

MEMORANDUM

TO: Waitaki District Council Job No.: 000442

ATTENTION: Michael Goldingham Date: 18th January 2019

FROM: Melanie Stevenson Page 1 of 16

SUBJECT: Ohau Water Supply Upgrade - Reference: MEMO 19-01-16 Mks 000442

Further Options (DRAFT)

1.0 Introduction

This memorandum is in response to a request from the Waitaki District Council to provide comment and costs on additional options for upgrading the Ohau Water Supply. These options have been requested by some of the property owners in Ohau Village. It should be noted that while these options were considered during preliminary investigations, they were discounted early on due to issues of expected costs and land access.

This memorandum also provides comment on other concerns, including:

- the effect of chlorine on polybutylene pipe and hot water cylinders
- the Local Govt Act and undertaking construction works on private land

2.0 Options

Subsequent to the Ohau Community meeting held on 3rd January 2019, there has been a request to provide costs of options that utilise the existing water source and maintain a gravity supply of water to Ohau Village.

Three options have been identified (in addition to those provided in the Ohau Alpine Village Water Supply Issues and Options Report [August 2018]). These are:

- Option 3 Utilise existing source and treat with microfiltration (membrane) and new storage (with and without chlorine)
- Option 4 Utilise existing source with selective abstraction, add raw water storage and treat water with bag and cartridge filtration followed by ultraviolet disinfection (with and without chlorine) and new treated water storage
- Option 5 New bores located near existing intake, treat water with cartridge filtration and ultraviolet disinfection, and add new storage (with and without chlorine).

Process flow diagrams and detailed costs for each option are attached in the appendices.



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2.1 Option 3: Utilise existing source and treat with microfiltration (membrane) and new storage (with and without chlorine)

2.1.1 Description

This option is for the utilisation of the existing source water, a new membrane treatment plant and new storage. The water treatment plant and storage would be located near the existing storage tanks to ensure adequate gravity pressure above Ohau Village as shown in Figure 2.1.

This option can only be constructed for restricted flow conditions due to the limited quantity of water available from the existing source, unless the intake is upgraded and new consents are obtained.

Works required are:

- Upgrade access road to provide all weather access to new plant
- New transformer and power line to site
- Construction of a waste system to handle backwash water from membrane and chemical waste from plant. A backwash pond, CIP holding tank and neutralisation system will be required. At this stage we have allowed for a pond for settling out sludge with the supernatant to go to ground. This would require resource consent.
- Fencing around intake the area of water supply protection zone could likely be reduce to the level of treatment in place.
- Fencing around WTP site
- New storage tanks to store treated water to replace existing storage that is in poor condition

The membrane system can be containerised with the chlorine disinfection installed in a small concrete shed.



Figure 2.1: Schematic of Proposed Option 3

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2.1.2 Cost Estimate

Estimated costs for Option 3 scenarios are provided in the table below. More detailed costing is attached.

Table 2.1: Preliminary Cost Estimates for Option 3, with and without Chlorine Disinfection, for Restricted Flows only.

Paradatta a	Existing source, membrane treatment, new storage at WTP	Existing source, membrane and CHLORINE treatment, new storage at WTP		
Description	Restricted	Restricted		
	Option 3 a - R	Option 3 b - R		
Source	145,600	145,600		
Treatment	659,360	729,660		
Reticulation	-	-		
Storage	87,880	87,880		
Fire Protection	11,700	11,700		
Generator	-	-		
P&G, Design and				
Contingency	361,800	389,900		
Capital cost	1,266,400	1,364,800		
Annual Cost	53,200	53,400		
NPV 20 years at 8%	1,788,700	1,889,100		

2.1.3 Pros and Cons

Pros and Cons for Option 3 are:

Pros

- Elevated storage provides a fire supply during power outage without the need for a generator (if properties are on a restricted supply the benefits of elevated storage cannot be taken advantage of).
- The WTP cannot be seen from the village.
- The treatment process is robust and can treat water of variable quality.
- The likely water protection zone and associated fencing requirements can be reduced due to the level of treatment.
- The membrane system can be containerised so is relatively simple to construct.
 Adding chlorine later is relatively simple with the installation of a standard concrete water shed.

Cons

This is a change to infrastructure on private land and will require landowner permissions, and likely compensation to the owner. The owners are not in favour of infrastructure on their land and with alternative options available, approval to proceed with this option is likely to end in legal action, with unknown and possibly significant costs and delays.



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- 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.
- Membrane processes are complex and require chemical cleaning. Backwash water and chemical cleaning water needs to be disposed of.
- The existing source is subject to drought conditions and can run out of water.
- The resource consent and probable yield of the existing source is for 2.2 L/sec and this option is only available for restricted flows. If the yield is to increase, it is likely that a new intake would need to be constructed at additional cost and a new consent. This has not been allowed for in the cost estimate above.
- 2.2 Option 4: Utilise existing source with selective abstraction, add raw water storage and treat water with cartridge filtration and Ultraviolet Disinfection (with and without chlorine)

2.2.1 Description

This option is for the utilisation of the existing source water and installing a large raw water reservoir to allow for selective abstraction. An actuated valve and turbidimeter would allow the supply to be shut down when turbidity exceeded a set turbidity of 1 or 2 NTU. Treatment will then be based around a bag filter, cartridge filtration and ultraviolet disinfection. The water treatment plant and storage would be located near the existing storage tanks to ensure adequate gravity pressure above Ohau Village as shown in Figure 2.2.

This option can only be constructed for restricted flow conditions due to the limited quantity of water available from the existing source, unless the intake is upgraded and new consents are obtained.

Online turbidity monitoring of the raw water should be performed to assess whether this option is viable.

Works required are:

- New 1,200m³ raw water storage tank (steel tank with liner allowed for)
- Upgrade access road to provide all weather access to new plant
- New transformer and power line to site
- Fencing around 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.
- New storage tanks to store treated water to replace existing storage that is in poor condition
- New WTP with bag and cartridge filtration and UV with allowance for chlorine.
- Fencing around WTP site

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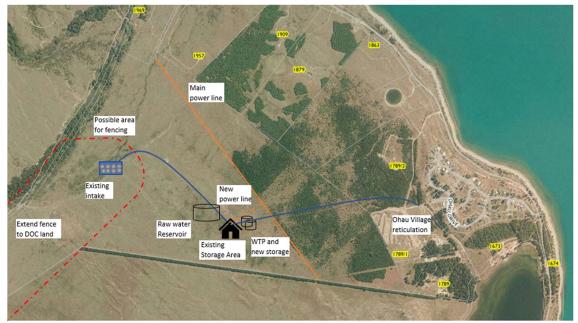


Figure 2.2: Schematic of proposed Option 4

2.2.2 Cost Estimate

Estimated costs for Option 4 scenarios are provided in the table below. More detailed costing is attached.

Table 2.2: Preliminary Cost Estimates for Option 4, with and without Chlorine Disinfection, for Restricted Flows only.

Description	Existing source, selective abstraction, treatment (bag, cartridge, UV), new storage at WTP	Existing source, selective abstraction, treatment (bag, cartridge, UV & CHLORINE), new storage at WTP
•	Restricted	Restricted
	Option 4 a - R	Option 4 b - R
Source	217,100	217,100
Treatment	707,694	764,958
Reticulation	-	-
Storage	87,880	87,880
Fire Protection	11,700	11,700
Generator	-	-
P&G, Design and		
Contingency	409,700	432,700
Capital cost	1,434,100	1,514,300
Annual Cost	46,600	46,700
NPV 20 years at 8%	1,891,600	1,972,800



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2.2.3 Pros and Cons

Pros and Cons for Option 4 are:

Pros

- Elevated storage provides a fire supply during power outage without the need for a generator (if properties are on a restricted supply the benefits of elevated storage cannot be taken advantage of).
- The WTP cannot be seen from the village.
- Raw water storage available for drought or intake maintenance

Cons

- This is a change to infrastructure on private land and will require landowner permissions, and likely compensation to the owner. The owners are not in favour of infrastructure on their land and with alternative options available, approval to proceed with this option is likely to end in legal action, with unknown and possibly significant costs and delays.
- 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.
- During times of extended heavy rainfall/snow melt, the raw water storage may not be adequate to cover the extent of the event. This may result in dirty water entering the treatment process and blocking the filters.
- A large catchment area will need to be fenced off to prevent livestock entering protection zone (if the owner wants to utilise the land for this purpose).
- The existing source is subject to drought conditions and can run out of water.
- The resource consent and probable yield of the existing source is for 2.2 L/sec and this option is only available for restricted flows. If the yield is to increase, it is likely that a new intake would need to be constructed at additional cost and a new consent. This has not been allowed for in the cost estimate above.
- 2.3 Option 5: New bore supply near existing source with cartridge filtration and Ultraviolet Disinfection (with and without chlorine)

2.3.1 Description

This option is for the development of new bores near the existing source water, and a new WTP and new storage at the current intake as shown in Figure 2.3. To provide adequate fire flow, the pipeline from the new storage tanks to the location of the existing storage tanks would need to be upgraded to a DN150.

