,000	$1,088,000	$821,000	$1,038,000	$1,510,000
NPV (20 years @ 8%)	$1,603,000	$1,892,000	$1,509,000	$1,262,000	$1,466,500	$1,684,000
Rates Impact	$1,099	$1,408	$1,041	$1,155	$1,313	$1,324

Process Flow Diagrams



Revision		App	Date
A	Concept Design	MKS	31/07/18

Surveyed	-	-
Designed	MKS	Jul '18
Drawn	EJC	Jul '18
Reviewed	MKS	Jul '18
Approved	-	-

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Client: Waitaki DISTRICT COUNCIL
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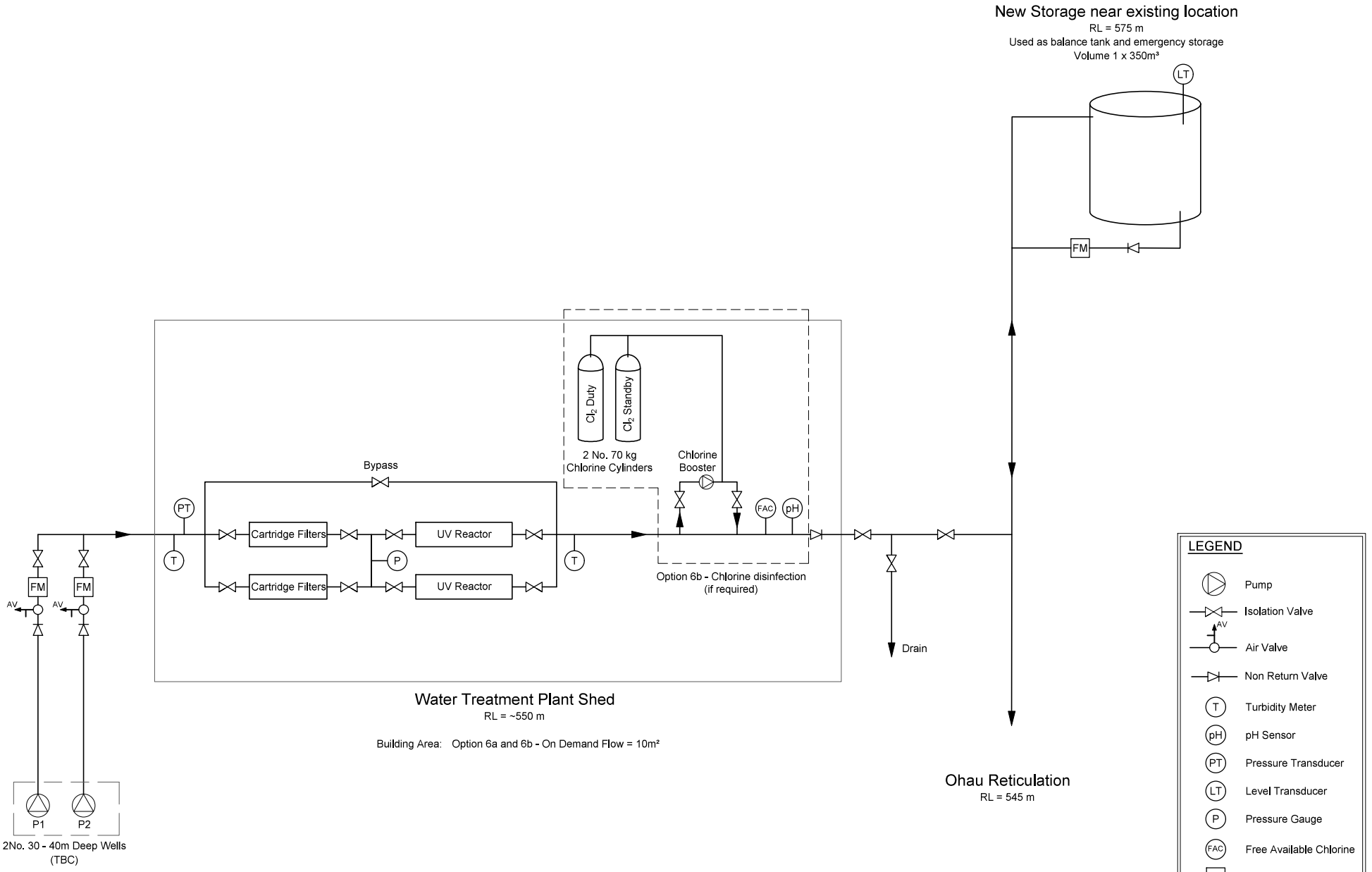
Project Title: Ohau Alpine Village Water Supply

Sheet Title: Process Flow Diagram Option 2a and Option 2b New Storage and Reticulation Pumps

Scale (A1 Original): NTS

Issue: Concept Design

Project No	Sheet	Revision
000442	P02	A



Revision	App	Date
-	-	-

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Approved	-	-

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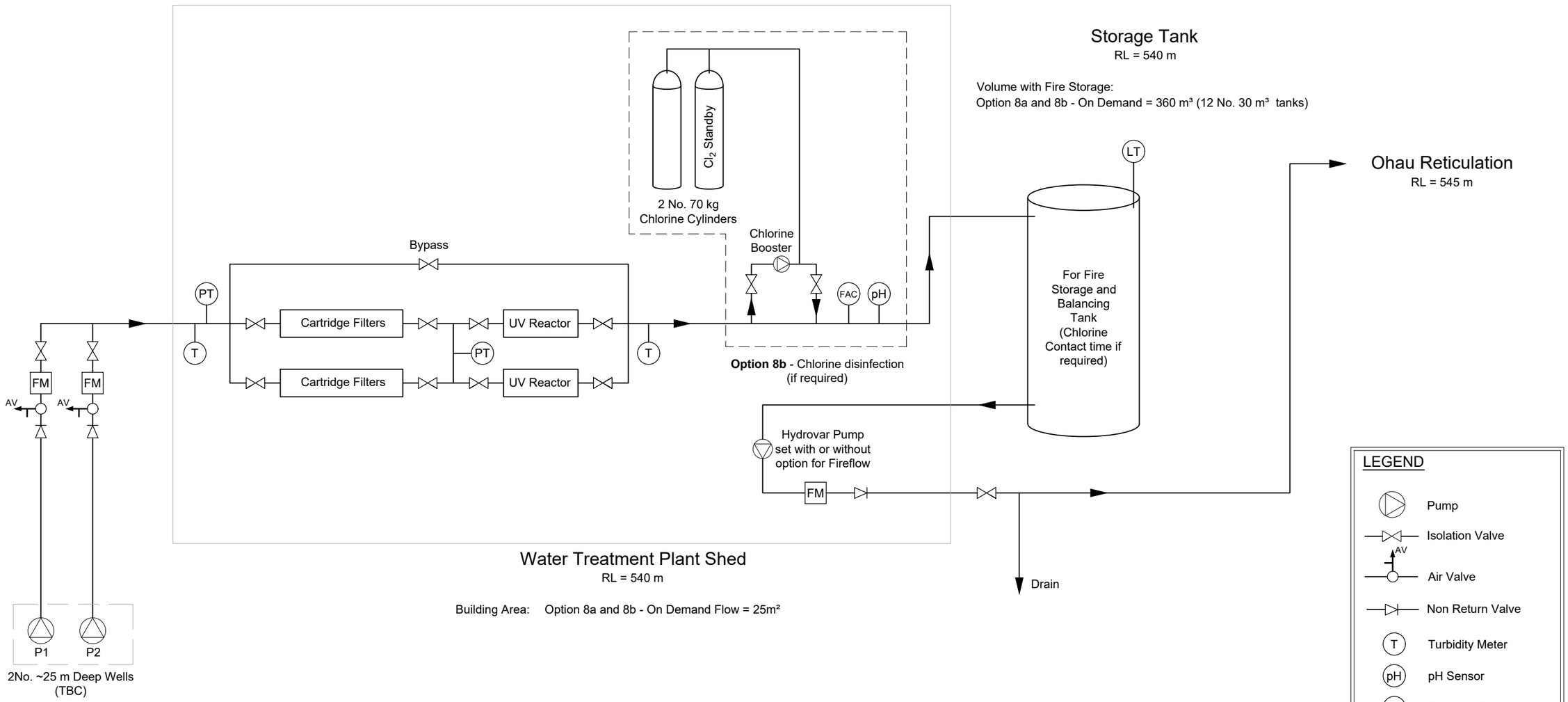
Project Title: Ohau Alpine Village Water Supply

