

Report

Executive Summary Report – Ranked Options (Option Shortlisting) Report

Prepared for Kāpiti Coast District Council (Client)

By CH2M Beca Limited

17 June 2010



Revision History

Revision Nº	Prepared By	Description	Date
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Document Acceptance

Action	Name	Signed	Date
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1 Introduction

Providing a water supply for the Waikanae, Paraparaumu and Raumati community that is reliable and will meet the expectations of consumers is a key project for Kāpiti Coast District Council.

This report provides a summary of the six options that have been investigated in Stage 3 of the Kāpiti Water Supply Project. Base capital cost estimates have been prepared for these six options based on the concept design and investigations that have occurred to date. It should be noted that some investigations are ongoing for some options. Specifically, the Lower Maungakotukutuku is being subjected to geotechnical drilling investigations, while 3D modelling of the deep aquifer is being completed which will better inform the three options that rely on the borefield in different ways. While this work is ongoing, base cost estimates have been prepared for each option based on the concept designs which are now complete. The estimates have identified that a number of options that are highly likely to go over the budget allocated.

This report seeks a decision from Council to cease investigations on the options that are unlikely to be within the project budget. The final ranked Options Report in July 2010 will provide a full technical overview of each of the options investigated since March 2010. .

The six in-catchment solutions have emerged from an analysis of a wider group of options. This stage of work has focussed on developing concept designs for each option, supplemented by technical investigations which have included:

- n Geotechnical investigations and drilling at two dam sites
- n Surface water modelling of the Waikanae River
- n Pump testing the existing Waikanae Borefield to determine the sustainable yield and overall performance of the borefield
- n Water taste testing of different water sources, once subjected to treatment methods (including nanofiltration, lime softening blending of bore and river water and
- n Investigation of terrestrial ecology
- n Investigation of in-stream ecology, including impacts of mixing bore water with river water;
- n Review of the treatment options required for different water sources
- n Preliminary examination of planning/regulatory requirements and the potential range of environmental effects that would need to be considered for the preferred option.

Council has also engaged with its key partner in relation to the Waikanae River basin, Te Ātiawa, to gain their input at this key stage on the most appropriate option and the potential impacts on the partnership with iwi.

In addition, over the course of these investigations, consultation has been occurring with a number of affected parties, landowners and stakeholders. The results of this consultation process will be report in the final technical report.

2 Options

The six solutions investigated to date are as follows (NB: option D has been split into three different sub-options, meaning the total of number distinct options is actually eight).

The first three options are dams, and they have a number of similarities. In particular, the way they would be operated is that during low flows in the Waikanae River, water would be released into the river from the dam, and abstracted at the existing water intake. All dams use the same technique to convey water to the treatment plant via the river.

2.1.1 Solution A - Kapakapanui Dam

Located on an unnamed tributary of the Waikanae River, this dam also provides for 2M cubic metres of storage. While it has a smaller contributing catchment area, the benefits of this includes its largely pastoral/grassland coverage meaning only minimal native vegetation clearance. There are some risks and concerns with risk related impacts on downstream properties, and potentially significant cost related concerns with the underlying rock substrate being very deep, thus increasing costs. Drilling carried out to date has confirmed that the depth to bedrock is significant, this increasing the overall costs of constructing a dam on this site. During the course of consultation, this dam has raised considerable concern with a number of local residents, in particular those downstream from the dam.

2.1.2 Solution B - Lower Maungakotukutuku Dam

This dam is located on the Maungakotukutuku River in the southern side of the Waikanae River basin. The dam allows for the storage of over 2M cubic metres of water, and is well located on a natural gorge allowing a large area of storage. The site does present some challenges in terms of ecological impacts – requiring the removal of some regenerating native vegetation which is subject to a covenant.

2.1.3 Solution C - Ngatiawa Dam

Located on the Ngatiawa Stream and north of Ngatiawa Road. This catchment has the greatest flows, and hence the dam design in this location must be able to deal with largely flood flows. The dam also 'fills' faster than the other two which are on smaller catchments. The site has a number of rural lifestyle blocks surrounding the impoundment, and thus may have a larger portion of land purchase costs along with social impacts. There will also be impacts on a number of native trees which are protected by the District Plan.

2.1.4 Solution D1 - Extended Waikanae Borefield and Storage

This option is split into two different scenarios, based on different sized storage ponds. It involves extending the existing Waikanae borefield, and storing river water in ponds for use during low flow periods to blend with bore water. Two different pond sizes have been used to provide for different blending / treatment proportions, and the option has the advantage of utilising the existing bore field infrastructure. The key disadvantage is that the construction of storage ponds is prohibitively expensive, and despite focussed design work on these ponds, it has not been possible to reduce the cost.

2.1.5 Solution D2 - Extended Waikanae Borefield and Treatment

The alternative approach to extending the borefield is to treat the water further and not include blending or storage of river water, but rather relies solely on an extended borefield to meet future demand when the river levels fall below the minimum flow. This option involves the addition of a nanofiltration plant to the existing water treatment plant. The water taste testing – while only a small sample of people – suggests that the changes made to the bore field (i.e. closure of the worst bore) over recent years and the additional treatment at the existing plant, have possibly remedied concerns that residents had. Extending the borefield does provide an alternative water source from the river, and utilises existing infrastructure. This option is also highly “stageable”, meaning headroom can be provided over the fifty year period as it is required.

2.1.6 Solution E - Aquifer Storage and Recovery

This option involves using the aquifer and elements of the existing borefield infrastructure to abstract water from the river during high winter flows, and inject it into the existing aquifer using new injection wells. The borefield essentially acts as an underground dam, and the existing borefield is then used to abstract the water during drier periods when it is needed. This option has the advantage of using existing infrastructure, not having major impacts on land use, and is also relatively inexpensive. There are however a number of unresolved risks, and in order to address these, this option would require an additional period of investigation.

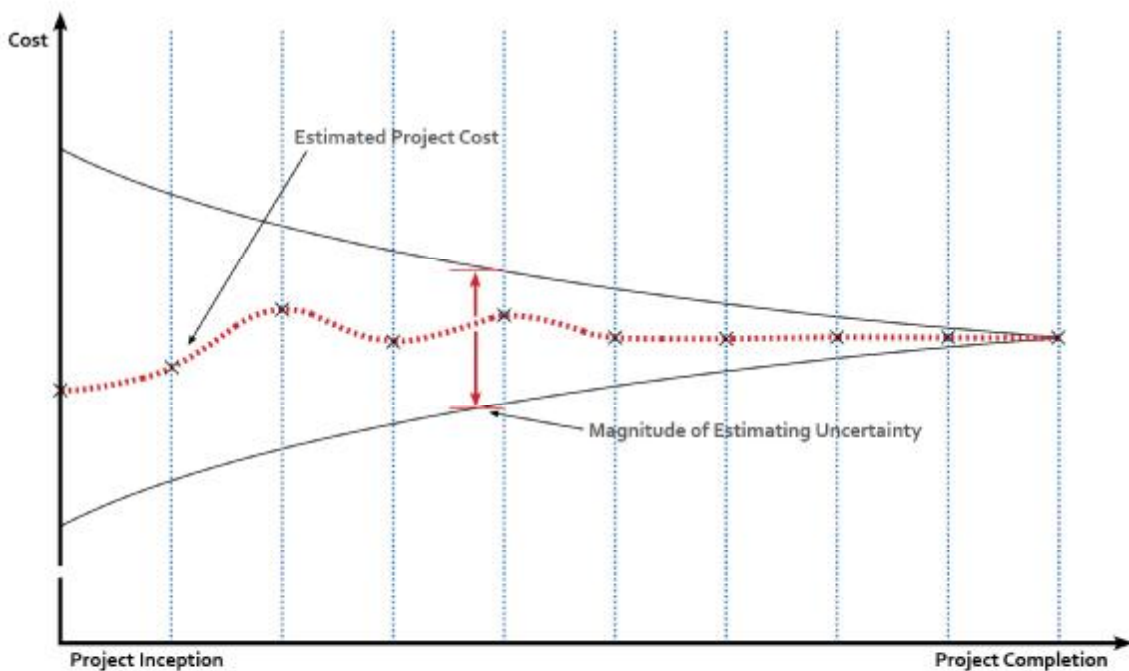
2.1.7 Solution F - River Recharge with Groundwater

This option involves taking water from the existing borefield, and discharging it into the Waikanae River immediately downstream from the existing intake. In this way, groundwater from the borefield is able to provide the minimum flow in the river, allowing more river water to be abstracted for consumer demand. The borefield would need to be extended to provide sufficient yield. The ecological impacts of this option appear to be generally acceptable, although some further investigation into potential algal impacts from phosphorus is required.