This option can be constructed for restricted and on-demand flow conditions provided there is adequate yield from the new bores.

Works required are:

- New bores near existing intake
- Upgrade access road to provide all weather access to new bores and plant



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- New transformer and power line to site
- Fencing around intake to protect area from any livestock this area needs to be confirmed based on advice from a Hydrogeologist but is may be up to 1km upstream of bore.
- New WTP with cartridge filtration and UV and allowance for chlorine.
- Fencing around WTP site.
- New storage tanks to store treated water to replace existing storage that is in poor condition
- Upgrade 750m of DN100 to DN150 supply pipe from existing intake to existing storage. This is to allow adequate fire flow.



Figure 2.3: Schematic of proposed option 5

2.3.2 Cost Estimate

Estimated costs for Option 5 scenarios are provided in the table below. More detailed costing is attached.

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Table 2.3: Preliminary Cost Estimates for Option 5, with and without Chlorine Disinfection, for Restricted and On-demand Flows.

Description	(cartridge	ek, treatment e, UV), new ited at source	Bore at creek, treatment (cartridge, UV & CHLORINE), new storage located at source		
Description	Restricted	On Demand	Restricted	On Demand	
	Option 5 a - R	Option 5 a - OD	Option 5 b - R	Option 5 b - OD	
Source	341,120.00	342,160	341,120	342,160	
Treatment	490,334	500,760	547,598	558,024	
Reticulation	-	-	-	-	
Storage	94,380	137,280	94,380	137,280	
Fire Protection	153,900	196,560	153,900	196,560	
Generator	-	-	-	-	
P&G, Design and					
Contingency	431,900	470,700	454,800	493,600	
Capital cost	1,511,600	1,647,500	1,591,800	1,727,600	
Annual Cost	43,500	43,500	43,700	43,700	
NPV 20 years at					
8%	1,938,700	2,074,600	2,020,800	2,156,600	

2.3.3 Pros and Cons

Pros and Cons for Option 5 are:

Pros

- Elevated storage provides supply during power outage without the need for a generator.
- The WTP cannot be seen from the village.
- Water yield is likely to be more than existing supply so can provide protection against drought and meet on-demand flow scenarios if the community requires.
- Bore supply is often cleaner and more consistent resulting in less complex treatment systems.

Cons

- This is a change to infrastructure on private land and will require landowner permissions, and likely compensation to the owner. The owners are not in favour of infrastructure on their land and with alternative options available, approval to proceed with this option is likely to end in legal action, with unknown and possibly significant costs and delays.
- 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.



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- A large catchment area will need to be fenced off to prevent livestock entering protection zone (if the owner want to utilise the land for this purpose).
- During times of extended heavy rainfall/snow melt, the bores may suffer from elevated turbidity which may result in dirty water entering the treatment process and blocking the filters.

2.4 Other Cost Information

2.4.1 Power Upgrade Cost

Cost estimates for supplying power to a new site were obtained from Network Waitaki. For a Three phase 30kVApower supply to site the base costs are as follows:

For transformer on pole, capacity levy and fuse box = \$16,560 Cost per meter from main power line (underground) = \$180/m Cost per meter from main line (overhead) = \$60/m

Any lines installed within private land would need to be underground.

The above data can be used an indication of costs for locating water treatment plants elsewhere.

2.4.2 Changing On-demand to Restricted Connections

There are estimated to be 34 properties with on-demand connections. These would need to be converted to a restricted connection requiring:

- Restrictor at manifold
- 3,000L PE tank
- Domestic pump
- Interconnecting pipework and electrical connection of pump.

A cost estimate for this work (if completed as one project) is:

Table 2.4: Preliminary Cost Estimates for Converting On-demand Connections to Restricted Connections

Item	Quantity	Cost	Total Cost
3000L tank	34	\$ 1,300	\$ 44,200
Pump 1L/s VFD	34	\$ 2,000	\$ 68,000
Plumbing	34	\$ 1,000	\$ 34,000
Electrical connection	34	\$ 1,200	\$ 40,800
Civil works misc.	25%	\$ 1,400	\$ 46,750
SUBTOTAL		\$ 6,900	\$ 233,750
P&G, Design & Contingency	40%	\$ 2,800	\$ 93,500
Total		\$ 9,700	\$ 327,250

Please note that these costs are in addition to all restricted options.

3.0 **Summary of Options**

For comparison, Table 3.1 and Figure 3.1 below summarises the various options presented in this memorandum and also in the Issues and Options Report, dated August 2018.

Table 3.1: Summary of All Options Presented with Corresponding Preliminary Cost Estimates

Option	Description	Option	Chlorine	Flow Type	Cost			
Option	Description	Code Disinfect		Flow Type	Capital	Operational	NPV	
	New bores and water	1a-R	No	Restricted	919,900	38,200	1,294,900	
1	treatment plant adjacent	1a-OD	No	On-demand	1,045,700	38,200	1,420,700	
1	lake. Elevated storage in	1b-R	Yes	Restricted	1,119,500	38,400	1,496,500	
	current location	1b-OD	Yes	On-demand	1,250,900	38,400	1,627,900	
	New bores, water treatment	2a-R	No	Restricted	964,000	33,000	1,288,000	
2	plant and storage with	2a-OD	No	On-demand	1,089,600	36,400	1,447,000	
	reticulation pumps adjacent	2b-R	Yes	Restricted	1,044,800	33,200	1,370,800	
	lake	2b-OD	Yes	On-demand	1,172,800	36,500	1,531,200	
3	Existing source, membrane filtration and storage at	3a-R	No	Restricted	1,266,400	53,200	1,788,700	
3	existing storage area	3b-R	Yes	Restricted	1,364,800	53,200	1,889,100	
4	Existing source with selective abstraction, water treatment	4a-R	No	Restricted	1,434,100	46,600	1,891,600	
4	plant and storage at existing							
	storage area	4b-R	Yes	Restricted	1,514,300	46,700	1,972,800	
		5a-R	No	Restricted	1,511,600	43,500	1,938,700	
5	New bores, water treatment	5a-OD	No	On-demand	1,647,500	43,500	2,074,600	
) 5	plant and storage at source	5b-R	Yes	Restricted	1,591,800	43,700	2,020,800	
		5b-OD	Yes	On-demand	1,727,600	43,700	2,156,600	

Key R

= Restricted Flow

OD = Without Chlorine Disinfection b

= On-demand Flow

= With Chlorine Disinfection

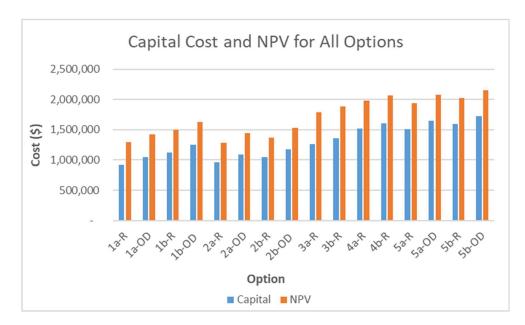


Figure 3.1: Graph Comparing Capital and NPV Costs for All Options Presented



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As can be seen from the table and graph above Options 3,4 and 5 are more expensive that Option 1 and 2. Option 3, using the existing source with membrane treatment moderately cheaper than other options presented in this memorandum. This is because the membrane process will likely require less fencing around the intake, there is no need for extensive changes to pipework and building costs will be less as the membrane is containerised.

4.0 Other Relevant Information

This section below provides commentary on other issues that have been highlighted following community consultation:

4.1 Chlorine Effect on Polybutylene Pipes and Hot Water Cylinders

A property owner from the Ohau Village has raised concerns about the effect of chlorine on polybutylene pipes and on hot water cylinders.

A brief literature review has been undertaken and is summarised below:

<u>Polybutylene</u> - while scientific evidence is scarce, it is believed that oxidants in the public water supplies, such as chlorine, react with the polybutylene piping and fittings causing them to scale and flake and become brittle. Polybutylene piping is not suitable for swimming pool piping systems, or where more than 2 ppm of chlorine (free residual) will be routinely encountered. A good summary can be found here: http://www.okvalleyinspector.ca/reports/polyb.pdf

As a general comment, there are a significant number of homes in metropolitan areas of New Zealand with polybutylene pipes who are exposed to chlorinated supplies and failure of these pipes is not a problem. We spoke with a Dunedin plumber who said failure of these pipes is mostly attributed to poor installation rather than scaling and becoming brittle.

Copper Hot Water Cylinders

Adding chlorine to drinking water will increase the corrosion of copper and iron in the system, however, provided the pH of the water is between 7.0 and 8, and the free chlorine is less than about 2 mg l⁻¹ only minor corrosion of copper will occur. Ref: https://www.sciencedirect.com/science/article/abs/pii/0043135482900938

The existing source has a pH averaging 6.8 and is already considered corrosive. A ground water source near Lake Ohau is likely to be similar to this however it is recommended that testing of the lake water is completed. pH control could be added to the water supply system by dosing soda ash, or using an akdolit filter if required. This can be addressed during detailed design.

4.2 Installing New Infrastructure on Private land

The existing intake, storage and connecting pipework is on private land and there is an easement in place.



