‘Water used for domestic purposes’ in Gisborne district:

Application of the river values assessment system (RiVAS and RiVAS+)

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Executive Summary

The River Values Assessment System (RiVAS) was applied to the river value 'water use for domestic purposes' in Gisborne District, to identify rivers of relatively higher and lower importance for this value. Two national level experts in the field assisted with identifying an initial list of primary indicators that best describe the value – this list was subsequently revised by the local expert value and indicators attached. The final list of six primary indicators is: 1. Number of residents supplied; 2. Quantity and reliability of supply; 3. Chemical/ physical; 4. Microbiological; 5. Climate change; and 6. Cost. Ten rivers were assessed by an expert panel: two, the Te Arai and the Mangapoike Dams stream complex are of national significance mainly because they are the principal water supply for Gisborne city. Three rivers were assessed for their restoration potential via RiVAS+, namely the Waiapu, Mangahauini and Waitakeao. The same two interventions were identified for each, i.e.,

- Improve riparian habitat - Pest control
- Enhance water quality - Remove/fence out stock.

'Investing' in these interventions would improve the score for each river but not move them out of their local significance classification.

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Chapter 1
Introduction

1.1 Purpose

This report presents an application of the River Values Assessment System for existing value (RiVAS) and for potential value (RiVAS+) to water used for domestic purposes in the Gisborne District, undertaken in November 2011 (see Appendix 1 for a brief summary of the system). There are three parts to this project:

1. Two national level experts (Peter Whitehouse, Water New Zealand, and Jim Bradley, MWH) helped identify an initial set of primary attributes, relevant indicators and weightings;
2. A workshop of regional experts was held in Gisborne on 28th November 2011 to apply the method, including refining the primary attribute set; and
3. The national level experts and GDC staff (not involved in the expert panel) then reviewed the report and their comments were integrated as appropriate by Ken Hughey, and finally checked by key report authors.

This Gisborne District water used for domestic purposes report needs to be read in conjunction with the RiVAS method (see Hughey et al. 2010) and with Hughey et al. (2011) re RiVAS+. The report will be used alongside others (e.g., Harris 2012, Bull et al. 2012) in development of the Water Plan.

1.2 Preparatory step: Establish an expert panel and identify peer reviewers

The process for developing the RiVAS application for water used for domestic purposes differed from other RiVAS applications. While an 'ad hoc' set of national experts (see acknowledgements) helped develop an initial set of primary attributes, peer review of this step did not occur until the local Expert Panel considered them and developed and refined the set further. The process changed because of limited resource availability for this project. The Regional Expert Panel for developing the water used for domestic purposes method for application in the Gisborne District comprised Bruce Duncan (Tairāwhiti District Health) and the following Gisborne District Council staff: Peter Higgs, Marcus Koll, Dennis Crone, Judith Robertson and Keriana Wilcox-Taylor. The panel were advised by Ken Hughey (Lincoln University) who managed the case study application in GDC. Credentials of the Expert Panel are provided in Appendix 2.

1.3 Context

River value context for water used for domestic purposes in Gisborne District

There are challenges around providing water of high quality for domestic use as the rivers that discharge to the East Coast are predominantly slow-flowing through wide, open valleys, become silt-laden after heavy rain, and experience low summer flows. The population of Gisborne District is approximately 45,000. The population of Gisborne City is approximately 33,000. The Te Arai River has a catchment of approximately 189 km², located to the south-east of Gisborne. The upper catchment (1,050 ha) is in native bush and is managed by the Gisborne District Council as the catchment for the main water supply to Gisborne City. Despite being located some 40km from the City this is considered to be the

best source of quality water for domestic use for the City. The rest of the district is sparsely populated meaning reticulation of water for domestic use from this source is generally not feasible and other sources of water need to be found including rivers. Some coastal streams, particularly during summer suffer from occasional extreme low flows and are thus unreliable sources of water.

Data

Work in advance of the expert panel meeting to collate existing data, indicated that empirical and expert knowledge primarily held by Gisborne DC, would be the primary data source. Considerable data exist for all existing water supplies, although not always in a form useable for an evaluation of this type, and not necessarily for tangata whenua aspirations.

Chapter 2
Application of the method

There are two parts of the system: RiVAS is applied to existing value in steps 1-9 and RiVAS+ to potential value in steps 10-14.

Step 1: Define river value categories and river segments

River value categories
All rivers for this value have been treated primarily in the same way, except where distinctive indicators for the prime attributes (see steps 3 and 4 below) can be identified and used appropriately.

River segments
For the purposes of this analysis we generally consider catchments as a whole.

Following a preliminary scanning exercise many rivers within the Gisborne District were excluded from further assessment. Criteria considered as part of this preliminary scanning were that the river or stream has:

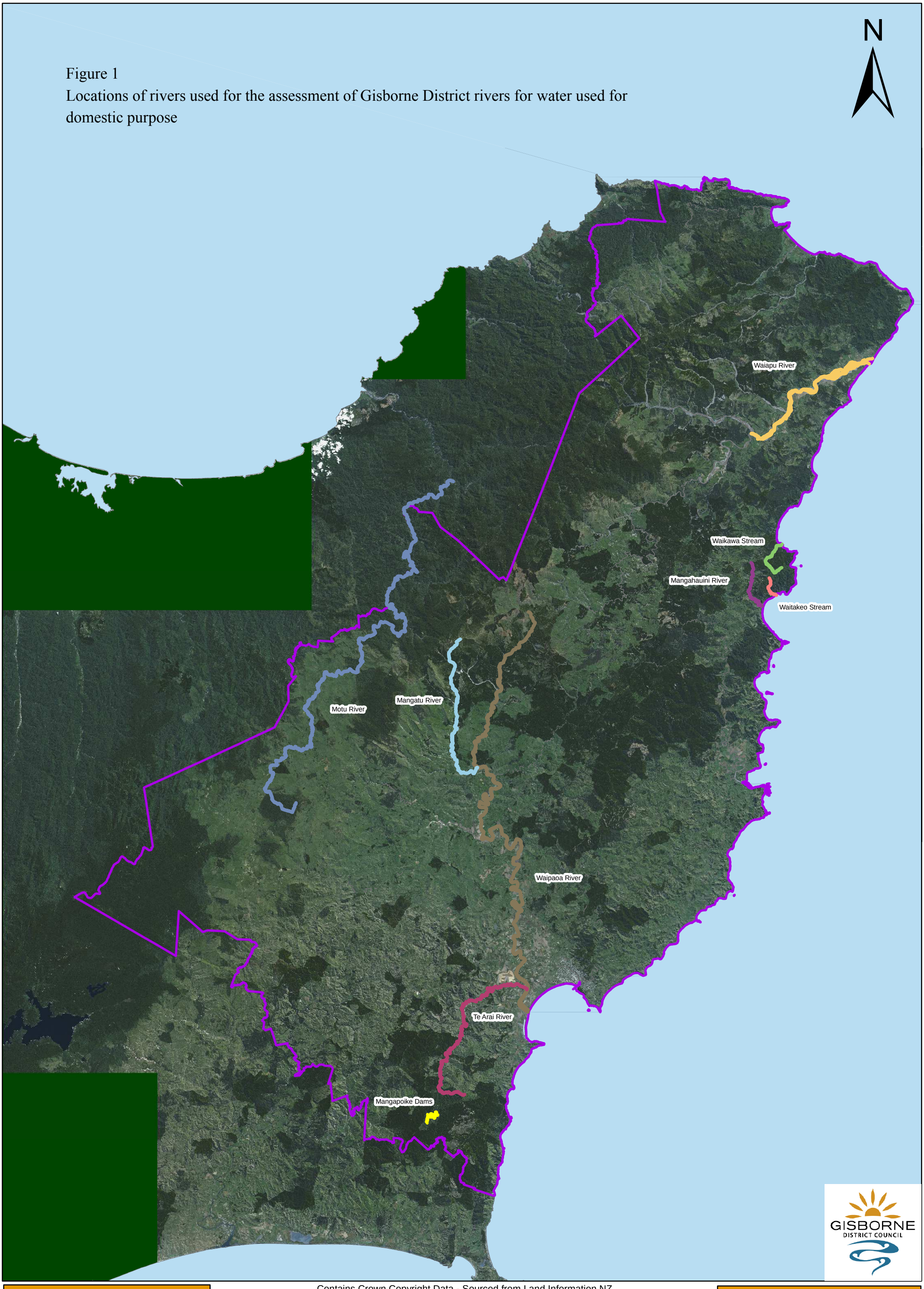
- no known or suspected use as a source of water for domestic purposes;
- no real potential to be used in the future.

There is a large number of rivers in this list, thus it is easier to examine those that were evaluated (see Figure 1).

Other Considerations
Tangata whenua considerations are clearly important but we did not have the information or other resource capacity to address this issue. In particular we were mindful of two issues: first, it is likely all primary attributes contribute to mauri and are therefore subsets thereof; and second, mauri or perhaps more appropriately waiora in this case needs separate consideration as a standalone attribute cluster. Further work is required in this area.

Outcomes
Use whole catchments as the primary data set and populate with existing data and/or expert panel considerations.

Figure 1
Locations of rivers used for the assessment of Gisborne District rivers for water used for domestic purpose



Planning Section

Scale 1:500,000

Step 2: Identify attributes

An earlier process used input from several external (to the Gisborne area) experts to generate an initial list of attributes for consideration by the expert panel. Appendix 3 presents the full list of attributes considered.

Step 3: Select and describe primary attributes

Seven primary attributes were ultimately identified (and which are highlighted in bold in Appendix 3) by the expert panel. There was considerable discussion about the rationale for each of these and this is summarised in Appendix 3. However, one, waiora, has been excluded from this analysis. The Council may consider this attribute in other tangata whenua values work being carried out. It is envisaged that results from this work would be added to the data in this report.

Step 4: Identify indicators

Indicators for each primary attribute were identified by the Expert Panel and are shown also in Appendix 3.

One indicator for each primary attribute was identified, using SMARTA criteria (see Hughey et al. 2010). Appendix 4 shows the assessment of each indicator against the SMARTA criteria.

Step 5: Determine indicator thresholds

Thresholds are applied to an indicator to determine high, medium and low relative importance for that indicator. Thresholds are defined by real data (e.g., for recreational fishing <1,000 angler days per annum = relatively low importance, or expert panel judgements, e.g., cost of supplying water on a relative scale) for each indicator and were identified by the Expert Panel. Because water used for domestic purposes is comparatively data rich (c.f. some other river values), this step was informed by 'hard' data (albeit much from expert panel assessment for this region) for most of the indicators.

Step 6: Apply indicators and indicator thresholds

Most indicators were assessed using expert panel based quantitative data, or interpretation of quantitative data by the Expert Panel (see Appendix 2) - this step involved entering data from the relevant data sources (primarily the experts).