2.2 Overview of Approach

2.2.1 Capital Costs - Overview

Traditionally capital cost estimates are updated at each phase and major milestones of a project's development from concept design, culminating in a pre-tender estimate on completion of detailed design (based on a traditional delivery mechanism). The following diagram illustrates the perceived degree of financial risk during the life cycle of a project. In particular, it demonstrates that as the design process advances, cost estimates do tend to move up or down as more information, investigation and design effort occurs. The magnitude of uncertainty therefore decreases, so in practical terms this means that cost estimates move from being $\pm 30\%$ or more, to about $\pm 10\%$ once detailed design is complete. The risk-based estimating process proposed for this project (that is, the P90 estimate) is a more robust approach again, which provides a 90% probability based on costs and risks that the project can be delivered within that dollar figure.



The following approach will be taken in the final Ranked Options report:

- n Produce a Capital Cost Estimate for the construction cost, plus design & management fees for each option. Prior to the final risk assessment being completed, this interim report includes a 25% contingency. This contingency will be replaced in the P90 estimate by a specific assessment of the risks for each scope item that makes up the Capital Cost Estimate.
- n Carry out a quantitative risk analysis on each scope item on the Capital Cost Estimate, and in addition a qualitative risk assessment on the risks which have cost implications that are on the risk register. Then, using the specialist software @Risk, we will establish a P90 Estimate. A P90 Estimate has a probability of 90% that the final cost will fall within the P90 figure.

The P90 estimate is essentially a more sophisticated analysis of the uncertainty in the estimating, as shown in the figure above. It gives a funding agency (in this case, Council) a 90% confidence that it can commit to a project without the budget being exceeded. The P90 is commonly used by large infrastructure agencies such as the New Zealand Transport Agency (NZTA). The only problem with a P90 estimate is that, because it is conservative, the high figure can be too daunting and lead to a reluctance to commit. To give Council some measure of the conservatism, we will also present the P75 and P50 estimates.

This initial report is therefore based on the preliminary Base Capital Cost Estimate, plus an interim contingency of 25% and land valuations. Even without this 25% contingency, all four options identified in this report would be excluded based on the base estimate.

The final P90 (risk based) estimate will include consulting fees up to and including resource consent applications, the Capital Cost Estimate, plus design and management fees, plus specific allowances for risks on the risk schedule. This will mean that the P90 cost is a higher figure than the base estimate, but it will be more “sophisticated” than simply adding a 25% contingency as has occurred in this report. Whichever way costs are presented – either now with a contingency, or later as a P90

risk based estimate, it is not sensible to continue investigating those options where the base estimate has climbed well above the Council budget limits.

2.2.2 Budget Available

The budget available for the project is set out in the LTCCP, which provides for \$23M (\$24.8M when inflation adjusted to 2015) for the supplementary water supply. In addition, the LTCCP includes a budget for upgrading work at the existing water treatment plant, because Council has recognised that the water treatment plant, while performing well, is ageing and is in need of renewals expenditure. How much of this budget may be available for the Water Supply Project is yet to be determined.

2.2.3 Basis of the Estimate

All cost estimates have been prepared based on:

- n The information provided in this report
- n Capital Costs only
- n a cost base date of May 2010
- n a traditional project delivery model utilising New Zealand design and construction resources. All costs are expressed in NZ dollars.
- n Design and management fees based on 12% of the overall capital cost estimate.
- n Land valuations as provided by a registered valuer (BJ Whitaker).

Elemental estimates have been produced for items where enough information is available and allowances have been included for the items not yet defined at this concept stage.

All rates used in these estimates are based on a mixture of the following:

- n First principles (Rates are built up from the various inputs needed to supply, transport, construct, fix, etc. of a specific item)
- n Beca/Damwatch databases
- n Comparison of similar current and historic projects
- n Rawlinson Construction Handbook, 2009
- n Cost from suppliers.

The cost estimates include allowances for preliminary & general, contractor's on-site and off-site overheads plus profit, professional fees, and consent fees.

2.2.4 Land Valuation - Overview

A number of options involve the purchase of significant areas of land. Specifically, these options includes the three dam sites, plus the storage ponds associated with Solution D1. A land valuer (BJ Whitaker) has been engaged to prepare these land value estimates and these are included in the overall cost of each option presented in this report. The other options are only to expected to involve purchasing small areas of land, if any, and no allowance has been made for these at this time.

2.3 Base Estimates

The following table provides a summary of the base estimate. For those options that continue to be investigated, the risk based assessment (P50, P75 and P90) will be reported to Council in July

2010. Further evaluation of the base estimates on those options is expected, so these figures are only an interim base estimate.

	Solution A Kapakapanui¹	Solution B Maunga- kotukutuku¹	Solution C Ngatiawa¹	Solution D1 Borefield & Storage (Lge)	Solution D1 Borefield & Storage (Sml)	Solution D2 Borefield & Treatment	Solution E ASR	Solution F River Recharge
Fees & Investigation²	\$2,000,000	\$2,000,000	\$2,000,000	\$2,000,000	\$2,000,000	\$2,000,000	\$2,000,000	\$2,000,000
Land Value	\$370,000	\$690,000 ³	\$2,310,000 ⁴	\$4,880,000	\$3,000,000	\$0	\$0	\$0
Capital Cost	\$29,320,000	\$16,040,000	\$19,720,000	\$35,190,000	\$26,480,000	\$19,790,000	\$14,780,000	\$12,110,000
Design and Management	\$3,520,000	\$1,930,000	\$2,370,000	\$4,220,000	\$3,180,000	\$2,370,000	\$1,770,000	\$1,450,000
25% Contingency	\$8,210,000	4,490,000	5,520,000	9,850,000	7,410,000	5,540,000 ⁵	4,140,000	3,390,000
TOTAL	\$43,420,000	\$25,150,000	\$31,920,000	\$56,140,000	\$42,070,000	\$29,700,000	\$22,690,000	\$18,950,000
Recommen- dation	Place on Hold	Continue	Place on Hold	Place on Hold	Place on Hold	Continue	Continue	Continue



¹ Note that there are two different capacity dams, one at 2M m³ and one at 1.4M m³. The cost of the larger dam is reported here because it incorporates the required headroom.

² This provisional figure is based on the fees to date, plus estimated fees to completion of RMA approvals (\$1.7M). In addition, we have allowed for geotechnical investigations carried out during Stage 3 (\$120,000), legal fees for Council hearings (\$100,000), plus Greater Wellington and KCDC processing costs (\$100,000).

³ This figure is based on the cost of buying the area necessary for the dam footprint, associated access, and the inundation area of the reservoir. It excludes the costs of small area of land owned by Greater Wellington, as the costs are expected to be minor (value is being confirmed).

⁴ This is the cost of partial buy of 4 properties and full buy of 2 properties (Section 80 and Lot 2 DP 63227). Partial buy calculated as the dam/reservoir footprint + 10 metre wide perimeter access strip, + any obvious severed areas.