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Although we have not sighted the wording of the easement, any significant changes to the infrastructure will require disruption to the land, permission from the landowner and changes to the easement to incorporate the extent and purpose of the new infrastructure It is known that the landowners do not want the new water infrastructure on their land so the Council would likely need to initiate procedures using the Local Government Act 2002 and the Public Works Act, which allow for public works to be carried out on private land.

Key Extracts from the Acts are detailed below:

4.2.1 Public Works Act

Section 197: Minister may construct and maintain water supply works

- The Minister is hereby empowered to investigate, design, construct, maintain, or control any water supply works which are proposed to be constructed, or which have been constructed wholly or partly, out of money appropriated by Parliament for the purpose, as part of an irrigation scheme.
- 2) The Minister has, in respect of water supply works to which subsection (1) applies, all the powers, rights, duties, and authorities conferred, in respect of water supply works, upon a territorial authority under the Local Government Act 2002; except that in any case where a resolution is required it may be made by the Minister in writing under his or her hand and published in the Gazette.

4.2.2 Local Government Act

Construction of works

Section 181 Construction of works on private land

- 1) A local authority may construct works on or under private land or under a building on private land that it considers necessary for—
 - (a) the supply by territorial authorities of water by means of reticulated systems:
- 2) A local authority or a territorial authority, as the case may be, must not exercise the power in subsection (1) or subsection (2) unless it has—
 - (a) the prior written consent of the owner of the land to the construction of the work; or
 - (b) complied with the requirements of Schedule 12.
- 3) A local authority may enter the land to inspect, alter, renew, repair, or clean any work constructed under this section or under the corresponding provision of a former Act.
- 4) The power in subsection (4) must not be exercised without first giving reasonable notice of the intention to enter the land to the owner and occupier (if any).
- This section applies subject to the Public Works Act 1981 as to compensation for injurious affection to land.



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Schedule 12

Conditions of constructing or undertaking works on private land without the owner's consent

Section 181(3)(b)

- 1) For the purposes of section 181(3)(b), the requirements are as follows:
 - a) a description of the works, accompanied by a plan (in the case of any works to be constructed), showing how they affect any land or building, must be deposited for public inspection at a place within the district in which the works are to be undertaken:
 - b) the territorial authority must give notice in writing of the intention to construct the works (referring to a plan and description of the works and where the plan and description can be viewed)
 - i. to the occupier of the land or building unless there is no occupier
 - ii. or, after all reasonable steps have been taken, the occupier cannot be found; and to the owner if known:
 - c) however, if there is a change of occupier, it is not necessary to give notice to however any subsequent occupier before the work is done:
 - d) if, within 1 month after the notice is given, the occupier or owner serves on the territorial authority a written objection to the proposed works, the territorial authority must
 - i. appoint a day for hearing the objection; and
 - ii. give to the objector reasonable notice of the day, time, and place of hearing so as to enable the objector to attend the hearing:
 - e) the territorial authority must hold a meeting on the day appointed, and may, after hearing any person making any objection, if present, determine
 - i. to abandon the works proposed; or
 - ii. to proceed with the works proposed, with or without any alterations that the territorial authority thinks fit.
- 2) A person who is aggrieved by a determination of the territorial authority under clause 1(e) to proceed with the works proposed (with or without alterations) may appeal to the District Court against the determination within 14 days after the date of the determination.
- 3) Pending the decision of the court on the appeal, the territorial authority must not proceed with the works.
- 4) On the hearing of the appeal, the court, whose decision is final, may confirm or amend or set aside the determination of the territorial authority.

4.2.3 Summary Comment

While the Local Govt Act and Public Works Act provide the Council with the ability to undertake public works in private land, there are procedures in place for appeal from the land owner and the final decision ends with the Minister, under the Public Works Act. With



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alternative and more cost effective options available to Council, there is a likelihood that the works would not be allowed to proceed.

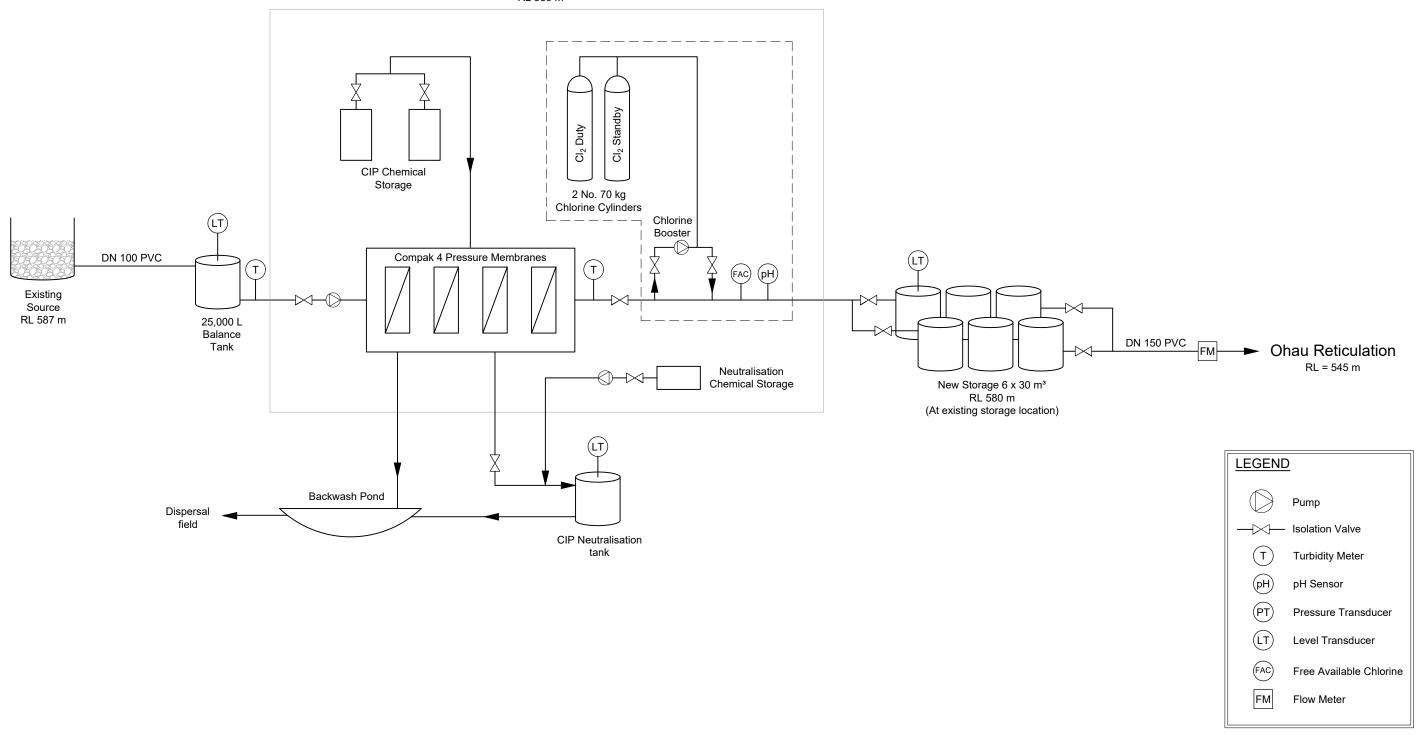


APPENDIX 1

Process Flow Diagrams



At Existing storage location RL 580 m



Verify all dimensions on site before commencing work. Prioritise figured dimensions over scaling. Refer all discrepancies to the drawing office.							
Revi	sion	Арр	Date	Approved	MS	Jan '19	
Α	Concept Design	MS	17/01/19	Reviewed	MS	Jan '19	
				Drawn	JP	Jan '19	
				Designed	FG	Jan '19	
				Surveyed	-	-	



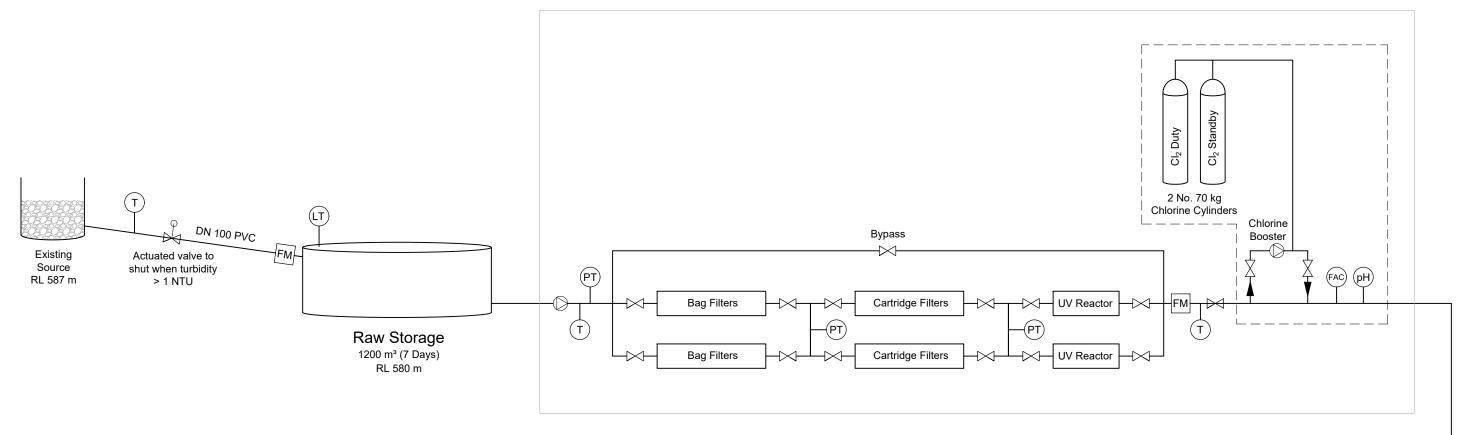
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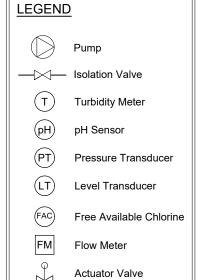
Project Title	Sheet Title
Ohau Alpine Village	Process Flow Diagram
Water Supply	Option 3
	Existing Source With
	Membrane Treatment