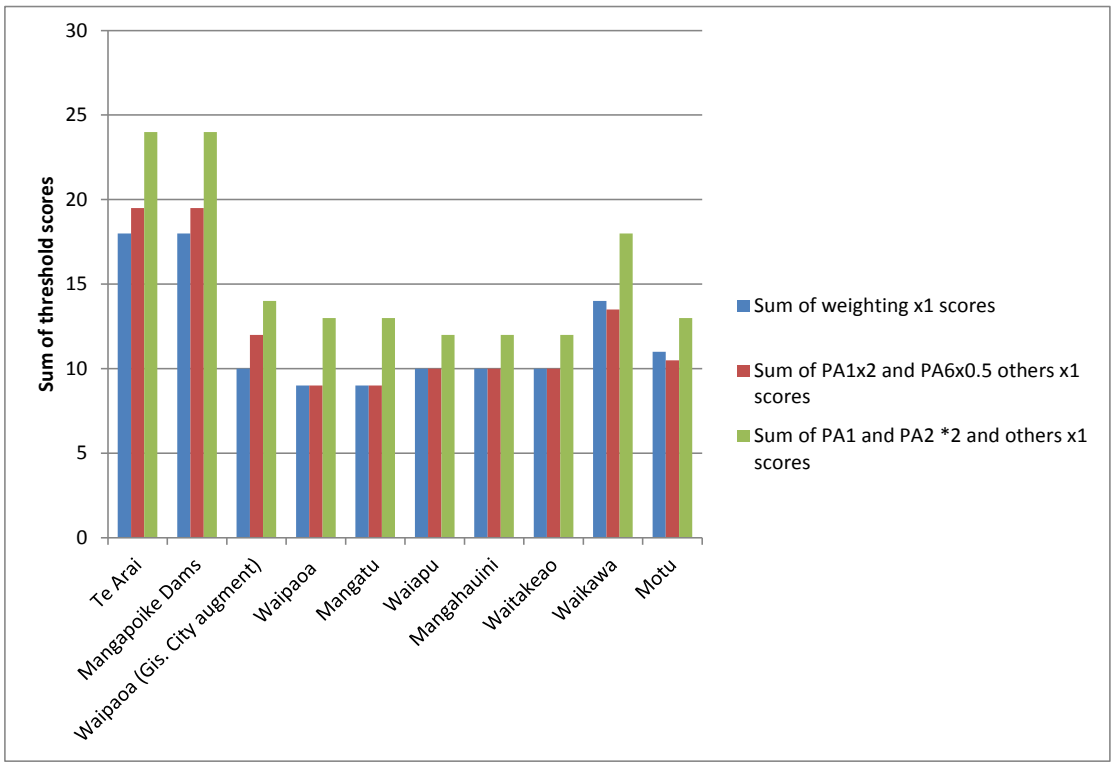
Step 7: Weighting of primary attributes

There was considerable discussion about the need to weight particular attributes, something that has occurred in the irrigation application (see Harris 2012). Three different weightings were trialled:

- Primary attribute (PA) 1 – population supplied (x2) and Primary attribute 6 – climate change (x0.5) with all others at 1
- Primary attribute 1 – population supplied (x2) and Primary attribute 2 – quantity and reliability of supply (x2) with all others at 1
- All weightings x1.

Analysis of the findings (Figure 2) shows that while scores obviously changed there was little to no change in the distribution pattern. The panel therefore decided to retain equal weightings.

Figure 2
Sensitivity analysis of different weightings



Outcome
Equal weighting

Step 8: Determine river significance

Step 8a: Rank rivers
The spreadsheet in Appendix 5 was used to sum the indicator threshold scores for each river.

Step 8b: Identify river significance
Determining criteria for significance assessments is challenging. The expert panel decided that a combination of population size and total score across the indicators would be appropriate for the high/national significance ranking. While this decision was relatively straight forward it was far more challenging to design criteria around medium/regional and local significance. Ultimately, again, the panel decided a population criterion would be helpful for regional and decided, somewhat arbitrarily, to define a community as >100 people and to link this also to a sum of scores between national and local. Thus, local was where the sum of scores was <11 and obviously the community supplied is <100 people. The panel observed that such criteria are likely not perfect but provide a useful insight into identifying priorities for management.

Based on the above and using the list from Step 8a, the Expert Panel closely examined the rivers, and their attribute scores. The following criteria were applied to defining importance within the Appendix 5 evaluation:

High or National significance:

Criterion 1: *Population supplied* – if any river supplied a population of more than 20,000 (for a significant >20% of people); or

Criterion 2: total score is 15 or more then national significance.

Medium or Regional significance:

Rivers supplying 100% of the water supply for the total community population where the community is >100 people

Those rivers in the table not defined as nationally or locally significant, and scoring 11-14.

Local significance:

A score of <11, where otherwise not categorised as regional above.

Outcome

A list of rivers ranked by a scoring system from highest to lowest, represents an initial significance ranking list. See Appendix 5.

Rivers are identified as significant at the national, regional and local level - see Appendix 5.

Rivers in the Gisborne District not listed have either very low value to 'water used for domestic purposes' rivers or streams or are of unknown value.

Step 9: Outline other factors relevant to the assessment of significance

Perhaps the most telling other issue concerns the primary attribute, waiora. Water used for domestic purposes is very important to Maori and more work is necessary in this context.

Outcome

Gisborne DC will consider the waiora concept further in consultation with tangata whenua through the development of the Water Plan.