⁵ This option requires disposal of brine water via the wastewater treatment plant discharge to the Mazengarb Drain. This will require additional consultant, design and investigations (including ecology) and potentially some additional attenuation pond storage if this option is pursued. It is considered that these costs are included in the contingency.

3 Conclusion and Recommendations

All six options have now had concept designs completed, and a number of investigations undertaken to fully understand the range of issues, and the pros & cons of each option. This is to ensure Council has the best information available to make a decision in relation to the preferred option.

There are further investigations going on at present in terms of specific options, including geotechnical drilling at the Lower Maungakotukutuku site, risk based assessment of capital cost estimates and groundwater modelling. These will be reported in the Ranked Options report.

While these investigations are ongoing, and a full P90 cost estimate is yet to be completed, the *capital cost estimates* for a number of options already indicate that they are substantially over the capital budget allocated by Council. Some uncertainties remain in relation to how the final options will perform in relation to the economic efficiency assessment, which is yet to be completed.

In addition, Solution C: Ngatiawa Dam has reasonably significant ecological and social impacts associated with it.

On the basis of the work undertaken to date, the following recommendations are made:

- < That the following options be put on hold, and not considered further:
 - Kapakapanui Dam
 - Ngatiawa Dam
 - Waikanae Borefield and Storage Pond options (both options involving ponds)
- < That Council recognise that each of these options, while being put on hold for capital cost (and other reasons for Ngatiawa), also have a number of other pros and cons, and these may well need to be re-evaluated in the event that no clear preferred option emerges from the final ranked options report.
- < That Council communicate with those landowners or other parties directly affected by these options so they are aware that these options are being placed on hold.
- < That Council continue to investigate the remaining four options, and note that a detailed technical report and executive summary will be received by Council in July 2010 with the ranked list of options, as well as consideration of relevant “hybrid” options.

The capital cost estimates and recommendations in this report do not reflect in any way the final recommendations of the Consultant, Council or Technical Advisory Group. There is further information and evaluation to carry out on the remaining options that has potential to further differentiate them. Specifically, the staging strategy for each of the four options (and any composite or hybrid options) is still being complete. This will have an impact not only on the capital cost estimates (or the P90 cost) but also on the ‘Present Value’ analysis that is occurring.

It is important to note that there are a number of risks associated with each of the remaining options and composite/hybrid options. The Lower Maungakotukutuku site for example is still being investigated in terms of geotechnical conditions. This information will only be available by early July 2010.

Overall, the options recommended for placing on hold at this stage also have a number of high level consenting, design and construction risks, so there is a high degree of confidence that holding further investigations of these options is the right decision at this stage. In particular, this will provide some certainty to those landowners and affected parties that have concerns.

The final executive summary report on all of the ranked options will include a final analysis of all of these risks, costs and pros/cons to allow Council to make an informed decision on the best in-catchment solution.

Kāpiti Water Supply Project

Stage 3 - Ranked Options Report
Option Shortlisting



17th June 2010

Purpose of the Option Shortlisting Report

“seeks a decision from Council to place on hold investigations on the options that are unlikely to be within the Water Supply Project budget”.

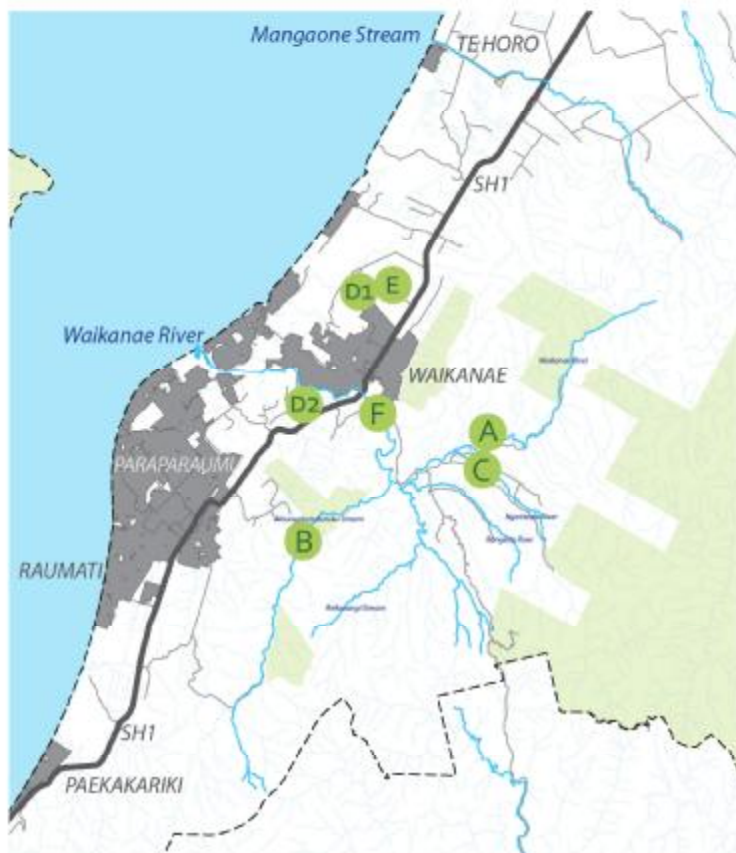


Options/Solutions

§ Eight in-catchment options carried forward into Stage 3

Solution #	Option Name
A	Kapakapanui Dam
B	Lower Maungakotukutuku Dam
C	Ngatiawa Dam
D1 (1)	Extended Waikanae Borefield & Storage (2 ponds)
D1 (2)	Extended Waikanae Borefield & Storage (1 pond)
D2	Extended Waikanae Borefield & Treatment
E	Aquifer Storage & Recovery
F	River Recharge with Groundwater