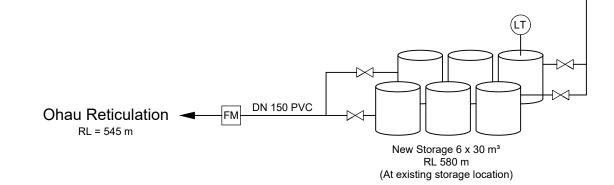
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Water Treatment Plant

At existing storage tank area RL 580 m







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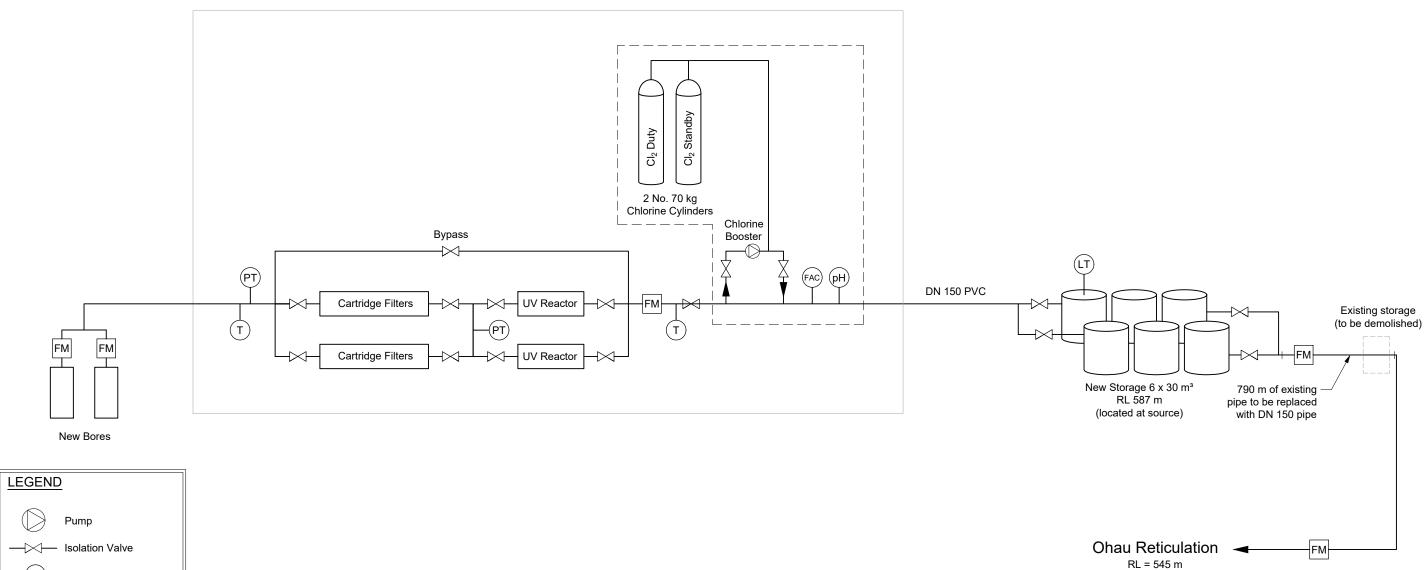
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Ohau Alpine Village	
Water Supply	

heet Title	
Process Flow Diagram	
Option 4	
Existing Source	
Selective Abstraction	

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Issue	Concep	t Design
Project No	Sheet	Revision
000442	P04	Α

Water Treatment Plant

Located at source RL 587 m



LEGEND	_
	Pump
→ >>	Isolation Valve
T	Turbidity Meter
(pH)	pH Sensor
PT	Pressure Transducer
LT	Level Transducer
FAC	Free Available Chlorine
FM	Flow Meter
	Actuator Valve

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Project Title
Ohau Alpine Village
Onau Alpine Village
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Water Supply
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Sheet Title
Process Flow Diagram Option 5
Option 5
New Bores near existing
source - with WTP

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Issue	Concep	t Design
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000442	P05	Α