Sheet Title: Process Flow Diagram Option 6a and Option 6b

Scale (A1 Original): NTS

Issue: Draft

Project No	Sheet	Revision
000442	P06	-



Revision	App	Date
-	-	-

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Reviewed	MKS	May'19
Approved	-	-

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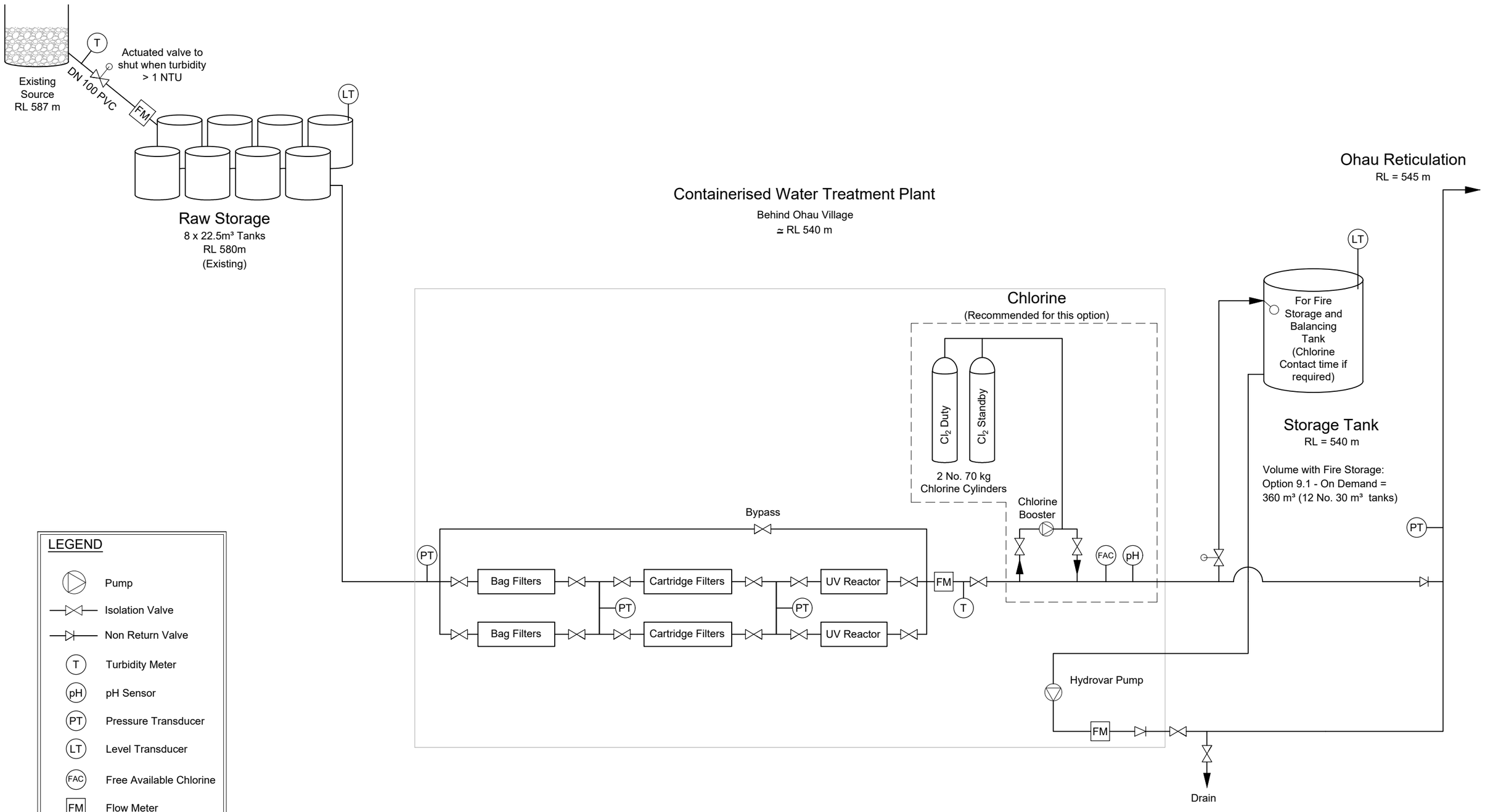
Project Title: Ohau Alpine Village Water Supply

Sheet Title: Process Flow Diagram Option 8a and 8b

Scale (A1 Original): NTS

Issue: Draft

Project No	Sheet	Revision
0000442	P08	A



LEGEND

- Pump
- Isolation Valve
- Non Return Valve
- T — Turbidity Meter
- pH — pH Sensor
- PT — Pressure Transducer
- LT — Level Transducer
- FAC — Free Available Chlorine
- FM — Flow Meter
- Actuator Valve
- Three way Actuator Valve

Revision		App	Date
B	Selective abstraction at source	F.G.	
A	Draft	-	-

Surveyed	-	-
Designed	Task Force	June'19
Drawn	D.R.	June'19
Reviewed	-	-
Approved	-	-

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Project Title: Ohau Alpine Village Water Supply

Sheet Title: Process Flow Diagram
Option 9.1 (Task Force Design)
Stage 1 - Existing Source
Selective Abstraction

Scale (A1 Original)		
NTS		
Issue		Draft
Project No	Sheet	Revision
000442	P09.1	B

Ohau Reticulation
RL = 545 m

Existing Source
RL 587 m

T

Actuated valve to shut when turbidity > 1 NTU

DN 100 PVC

FM

LT

Raw Storage
8 x 22.5m³ Tanks
RL 580m
(Existing)

For Fire Storage and Balancing Tank (Chlorine Contact time if required)

Storage Tank
RL = 540 m
To be located near lakefront if required

Volume with Fire Storage:
Option 9.2 - On Demand = 360 m³
(12 No. 30 m³ tanks)

Cl_2 Standby

2 No. 70 kg Chlorine Cylinders

Chlorine Booster

FAC

pH

PT

Bypass

Bag Filters

Bag Filters

Cartridge Filters

Cartridge Filters

UV Reactor

UV Reactor

Chlorine disinfection (if required)

New Bores

3 way Actuator Valve

AV

Hydrovar Pump set with or without option for Fireflow

Drain

P1

~25 m Deep Wells (TBC)

To be located behind village

Containerised Water Treatment Plant

Behind Ohau Village

~ RL 540 m

LEGEND

- Pump
- Isolation Valve
- Air Valve
- Non Return Valve
- Turbidity Meter
- pH Sensor
- Pressure Transducer
- Level Transducer
- Pressure Gauge
- Free Available Chlorine
- Flow Meter

Revision		App	Date
B	Continued use of existing source	M.S	12/07/19
A	Draft	M.S	June '19

Surveyed	-	-
Designed	F.G	June'19
Drawn	D.R & J.P	June'19
Reviewed	M.S	June'19
Approved	M.S	June'19

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Project Title: Ohau Alpine Village Water Supply

Sheet Title: Process Flow Diagram Option 9.2 (i) Stage 2 - Add Bores

Scale (A1 Original): NTS

Issue: Concept Design

Project No	Sheet	Revision
000442	P09.2	B

Ohau Reticulation
RL = 545 m

LT

For Fire Storage and Balancing Tank (Chlorine Contact time if required)

Storage Tank

RL = 540 m
To be located near lakefront if required

Volume with Fire Storage:
Option 9.2 - On Demand = 360 m³
(12 No. 30 m³ tanks)

PT

New Bores

Bypass

PT

Bag Filters

Cartridge Filters

UV Reactor

Bag Filters

Cartridge Filters

UV Reactor

PT

PT

FM

T

T

Cl_2 Standby

2 No. 70 kg
Chlorine Cylinders

Chlorine
Booster

FAC

pH

Chlorine disinfection
(if required)

FM

FM

AV

AV

P1

P2

2No. ~25 m Deep Wells
(TBC)