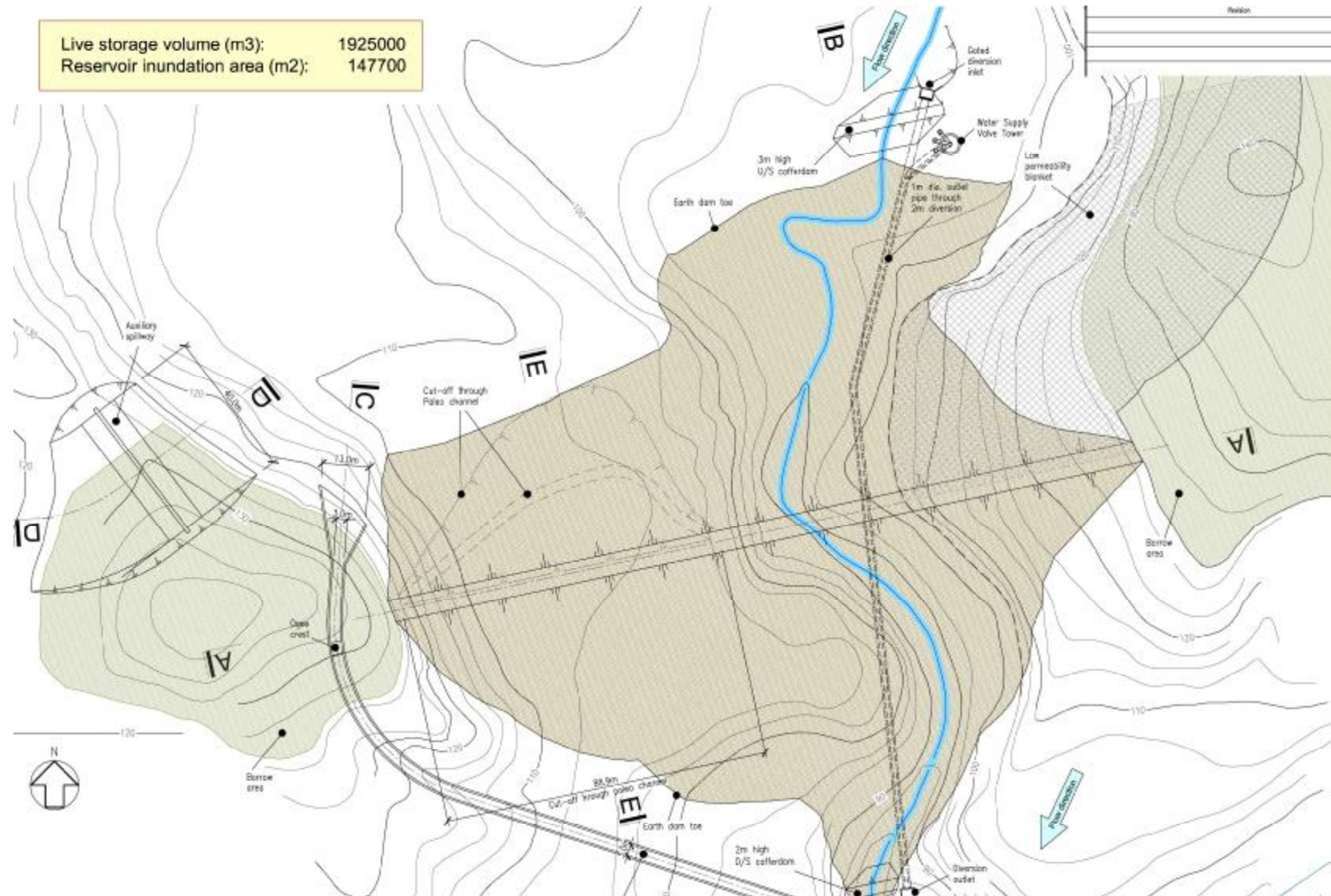
Location Map



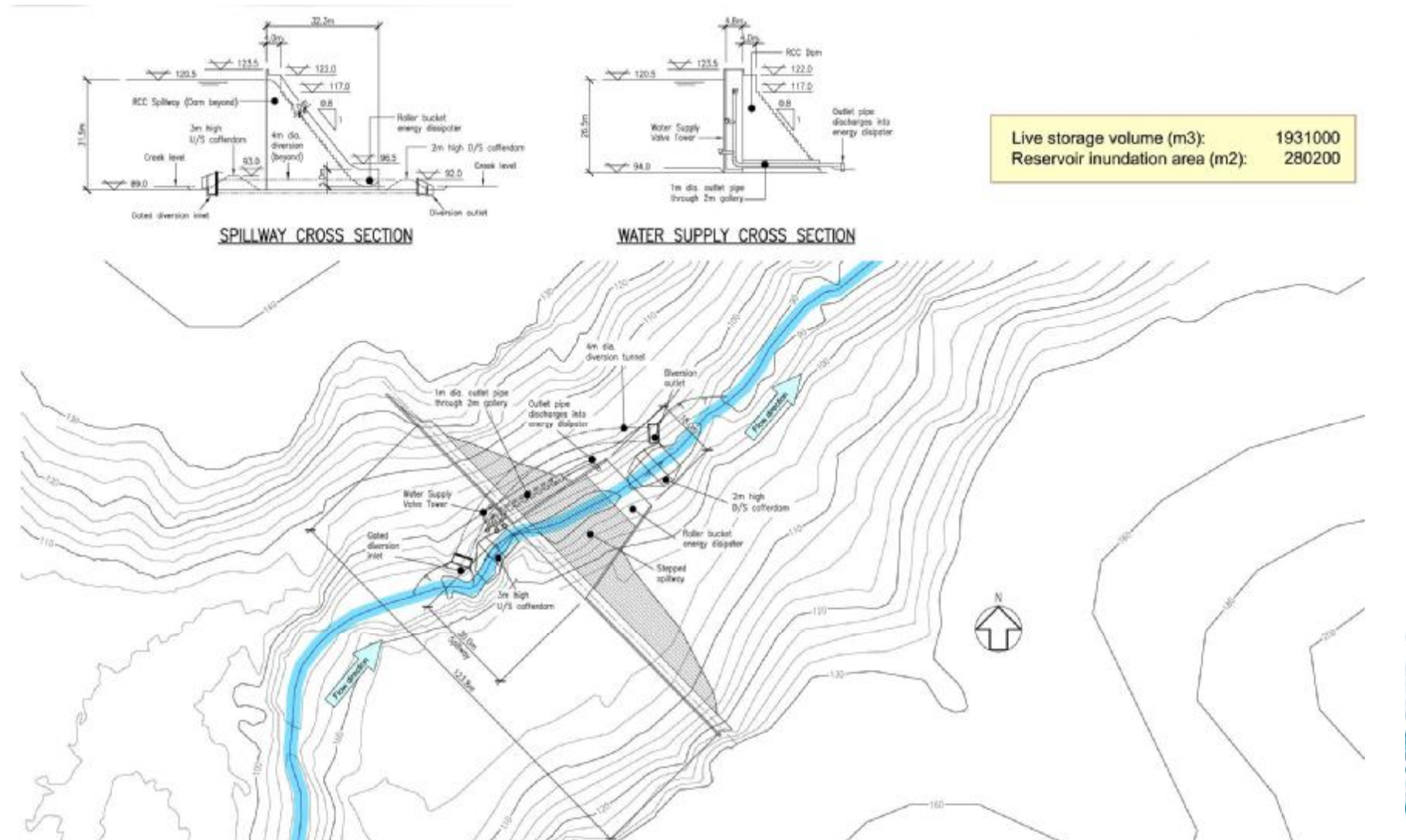
- A Kapakapanui Dam
- B Lower Maungakotukutuku Dam
- C Ngatiawa Dam
- D1 Extended Waikanae Borefield & Storage (2 scenarios)
- D2 Extended Waikanae Borefield & Treatment
- E Aquifer Storage and Recovery
- F Groundwater River with Recharge