Chapter 3
Application of the RiVAS+ Methodology

Step 10: Identify rivers and interventions

Rivers for potential state assessment

The river sections identified in the RiVAS assessment (see Appendix 5) were used as the basis for the RiVAS+ analysis. RiVAS+ involves a preliminary evaluation of the potential of a river to achieve a higher score and importance ranking if selected management interventions are undertaken. No explicit consideration of cost effectiveness is made but the expert panel is advised to suggest only realistic interventions. Only two interventions are applied to each river and each is weighted as one for the evaluation. The Expert Panel considered every river section for its potential value.

No new river reaches were added that represent rivers with potential value for water used for domestic purposes but hold little current value.

Potential interventions

Means by which river conditions may be enhanced are listed in Table 1. Note that the intervention list sometimes increases with further applications of RiVAS+ and when used for other values. Care therefore needs to be taken when looking at the numeric codes (e.g., 2d, 3a) to ensure they refer to the same intervention.

Table 1
Potential interventions to enhance river values

1. Enhance access		
	a. Helicopter access	
	b. Vehicle access	
	c. Boat access	
	d. Foot access	
2. Enhance flow		
	a. Increase minimum	
	b. Stabilise (around targeted specific flow)	
	c. More natural variability	
	d. Restore flood flows	
	e. Transfer water between catchments	
3. Improve bed & in-stream habitat		
	a. Maintain channel works (e.g. groynes, other structures) that enhance worth	
	b. Remove channel works (groynes, stop banks etc) that detract from worth	
	c. Control weeds (in-stream, including active river bed) to enhance worth	
	d. Remove hazards (e.g., wire, trees, old structures, forestry slash)	
	e. Leave woody debris in river that enhance worth	
4. Remove or mitigate fish barriers		
	a. Culverts	
	b. Dams	
	c. Flood gates	

	d. Chemical	
5. Set back stopbanks		
6. Improve riparian habitat		
	a. Weed & pest control	
	b. Native revegetation	
	c. Remove litter	
7. Enhance water quality		
	a. Remove/fence out stock	
	b. Reduce non-point source nutrient pollution (e.g., farm nutrient budgets)	
	c. Reduce point source pollution (e.g., mining waste)	
	d. Reduce sediment input (e.g., forest management practices)	
8. Stock with fish		
9. Provide amenities		
	a. Boat launching facilities	
	b. Car parking	
	c. Toilets	
	d. Storage facilities (for kayaks etc)	
	e. Artificial hydraulic feature (for kayakers, swimmers, anglers)	
		i) Slalom course
		ii) Play wave
		iii) Swimming hole
	f. Interpretive signage	
	g. Riverside track (for access)	
10. Construct water storage		
	a. In-river	
	b. Out-of-river	
11. Develop a run-of-the-river diversion		
12. Provide telemetered flow monitoring (& communicate readings)		

Outcomes

Appendix 6 lists the Gisborne District river sections used for the RiVAS+ assessment.

Table 1 and Appendix 6 record potential interventions.

Step 11: Apply indicators and indicator thresholds for potential value

Taking each river in turn, the Expert Panel considered which interventions were relevant to that river. These were recorded in Appendix 6.

Then the Panel considered the net effect of these interventions upon the value of the river to water used for domestic purposes. The degree or extent of intervention was discussed. The RiVAS+ methodology calls for the panel to select the two most important interventions for each river, and for these to be practical and feasible rather than ideal. As only two interventions for each of the four river sections where potential changes could occur were recorded this task was not necessary.

The effect of the potential interventions was assessed for each indicator by considering the current score (from RiVAS) and identifying whether the score would change as a result of the interventions.

By definition, there are no raw data for water used for domestic purposes based on potential future conditions of a river, so the Panel focused primarily on the scores. Occasionally, the Panel considered whether interventions would be likely to shift the raw data over the relevant threshold value to a higher score.

The new scores were recorded. Where the Panel believed the interventions were likely to enhance (or degrade) river conditions for water used for domestic purposes, but that the score itself would not change, '+' or '-' was recorded, indicating a positive or negative shift respectively. Where no change was thought likely, the RIVAS score was not altered (cells were left blank for convenience).

As may be expected, rivers with high current value did not change – rivers with lower current value offer the greatest opportunities for enhancement.

Outcome

Appendix 6 records the indicator scores for potential value.

Step 12: Weight the primary attributes for potential value

Because no attributes or indicators were altered for the RIVAS exercise, weightings were not revisited (i.e. an equal weighting regime was automatically applied to the RIVAS+ exercise).

Outcome

The RIVAS weighting regime (equal weighting) applied.

Step 13: Determine river potential value

The scores were summed for each river. A score of 0.5 was given to each '+' and '-' (i.e. +0.5 or -0.5).

The expert panel considered that of the 10 rivers evaluated in RiVAS only four, namely:

- Waiapu;
- Mangahauini;
- Waitakeao; and
- Motu

would benefit from management interventions (Appendix 6). All four altered their sum scores, all in a positive direction. However, no river shifted by more than one numeric point, i.e., by more than 1.0, and no river changed in terms of its overall significance ranking. The same interventions were always identified for enhancing water used for domestic purposes value, i.e.,

- 6b. Improve riparian habitat - Pest control
- 7a. Enhance water quality - Remove/fence out stock.

Outcome

Appendix 6 provides a list of rivers ranked by their potential increase in value for water used for domestic purposes, with possible interventions identified for each river.