Adjacent to Lake Ohau

Hydrovar Pump
set with or without
option for Fireflow

FM

Drain

Containerised Water Treatment Plant

Lake Middleton Campground
~ RL 525 m

LEGEND

- Pump
- Isolation Valve
- Air Valve (AV)
- Non Return Valve
- Turbidity Meter (T)
- pH Sensor (pH)
- Pressure Transducer (PT)
- Level Transducer (LT)
- Pressure Gauge (P)
- Free Available Chlorine (FAC)
- Flow Meter (FM)

Revision		App	Date
A	Removal of Option 9.2 (i)	M.S	12/07/19

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Designed	F.G	June '19
Drawn	D.R & J.P	June '19
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Approved	M.S	June '19

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Project Title: Ohau Alpine Village Water Supply

Sheet Title: Process Flow Diagram Option 9.2 (ii) Stage 2 - Add Bores Near Lake Middleton

Scale (A1 Original): NTS

Issue: Concept Design

Project No	Sheet	Revision
000442	P09.2	A

Detailed Cost Estimates

Option 2 a OD (rev A) - New bores, WTP, Storage, Reticulation pumps (adjacent lake) - ON-DEMAND FLOW				
Description	**Unit**	**Quantity**	**Rate**	**Cost**
Source Water				
Application to work in reserve	With WDC	1	$ 5,000	$ 5,000
ECAN Consent	consent to take groundwater	1	$ 25,000	$ 25,000
Bores drilling and headworks		2	$ 30,000	$ 60,000
Bore Pumps	2.75L/sec at up to 55 m allowed for	2	$ 2,500	$ 5,000
VFD	VFD for pumps	2	$ 3,500	$ 7,000
Raw water turbidimeter	Hach 1720E	1	$ 7,000	$ 7,000
Flow meter	DN80 yokogawa mag flowmeter	2	$ 4,600	$ 9,200
Low voltage cable	Additional (aluminium) cable required to supply bore pumps	400	$ 40	$ 16,000
Electrical and Control	level switches electrical cabinet, install	1	$ 15,000	$ 15,000
Installation and Construction		25%	$ 149,200	$ 37,300
SUBTOTAL				***$ 186,500***
Water Treatment				
Cartridge	1 HF40H304 1 um - will treat up to 5 L/sec (Duty assist)	2	$ 8,250	$ 16,500
Ultraviolet Disinfection	UV Pro 50 (up to 3.15 L/sec) Duty assist	2	$ 10,000	$ 20,000
UPS for UV	UPS - for management of brown outs 30min	1	$ 3,000	$ 3,000
Pressure Transducer	For monitoring pressure across cartridges	6	$ 500	$ 3,000
Turbiditmeter	For treated water	1	$ 7,000	$ 7,000
Flow meter	DN80 yokogawa mag flowmeter	1	$ 4,600	$ 4,600
Pipes, valves and fittings	50 to 100 mm	1	$ 10,000	$ 10,000
Water Treatment Plant Building	Alpine style m2	25	$ 4,000	$ 100,000
Building Consent	Building consent for WTP	1	$ 10,000	$ 10,000
Landscaping/Access/Fencing	Landscaping/ Access Road	1	$ 50,000	$ 50,000
Telemetry	RTU and Aerial, programming etc	1	$ 20,000	$ 20,000
Electrical and Switchboard		1	$ 40,000	$ 40,000
Power Upgrade	Upgrade to provide service fuse box on boundary of 98 Ohau Drive	1	$ 20,000	$ 20,000
Power Upgrade	High voltage line to site - overhead power	128	$ 60	$ 7,680
Installation and Construction		25%	$ 304,100	$ 76,025
SUBTOTAL				***$ 387,805***
Reticulation				
Hydrovar Pump set (12 L/sec at 50m)	Lowara Twin Pac Dual 15SV06F055T5.5 KW	1	$ 11,000	$ 11,000
Flow meter	DN80 yokogawa mag flowmeter	1	$ 4,600	$ 4,600
Bores to WTP	DN100 PVC/PE	472	$ 150	$ 70,800
WTP to Storage	DN100 PVC/PE	16	$ 150	$ 2,400
Storage to Retic	DN150 PVC/PE	128	$ 180	$ 23,040
Installation and Construction		25%	$ 111,840	$ 27,960
SUBTOTAL				***$ 139,800***
Storage				
Storage (operational and emergency)	30,000 L tanks with fittings (operational and emergency -287m3)	10	$ 6,000	$ 60,000
Installation and Construction		25%	$ 60,000	$ 15,000
SUBTOTAL				***75,000***
Fire Protection				
Fire Tanks	30,000 L tanks with fittings	2	$ 6,000	$ 12,000
Added building space		5	$ 4,000	$ 20,000
Additional Generator Cost	increase in size of generaotr for Fire pump	1	$ 6,000	$ 6,000
Fire Pump		*1*	19,000	$ 19,000
Installation and Construction		25%	$ 57,000	$ 14,250
SUBTOTAL				***71,250***
Add- ons				
Generator	30 KVA generator	1	20,500	$ 20,500
Installation and Construction		25%	$ 20,500	$ 5,125
SUBTOTAL				***25,625***
SUBTOTAL				**885,980**
Preliminary and General		10%		88,598
Design		20%		177,196
Contingency		10%		88,598
Total Estimated Capital Cost:			**-**	**1,240,372**
Annual Operational Costs	*assumed average daily flow (m3/day)*	*50*		
Compliance and Management	per hour (4 hours monthly)	48	180	**8,640**
Labour	per hour (weekly visits for 5 hours)	260	70	**18,200**
UV Disinfection	kWhr (assumes 0.23 kw operating 24 hours per day)	2014.8	0.4	**806**
Lamp Replacement	Assumes yearly reaplacement of 1 lamp (1 lamp per unti)	1.0	433.0	**433**
Cartridges	per cartridge (assume quarterly)	4	500	**2,000**
Electricity for Bore Pumps	kWhr (assumes 2kw pump operating at 2L/sec for about 7 hours per day)	5,069	0.3	**1,521**
Electricity for Reticulation Pumps	kWhr (assumes4kw pump operating at 1.5 L/sec for 12 hours per day)	17,520	0.3	**5,256**
SUBTOTAL				*$ 36,855.75*
Total Estimated Annual Operational Costs				**$ 36,900**
NPV of Operating Costs (20 yr @ 8%)				**$ 362,300**
NPV Capital plus Operating Costs				**$ 1,602,672**