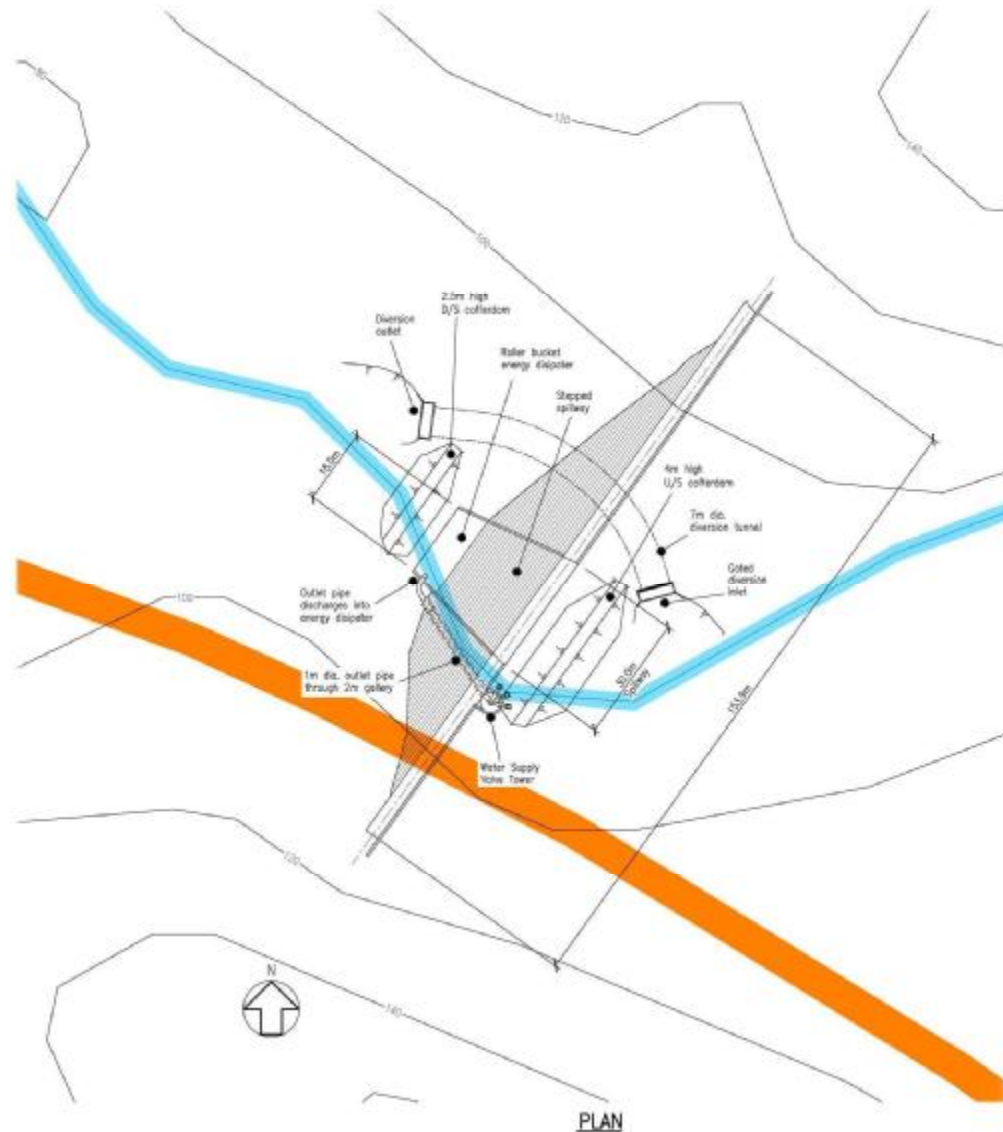
A: Kapakapanui Dam



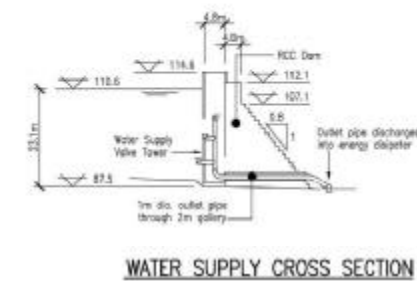
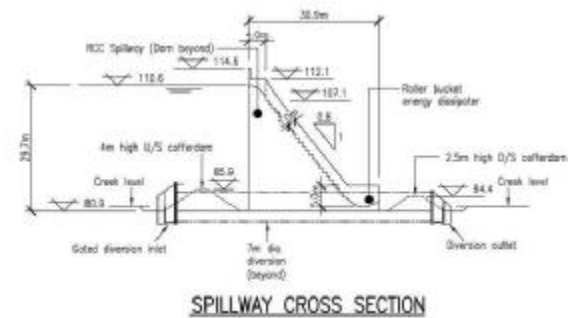
B: Lower Maungakotukutuku Dam