Some additional comments made by the expert panel from the RiVAS+ exercise were:

- It is better to spend capital on rain water tank storage and guttering, given demographics of the region

- Keen to see springs protected, i.e., tidy and clean
- Stock control is considered to be the single most useful intervention. Riparian protection is also important
- Could GPS locations of safe drinking water spots be recorded and put in a plan/register?

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Appendix 1
Brief summary of the RiVAS and RiVAS+ system

River values assessment system (RiVAS and RiVAS+): a brief overview

Purpose

The River Values Assessment System (RiVAS) is a tool that can be used to assess a set of rivers for a particular value (e.g. native birds, whitewater kayaking, irrigation). It results in a ranked list of the rivers, sorted by importance for that value.

RiVAS provides a standardised method that can be applied to the wide range of river values. However, it does not compare *across* values. A new method (RiVAS+) provides for this cross-value comparison, using RiVAS as its basic building block.

Approach

RiVAS was developed by a team led by Prof Ken Hughey (Lincoln University) and Mary-Anne Baker (Tasman District Council). Initially conceived in 2009, it has now been applied to multiple river values in various regions. The method:

- Uses an expert panel and the best available information – in some cases this means almost no quantitative scientific information (e.g. river swimming), while in others it's mainly based on scientific data (e.g. native birds).
- Defines assessment criteria by selecting key attributes of the value for which indicators are identified – examples of attributes are aspects of the river condition required by the value (e.g. parameters of water quality, flow requirements), use parameters (e.g., numbers of users) and so on.
- Selects indicators for each attribute, scores them (using actual data or Expert Panel estimates), and turns those into numeric scores.
- Sums these numeric scores (sometimes weighted where particular criteria are more or less important than others) so that each river has a single score on which it can be ranked.
- Translates the ranked list of rivers into classes of importance (high, medium, low) or significance (national, regional, local) using predetermined criteria.
- Results in a list of rivers ranked for that river value and assigned an importance/significance category.

The RiVAS approach has been applied to ten river values to date: salmonid angling, whitewater kayaking, river swimming, native birds, native fish, natural character, irrigation, water used for domestic purposes, hydro power and tangata whenua.

Once the RiVAS method has been tailored to a specific river value, then the RiVAS application for that value can easily be applied anywhere.

Assessing current value (RiVAS) and future potential value (RiVAS+)

RiVAS was first established to assess **current value** – the assessment was based on present-day conditions. The rationale was that the tool needed to be practical and easy to implement. However, it was recognised that development oriented river values (e.g. irrigation) were based on future potential value and that decision-makers required knowledge, for all values, about the potential opportunities they may be trading-off.

Therefore, the RiVAS method is being extended in 2011 to include **potential future value.** This future focus considers desired rehabilitation and/or development options, and has been translated into additional steps in the RiVAS process. Called RiVAS+, these extra steps are:

- Identify interventions – what attributes can be altered to enhance river conditions (e.g. whitewater kayaking may be enhanced through the removal of willow trees).
- Identify which rivers would enhance their value if these interventions were implemented.
- Assess the potential value for each of these selected rivers under the intervention scenario (using the RiVAS steps).
- Compare the results from the current (RiVAS) and potential (RiVAS+) assessments – which rivers will most enhance the value under consideration and what interventions are required?

RiVAS+ can be undertaken in tandem with the initial RiVAS exercise (both done at once) or subsequent to an earlier RiVAS exercise (where RiVAS has already been completed).

Applying RiVAS

In practical terms, applying RiVAS (and RiVAS+) in a region involves:
1. Collecting together relevant data, listing rivers, and convening an Expert Panel (people knowledgeable about the value in the region).
2. Running a workshop with the Expert Panel - they 'do' the RiVAS exercise at the workshop (takes 1-2 days).
3. Writing up the results from the workshop: a brief report and a spreadsheet of rivers showing their scores and rankings.

Information

More information about RiVAS can be obtained from:
http://www.lincoln.ac.nz/Research-Centres/LEaP/Environmental-Management--Planning/Projects/Prioritising-river-values

Appendix 2
Credentials of the Expert Panel members

The Expert Panel comprised six members. Their credentials are:

Peter Higgs - Peter is a chartered professional engineer and Fellow of the Institute of Professional Engineers of New Zealand (IPENZ) and is currently on the Board of Ingenium Local Authority Engineers and Asset Managers). He has experience in environmental and civil engineering including asset management with a particular focus on sustainable development.

Marcus Koll is the Water Team Leader at GDC. He has seven years work experience within the Water Utilities division and manages the water supply activity including water sources, treatment facilities and the distribution network.

Judith Robertson is Team Leader Healthy Living (a division of Regulatory Services) at GDC.

Dennis Crone is Team Leader Water Conservation at GDC. He is responsible for assessing resource consent applications in regard to freshwater and coastal environments. His qualifications include agricultural engineering and he has spent several years as a farm consultant advising on farm water supply design. His current responsibilities also include the provision of data for assessing the State of the Environment (fresh and coastal waters) monitoring for the Gisborne District Council.

Bruce Duncan - is a trained GP and has worked for Tairawhiti District Health since 1997. He is currently a Medical Officer of Health and is involved with the Wastewater Technical Advisory Group.

Keriana Wilcox-Taylor is a Senior Planner in the Natural Resources Policy Team with over 10 years experience in local government.

The panel was assisted by Ken Hughey who is Professor of Environmental Management at Lincoln University. His expert knowledge of freshwater related issues spans the period 1981-2012, including his PhD thesis (habitat needs of birds of braided rivers), multiple ecological projects in almost all regions of the South Island, expert evidence at multiple hearings and published research papers. Ken is overall project manager of the river values (RiVAS) project.