Option 6a OD- New bores, WTP in New Location, Storage Close to Existing Location - ON DEMAND FLOW				
Description	**Unit**	**Quantity**	**Rate**	**Cost**
Source Water				
Additional Time to work with Landowner / public works act	less time as option more aggreeable to landowner	1	$ 10,000	$ 10,000
Land owner compensation	10,000 per bore plus 30,000 plus facilities	1	$ 50,000	$ 50,000
ECAN Consent	consent to take groundwater	1	$ 25,000	$ 25,000
Bores drilling and headworks		2	$ 50,000	$ 100,000
Bore Pumps	2.8 L/sec at up to 30m allowed for	2	$ 2,500	$ 5,000
VFD	VFD for pumps	2	$ 3,500	$ 7,000
Raw water turbidimeter	Hach 1720E	1	$ 7,000	$ 7,000
Flow meter	DN80 yokogawa mag flowmeter	2	$ 4,600	$ 9,200
Electrical and Control	level switches electrical cabinet, install	1	$ 15,000	$ 15,000
Installation and Construction		30%	$ 228,200	$ 68,460
SUBTOTAL Source				***$ 296,660***
Water Treatment				
Filtration, UV, Building, Civil				
Cartridge	1 HF40H304 (duty/standby) 1 um nominal - will treat up to 5 L/sec	2	$ 8,250	$ 16,500
Ultraviolet Disinfection	UV Pro 50 (up to 3.15 L/sec) Duty assist	2	$ 10,000	$ 20,000
UPS for UV	UPS - for management of brown outs 30min	1	$ 3,000	$ 3,000
Pressure Transducer	For monitoring pressure across cartridges	3	$ 500	$ 1,500
Turbiditmeter	For treated water	1	$ 7,000	$ 7,000
Flow meter	DN80 yokogawa mag flowmeter	1	$ 4,600	$ 4,600
Pipes, valves and fittings	50 to 100 mm	1	$ 10,000	$ 10,000
Water Treatment Plant Building	Alpine style m2	10	$ 4,000	$ 40,000
Fencing		1	$ 8,000	$ 8,000
Landscaping/Access	Landscaping/ Access Road	1	$ 70,000	$ 70,000
Tree Clearing	allowance	1	$ 20,000	$ 20,000
Telemetry	RTU and Aerial, programming etc	1	$ 30,000	$ 30,000
Electrical and Switchboard		1	$ 40,000	$ 40,000
Power Upgrade	power to new site - transformer near village- network Waitaki	1	$ 16,600	$ 16,600
	High voltage line to site - overhead power	414	$ 180	$ 74,520
Installation and Construction		30%	$ 361,720	$ 108,516
SUBTOTAL Treatment				***$ 470,236***
Reticulation				
Bores to WTP	DN100 PVC/PE - 50m to each bore	100	$ 150	$ 15,000
WTP to Retic	DN150 PVC o (for additional chlorine contact time)	110	$ 150	$ 16,500
Installation and Construction		30%	$ 31,500	$ 9,450
SUBTOTAL Reticulation				***$ 40,950***
Storage				
Replacement of existing tanks				
Demolition of tanks	Not required for this option	20%	$ -	$ -
New Flow meter	DN80 yokogawa mag flowmeter	1	$ 4,600	$ 4,600
New Storage Tank	350m3 steel tank plus ancillary	1	$ 120,000	$ 120,000
Concrete slab	90m2	1	$ 20,000	$ 20,000
Pipework	Allowance for pipework	1	$ 15,000	$ 15,000
Solar Panel		1	$ 7,000	$ 7,000
Installation and Construction		30%	$ 159,600	$ 47,880
SUBTOTAL Storage				***214,480***
Fire Protection				
included in above storage				
Installation and Construction		30%	$ -	$ -
SUBTOTAL Fire Protection				**-**
Add- ons				
Generator	allow to bring in plug in generator			
SUBTOTAL				**1,022,326**
Preliminary and General		10%		102,233
Design		20%		204,465
Contingency		10%		102,233
Total Estimated Capital Cost:			-	**1,431,300**
Annual Operational Costs	*assumed average daily flow (m3/day)*	*50*		
Compliance and Management	per hour (5 hours monthly) extra 1 hour as infrastructure on private land	60	$ 180	10,800
Labour	per hour (weekly visits for 6 hours) plus additional 6 hours /monthly to address issues with land owner and changing filters etc	384	$ 70	26,880
UV Disinfection	kWhr (assumes 0.23 kw operating 24 hours per day)	2,015	$ 0.4	806
Lamp Replacement	Assumes yearly reaplacement of 1 lamp (1 lamp per unit)	1.0	$ 433	433
Cartridges	per cartridge (assume quarterly)	4	500	**2,000**
Electricity for Bore Pumps	kWhr (assumes 2kw pump operating at 2 L/sec)	5,069	$ 0.4	2,028
SUBTOTAL				***$ 42,946.70***
Landowner Rental				
Rental to landowner	Payback over 5 year period	0.2	$ 50,000	**10,000**
Total Estimated Annual Operational Costs				**$ 42,900**
NPV of Operating Costs (20 yr @ 8%)				**$ 421,200**
NPV of Rental (5 yr @ 8%)				**$ 39,900**
NPV Capital plus Operating Costs				**$ 1,892,400**

Option 8a OD- New bores, WTP & Storage behind Village with reticulation pumps - ON DEMAND FLOW				
Description	**Unit**	**Quantity**	**Rate**	**Cost**
Source Water				
Additional Time to work with Landowner / public works act		1	$ 20,000	$ 20,000
ECAN Consent	consent to take groundwater	1	$ 25,000	$ 25,000
Bores drilling and headworks		2	$ 40,000	$ 80,000
Bore Pumps	2.8 L/sec at up to 30m allowed for	2	$ 2,500	$ 5,000
VFD	VFD for pumps	2	$ 3,500	$ 7,000
Raw water turbidimeter	Hach 1720E	1	$ 7,000	$ 7,000
Flow meter	DN80 yokogawa mag flowmeter	2	$ 4,600	$ 9,200
Electrical and Control	level switches electrical cabinet, install	1	$ 15,000	$ 15,000
Installation and Construction		25%	$ 168,200	$ 42,050
SUBTOTAL Source				***$ 210,250***
Water Treatment				
Filtration, UV, Building, Civil				
Cartridge	1 HF40H304 (duty/standby) 1 um nominal - will treat up to 5 L/sec	2	$ 8,250	$ 16,500
Ultraviolet Disinfection	UV Pro 50 (up to 3.15 L/sec) Duty assist	2	$ 10,000	$ 20,000
UPS for UV	UPS - for management of brown outs 30min	1	$ 3,000	$ 3,000
Pressure Transducer	For monitoring pressure across cartridges	3	$ 500	$ 1,500
Turbiditmeter	For treated water	1	$ 7,000	$ 7,000
Flow meter	DN80 yokogawa mag flowmeter	1	$ 4,600	$ 4,600
Pipes, valves and fittings	50 to 100 mm	1	$ 10,000	$ 10,000
Water Treatment Plant Building	Alpine style m2	25	$ 4,000	$ 100,000
Fencing		1	$ 8,000	$ 8,000
Landscaping/Access	Landscaping/ Access Road	1	$ 10,000	$ 10,000
Tree Clearing	allowance	1	$ 10,000	$ 10,000
Telemetry	RTU and Aerial, programming etc	1	$ 10,000	$ 10,000
Electrical and Switchboard		1	$ 40,000	$ 40,000
Power Upgrade	power to new site - transformer on property-network Waitaki	1	$ 16,600	$ 16,600
	High voltage line to site - overhead power	20	$ 60	$ 1,200
Installation and Construction		25%	$ 258,400	$ 64,600
SUBTOTAL Treatment				***$ 323,000***
Reticulation				
Hydrovar Pump set (12 L/sec at 50m)	Lowara Twin Pac Dual 15SV06F055T5.5 KW	1	$ 11,000	$ 11,000
Flow meter	DN80 yokogawa mag flowmeter	1	$ 4,600	$ 4,600
Bores to WTP	DN100 PVC/PE - 50m to each bore	100	$ 150	$ 15,000
WTP to Retic	DN150 PVC o	80	$ 150	$ 12,000
Installation and Construction		25%	$ 42,600	$ 10,650
SUBTOTAL Reticulation				***$ 53,250***
Storage				
Storage (operational and emergency)	30,000 L tanks with fittings (operational and emergency -287m3)	10	$ 6,000	$ 60,000
Pipework	Allowance for pipework	1	$ 15,000	$ 15,000
Installation and Construction		25%	$ 75,000	$ 18,750
SUBTOTAL Storage				***93,750***
Fire Protection				
Fire Tanks	30,000 L tanks with fittings	2	$ 6,000	$ 12,000
Added building space		5	$ 4,000	$ 20,000
Additional Generator Cost	increase in size of generator for Fire pump	1	$ 6,000	$ 6,000
Fire Pump		*1*	$ 19,000	$ 19,000
Installation and Construction		25%	$ 57,000	$ 14,250
SUBTOTAL Fire Protection				***71,250***
Add- ons				
Generator	30 KVA generator	1	20,500	$ 20,500
Installation and Construction		25%	$ 20,500	$ 5,125
SUBTOTAL Generator				***25,625***
SUBTOTAL				**777,125**
Preliminary and General		10%		77,713
Design		20%		155,425
Contingency		10%		77,713
Total Estimated Capital Cost:			-	**1,088,000**
Annual Operational Costs	*assumed average daily flow (m3/day)*	*50*		
Compliance and Management	per hour (**5** hours monthly)	60	$ 180	10,800
Labour	per hour (weekly visits for 5 hours) plus additional 4 hours /monthly to address issues with land owner	308	$ 70	21,560
UV Disinfection	kWhr (assumes 0.23 kw operating 24 hours per day)	2,015	$ 0.4	806
Lamp Replacement	Assumes yearly reaplacement of 1 lamp (1 lamp per unit)	1.0	$ 433	433
Cartridges	per cartridge (assume quarterly)	4	$ 500	2,000
Electricity for Bore Pumps	kWhr (assumes 2kw pump operating at 2 L/sec)	5,069	$ 0.4	2,028
Electricity for Retic Pumps	kWhr (assumes4kw pump operating at 1.5 L/sec for 12 hours per day)	17,520	0.3	5,256
SUBTOTAL				***$ 42,882.70***
Total Estimated Annual Operational Costs				**$ 42,900**
NPV of Operating Costs (20 yr @ 8%)				**$ 421,200**
NPV Capital plus Operating Costs				**$ 1,509,200**