C: Ngatiawa Dam

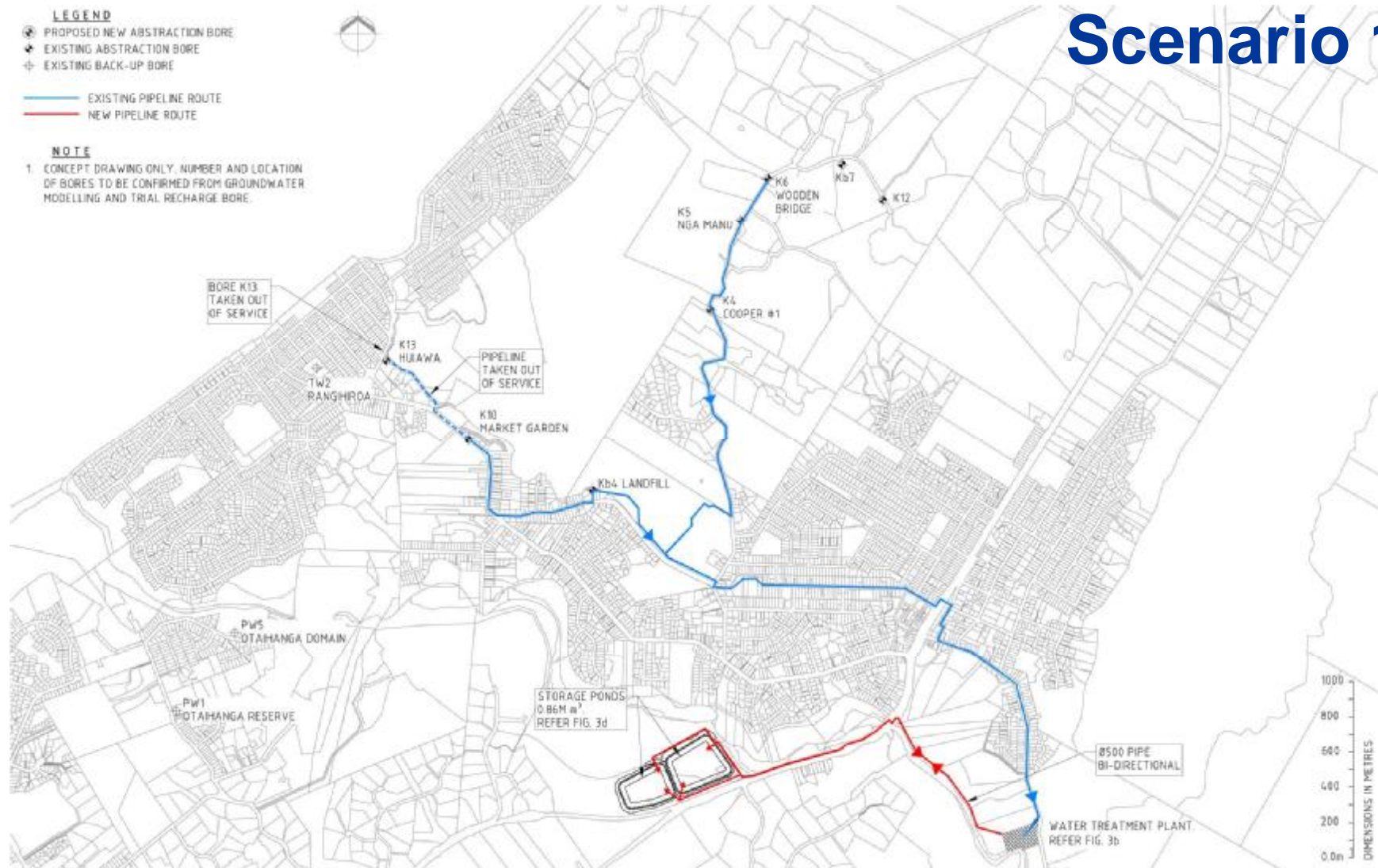


Live storage volume (m3): 2031708
Reservoir inundation area (m2): 198172



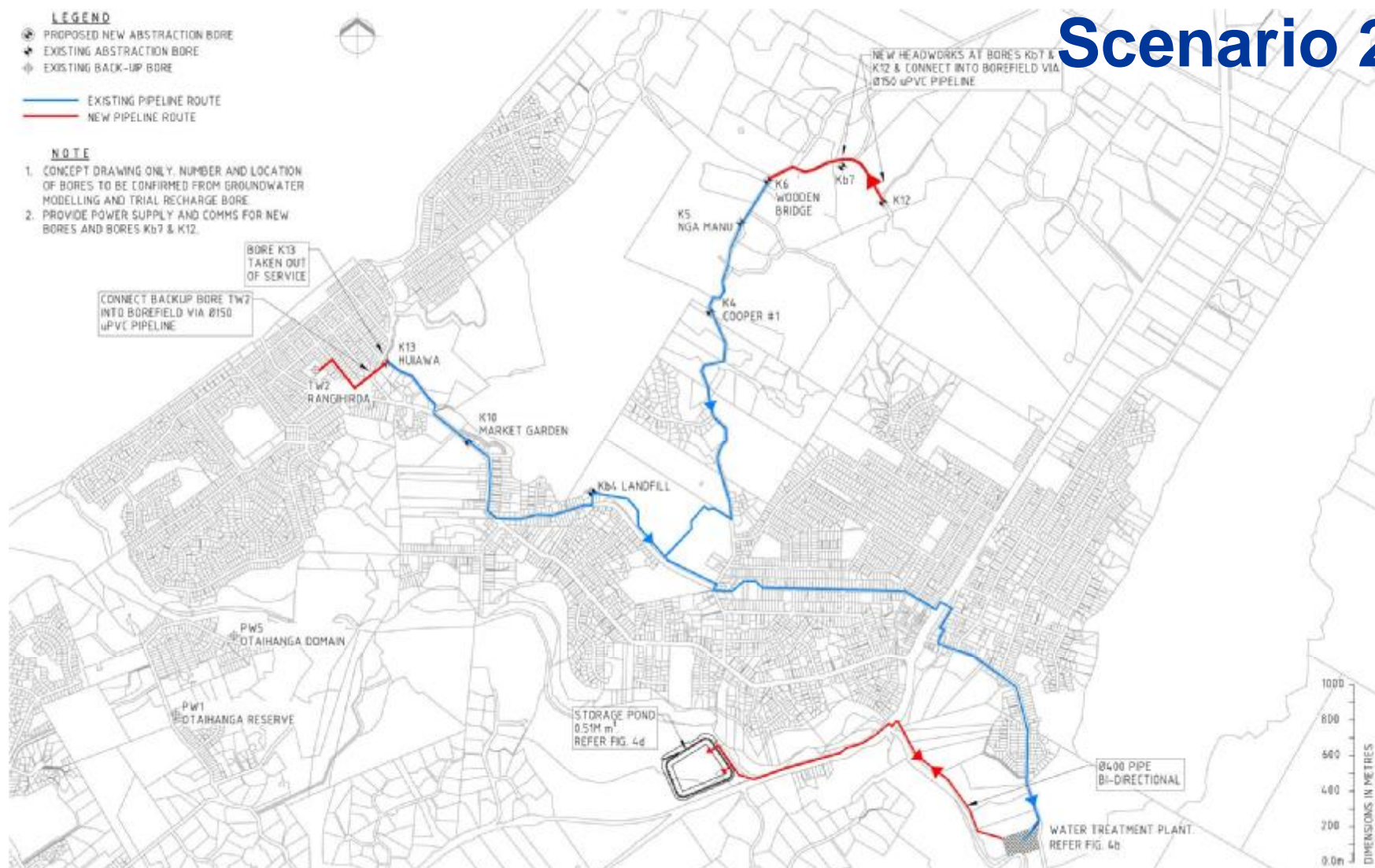
D1: Extended Waikanae Borefield & Storage