APPENDIX 2

Detailed Cost Estimates

Source Water	Option 3 a R - Existing	source, membrane WTP and new storage	at existing stor	age lo	cation - RESTF	RICTE	FLOW
Additional Time to work with Landsowern Read Generation in Conner Compression in Indianal Amount of Conner Compression in Conner Compression in Indianal Amount Conner Compression in Indianal Conner Conner Compression in Indianal Conner Compression in Indianal Conner Compression in Indianal Conner Con	Description	Unit	Quantity		Rate		Cost
Landoscent Local Coverment compensation to Covere compensation to Covere Compensation to Covere Compensation to Covere Hach 1720E 1 5 5,000 5 5,000 contract and the covere Covered Co	Source Water						
1	Additional Time to work with Landowner /Local Government act		1	\$	50,000	\$	50,000
Improvements to intake- Interesting In	Compensation to Owner		1	\$	50,000	\$	50,000
Section Sect	Raw water turbidimeter	Hach 1720E	1	\$	7,000	\$	7,000
Interdiation and Construction 30% \$ 112,000 \$ 3,30% \$ 145,600 \$ 14	Improvements to intake -	allowance	1	\$	5,000	\$	5,000
SUBSTOTAL	Installation and Construction		30%	\$	112,000	\$	33,600
Membrane, Building, Civit Membrane Filtration package ComPak 4	SUBTOTAL					\$	145,600
Membrane Filtration package Biselevash Port Disposal Biselevash Port Disposal Disperse over land 1 1 3 15,000 5 15,000 5 15,000 Containerated Membrane s Containerated Science	Water Treatment						
Disperse over land	Membrane, Building, Civil						
Auxillating requirements for Containersed Membrane s CIP Holding tank and neutralise waste dosing to neutralise waste 1 \$ 15,000 \$ 15,000 \$ 15,000 \$ 15,000 \$ 15,000 \$ 15,000 \$ 15,000 \$ 15,000 \$ 15,000 \$ 1,0	Membrane Filtration package	ComPak 4	1	\$	219,000	\$	219,000
Containenteed Membranes of (Installation, anchiatry 1	Backwash Pond Disposal	Disperse over land	1	\$	15,000	\$	15,000
Cili Hodding tank and	Auxillary requirements for Containerised Membrane s	insulation, ancillary	1	\$	10,000	\$	10,000
1 x 25,000L tank (raw water) 1	CIP Holding tank and	desing to poutralise waste		l _e	15 000	e	15,000
Turbiditmeter For treated water 1 \$ 7,000 \$ 7,000	neutralisation	dosting to neutralise waste	'	٩	15,000	٥	15,000
Pipes, valves and fittings	Balance tank	1 x 25,000L tank (raw water)	1	\$	6,000	\$	6,000
Pipes, valves and filtings	Turbiditmeter		· ·	1			
Landscaping/encing/Access Telemetry Landscaping/encing/Access Telemetry RTU and Aerial, programming etc RTU and Aerial, programming etc 1	Flow meter	DN80 yokogawa mag flowmeter	1	\$	4,600	\$	4,600
RTU and Aerial, programming etc	Pipes, valves and fittings	50 to 100 mm	1	\$	20,000	\$	20,000
Selectrical and Switchboard	Landscaping/fencing/Access	Landscaping/ Access Road	l	1			
Power Upgrade	Telemetry	RTU and Aerial, programming etc	1	\$	30,000	\$	30,000
Waltaki	Electrical and Switchboard		1	\$	40,000	\$	40,000
Validation Va	Power Upgrade		1	\$	16,600	\$	16,600
Installation and Construction 30% \$ 507,200 \$ 152,160 \$ 507,300 \$ 507,200 \$ 152,160 \$ 507,300 \$			l	\$	180	\$	
Demolition of tanks Demolition of existing tanks Demolition of existing tanks Demolition of tanks Demolition of existing tanks 20% \$ 130,000 \$ 26,000 \$ 26,000 \$ 26,000 \$ 26,000 \$ 27,000 \$ 27,000 \$ 20% \$ 10,000 \$ 27,000 \$ 20,000	Installation and Construction	3 3	30%	1 '			
Demolition of tanks Demolition of existing tanks Demolition of tanks Demolition Discovery Discovery Demolition Discovery Demolition Discovery Demolition Discovery Demolition Discovery Discovery Discovery Demolition Discovery Discovery Demolition Discovery Discovery Demolition Discovery Discovery Demolition Discovery Demolition Discovery Demolition Discovery Demolition Discovery Demolition Disc	SUBTOTAL Treatment					\$	659,360
Demolition of tanks							
Not required for restricted flow- allow to bring in plug in generator 1	Replacement of existing tanks	Demolition of existing tanks (20%					
New tanks	Demolition of tanks		20%	\$	130,000	\$	26,000
Pipework valving 1	New Flow meter		l	1		1	
Substitution and Construction 30% \$ 67,600 \$ 20,280		24 Hours emergency storage = 116m3	l	1		ı	
Fire Protection	Installation and Construction		l	1 '			
Signature Sign	SUBTOTAL Storage						87,880
Installation and Construction 30% \$ 9,000 \$ 2,700	Fire Protection						
SUBTOTAL Fire Protection 30% \$ 9,000 \$ 2,700	Fire Tanks	30,000 L tanks with fittings (45m3)		\$	6,000	\$	9,000
SUBTOTAL Fire Protection Add- ons			1.5				
Add-ons Substitute Substi	Installation and Construction		30%	\$	9,000	\$	2,700
SUBTOTAL Preliminary and General Design Contingency Total Estimated Capital Cost: Labour Labour Power Power Power Power Bull Membrane Replacement Chemical Use CIP / Neutralisation Design 10% 90,454 90,454 10% 90,45 10% 10% 10% 10% 10% 10% 10% 10	SUBTOTAL Fire Protection						11,700
SUBTOTAL	Add- ons						
SUBTOTAL 904,540 904,540 90,454	Generator						
Preliminary and General 10% 20% 180,908 20% 180,908 20%		bring in plug in generator					
Design 20% 180,908 20,454 10% 90,454 1704 Estimated Capital Cost: - 1,266,400 1,26	SUBTOTAL						
10% 90.454			l				
Annual Operational Costs assumed average daily flow (m3/day) per hour (5.5 hours monthly) extra 1.5 hours as infrastructure on private land per hour (weekly visits for 6 hours) plus additional 10 hours /monthly to address issues with land owner and membrane process - cleaning etc. Power	Contingency		l				
Annual Operational Costs assumed average daily flow (m3/day) per hour (5.5 hours monthly) extra 1.5 hours as infrastructure on private land per hour (weekly visits for 6 hours) plus additional 10 hours /monthly to address issues with land owner and membrane process - cleaning etc. Power	Total Estimated Capital Cost:						
Description	Annual Operational Costs	assumed average daily flow (m3/dav)	50	\vdash			,
Labour Description Descr	Compliance and Management	per hour (5.5 hours monthly) extra 1.5			180		11,880
Labour additional 10 hours /monthly to address issues with land owner and membrane process - cleaning etc 432 70 30,240 Power kWhr (assumes 2kw operating 24 hours per day) 17520.0 0.4 7,008 Membrane Replacement 2 year replacement \$2875 for replacement (based on other pressure membranes) 1.0 1,642.9 Chemical Use CIP / Neutralisation 1 2,000 2,000 Desludging 1 500 500 SUBTOTAL \$ 53,200.00 Total Estimated Annual Operating Costs (20 yr @ 8%) \$ \$ 522,300 NPV of Operating I plus Operating \$ \$ 522,300		per hour (weekly visits for 6 hours) plus					,
Power Power KWhr (assumes 2kw operating 24 hours per day) 17520.0 0.4 7,008	Labour	additional 10 hours /monthly to address	432		70		30,240
Power		process - cleaning etc					
Membrane Replacement replacement (based on other pressure membranes) 1.0 1.642.9 1.600	Power		17520.0		0.4		7,008
Test	Membrane Replacement		1.0				1 600
Desiludging 1 500 500 SUBTOTAL \$ 53,200.00 Total Estimated Annual Operational Costs \$ 53,200 NPV of Operating Costs (20 yr @ 8%) \$ 522,300 NPV Capital plus Operating \$ 1,788,700	·	membranes)					•
SUBTOTAL \$ 53,200.00 Total Estimated Annual Operational Costs \$ 53,200 NPV of Operating Costs (20 yr @ 8%) \$ 522,300 NPV Capital plus Operating \$ 1,788,700	Chemical Use	CIP / Neutralisation	l				
Total Estimated Annual State Sta	SUBTOTAL		'		555	\$	
Operational Costs	Total Estimated Annual						
yr @ 8%) NPV Capital plus Operating	Operational Costs NPV of Operating Costs (20						
	yr @ 8%)			 			
	Costs Capital plus Operating			\bot		\$	1,788,700

Option 3 a R - Existing	source, membrane WTP and new storage	at existing stor	age lo	cation - RESTF	RICTE	ED FLOW
Description Description	Unit	Quantity	33.0	Rate		Cost
Source Water	5					
Additional Time to work with						
Landowner /Local Government		1	\$	50,000	\$	50,000
act Compensation to Owner		1	\$	50,000	\$	50,000
Raw water turbidimeter	Hach 1720E	1	\$	7,000	\$	7,000
Improvements to intake -	-		1			
fencing	allowance	1	\$	5,000	\$	5,000
Installation and Construction		30%	\$	112,000	\$	33,600
SUBTOTAL					\$	145,600
Water Treatment						
Membrane, Building, Civil			١.			
Membrane Filtration package	ComPak 4	1	\$	219,000	\$	219,000
Backwash Pond Disposal Auxillary requirements for	Disperse over land	1	\$	15,000	\$	15,000
Containerised Membrane s	insulation, ancillary	1	\$	10,000	\$	10,000
CIP Holding tank and	dosing to neutralise waste	1	\$	15,000	\$	15,000
neutralisation		·	1			
Balance tank	1 x 25,000L tank (raw water)	1	\$	6,000	\$	6,000
Turbiditmeter Flow meter	For treated water	1	\$	7,000	\$	7,000
	DN80 yokogawa mag flowmeter 50 to 100 mm	1 1	\$	4,600	\$	4,600 20,000
Pipes, valves and fittings		1	\$	20,000 70,000	\$	70.000
Landscaping/fencing/Access Telemetry	Landscaping/ Access Road RTU and Aerial, programming etc	1	\$	30,000	\$	30,000
Electrical and Switchboard	10 and Aerial, programming etc	1	\$	40,000	\$	40,000
	power to new site - transformer - network		1			
Power Upgrade	Waitaki	1	\$	16,600	\$	16,600
	High voltage line to site	300	\$	180	\$	54,000
Installation and Construction		30%	\$	507,200	\$	152,160
SUBTOTAL			_		\$	659,360
Chlorine Disinfection, Contact Time						
Chlorine Gas Dosing	Gas Cylinders and Dosing	1	\$	30,749	\$	30,749
Carry water Pump	Carry water Pump	1	\$	2,000	\$	2,000
Chlorine Analyser	MFC with Depolox 5	1	\$	11,300	\$	11,300
Shed	5 2	1	\$	10,000	\$	10,000
Installation and Construction		30%	\$	54,049	\$	16,215
SUBTOTAL					\$	70,300
SUBTOTAL Treatment					\$	729,660
Storage						
Replacement of existing tanks						
	Demolition of existing tanks (20%					
Demolition of tanks	replacement cost)	20%	\$	130,000	\$	26,000
New Flow meter	DN80 yokogawa mag flowmeter	1	\$	4,600	\$	4,600
New tanks	24 Hours emergency storage = 116m3	4.5	\$	6,000	\$	27,000
Pipework valving		1	\$	10,000	\$	10,000
Installation and Construction		30%	\$	67,600	\$	20,280
SUBTOTAL Storage						87,880
Fire Protection			١.			
Fire Tanks	30,000 L tanks with fittings (45m3)	1.5	\$	6,000	\$	9,000
Installation and Construction		30%	\$	9,000	\$	2,700
SUBTOTAL Fire Protection			-			11,700
Add- ons	Not required for restricted flow - allow to		-			
Generator	bring in plug in generator		L		L	
SUBTOTAL						974,840
Preliminary and General		10%				97,484
Design		20%				194,968
Contingency		10%	_			97,484
Total Estimated Capital Cost:				-		1,364,800
Annual Operational Costs	assumed average daily flow (m3/day)	50	\vdash			-
	per hour (5.5 hours monthly) extra 1.5					
Compliance and Management	hours as infrastructure on private land	66		180		11,880
	per hour (weekly visits for 6 hours) plus					
Labour	additional 10 hours /monthly to address issues with land owner and membrane	432		70		30,240
	process - cleaning etc					
Power	kWhr (assumes 2kw operating 24 hours	17520.0		0.4		7,008
	per day)	520.0		0.4		7,000
Membrane Replacement	assume 7 year replacement \$2875 for replacement (based on other pressure	1.0				1,600
	membranes)			1,642.9		,
Chemical Use	CIP / Neutralisation	1		2,000		2,000
_	er kg (based on 70kg cylinder assume 1.5g/m			5		145
Desludging		1		500		500
SUBTOTAL					\$	53,400.00
Total Estimated Annual Operational Costs					\$	53,400
NPV of Operating Costs (20					_	
yr @ 8%)					\$	524,300
NPV Capital plus Operating					\$	1,889,100
Costs					Ĺ	.,,