Option 9a OD- Selective Abstraction Existing Source then existing storage and new pumps - Current FLOW WTP & Storage behind Village with reticulation				
Description	**Unit**	**Quantity**	**Rate**	**Cost**
Source Water				
Additional Time to work with Landowner / public works act		1	$ 20,000	$ 20,000
ECAN Consent	consent to discharge to land	1	$ 10,000	$ 10,000
Improvements to intake - fencing	allowance	1	$ 20,000	$ 20,000
Raw water turbidimeter	Hach 1720E	1	$ 7,000	$ 7,000
Actuated valve to shut down when water above 1 NTU	Rotork	1	$ 15,000	$ 15,000
Flow meter	DN80 yokogawa mag flowmeter	2	$ 4,600	$ 9,200
Electrical, control and Telemetry (to provide data, alarms and shut down of Rotork)	RTU and aerial, pole, solar panel, battery and repeater	1	$ 25,000	$ 25,000
Installation and Construction		30%	$ 86,200	$ 25,860
SUBTOTAL Source				***$ 132,060***
Water Treatment				
Filtration, UV, Building, Civil				
Cartridge	1 HF40H304 (duty/standby) 1 um nominal - will treat up to 5 L/sec	2	$ 8,250	$ 16,500
Ultraviolet Disinfection	UV Pro 50 (up to 3.15 L/sec) Duty assist	2	$ 10,000	$ 20,000
UPS for UV	UPS - for management of brown outs 30min	1	$ 3,000	$ 3,000
Pressure Transducer	For monitoring pressure across cartridges	3	$ 500	$ 1,500
Turbiditmeter	For treated water	1	$ 7,000	$ 7,000
Flow meter	DN80 yokogawa mag flowmeter	1	$ 4,600	$ 4,600
Pipes, valves and fittings	50 to 100 mm	1	$ 10,000	$ 10,000
Water Treatment Plant Building	40ft Containter (incl pad & modification - cedar cladding, insulation)	1	$ 30,000	$ 30,000
Fencing		1	$ 8,000	$ 8,000
Landscaping/Access	Landscaping/ Access Road	1	$ 10,000	$ 10,000
Tree Clearing	allowance	1	$ 10,000	$ 10,000
Telemetry	RTU and Aerial, programming etc	1	$ 10,000	$ 10,000
Electrical and Switchboard		1	$ 40,000	$ 40,000
Power Upgrade	power to new site - transformer on property- network Waitaki	1	$ 16,600	$ 16,600
	High voltage line to site - overhead power	20	$ 60	$ 1,200
Installation and Construction		25%	$ 188,400	$ 47,100
SUBTOTAL Treatment				***$ 235,500***
Reticulation				
Hydrovar Pump set (12 L/sec at 50m)	Lowara Twin Pac Dual 15SV06F055T5.5 KW	1	$ 11,000	$ 11,000
Flow meter	DN80 yokogawa mag flowmeter	1	$ 4,600	$ 4,600
WTP to Retic	DN150 PVC o	80	$ 150	$ 12,000
Installation and Construction		25%	$ 27,600	$ 6,900
SUBTOTAL Reticulation				***$ 34,500***
Storage				
Storage (operational and emergency)	30,000 L tanks with fittings (operational and emergency -287m3)	10	$ 6,000	$ 60,000
Telemetry (to talk to pumps and provide data, alarms)	RTU and aerial, pole, solar panel, battery and repeater	1	$ 15,000	$ 15,000
Pipework	Allowance for pipework	1	$ 15,000	$ 15,000
Installation and Construction		25%	$ 90,000	$ 22,500
SUBTOTAL Storage				***112,500***
Fire Protection				
Fire Tanks	30,000 L tanks with fittings	2	$ 6,000	$ 12,000
Additional Generator Cost	increase in size of generator for Fire pump	1	$ 6,000	$ 6,000
Fire Pump		*1*	$ 19,000	$ 19,000
Installation and Construction		25%	$ 37,000	$ 9,250
SUBTOTAL Fire Protection				***46,250***
Add- ons				
Generator	30 KVA generator	1	20,500	$ 20,500
Installation and Construction		25%	$ 20,500	$ 5,125
SUBTOTAL Generator				***25,625***
SUBTOTAL				**586,435**
Preliminary and General		10%		58,644
Design		20%		117,287
Contingency		10%		58,644
Total Estimated Capital Cost:			**-**	**821,000**
Annual Operational Costs	*assumed average daily flow (m3/day)*	*50*		
Compliance and Management	per hour **(5** hours monthly)	60	$ 180	10,800
Labour	per hour (weekly visits for 5 hours) plus additional 4 hours /monthly to address issues with land owner	308	$ 70	21,560
UV Disinfection	kWhr (assumes 0.23 kw operating 24 hours per day)	2,015	$ 0.4	806
Lamp Replacement	Assumes yearly reaplacement of 1 lamp (1 lamp per unit)	1.0	$ 433	433
Cartridges	per cartridge (assume monthly)	12	$ 500	6,000
Electricity for Retic Pumps	kWhr (assumes4kw pump operating at 1.5 L/sec for 12 hours per day)	17,520	0.3	5,256
SUBTOTAL				***$ 44,854.92***
Total Estimated Annual Operational Costs				**$ 44,900**
NPV of Operating Costs (20 yr @ 8%)				**$ 440,800**
NPV Capital plus Operating Costs				**$ 1,261,800**