Scenario 1

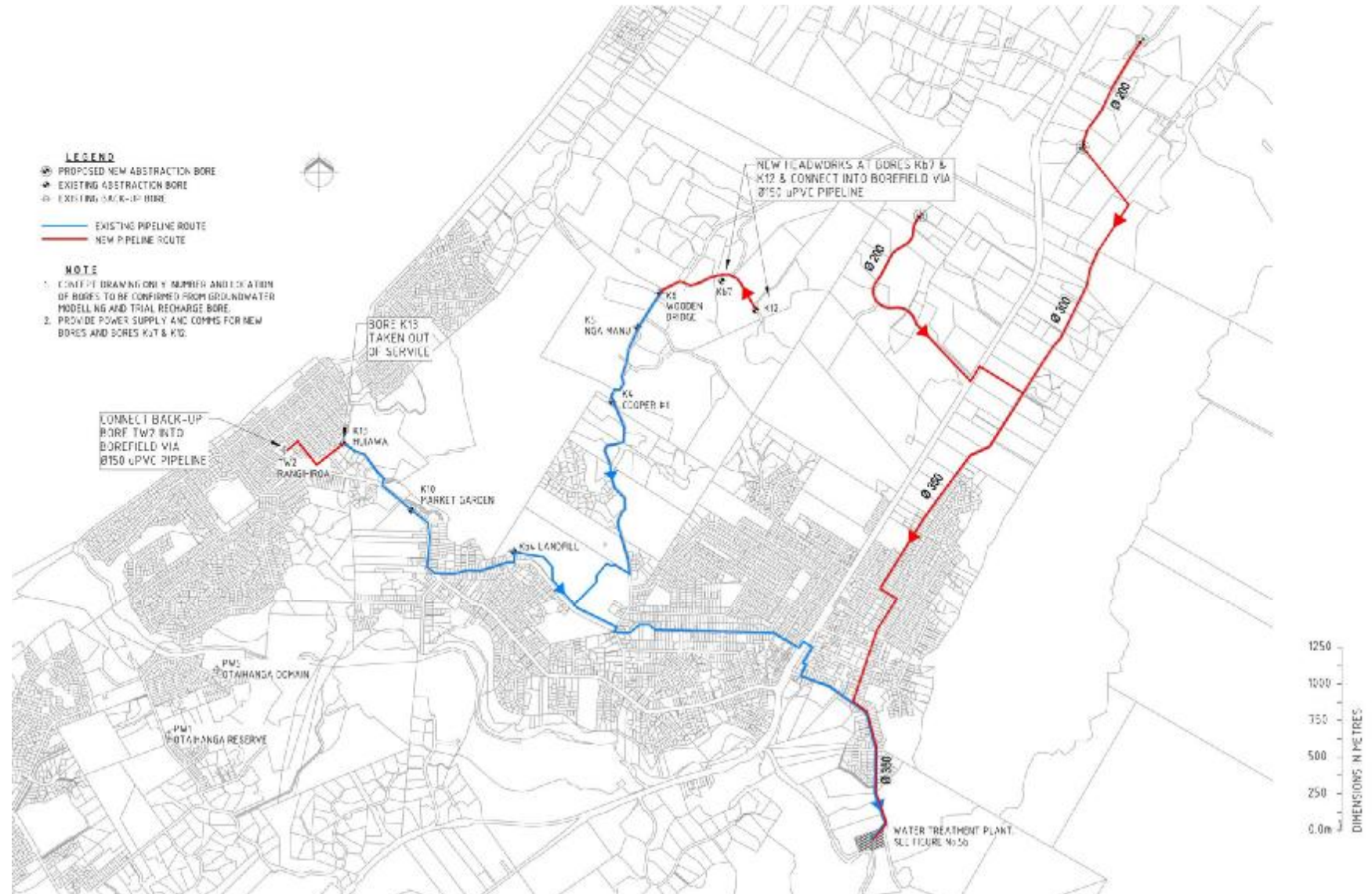


D1: Extended Waikanae Borefield & Storage

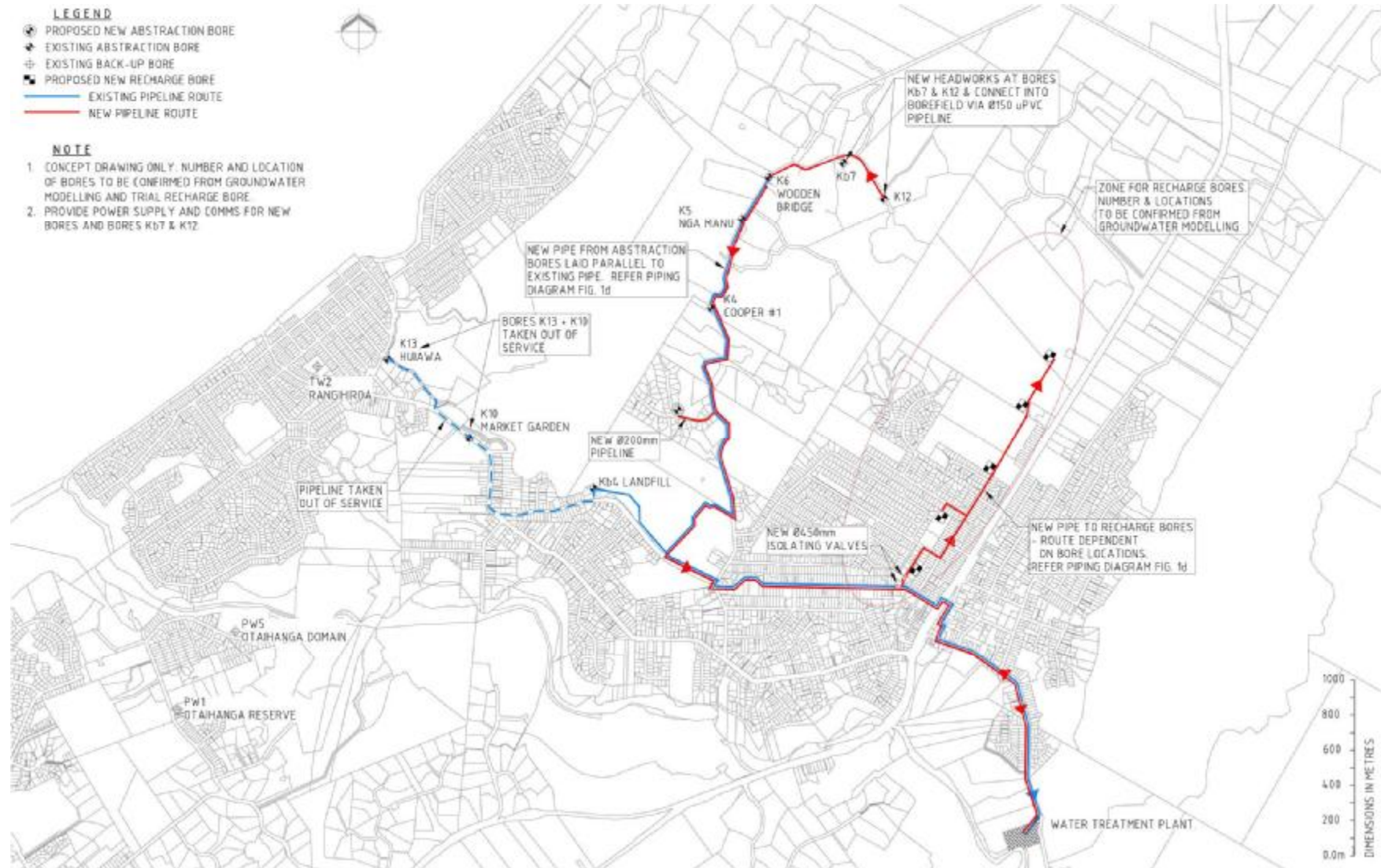
Scenario 2



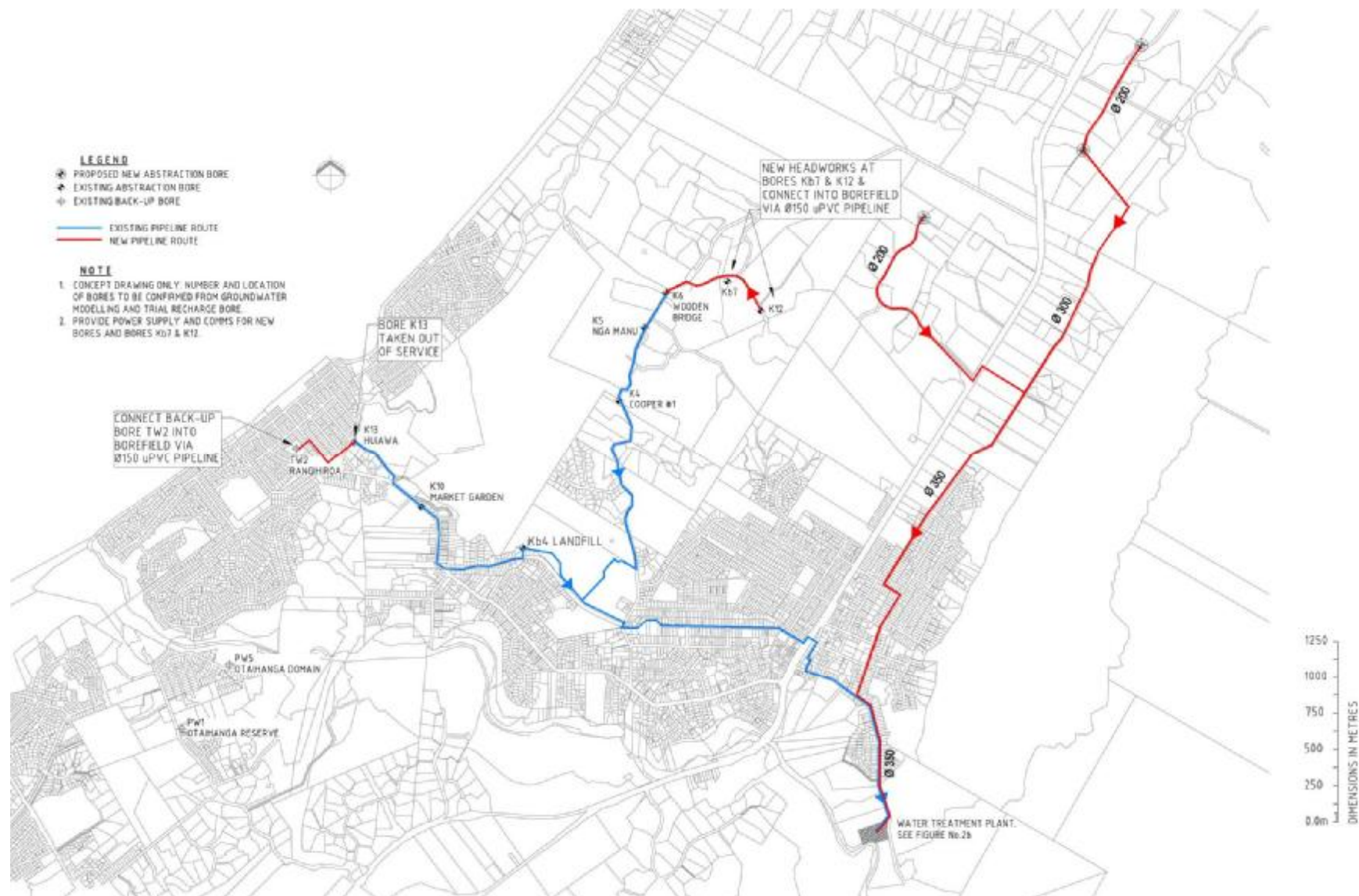
D2: Extended Waikanae Borefield & Treatment



E: Aquifer Storage & Recovery



F: River Recharge with Groundwater



Scope of Work in Stage 3

- § Gathering of information
- § Stakeholder consultation
- § Specific technical investigations
- § Modelling of surface water and groundwater
- § Concept design of each solution
- § Cost estimates
 - base capital costs
 - risk based cost analysis (P90 estimate)