Appendix 3
Attributes, indicators and thresholds – Water Used for Domestic Purposes

ATTRIBUTE CLUSTERS	ATTRIBUTE (primary attributes in bold)	DESCRIPTION OF PRIMARY ATTRIBUTES	INDICATORS	INDICATOR SIGNIFICANCE THRESHOLDS	DATA SOURCES (AND RELIABILITY)
Step 2: Identify attributes Step 3: Select and describe primary attributes		Step 3: Select and describe primary attributes	Step 4: Identify indicators	Step 5: Determine significance thresholds	
Number	**1. Number of residents supplied**	Number of residents supplied	Number	3=>20000; 2= 5,000-19,999; 1=<5,000	Based on census or Council's own data
Quantity	**2. Quantity and reliability of supply**	Need to consider how much water is needed within an area, and the ability to supply reliably from this river source	Percent of resident population supplied (%) and Reliability of supply (%) (Expressed as %/%). 3 = Able to reliably supply over 50% of population with >90% reliability; or in concert with others >30% for 100% reliability; 2 = Able to supply between 20 and 50% of population with >70% reliability; 1 = Able to supply up to 20% of population with >50% reliability	3=3 2=2 1=1	LTCCPs re population predictions and potable water demands DC staff use and modelled predictions of potable water demands NIWA and Council river flow data

ATTRIBUTE CLUSTERS	ATTRIBUTE (primary attributes in bold)	DESCRIPTION OF PRIMARY ATTRIBUTES	INDICATORS	INDICATOR SIGNIFICANCE THRESHOLDS	DATA SOURCES (AND RELIABILITY)
	Availability and allocation	Needs to consider other water users including instream (e.g., fishing and kayaking) and out-of-stream (e.g., irrigation) needs	Ability of river to provide water used for domestic purposes while meeting other instream and out-of-stream demands. 3 = River fully capable of meeting needs 2 = River can meet needs more than 50% of the time 1 = River can meet needs 25-50% of the time	3=3 2=2 1=1	Catchment or river management plans
Quality	**3. Chemical/ physical**	Includes heavy metals, trace organic compounds, alkalinity, humic acids, true colour, total suspended solids (TSS), and turbidity. Treatable and degree of treatment needed	Ease of treatment (Council operated schemes) OR risk to health (Community or other schemes). 3 = Very easy; 2 = Average; 1 = Very difficult	3 = Chemical and physical properties are within defined limits 2 = Some chemical and physical properties exceed defined limits but are manageable with cost effective treatment 1 = Most chemical and physical properties exceed defined limits but are manageable with cost effective treatment	Council and MOH data – NZ Drinking Water Supplies by District: http://www.drinkingwater.org.nz/supplies/Suppliescompliance.asp and http://www.moh.govt.nz/moh.nsf/indexmh/register-community-drinkingwater-supplies-nz2011 National Env Stds for source of human drinking water – NES; Appendix 1, 2005 NZ drinking water stds; constituent – microb, chem., physical and

ATTRIBUTE CLUSTERS	ATTRIBUTE (primary attributes in bold)	DESCRIPTION OF PRIMARY ATTRIBUTES	INDICATORS	INDICATOR SIGNIFICANCE THRESHOLDS	DATA SOURCES (AND RELIABILITY)
					radiological; also contaminants under RMS related to land use and industries and bridges etc re accidents (e.g. Warkworth tanker incident 2011)
	4. Microbiological	Includes Coliform bacteria, *E. coli*, and specific pathogenic species of bacteria (such as cholera-causing *Vibrio cholerae*), viruses, and protozoan parasites. Treatable and degree of treatment needed	Levels of microbiological contaminants	3 = Microbiological properties are within defined limits 2 = Some microbiological properties exceed defined limits but are manageable with cost effective treatment 1 = Most microbiological properties exceed defined limits but are manageable with cost effective treatment	Council and MOH data NZ Drinking Water Supplies by District: http://www.drinkingwater.org.nz/supplies/Suppliescompliance.asp and http://www.moh.govt.nz/moh.nsf/indexmh/register-community-drinkingwater-supplies-nz2011 See above
	Land use	Land use practices strongly influence water quality for drinking purposes	Suitability of land use	3 = Natural land cover with no or minimal agricultural use 2 = >50% natural land cover and extensive agricultural use dominating the remainder	LRI. Councils have data

ATTRIBUTE CLUSTERS	ATTRIBUTE (primary attributes in bold)	DESCRIPTION OF PRIMARY ATTRIBUTES	INDICATORS	INDICATOR SIGNIFICANCE THRESHOLDS	DATA SOURCES (AND RELIABILITY)
				1 = 25-50% natural land cover and extensive agricultural use dominating the remainder	
Proximity and elevation	Proximity to consumer	Close sites are more cost effective, e.g., less piping, and perhaps more resilient	Proximity to users	3 = Less than 10km from majority of users 2 = 10-25km from majority of users 1 = >25km from majority of users	Council data
	Location in catchment	The higher the catchment the more likely it is to meet standard requirements	Location in catchment	3 = Upper catchment 2 = Mid-Upper catchment 1 = Mid-lower catchment	Council data/mapping
	Use of gravity	Elevation cf use is important for cost effective supply	Degree of gravity fed supply	3 = Fully gravity fed 2 = Mixed gravity and pumping 1 = Extensive pumping	Council topographical data
River morphology	Stability – bed aggrading etc	This attribute is associated with the ability to extract or to store water in a safe, reliable and cost effective way	Stability of site	3 = Very stable 2 = Moderately stable with periodic instability episodes 1 = Very unstable with highly mobile banks	River channel stability data held by councils