Option 9.2(i)a OD- New bores upgrading Option 8 (WTP & Storage behind Village with reticulation pumps) - ON DEMAND FLOW				
Description	**Unit**	**Quantity**	**Rate**	**Cost**
Source Water				
Additional Time to work with Landowner / public works act	New land area/landowners	1	$ 20,000	$ 20,000
ECAN Consent	consent to take groundwater	1	$ 25,000	$ 25,000
Bores drilling and headworks		1	$ 40,000	$ 40,000
Bore Pumps	2.8 L/sec at up to 30m allowed for	1	$ 2,500	$ 2,500
VFD	VFD for pumps	1	$ 3,500	$ 3,500
Raw water turbidimeter	Included in Option 9.1	0	$ 7,000	$ -
Flow meter	New to measure bore flow	1	$ 4,600	$ 4,600
Electrical and Control	Included but requires upgrade	1	$ 5,000	$ 5,000
Installation and Construction		25%	$ 80,600	$ 20,150
SUBTOTAL Source				***$ 120,750***
Water Treatment				
Filtration, UV, Building, Civil				
Cartridge	Included in Option 9.1	0	$ 8,250	$ -
Ultraviolet Disinfection	Included in Option 9.1	0	$ 10,000	$ -
UPS for UV	Included in Option 9.1	0	$ 3,000	$ -
Pressure Transducer	Included in Option 9.1	0	$ 500	$ -
Turbiditmeter	Included in Option 9.1	0	$ 7,000	$ -
Flow meter	Included in Option 9.1	0	$ 4,600	$ -
Pipes, valves and fittings	Included in Option 9.1	0	$ 10,000	$ -
Water Treatment Plant Building	Included in Option 9.1	0	$ 30,000	$ -
Fencing	Included in Option 9.1 but requires upgrade	1	$ 2,500	$ 2,500
Landscaping/Access	Included in Option 9.1	0	$ 10,000	$ -
Tree Clearing	Included in Option 9.1 but requires upgrade	1	$ 5,000	$ 5,000
Telemetry	Included in Option 9.1	0	$ 10,000	$ -
Electrical and Switchboard	Included in Option 9.1 but requires upgrade	1	$ 5,000	$ 5,000
Power Upgrade	Included in Option 9.1	0	$ 16,600	$ -
	Included in Option 9.1	0	$ 60	$ -
Installation and Construction		25%	$ 12,500	$ 3,125
SUBTOTAL Treatment				***$ 15,625***
Reticulation				
Hydrovar Pump set (12 L/sec at 50m)	Included in Option 9.1	0	$ 11,000	$ -
Flow meter	Included in Option 9.1	0	$ 4,600	$ -
Bores to WTP	DN100 PVC/PE - 50m to each bore	100	$ 150	$ 15,000
WTP to Retic	Included in Option 9.1	0	$ 150	$ -
Installation and Construction		25%	$ 15,000	$ 3,750
SUBTOTAL Reticulation				***$ 18,750***
Storage				
Storage (operational and emergency)	Included in Option 9.1	0	$ 6,000	$ -
Pipework	Included in Option 9.1	0	$ 15,000	$ -
Installation and Construction		25%	$ -	$ -
SUBTOTAL Storage				**-**
Fire Protection				
Fire Tanks	Included in Option 9.1	0	$ 6,000	$ -
Additional Generator Cost	Included in Option 9.1	0	$ 6,000	$ -
Fire Pump	Included in Option 9.1	*0*	$ 19,000	$ -
Installation and Construction		25%	$ -	$ -
SUBTOTAL Fire Protection				**-**
Add- ons				
Generator	Included in Option 9.1	0	20,500	$ -
Installation and Construction		25%	$ -	$ -
SUBTOTAL Generator				**-**
SUBTOTAL				**155,125**
Preliminary and General		10%		15,513
Design		20%		31,025
Contingency		10%		15,513
Total Estimated Capital Cost:			**-**	**217,200**
Annual Operational Costs	*assumed average daily flow (m3/day)*	*50*		
Compliance and Management	per hour **(5** hours monthly)	60	$ 180	10,800
Labour	per hour (weekly visits for 5 hours) plus additional 4 hours /monthly to address issues with land owner	308	$ 70	21,560
UV Disinfection	kWhr (assumes 0.23 kw operating 24 hours per day)	2,015	$ 0.4	806
Lamp Replacement	Assumes yearly reaplacement of 1 lamp (1 lamp per unit)	1.0	$ 433	433
Cartridges	per cartridge (assume quarterly)	4	$ 500	2,000
Electricity for Bore Pumps	kWhr (assumes 2kw pump operating at 2 L/sec)	5,069	$ 0.4	2,028
Electricity for Retic Pumps	kWhr (assumes4kw pump operating at 1.5 L/sec for 12 hours per day)	17,520	0.3	5,256
SUBTOTAL				***$ 42,882.70***
Total Estimated Annual Operational Costs				**$ 42,900**
NPV of Operating Costs (20 yr @ 8%)				**$ 421,200**
NPV Capital plus Operating Costs				**$ 638,400**

Option 9.2(ii)a OD- New bores upgrading Option 9 and relocating WTP and storage to lakefront - ON DEMAND FLOW				
Description	**Unit**	**Quantity**	**Rate**	**Cost**
Source Water				
Additional Time to work with Landowner / public works act	No private landowners	0	$ 20,000	$ -
ECAN Consent	consent to take groundwater	1	$ 25,000	$ 25,000
Bores drilling and headworks	Two new bores at lakefront	2	$ 40,000	$ 80,000
Bore Pumps	2.8 L/sec at up to 30m allowed for	2	$ 2,500	$ 5,000
VFD	VFD for pumps	2	$ 3,500	$ 7,000
Raw water turbidimeter	Included in Option 9.1	0	$ 7,000	$ -
Flow meter	Included in Option 9.2	0	$ 4,600	$ -
Power cable connection to Bores	low voltage underground	400	$ 40	$ 16,000
Electrical and Control	Included but requires upgrade	1	$ 5,000	$ 5,000
Test bore drilling	Cost of failed test bore from 9.2(i)	1	$ 40,000	$ 40,000
Installation and Construction		25%	$ 138,000	$ 34,500
SUBTOTAL Source				***$ 212,500***
Water Treatment				
Filtration, UV, Building, Civil				
Cartridge	Included in Option 9.1	0	$ 8,250	$ -
Ultraviolet Disinfection	Included in Option 9.1	0	$ 10,000	$ -
UPS for UV	Included in Option 9.1	0	$ 3,000	$ -
Pressure Transducer	Included in Option 9.1	0	$ 500	$ -
Turbiditmeter	Included in Option 9.1	0	$ 7,000	$ -
Flow meter	Included in Option 9.1	0	$ 4,600	$ -
Pipes, valves and fittings	Included in Option 9.1	0	$ 10,000	$ -
Water Treatment Plant Building	Included in Option 9.1	0	$ 30,000	$ -
Landscaping/Access/Fencing/ tree clearing	Landscaping/ Access Road	1	$ 50,000	$ 50,000
Telemetry	Included in Option 9.1	0	$ 10,000	$ -
Electrical and Switchboard	Included in Option 9.1 but requires upgrade	1	$ 5,000	$ 5,000
Power Upgrade	Upgrade to provide service fuse box on boundary of 98 Ohau Drive	1	$ 20,000	$ 20,000
	High voltage line to site - overhead power	128	$ 60	$ 7,680
Relocating WTP and components	allowance for transport and reconnection	1	$ 20,000	$ 20,000
Installation and Construction		25%	$ 82,680	$ 20,670
SUBTOTAL Treatment				***$ 123,350***
Reticulation				
Hydrovar Pump set (12 L/sec at 50m)	Included in Option 9.1	0	$ 11,000	$ -
Flow meter	Included in Option 9.1	0	$ 4,600	$ -
Bores to WTP	DN100 PVC/PE - 50m to each bore	472	$ 150	$ 70,800
WTP to Retic	New pipework to connet to reticulation	128	$ 150	$ 19,200
Relocating pump set		1	$ 15,000	$ 15,000
Installation and Construction		25%	$ 90,000	$ 22,500
SUBTOTAL Reticulation				***$ 127,500***
Storage				
Storage (operational and emergency)	Included in Option 9.1	0	$ 6,000	$ -
Relocating storage		1	$ 15,000	$ 15,000
Pipework	Included in Option 9.1	0	$ 15,000	$ -
Installation and Construction		25%	$ 15,000	$ 3,750
SUBTOTAL Storage				***18,750***
Fire Protection				
Fire Tanks	Included in Option 9.1	0	$ 6,000	$ -
Additional Generator Cost	Included in Option 9.1	0	$ 6,000	$ -
Fire Pump	Included in Option 9.1	*0*	$ 19,000	$ -
Relocating fire protection		1	$ 5,000	$ 5,000
Installation and Construction		25%	$ -	$ -
SUBTOTAL Fire Protection				***5,000***
Add- ons				
Generator	Included in Option 9.1	0	20,500	$ -
Relocating Generator		1	$ 5,000	$ 5,000
Installation and Construction		25%	$ -	$ -
SUBTOTAL Generator				***5,000***
SUBTOTAL				**492,100**
Preliminary and General		10%		49,210
Design		20%		98,420
Contingency		10%		49,210
Total Estimated Capital Cost:			**-**	**688,900**
Annual Operational Costs	*assumed average daily flow (m3/day)*	*50*		
Compliance and Management	per hour (4 hours monthly)	48	180	**8,640**
Labour	per hour (weekly visits for 5 hours)	260	70	**18,200**
UV Disinfection	kWhr (assumes 0.23 kw operating 24 hours per day)	2014.8	0.4	**806**
Lamp Replacement	Assumes yearly reaplacement of 1 lamp (1 lamp per unti)	1.0	433.0	**433**
Cartridges	per cartridge (assume quarterly)	4	500	**2,000**
Electricity for Bore Pumps	kWhr (assumes 2kw pump operating at 2L/sec for about 7 hours per day)	5,069	0.3	**1,521**
Electricity for Retic Pumps	kWhr (assumes4kw pump operating at 1.5 L/sec for 12 hours per day)	17,520	0.3	**5,256**
SUBTOTAL				***$ 36,855.75***
Total Estimated Annual Operational Costs				**$ 36,900**
NPV of Operating Costs (20 yr @ 8%)				**$ 362,300**
NPV Capital plus Operating Costs				**$ 1,051,200**