Option	4 a R - New bores, WTP at source, storage a	t existing site - F	REST	RICTED FLOW		
Description	Unit	Quantity		Rate		Cost
Source Water						
Additional Time to work with Landowner / public works act		1	\$	50,000	\$	50,000
Landowner Compensation		1	\$	50,000	\$	50,000
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
Improvements to intake - fencing	allowance	1	\$	20,000	\$	20,000
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 SUBTOTAL		30%	\$	167,000	\$ \$	50,100 217,100
Water Treatment						
Filtration, UV, Building, Civil						
1200 m3 RAW WATER	Steel Tank	1	\$	220,000	\$	220,000
STORAGE (7 days)	For overcoming headloss through cartridge	1				
Treatment pump	and backwashing filter	1	\$	5,000	\$	5,000
Bag Filter	Bag filter 1 HF40H304 (duty/standby) 1 um nominal -	2	\$	3,100	\$	6,200
Cartridge	will treat up to 5 L/sec	2	\$	8,250	\$	16,500
Ultraviolet Disinfection	UV Pro 30 (up to 1.89 L/sec) (Duty Assist)	2	\$	5,990	\$	11,980
UPS for UV	UPS - for management of brown outs 30min	1	\$	3,000	\$	3,000
Pressure Transducer	For monitoring pressure across cartridges/bags	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	\$	20,000	\$	20,000
Water Treatment Plant Building	Alpine style m2	12	\$	4,000	\$	48,000
Landscaping/Access	fencing/Landscaping/ Access Road	1	\$	70,000	\$	70,000
Telemetry	RTU and Aerial, programming etc	1	\$	20,000	\$	20,000
Electrical and Switchboard		1	\$	40,000	\$	40,000
Power Upgrade	power to new site - transformer - network Waitaki	1	\$	16,600	\$	16,600
	High voltage line to site	300	\$	180	\$	54,000
Installation and Construction SUBTOTAL Treatment		30%	\$	544,380	\$ \$	163,314 707,694
Storage					_	707,034
Replacement of existing tanks						
Demolition of tanks	Demolition of existing tanks (20%	20%	\$	130,000	\$	26,000
New Flow meter	replacement cost) DN80 yokogawa mag flowmeter	1	\$	4,600	\$	4,600
New tanks	24 Hours emergency storage = 116m3	4.5	\$	6,000	\$	27,000
Pipework valving Installation and Construction		1 30%	\$	10,000 67,600	\$	10,000 20,280
SUBTOTAL Storage		30%	٥	67,000	Ф	20,280 87,880
Fire Protection						·
Fire Tanks	30,000 L tanks with fittings (45m3)	1.5	\$	6,000	\$	9,000
Installation and Construction			\$	9,000	\$	2,700
SUBTOTAL Fire Protection		30%				11,700
Add- ons	Not required for restricted flow - allow to bring					
Generator	in plug in generator					
SUBTOTAL Preliminary and General		10%				1,024,374
Preliminary and General Design		10% 20%				102,437 204,875
Contingency		10%				102,437
Total Estimated Capital Cost:				-		1,434,100
Annual Operational Costs	assumed average daily flow (m3/day)	50				
Compliance and Management	per hour (5.5 hours monthly) extra 1.5 hours as infrastructure on private land	66	\$	180		11,880
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)	2014.8	\$	0		806
Lamp Replacement	Assumes yearly reaplacement of 1 lamp (1 lamp per unti)	1.0	\$	433		433
Cartridges	per cartridge (assume montly)	12	\$	500		6,000
	per bag	12	\$	50	_ ا	600
SUBTOTAL Total Estimated Annual					\$	46,598.92
Operational Costs NPV of Operating Costs (20					\$	46,600
yr @ 8%) NPV Capital plus Operating					\$	457,500
Costs Capital plus Operating					\$	1,891,600

Option 4 a R - New bores, WTP at source, storage at existing site - RESTRICTED FLOW						
Description	Unit	Quantity	Rate	Cost		
Source Water						
Additional Time to work with Landowner / public works act		1	\$ 50,000	\$ 50,000		
Landowner Compensation Raw water turbidimeter	Hach 1720E	1	\$ 50,000 \$ 7,000	\$ 50,000 \$ 7,000		
Actuated valve to shut down	Rotork	1	\$ 15,000	\$ 15,000		
when water above 1 NTU Improvements to intake -		1				
fencing Electrical, control and	allowance	1	\$ 20,000	\$ 20,000		
Telemetry (to provide data,	RTU and aerial, pole, solar panel, battery	1	\$ 25,000	\$ 25,000		
alarms and shut down of Rotork)	and repeater					
Installation and Construction SUBTOTAL		30%	\$ 167,000	\$ 50,100 \$ 217,100		
Water Treatment				\$ 217,100		
Filtration, UV, Building, Civil						
1200 m3 RAW WATER	Steel Tank	1	\$ 220,000	\$ 220,000		
STORAGE (7 days)	For overcoming headloss through cartridge					
Treatment pump Bag Filter	and backwashing filter Bag filter	1 2	\$ 5,000 \$ 3,100	\$ 5,000 \$ 6,200		
Cartridge	1 HF40H304 (duty/standby) 1 um nominal -	2	\$ 8,250	\$ 16,500		
Ultraviolet Disinfection	will treat up to 5 L/sec	2	\$ 5,990	\$ 11,980		
Oli aviolet Disiffection	UV Pro 30 (up to 1.89 L/sec) (Duty Assist) UPS - for management of brown outs	2	\$ 5,990	\$ 11,900		
UPS for UV	30min	1	\$ 3,000	\$ 3,000		
Pressure Transducer	For monitoring pressure across cartridges/bags	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	\$ 20,000	\$ 20,000		
Water Treatment Plant Building	Alpine style m2	12	\$ 4,000	\$ 48,000		
Landscaping/Access	fencing/Landscaping/ Access Road	1	\$ 70,000	\$ 70,000		
Telemetry	RTU and Aerial, programming etc	1	\$ 20,000	\$ 20,000		
Electrical and Switchboard		1	\$ 40,000	\$ 40,000		
Power Upgrade	power to new site - transformer - network		\$ 16,600	\$ 16,600		
rower opgrade	Waitaki High voltage line to site	1 300	\$ 180	\$ 54,000		
Installation and Construction		30%	\$ 544,380	\$ 163,314		
SUBTOTAL Chlorine Disinfection,				\$ 707,694		
Contact Time						
Chlorine Gas Dosing Carry water Pump	Gas Cylinders and Dosing - Carry water Pump	1	\$ 30,749 \$ 2,000	\$ 30,749 \$ 2,000		
Chlorine Analyser	MFC with Depolox 5	1	\$ 11,300	\$ 11,300		
Installation and Construction SUBTOTAL		30%	\$ 44,049	\$ 13,215 \$ 57,264		
SUBTOTAL Treatment				\$ 764,958		
Storage						
Replacement of existing tanks						
Demolition of tanks	Demolition of existing tanks (20% replacement cost)	20%	\$ 130,000	\$ 26,000		
New Flow meter New tanks	DN80 yokogawa mag flowmeter 24 Hours emergency storage = 116m3	1 4.5	\$ 4,600 \$ 6,000	\$ 4,600 \$ 27,000		
Pipework valving	24 Hours emergency storage - 110mb	1	\$ 10,000	\$ 10,000		
Installation and Construction		30%	\$ 67,600	\$ 20,280		
SUBTOTAL Storage Fire Protection				87,880		
Fire Tanks	30,000 L tanks with fittings (45m3)		\$ 6,000	\$ 9.000		
File Taliks	50,000 L tanks with hittings (45H5)	1.5	\$ 6,000	\$ 9,000		
Installation and Construction		30%	\$ 9,000	\$ 2,700		
SUBTOTAL Fire Protection		30%		11,700		
Add- ons	Not required for restricted form all or					
Generator	Not required for restricted flow - allow to bring in plug in generator					
SUBTOTAL Preliminary and General		10%		1,081,638 108,164		
Design Design		20%		216,328		
Contingency Total Estimated Capital		10%		108,164		
Cost:			-	1,514,300		
Annual Operational Costs	assumed average daily flow (m3/day) per hour (5.5 hours monthly) extra 1.5	50				
Compliance and Management	hours as infrastructure on private land per hour (weekly visits for 6 hours) plus	66	180	11,880		
Labour	additional 6 hours /monthly to address	384	70	26,880		
	issues with land owner and changing filters etc					
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 montly)	12	500	6,000		
Chlorine Dosing	per bag er kg (based on 70kg cylinder assume 1.5g/m	12 27.4	50 5	600 145		
SUBTOTAL	o (based on rong cymidel assume 1.5g/ff	21.4	5	\$ 46,744.01		
Total Estimated Annual Operational Costs				\$ 46,700		
NPV of Operating Costs (20				\$ 458,500		
yr @ 8%) NPV Capital plus Operating				\$ 1,972,800		
Costs				1,572,000		