ATTRIBUTE CLUSTERS	ATTRIBUTE (primary attributes in bold)	DESCRIPTION OF PRIMARY ATTRIBUTES	INDICATORS	INDICATOR SIGNIFICANCE THRESHOLDS	DATA SOURCES (AND RELIABILITY)
Climate change	**5. Climate change**	Climate change could lead to longer drier drought periods also flood events etc and these need to be considered	Expert panel based on last c.10 years history of events combined with forward NIWA informed predictions: 1= rivers dry up and likely to worsen; 2: some drying but more reliable year round water supply; 3: spring fed or higher catchment with more reliable rain	3 = No significant climate change implications 2 = Minor (<5%) changes to flow and quality possible 1 = Moderate (5-20%) changes to flow and quality possible	An expert panel consideration of any or all of: NIWA regional modelling data ESR Climate Change Water Supply assessment tool Council data
Economic	**6. Cost**	An importance attribute of whether or not a water source ultimately is useable by a community	Composite EP indicator of whole life cost of supply including treatment, storage, reticulation to town supply storage: 5= very cheap; 4= cheap; 3= moderate; 2= expensive; 1= very expensive	3 = 4 or 5 2 = 3 1 = 1 or 2	Expert panel – relative index protects councils from explicit identification of all costs. Also an attribute which encompasses some other considerations, e.g., 'proximity to consumer' and 'use of gravity'
Tangata whenua	**7. Waiora** (Note – could be more than one, or there may be a subset of this one: to be determined)	To be determined by the tangata whenua	To be determined by the tangata whenua	To be determined by the tangata whenua	Tangata whenua

Appendix 4
Assessment of indicators by SMARTA criteria

Indicator	Specific	Measurable	Achievable	Relevant	Timely	Already in use
1. Number of residents supplied	Yes	Population number	Census data	Addresses demand	Data available	Census
2. Quantity and reliability of supply	Yes	Physical measure	Council's own data	Addresses reliability of supply	Data available	Data kept by councils
3. Chemical/ physical	Yes	Water quality data routinely monitored in accordance with national water quality measures	Council's own data	Has direct bearing on domestic water supply management	Data available	Data kept by councils
4. Microbiological	Yes	E. coli etc already being measured in accordance with national water quality measures	Council and health authority's own monitoring	Has direct bearing on domestic water supply management	Data available	Data used by councils and others
5. Climate change	Yes	Regional and finer scale predictions now being made	NIWA and other data	Helps identify pressure areas	Data and predictions increasingly available	Being made available to councils
6. Cost	Yes	Actual costs known so relative scale	Council's own data	Influences management decisions directly	Data available	Data kept by councils
7. Waiora	Development of this indicator requires more work					

Appendix 5
Existing significance assessment calculations for 'water used for domestic purposes' (RiVAS) (Steps 1 and 5-8)

			Attributes and Indicators						Thresholds							
		Number	1	2	3	4	5	6	1	2	3	4	5	6		
		Primary attributes	Population supplied	Quantity and reliability of supply	Chemical/ physical	Microbiological	Cost	Climate change implications	Population supplied	Quantity and reliability of supply	Chemical/ physical	Microbiological	Cost	Climate change implications		
		Indicator	Number of residents supplied	Percent of resident population supplied and Reliability of supply (Expressed as %/%)	Ease of treatment (Council operated schemes) OR risk to health (Community or other schemes). 3 = Very easy; 2 = Average; 1 = Very difficult	Levels of microbiological contaminants: E. coli levels. 3 = <10mg/100ml 2 = 10-100mg/100ml 1 = >100mg/100ml	Composite EP indicator of whole life cost of supply including treatment, storage, reticulation to town supply storage 5= very cheap; 4= cheap; 3= moderate;2= expensive; 1= very expensive	Expert panel based on last c.10 years history of events combined with forward NIWA informed predictions: 1= rivers dry up and likely to worsen; 2: some drying but more reliable year round water supply; 3: spring fed or higher catchment with more reliable rain	3=>20000; 2= 5,000-19,999; 1=<5,000	3 = Able to reliably supply over 50% of population with >90% reliability; or in concert with others >30% for 100% reliability; 2 = Able to supply between 20 and 50% of population with >70% reliability; 1 = Able to supply up to 20% of population with >50% reliability	3 = Chemical and physical properties are within defined limits 2 = Some chemical and physical properties exceed defined limits but are manageable with cost effective treatment 1 = Most chemical and physical properties exceed defined limits but are manageable with cost effective treatment	3 = Pristine conditions 2 = Microbiological properties are within defined limits 1 = Some microbiological properties exceed defined limits	3 = 4 or 5; 2 = 3; 1 = 1 or 2	3 = No significant climate change implications 2 = Minor (<5%) changes to flow and quality possible 1 = Moderate (5-20%) changes to flow and quality possible	Sum of unweighted threshold scores	Ranking
Name of GDC Administered Scheme	Rivers															
Gisborne City Water Supply	Te Arai		35000	40/100	3	3	4	3	3	3	3	3	3	3	18	National
Gisborne City Water Supply	Mangapoike Dams		35000	60/100	3	3	4	3	3	3	3	3	3	3	18	National
Gisborne City Augmentation	Waipaoa		35000	10/99	1	1	3	2	3	1	1	1	2	2	10	Local
Te Karaka Community Supplementary Supply	Waipaoa		600	100/100	1	1	2	2	1	3	1	1	1	2	9	Regional
Whatatutu Community Supplementary Supply	Mangatu		200	100/100	1	1	2	2	1	3	1	1	1	2	9	Regional
Name of non-GDC administered scheme																
	Waiapu		743	5/40	1	2	4	2	1	1	1	2	3	2	10	Local
	Mangahauini		400	5/40	1	2	4	2	1	1	1	2	3	2	10	Local
	Waitakeao		50	5/40	1	2	4	2	1	1	1	2	3	2	10	Local
Te Puia Hospital and Community Scheme	Waikawa		200	100/100	3	3	2	3	1	3	3	3	1	3	14	Regional
	Motu		200	5/40	1	2	4	3	1	1	1	2	3	3	11	Local