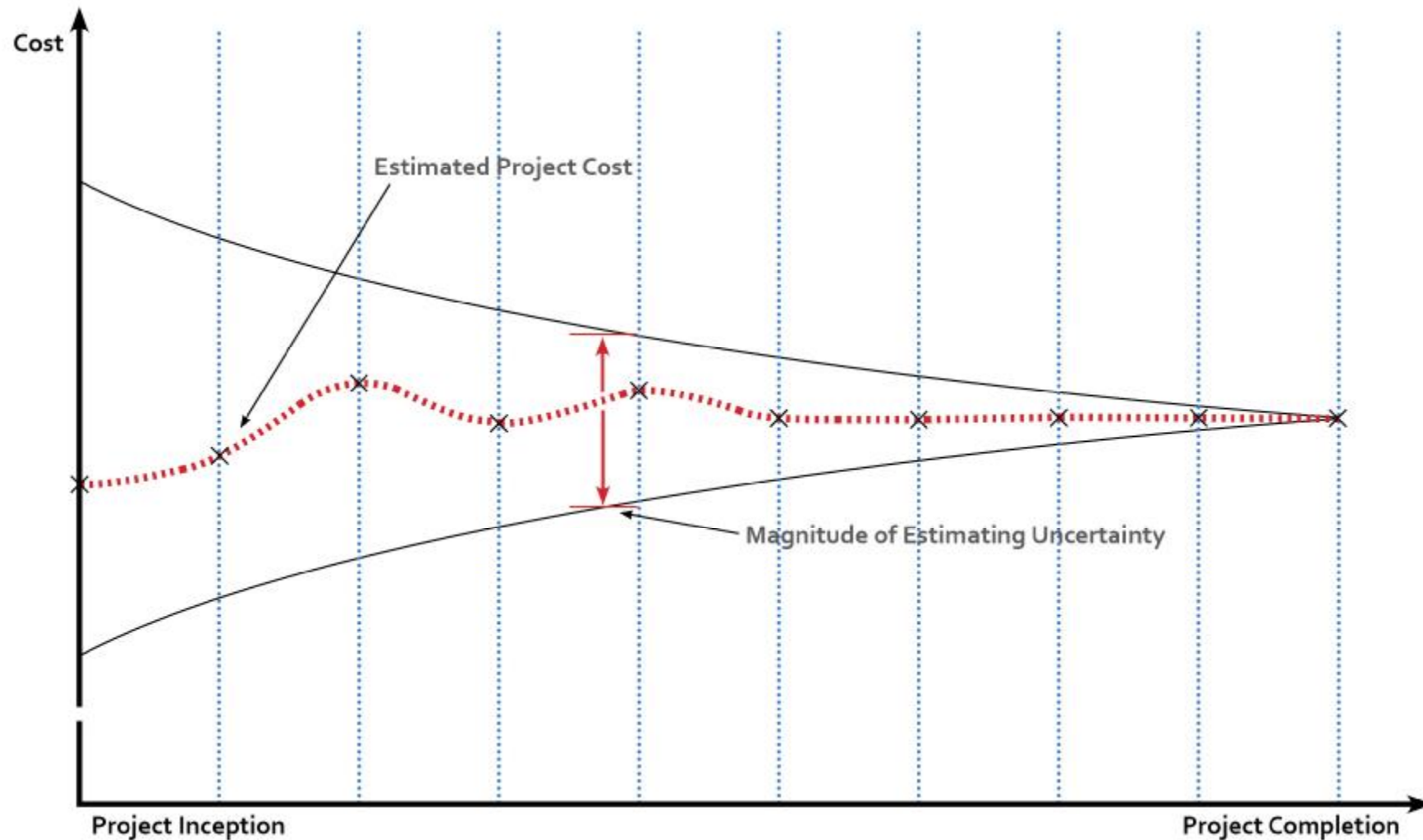
Technical Investigations

- § Geotechnical investigations and drilling at two dam sites
- § Surface water modelling of the Waikanae River
- § Pump testing existing Waikanae Borefield
- § Water taste testing of different water sources
- § Terrestrial ecology
- § Aquatic (in-stream) ecology
- § Water treatment option reviews
- § Preliminary review of planning/regulatory requirements, including environmental effects to be considered



Cost Estimates

Perceived degree of financial risk during the life cycle of a project



Cost Estimates

Option Shortlisting Report (this report)

- q Fees & investigations
- q Land valuations
- q Capital costs
- q Design & management fees
- q 25% contingency

Ranked Options Report - P90 (and P50 & P75) estimates (29 July meeting)

- q Fees & investigations
- q Capital and land costs (risk based)
- q Qualitative costs for other risks
- q Design & management fees
- q Scope contingency
- q Operational & maintenance costs

Cost Estimates - Basis

- § Capital costs only (in NZ dollars)
- § Cost base date of May 2010
- § Traditional project delivery model utilising New Zealand design and construction resources
- § Design and management fees are based on 12% of the overall capital cost estimate
- § Land valuations as provided by registered valuer



Cost Estimates - Rates

- § First principles (rates are built up from the various inputs needed to supply, transport, construct, fix, etc. of a specific item):
 - Beca & Damwatch databases
 - Rawlinson Construction Handbook, 2009
 - Costs from suppliers
- § Check with comparison of similar current and historic projects
- § Preliminary & general, and contractor's overheads/profits



Project Budget Available

- § LTCCP
- § Water supply project: \$23 million (\$24.8 million in 2015)
- § Upgrading work at WTP – depending upon scope some funding may be available



Base Project Cost Estimates

	Solution-A Kapakapanui	Solution-B Maunga-kotukutuku	Solution-C Ngatiawa	Solution-D1 Borefield & Storage (Lge)	Solution-D1 Borefield & Storage (Sml)	Solution-D2 Borefield & Treatment	Solution-E ASR	Solution-F River-Recharge
Fees & Investigation	\$2,000,000	\$2,000,000	\$2,000,000	\$2,000,000	\$2,000,000	\$2,000,000	\$2,000,000	\$2,000,000
Land Value	\$370,000	\$690,000	\$2,310,000	\$4,880,000	\$3,000,000	\$0	\$0	\$0
Capital Costs	\$29,320,000	\$16,040,000	\$19,720,000	\$35,190,000	\$26,480,000	\$19,790,000	\$14,780,000	\$12,110,000
Design and Management	\$3,520,000	\$1,930,000	\$2,370,000	\$4,220,000	\$3,180,000	\$2,370,000	\$1,770,000	\$1,450,000
25% Contingency	\$8,210,000	\$4,490,000	\$5,520,000	\$9,850,000	\$7,410,000	\$5,540,000	\$4,140,000	\$3,390,000
TOTAL	\$43,420,000	\$25,150,000	\$31,920,000	\$56,140,000	\$42,070,000	\$29,700,000	\$22,690,000	\$18,950,000



Basis of Shortlisting

§ Three solutions well above project budget (over \$40M):

- A: Kapakapanui Dam
- D1: Waikanae Borefield and Storage (both scenarios)

§ One solution – C: Ngatiawa Dam

- High cost (over \$30M)
- Has social and ecological impacts



Shortlisting

	Solution-A Kapakapanui	Solution-B Maunga-kotukutuku	Solution-C Ngatiawa	Solution-D1 Borefield & Storage (Lge)	Solution-D1 Borefield & Storage (Sml)	Solution-D2 Borefield & Treatment	Solution-E ASR	Solution-F River-Recharge
Fees & Investigation	\$2,000,000	\$2,000,000	\$2,000,000	\$2,000,000	\$2,000,000	\$2,000,000	\$2,000,000	\$2,000,000
Land Value	\$370,000	\$690,000	\$2,310,000	\$4,880,000	\$3,000,000	\$0	\$0	\$0
Capital Cost	\$29,320,000	\$16,040,000	\$19,720,000	\$35,190,000	\$26,480,000	\$19,790,000	\$14,780,000	\$12,110,000
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TOTAL	\$43,420,000	\$25,150,000	\$31,920,000	\$56,140,000	\$42,070,000	\$29,700,000	\$22,690,000	\$18,950,000
Recommendation	Place on Hold	Continued	Place on Hold	Place on Hold	Place on Hold	Continued	Continued	Continued

Conclusion & Recommendations

- § Concept designs completed
- § Investigations yet to be completed:
 - Geotechnical drilling at Lower Maungakotukutuku
 - Groundwater modelling
- § Risk based cost estimates and cost effectiveness study being finalised
- § Four solutions not shortlisted – recommended to be put on hold:
 - A: Kapakapanui Dam
 - C: Ngatiawa Dam
 - D1: Waikanae Borefield and Storage (both scenarios)