Description	Unit	Quantity		Rate		Cost
Source Water Additional Time to work with Landowner		1	\$	50,000	\$	50,000
/ public works act Land owner compensation		1	\$	50,000	\$	50,000
Further investigation for ground water		1	\$	15,000	\$	15,000
ECAN Consent	consent to take groundwater	1	\$	25,000	\$	25,000
Bores drilling and headworks	consent to take groundwater	2	\$	40,000	\$	80,000
Bore Pumps	2.8 L/sec at up to 30m allowed for	2	\$	2,500	\$	5,00
VFD	VFD for pumps	2	\$	3,500	\$	7,00
Raw water turbidimeter	Hach 1720E	1	\$	7,000	\$	7,00
Flow meter	DN80 yokogawa mag flowmeter	2	\$	4,600	\$	9,20
Electrical and Control	level switches electrical cabinet, install	1	\$	15,000	\$	15,00
Installation and Construction SUBTOTAL Source		30%	\$	263,200	\$ \$	78,96 342,16 0
Water Treatment						
Filtration, UV, Building, Civil						
Cartridge	1 HF40H304 (duty/standby) 1 um	2	\$	8,250	\$	16,50
-	nominal - will treat up to 5 L/sec UV Pro 50 (up to 3.15 L/sec) Duty	_				
Ultraviolet Disinfection	assist	2	\$	10,000	\$	20,000
UPS for UV	UPS - for management of brown outs 30min	1	\$	3,000	\$	3,00
Pressure Transducer	For monitoring pressure across cartridges	3	\$	500	\$	1,50
Turbiditmeter	For treated water	1	\$	7,000	\$	7,00
Flow meter	DN80 yokogawa mag flowmeter	1	\$	4,600	\$	4,60
Pipes, valves and fittings	50 to 100 mm	1	\$	10,000	\$	10,000
Water Treatment Plant Building	Alpine style m2	10	\$	4,000	\$	40,00
Landscaping/Access	Landscaping/ Access Road	1	\$	70,000	\$	70,00
Telemetry	RTU and Aerial, programming etc	1	\$	30,000	\$	30,00
Electrical and Switchboard		1	\$	40,000	\$	40,00
Power Upgrade	power to new site - transformer - network Waitaki	1	\$	16,600	\$	16,60
	High voltage line to site	700	\$	180	\$	126,000
Installation and Construction SUBTOTAL Treatment		30%	\$	385,200	\$ \$	115,560 500,76 0
Storage Replacement of existing tenics						
Replacement of existing tanks	Demolition of existing tanks (20%					
Demolition of tanks	replacement cost)	20%	\$	130,000	\$	26,00 4,60
New Flow meter New tanks	DN80 yokogawa mag flowmeter 24 Hours emergency storage,	10	\$	4,600 6,000	\$	60,00
Pipework	operational storage = 287m3 Allowance for pipework	1	\$	15,000	\$	15,00
Installation and Construction		30%	\$	105,600	\$	31,68
SUBTOTAL Storage Fire Protection						137,280
Fire Tanks	30,000 L tanks with fittings (45m3)	1.5	\$	6,000	\$	9,000
Upgrade main from intake to old storage location (to achieve fireflows)	DN150 PVC/PE	=00	\$	180	\$	142,20
Installation and Construction		790 30%	\$	151,200	\$	45,360
SUBTOTAL Fire Protection						196,56
Add- ons						
Generator	allow to bring in plug in generator				\$	-
SUBTOTAL						1,176,76
Preliminary and General		10%				117,67
Design Contingency		20% 10%				235,35 117,67
Total Estimated Capital Cost:				-		1,647,50
Annual Operational Costs	assumed average daily flow (m3/day)	50				•
Compliance and Management	per hour (5.5 hours monthly) extra 1.5 hours as infrastructure on private land	66		180		11,88
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		26,88
	kWhr (assumes 0.23 kw operating 24 hours per day)	2014.8		0.4		806
UV Disinfection				433.0		433
UV Disinfection Lamp Replacement	Assumes yearly reaplacement of 1	1.0	l	₹00.0		
	Assumes yearly reaplacement of 1 lamp (1 lamp per unit) per cartridge (assume quarterly)	1.0 3		500		1,500
Lamp Replacement	Assumes yearly reaplacement of 1 lamp (1 lamp per unit)					
Lamp Replacement Cartridges Electricity for Bore Pumps SUBTOTAL	Assumes yearly reaplacement of 1 lamp (1 lamp per unit) per cartridge (assume quarterly) kWhr (assumes 2kw pump operating	3		500	\$	2,028
Lamp Replacement Cartridges Electricity for Bore Pumps	Assumes yearly reaplacement of 1 lamp (1 lamp per unit) per cartridge (assume quarterly) kWhr (assumes 2kw pump operating	3		500	\$	2,02 8
Lamp Replacement Cartridges Electricity for Bore Pumps SUBTOTAL Total Estimated Annual Operational	Assumes yearly reaplacement of 1 lamp (1 lamp per unit) per cartridge (assume quarterly) kWhr (assumes 2kw pump operating	3		500		1,500 2,028 43,526.70 43,500 427,100

Option 5 a R - New bores, WTP at source, storage at source - RESTRICTED FLOW					
Description	Unit	Quantity	Rate	Cost	
	Oint	Quantity	Nate	Cost	
Source Water Additional Time to work with		1	\$ 50,000	\$ 50,000	
Landowner / public works act Land owner compensation		1	\$ 50,000	\$ 50,000	
Further investigation for ground		1	\$ 15,000	\$ 15,000	
water		'	\$ 15,000	\$ 15,000	
ECAN Consent	consent to take groundwater	1	\$ 25,000	\$ 25,000	
Bores drilling and headworks		2	\$ 40,000	\$ 80,000	
Bore Pumps	1.3L/sec at up to 20m allowed for	2	\$ 2,100	\$ 4,200	
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 SUBTOTAL Source		30%	\$ 262,400	\$ 78,720 \$ 341,120	
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 30 (up to 1.89 L/sec) (Duty Assist)	2	\$ 5,990	\$ 11,980	
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	
Landscaping/Access	Landscaping/ Access Road	1	\$ 70,000	\$ 70,000	
Telemetry	RTU and Aerial, programming etc		\$ 30,000	\$ 30,000	
Electrical and Switchboard		1	\$ 40,000	\$ 40,000	
	power to new site - transformer - network		\$ 16,600	\$ 16,600	
Power Upgrade	Waitaki	1 700	\$ 16,600	\$ 126,000	
Installation and Construction	High voltage line to site	30%	\$ 377,180	\$ 113,154	
SUBTOTAL Treatment				\$ 490,334	
Storage					
Replacement of existing tanks					
Demolition of tanks	Demolition of existing tanks (20% replacement cost)	20%	\$ 130,000	\$ 26,000	
New Flow meter	DN80 yokogawa mag flowmeter	1	\$ 4,600	\$ 4,600	
New tanks	24 Hours emergency storage = 116m3	4.5	\$ 6,000	\$ 27,000	
Pipework valving		1	\$ 15,000	\$ 15,000	
Installation and Construction SUBTOTAL Storage		30%	\$ 72,600	\$ 21,780 94,380	
Fire Protection				. ,	
Fire Tanks Upgrade main from intake to	30,000 L tanks with fittings (45m3)	1.5	\$ 6,000	\$ 9,000	
old storage location (to achieve fireflows)	DN150 PVC/PE	790	\$ 180	\$ 142,200	
Installation and Construction		30%	\$ 9,000	\$ 2,700	
SUBTOTAL Fire Protection Add- ons				153,900	
	Not required for restricted flow - allow to				
Generator	bring in plug in generator				
SUBTOTAL			<u> </u>	1,079,734	
Preliminary and General		10%		107,973	
Design Contingency		20% 10%		215,947	
		1070	_	1,511,600	
Total Estimated Capital Cost: <u>Annual Operational Costs</u>	assumed average daily flow (m3/day)	50	-	1,511,600	
	per hour (5.5 hours monthly) extra 1.5				
Compliance and Management	hours as infrastructure on private land	66	180	11,880	
Labour	per hour (weekly visits for 6 hours) plus additional 6 hours /monthly to address issues with land owner and changing filters	384	70	26,880	
UV Disinfection	etc kWhr (assumes 0.23 kw operating 24	2014.8	0.4	806	
	hours per day) Assumes yearly reaplacement of 1 lamp (1		0.4		
Lamp Replacement	lamp per unit)	1.0	433.0 500	433	
Cartridges	per cartridge (assume quarterly) kWhr (assumes 2kw pump operating at	5,069		1,500	
Electricity for Bore Pumps SUBTOTAL	2L/sec)	5,009	0.4	2,028 \$ 43,526.70	
Total Estimated Annual				\$ 43,526.70	
Operational Costs NPV of Operating Costs (20					
yr @ 8%) NPV Capital plus Operating				\$ 427,100	
Costs				\$ 1,938,700	