APPENDIX 3

Workshop Results
Calibrated Results (Revision A)
July 2019

Option	2 (revA)	24-Jun
Description	Bore supply, treatment (cartridge, UV), new storage at WTP (located behind campground) and reticulation pumps	

Criterion	Question	Likelihood	Consequence	Risk	Score
Cost	Capital cost				3
	NPV				3
	Rates impact				3
	Risk of cost escalation	Possible	Minor	Medium	3
	Risk of escalating staff time	Likely	Minor	Medium	3
	Average				**3**
Water Safety	<u>Source</u>				
	Risk of water source being unable to meet current on demand	Unlikely	Moderate	Medium	3
	Risk of source water contamination	Likely	Insignificant	Low	4
	<u>Treatment</u>				
	Risk of water treatment not meeting DWSNZ	Unlikely	Moderate	Medium	3
	Risk of water treatment process failure	Rare	Major	Medium	3
	<u>Reticulation</u>				
	Risk of pipe failure	Unlikely	Minor	Low	4
	Risk of inadequate fire flow	Unlikely	Major	Medium	3
	Average				**3**
Location	Construction accessability				4
	Locality of infrastructure				4
	Impact of water protection zone on landowners	Unlikely	Moderate	Medium	3
	Risk of landowner legal action	Rare	Insignificant	Very Low	5
	Average				**4**
Environment	Risk of exceeding consent limits	Rare	Minor	Low	4
	Impact on the environment	Likely	Moderate	High	2
	Visual/aesthetic risk	Likely	Major	Very High	1
	Average				**2**
Future Proofing/ Resilience	Risk of not meeting future demands	Rare	Minor	Low	4
	Risk of climate change	Rare	Moderate	Low	4
	Risk of earthquake	Rare	Extreme	Medium	3
	Average				**4**

Option	6	24-Jun
Description	Bore and treatment at new location on Don Edwards property, new storage located near existing	

Criterion	Question	Likelihood	Consequence	Risk	Score
Cost	Capital cost				2
	NPV				2
	Rates impact				2
	Risk of cost escalation	Almost certain	Moderate	High	2
	Risk of escalating staff time	Almost certain	Moderate	High	2
	Average				**2**
Water Safety	Source				
	Risk of water source being unable to meet current on demand	Likely	Extreme	Very High	1
	Risk of source water contamination	Unlikely	Minor	Low	4
	Treatment				
	Risk of water treatment not meeting DWSNZ	Unlikely	Moderate	Medium	3
	Risk of water treatment process failure	Possible	Major	High	2
	Reticulation				
	Risk of pipe failure	Possible	Moderate	Medium	3
	Risk of inadequate fire flow	Possible	Major	High	2
	Average				**3**
Location	Construction accessability				1
	Locality of infrastructure				2
	Impact of water protection zone on landowners	Rare	Minor	Low	4
	Risk of landowner legal action	Likely	Extreme	Very High	1
	Average				**2**
Environment	Risk of exceeding consent limits	Rare	Minor	Low	4
	Impact on the environment	Likely	Major	Very High	1
	Visual/aesthetic risk	Possible	Insignificant	Very Low	5
	Average				**3**
Future Proofing/ Resilience	Risk of not meeting future demands	Unlikely	Minor	Low	4
	Risk of climate change	Likely	Major	Very High	1
	Risk of earthquake	Rare	Extreme	Medium	3
	Average				**3**

Option 8 24-Jun

Description Bore and treatment behind town, new storage with retic pumps

Criterion	Question	Likelihood	Consequer	Risk	Score
Cost	Capital cost				4
	NPV				3
	Rates impact				3
	Risk of cost escalation	Likely	Moderate	High	2
	Risk of escalating staff time	Likely	Minor	Medium	3
	Average				**3**
Water Safety	Source				
	Risk of water source being unable to meet current on demand	Likely	Major	Very High	1
	Risk of source water contamination	Likely	Minor	Medium	3
	Treatment				
	Risk of water treatment not meeting DWSNZ	Likely	Moderate	High	2
	Risk of water treatment process failure	Possible	Major	High	2
	Reticulation				
	Risk of pipe failure	Unlikely	Moderate	Medium	3
	Risk of inadequate fire flow	Unlikely	Major	Medium	3
	Average				**2**
Location	Construction accessability				4
	Locality of infrastructure				5
	Impact of water protection zone on landowners	Likely	Moderate	High	2
	Risk of landowner legal action	Possible	Minor	Medium	3
	Average				**4**
Environment	Risk of exceeding consent limits	Rare	Minor	Low	4
	Impact on the environment	Likely	Minor	Medium	3
	Visual/aesthetic risk	Possible	Major	High	2
	Average				**3**
Future Proofing/ Resilience	Risk of not meeting future demands	Unlikely	Minor	Low	4
	Risk of climate change	Likely	Major	Very High	1
	Risk of earthquake	Rare	Extreme	Medium	3
	Average				**3**

Option	9.1	24-Jun
Description	Utilising existing source and raw water storage with treatment, storage and reticulation pumps behind village	

Criterion	Question	Likelihood	Consequence	Risk	Score
Cost	Capital cost				5
	NPV				4
	Rates impact				4
	Risk of cost escalation	Possible	Extreme	High	2
	Risk of escalating staff time	Likely	Moderate	High	2
	Average				**3**
Water Safety	Source				
	Risk of water source being unable to meet current on demand	Possible	Moderate	Medium	3
	Risk of source water contamination	Almost certain	Minor	High	2
	Treatment				
	Risk of water treatment not meeting DWSNZ	Possible	Moderate	Medium	3
	Risk of water treatment process failure	Likely	Major	Very High	1
	Reticulation				
	Risk of pipe failure	Possible	Moderate	Medium	3
	Risk of inadequate fire flow	Unlikely	Major	Medium	3
	Average				**3**
Location	Construction accessability				4
	Locality of infrastructure				3
	Impact of water protection zone on landowners	Rare	Minor	Low	4
	Risk of landowner legal action	Likely	Extreme	Very High	1
	Average				**3**
Environment	Risk of exceeding consent limits	Unlikely	Minor	Low	4
	Impact on the environment	Likely	Minor	Medium	3
	Visual/aesthetic risk	Possible	Major	High	2
	Average				**3**
Future Proofing/ Resilience	Risk of not meeting future demands	Possible	Moderate	Medium	3
	Risk of climate change	Likely	Major	Very High	1
	Risk of earthquake	Rare	Major	Medium	3
	Average				**2**

CALIBRATED RESULTS

Revision A

July 2019

Option	2 (revA)
Description	Bore supply, treatment (cartridge, UV), new storage at WTP (located behind campground) and reticulation pumps

Criterion	Question	Likelihood	Consequence	Risk	Score
Cost	Capital cost				3
	NPV				3
	Rates impact				4
	Risk of cost escalation	Possible	Minor	Medium	3
	Risk of escalating staff time	Likely	Minor	Medium	3
	Average				**3**
Water Safety	Source				
	Risk of water source being unable to meet current on demand	Unlikely	Moderate	Medium	3
	Risk of source water contamination	Possible	Minor	Medium	3
	Treatment				
	Risk of water treatment not meeting DWSNZ	Unlikely	Moderate	Medium	3
	Risk of water treatment process failure	Unlikely	Major	Medium	3
	Reticulation				
	Risk of pipe failure	Unlikely	Minor	Low	4
	Risk of inadequate fire flow	Unlikely	Major	Medium	3
	Average				**3**
Location	Construction accessability				4
	Locality of infrastructure				4
	Impact of water protection zone on landowners	Unlikely	Moderate	Medium	3
	Risk of landowner legal action	Rare	Insignificant	Very Low	5
	Average				**4**
Environment	Risk of exceeding consent limits	Rare	Minor	Low	4
	Impact on the environment	Likely	Moderate	High	2
	Visual/aesthetic risk	Likely	Major	High	2
	Average				**3**
Future Proofing/ Resilience	Risk of not meeting future demands	Rare	Moderate	Low	4
	Risk of climate change	Rare	Moderate	Low	4
	Risk of earthquake	Rare	Extreme	Medium	3
	Average				**4**