Significance thresholds (highlights in ranking column)

Green	High = National
Blue	Medium = Regional
Yellow	Low = Local

Appendix 6
Potential significance assessment calculations for 'water used for domestic purposes' (RiVAS+) (Steps 10-13)

					Attributes and Indicators						**Thresholds**							
			Number	1	2	3	4	5	6	1	2	3	4	5	6			
			Primary attributes	Population supplied	Quantity and reliability of supply	Chemical/ physical	Microbiological	Cost	Climate change implications	Population supplied	Quantity and reliability of supply	Chemical/ physical	Microbiological	Cost	Climate change implications			
			Indicator	Number of residents supplied	Percent of resident population supplied and Reliability of supply (Expressed as %/%)	Ease of treatment (Council operated schemes) OR risk to health (Community or other schemes). 3 = Chemical and physical properties are within defined limits (very easy); 2 = Some chemical and physical properties exceed defined limits but are manageable with cost effective treatment (Relatively manageable) 1 = Most chemical and physical properties exceed defined limits but are manageable with cost effective treatment (Very difficult)	Levels of microbiological contaminants: E. coli levels. 3 = <10mg/100ml (pristine); 2 = 10-100mg/100ml 1 = >100mg/100ml	Composite EP indicator of whole life cost of supply including treatment, storage, reticulation to town supply storage 5= very cheap; 4= cheap; 3= moderate;2 = expensive; 1= very expensive	Expert panel based on last c.10 years history of events combined with forward NIWA informed predictions: 1= rivers dry up and likely to worsen; 2: some drying but more reliable year round water supply; 3: spring fed or higher catchment with more reliable rain	3=>20000; 2= 5,000-19,999; 1=<5,000	3 = Able to reliably supply over 50% of population with >90% reliability; or in concert with others >30% for 100% reliability; 2 = Able to supply between 20 and 50% of population with >70% reliability; 1 = Able to supply up to 20% of population with >50% reliability	3=3; 2=2; 1=1	3 = Pristine conditions 2 = Microbiological properties are within defined limits 1 = Some microbiological properties exceed defined limits	3 = 4 or 5; 2 = 3; 1 = 1 or 2	3 = No significant climate change implications 2 = Minor (<5%) changes to flow and quality possible 1 = Moderate (5-20%) changes to flow and quality possible	Sum of unweighted threshold scores	RiVAS+ scores	Ranking
Name of GDC Administered Scheme	Rivers	Interventions																
Gisborne City Water Supply	Te Arai			35000	40/100	3	3	4	3	3	3	3	3	3	3	18	18	National
Gisborne City Water Supply	Mangapoike Dams			35000	60/100	3	3	4	3	3	3	3	3	3	3	18	18	National
Gisborne City Augmentation	Waipaoa			35000	10/99	1	1	3	2	3	1	1	1	2	2	10	10	Local
Te Karaka Community Supplementary Supply	Waipaoa			600	100/100	1	1	2	2	1	3	1	1	1	2	9	9	Regional
Whatatutu Community Supplementary Supply	Mangatu			200	100/100	1	1	2	2	1	3	1	1	1	2	9	9	Regional
Name of non-GDC administered scheme																		
Ruatoria	Waiapu	6b,7a		743	5/40	1+	2+	4	2	1	1	1(+0.05)	2(+0.05)	3	2	10	11	Local
Tokomaru Bay	Mangahauini	6b,7a		400	5/40	1+	2+	4	2	1	1	1(+0.05)	2(+0.05)	3	2	10	11	Local
	Waitakeao	6b,7a		50	5/40	1+	2+	4	2	1	1	1(+0.05)	2(+0.05)	3	2	10	11	Local

Te Puia Hospital and Community Scheme	Waikawa			200	100/100	3	3	2	3	1	3	3	3	1	3	14	15	Regional
Motu	Motu	6b,7a		200	5/40	1+	2+	4	3	1	1	1(+0.05)	2(+0.05)	3	3	11	12	Local

Significance thresholds (highlighted columns)

Green	High = National
Blue	Medium = Regional
Yellow	Low = Local

Miscellaneous (highlighted rivers)

Pink	Rivers overlap with neighbouring council

Data reliability (font colour)

Black	Reliable data
Blue/Purple	Less reliable data
Red	Data checked by Expert Panel and has been adjusted

RiVAS+ (highlighted rows and cells)

Blue	Also assessed for potential future state (RiVAS+)
Orange	Score changed by proposed interventions (RiVAS+)
Green	Positive influence on attribute but not enough to shift value - counted as an increase of 0.5 (RiVAS+)