Option 5 a OD-	New bores, WTP, Storage in Existing Location	n - ON DEMAN	AND FLOW					
Description	Unit	Quantity		Rate		Cost		
Source Water			_					
Additional Time to work with Landowner / public works act		1	\$	50,000	\$	50,000		
Land owner compensation		1	\$	50,000	\$	50,000		
Further investigation for ground water		1	\$	15,000	\$	15,000		
ECAN Consent	consent to take groundwater	1	\$	25,000	\$	25,000		
Bores drilling and headworks Bore Pumps	2.8 L/sec at up to 30m allowed for	2	\$	40,000 2,500	\$	80,000 5,000		
	·	_	1					
VFD	VFD for pumps	2	\$	3,500	\$	7,000		
Raw water turbidimeter	Hach 1720E	1	\$	7,000	\$	7,000		
Flow meter Electrical and Control	DN80 yokogawa mag flowmeter level switches electrical cabinet, install	2	\$	4,600 15,000	\$	9,200 15,000		
Installation and Construction	iever switches electrical cabinet, install	30%	\$	263,200	\$	78,960		
SUBTOTAL Source					\$	342,160		
Water Treatment								
FW -41 - 104 B 115 - 015								
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		
		=	ľ		ľ			
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		
Landscaping/Access	Landscaping/ Access Road	1	\$	70,000	\$	70,000		
Telemetry	RTU and Aerial, programming etc		\$	30,000	\$	30,000		
		1						
Electrical and Switchboard	power to new site - transformer - network	'	\$	40,000	\$	40,000		
Power Upgrade	Waitaki	1	\$	16,600	\$	16,600		
Installation and Construction	High voltage line to site	700 30%	\$	180 385,200	\$	126,000 115,560		
SUBTOTAL		3070	Ψ	303,200	\$	500,760		
Chlorine Disinfection, Contact Time								
Chlorine Gas Dosing	Gas Cylinders and Dosing	1	\$	30,749	\$	30,749		
Carry water Pump	Carry water Pump	1	\$	2,000	\$	2,000		
Chlorine Analyser	MFC with Depolox 5	1	\$	11,300	\$	11,300		
Installation and Construction SUBTOTAL		30%	\$	44,049	\$ \$	13,215 57,264		
SUBTOTAL Treatment					\$	558,024		
Storage								
Replacement of existing tanks								
Demolition of tanks	Demolition of existing tanks (20% replacement cost)	20%	\$	130,000	\$	26,000		
New Flow meter	DN80 yokogawa mag flowmeter	1	\$	4,600	\$	4,600		
New tanks	24 Hours emergency storage, operational storage = 287m3	10	\$	6,000	\$	60,000		
Pipework	Allowance for pipework	1	\$	15,000	\$	15,000		
Installation and Construction		30%	\$	105,600	\$	31,680		
SUBTOTAL Storage Fire Protection			-		\vdash	137,280		
Fire Tanks	30,000 L tanks with fittings (45m3)	1.5	\$	6,000	\$	9,000		
Upgrade main from intake to old storage			ľ		ľ			
location (to achieve fireflows)	DN150 PVC/PE	790	\$	180	\$	142,200		
Installation and Construction		30%	\$	151,200	\$	45,360		
SUBTOTAL Add- ons			\vdash		\vdash	196,560		
Generator	allow to bring in plug in generator				\$	-		
SUBTOTAL						1 224 00		
						1,234,024		
Preliminary and General Design		10% 20%				123,402 246,805		
Contingency		10%				123,402		
Total Estimated Capital Cost:						1,727,600		
Annual Operational Costs	assumed average daily flow (m3/day)	50				,		
Compliance and Management	per hour (5.5 hours monthly) extra 1.5 hours	66		180		11,880		
, ,	as infrastructure on private land	-				,		
Labour	per hour (weekly visits for 6 hours) plus additional 6 hours /monthly to address issues	384		70		26,880		
	with land owner and changing filters etc							
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	1.0		433.0		433		
	lamp per unti) per cartridge (assume quarterly)	3		500		1,500		
Cartridges		27.4		5		14		
	per kg (based on 70kg cylinder assume 1.5g/m3	21.4						
Cartridges	kWhr (assumes 2kw pump operating at 2	5,069		0.4		2,028		
Cartridges Chlorine Dosing Electricity for Bore Pumps SUBTOTAL				0.4	\$			
Cartridges Chlorine Dosing Electricity for Bore Pumps SUBTOTAL Total Estimated Annual Operational	kWhr (assumes 2kw pump operating at 2			0.4	\$ \$	43,671.79		
Cartridges Chlorine Dosing Electricity for Bore Pumps SUBTOTAL Total Estimated Annual Operational Costs	kWhr (assumes 2kw pump operating at 2			0.4		43,671.79 43,700		
Cartridges Chlorine Dosing Electricity for Bore Pumps SUBTOTAL Total Estimated Annual Operational	kWhr (assumes 2kw pump operating at 2			0.4	\$	2,028 43,671.79 43,700 429,000 2,156,600		

Optio	on 5 a R - New bores, WTP at source, storag	e at source - RE	ESTRICTED FLOW			
Description	Unit	Quantity	Rate	Cost		
Source Water						
Additional Time to work with Landowner / public works act		1	\$ 50,000	\$ 50,000		
Land owner compensation		1	\$ 50,000	\$ 50,000		
Further investigation for ground water		1	\$ 15,000	\$ 15,000		
ECAN Consent	consent to take groundwater	1	\$ 25,000	\$ 25,000		
Bores drilling and headworks	-	2	\$ 40,000	\$ 80,000		
Bore Pumps	1.3L/sec at up to 20m allowed for	2	\$ 2,100	\$ 4,200		
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 Installation and Construction	level switches electrical cabinet, install	1 30%	\$ 15,000 \$ 262,400	\$ 15,000 \$ 78,720		
SUBTOTAL Source				\$ 341,120		
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 30 (up to 1.89 L/sec) (Duty Assist)	2	\$ 5,990	\$ 11,980		
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		
Landscaping/Access	Landscaping/ Access Road	1	\$ 70,000	\$ 70,000		
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 - network Waitaki	1	\$ 16,600	\$ 16,600		
	High voltage line to site	700	\$ 180	\$ 126,000		
Installation and Construction		30%	\$ 377,180	\$ 113,154 \$ 490,334		
Chlorine Disinfection,				100,001		
Contact Time Chlorine Gas Dosing	Gas Cylinders and Dosing	1	\$ 30,749	\$ 30,749		
Carry water Pump	Carry water Pump	1	\$ 2,000	\$ 2,000		
Chlorine Analyser Installation and Construction	MFC with Depolox 5	1 30%	\$ 11,300 \$ 44,049	\$ 11,300 \$ 13,215		
SUBTOTAL				\$ 57,264		
SUBTOTAL Treatment Storage				\$ 547,598		
Replacement of existing tanks						
Demolition of tanks	Demolition of existing tanks (20% replacement cost)	20%	\$ 130,000	\$ 26,000		
New Flow meter	DN80 yokogawa mag flowmeter	1	\$ 4,600	\$ 4,600		
New tanks	24 Hours emergency storage = 116m3	4.5	\$ 6,000	\$ 27,000		
Pipework valving Installation and Construction		1 30%	\$ 15,000 \$ 72,600	\$ 15,000 \$ 21,780		
SUBTOTAL Storage			, , , , , , , , , , , , , , , , , , , ,	94,380		
Fire Protection Fire Tanks	30,000 L tanks with fittings (45m3)	1.5	\$ 6,000	\$ 9,000		
Upgrade main from intake to old storage location (to achieve	DN150 PVC/PE		\$ 180	\$ 142,200		
fireflows) Installation and Construction		790 30%	\$ 9,000	\$ 2,700		
SUBTOTAL				153,900		
Add- ons						
Generator	Not required for restricted flow - allow to bring in plug in generator					
SUBTOTAL				1,136,998		
Preliminary and General Design		10% 20%		113,700 227,400		
Contingency		10%		113,700		
Total Estimated Capital Cost:			-	1,591,800		
Annual Operational Costs Compliance and Management	assumed average daily flow (m3/day) per hour (5.5 hours monthly) extra 1.5 hours as infrastructure on private land	50 66	180	11,880		
Labour	per hour (weekly visits for 6 hours) plus additional 6 hours /monthly to address issues	384	70	26,880		
UV Disinfection	with land owner and changing filters etc kWhr (assumes 0.23 kw operating 24 hours	2014.8	0.4	806		
Lamp Replacement	per day) Assumes yearly reaplacement of 1 lamp (1	1.0	433.0	433		
Cartridges	lamp per unti) per cartridge (assume quarterly)	3	433.0 500	1,500		
Chlorine Dosing	er kg (based on 70kg cylinder assume 1.5g/m	27.4	5	145		
Electricity for Bore Pumps	kWhr (assumes 2kw pump operating at 2L/sec)	5,069	0.4			
SUBTOTAL Total Estimated Annual				\$ 43,671.79		
Operational Costs NPV of Operating Costs (20				\$ 43,700		
yr @ 8%) NPV Capital plus Operating				\$ 429,000		
Costs				\$ 2,020,800		