Option 6

Description Bore and treatment at new location on Don Edwards property, new storage located near existing

Criterion	Question	Likelihood	Consequence	Risk	Score
Cost	Capital cost				2
	NPV				2
	Rates impact				2
	Risk of cost escalation	Almost certain	Moderate	High	2
	Risk of escalating staff time	Almost certain	Moderate	High	2
	Average				**2**
Water Safety	Source				
	Risk of water source being unable to meet current on demand	Likely	Extreme	Very High	1
	Risk of source water contamination	Unlikely	Minor	Low	4
	Treatment				
	Risk of water treatment not meeting DWSNZ	Unlikely	Moderate	Medium	3
	Risk of water treatment process failure	Unlikely	Major	Medium	3
	Reticulation				
	Risk of pipe failure	Possible	Major	High	2
	Risk of inadequate fire flow	Possible	Major	High	2
	Average				**3**
Location	Construction accessability				1
	Locality of infrastructure				2
	Impact of water protection zone on landowners	Rare	Minor	Low	4
	Risk of landowner legal action	Likely	Major	High	2
	Average				**2**
Environment	Risk of exceeding consent limits	Rare	Minor	Low	4
	Impact on the environment	Likely	Major	High	2
	Visual/aesthetic risk	Possible	Insignificant	Very Low	5
	Average				**4**
Future Proofing/ Resilience	Risk of not meeting future demands	Unlikely	Moderate	Medium	3
	Risk of climate change	Likely	Major	High	2
	Risk of earthquake	Rare	Extreme	Medium	3
	Average				**3**

Option 8

Description Bore and treatment behind town, new storage with retic pumps

Criterion	Question	Likelihood	Consequer	Risk	Score
Cost	Capital cost				3
	NPV				3
	Rates impact				4
	Risk of cost escalation	Likely	Moderate	High	2
	Risk of escalating staff time	Likely	Minor	Medium	3
	Average				**3**
Water Safety	Source				
	Risk of water source being unable to meet current on demand	Likely	Major	High	2
	Risk of source water contamination	Likely	Minor	Medium	3
	Treatment				
	Risk of water treatment not meeting DWSNZ	Unlikely	Moderate	Medium	3
	Risk of water treatment process failure	Unlikely	Major	Medium	3
	Reticulation				
	Risk of pipe failure	Unlikely	Minor	Low	4
	Risk of inadequate fire flow	Unlikely	Major	Medium	3
	Average				**3**
Location	Construction accessability				4
	Locality of infrastructure				5
	Impact of water protection zone on landowners	Likely	Moderate	High	2
	Risk of landowner legal action	Possible	Moderate	Medium	3
	Average				**4**
Environment	Risk of exceeding consent limits	Rare	Minor	Low	4
	Impact on the environment	Likely	Minor	Medium	3
	Visual/aesthetic risk	Possible	Major	High	2
	Average				**3**
Future Proofing/ Resilience	Risk of not meeting future demands	Unlikely	Moderate	Medium	3
	Risk of climate change	Likely	Major	High	2
	Risk of earthquake	Rare	Extreme	Medium	3
	Average				**3**

Option 9.1

Description Utilising existing source and raw water storage with treatment, storage and reticulation pumps behind village

Criterion	Question	Likelihood	Consequence	Risk	Score
Cost	Capital cost				4
	NPV				4
	Rates impact				3
	Risk of cost escalation	Possible	Extreme	High	2
	Risk of escalating staff time	Almost certain	Moderate	High	2
	Average				**3**
Water Safety	<u>Source</u>				
	Risk of water source being unable to meet current on demand	Possible	Moderate	Medium	3
	Risk of source water contamination	Almost certain	Minor	High	2
	<u>Treatment</u>				
	Risk of water treatment not meeting DWSNZ	Possible	Moderate	Medium	3
	Risk of water treatment process failure	Likely	Major	Very High	2
	<u>Reticulation</u>				
	Risk of pipe failure	Possible	Moderate	Medium	3
	Risk of inadequate fire flow	Unlikely	Major	Medium	3
	Average				**3**
Location	Construction accessability				3
	Locality of infrastructure				1
	Impact of water protection zone on landowners	Likely	Moderate	High	2
	Risk of landowner legal action	Likely	Extreme	Very High	1
	Average				**2**
Environment	Risk of exceeding consent limits	Unlikely	Minor	Low	4
	Impact on the environment	Likely	Minor	Medium	3
	Visual/aesthetic risk	Possible	Major	High	2
	Average				**3**
Future Proofing/ Resilience	Risk of not meeting future demands	Likely	Major	High	2
	Risk of climate change	Likely	Major	High	2
	Risk of earthquake	Rare	Major	Medium	3
	Average				**2**

Option	9.2(i) (Rev A)
Description	Stage 2: Bore and treatment behind town, new storage with retic pumps

Criterion	Question	Likelihood	Consequence	Risk	Score
Cost	Capital cost				3.5
	NPV				3.3
	Rates impact				2.7
	Risk of cost escalation	Likely	Moderate	High	2.0
	Risk of escalating staff time	Likely	Minor	Medium	3.0
	Average				**2.9**
Water Safety	Source				
	Risk of water source being unable to meet current on demand	Likely	Major	High	2.0
	Risk of source water contamination	Likely	Minor	Medium	3.0
	Treatment				
	Risk of water treatment not meeting DWSNZ	Unlikely	Moderate	Medium	3.0
	Risk of water treatment process failure	Unlikely	Major	Medium	3.0
	Reticulation				
	Risk of pipe failure	Possible	Minor	Medium	3.0
	Risk of inadequate fire flow	Unlikely	Major	Medium	3.0
	Average				**2.8**
Location	Construction accessability				3.0
	Locality of infrastructure				5.0
	Impact of water protection zone on landowners	Likely	Moderate	High	2.0
	Risk of landowner legal action	Likely	Extreme	Very High	1.0
	Average				**2.8**
Environment	Risk of exceeding consent limits	Rare	Minor	Low	4.0
	Impact on the environment	Likely	Minor	Medium	3.0
	Visual/aesthetic risk	Possible	Major	High	2.0
	Average				**3.0**
Future Proofing/ Resilience	Risk of not meeting future demands	Unlikely	Moderate	Medium	3.0
	Risk of climate change	Likely	Major	High	2.0
	Risk of earthquake	Rare	Extreme	Medium	3.0
	Average				**2.7**

Option 9.2 (ii)
Description Stage 2: New bores on lakefront with treatment, storage and retic pumps behind campground

Criterion	Question	Likelihood	Consequence	Risk	Score
Cost	Capital cost				2
	NPV				3
	Rates impact				3
	Risk of cost escalation	Possible	Minor	Medium	3
	Risk of escalating staff time	Likely	Minor	Medium	3
	Average				**3**
Water Safety	Source				
	Risk of water source being unable to meet current on demand	Unlikely	Moderate	Medium	3
	Risk of source water contamination	Possible	Minor	Medium	3
	Treatment				
	Risk of water treatment not meeting DWSNZ	Likely	Moderate	High	2
	Risk of water treatment process failure	Unlikely	Major	Medium	3
	Reticulation				
	Risk of pipe failure	Unlikely	Minor	Low	4
	Risk of inadequate fire flow	Unlikely	Major	Medium	3
	Average				**3**
Location	Construction accessability				3
	Locality of infrastructure				4
	Impact of water protection zone on landowners	Unlikely	Moderate	Medium	3
	Risk of landowner legal action	Rare	Insignificant	Very Low	5
	Average				**4**
Environment	Risk of exceeding consent limits	Rare	Minor	Low	4
	Impact on the environment	Likely	Moderate	High	2
	Visual/aesthetic risk	Likely	Major	High	2
	Average				**3**
Future Proofing/ Resilience	Risk of not meeting future demands	Rare	Moderate	Low	4
	Risk of climate change	Rare	Moderate	Low	4
	Risk of earthquake	Rare	Extreme	Medium	3
	Average				**4**