



Manaaki Whenua
Landcare Research

Improving NZ's water quality– what is it worth?

Link Seminar

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Public Perceptions of NZ's Environment 2019 (Lincoln University):

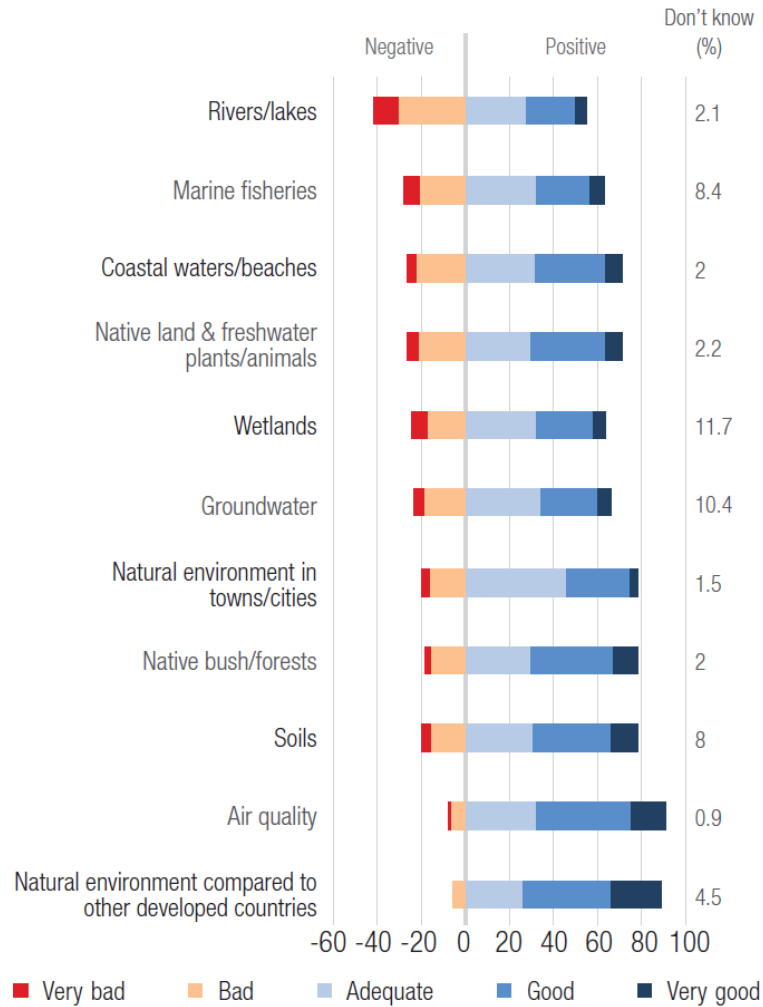
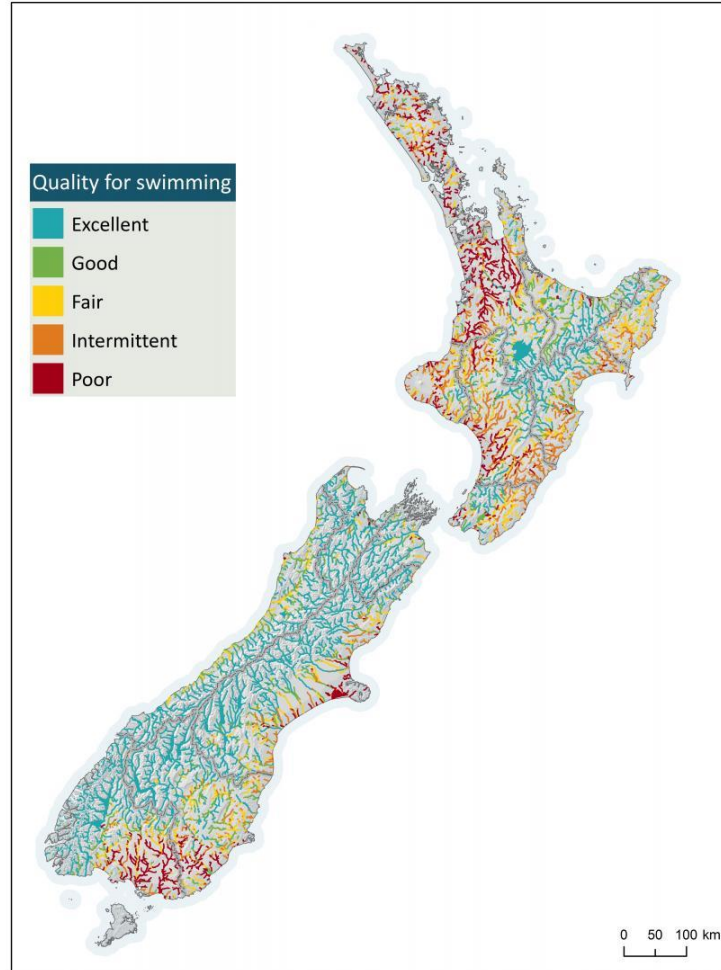


Figure 3.5. Perceived state of the environment.

Environment Aotearoa Report





Budget 2019's environment spend: \$229m to help clean up rivers

29 May, 2019 11:03 PM

© 4 minutes to read



Millions of dollars spent every year by central, regional, and local governments in restoring freshwater.



Budget NZ 2019: Plan for \$229m water clean-up is clear as mud

David Williams of Newsroom.co.nz · 09:43, May 31 2019



Benefits of water quality policy - difficult to convey

Hard to monetize

- Thin literature
- Values vs policy levers
- Methodological issues with valuation



Table 1. CBAs of water quality programs

Regulation	Study time frame	Benefit-to-cost ratio	Benefits, per year	Costs, per year
CWA				
Freeman (6)	1985	0.19–1.23	\$13.6B to \$65.9B	\$53.7B to \$71.6B
Carson and Mitchell (7)	1990s	0.61–1.25	\$98.1B	\$78.3B to \$160.2B
Lyon and Farrow (8)	1990s	0.25–1.16	\$10.9B to \$22.0B	\$18.9B to \$43.7B
US EPA (21, 61)	1990s	0.79–0.88	\$18.9B	\$21.5B to \$24.0B
Keiser and Shapiro (1)	1962–2001	0.24	\$3.9B	\$16.3B
WOTUS				
Obama Administration	2015	1.10–2.41	\$0.3B to \$0.6B	\$0.2B to \$0.5B
Trump Administration	2017	0.11–0.30	\$0.03B to \$0.07B	\$0.2B to \$0.5B
CRP				
Hansen (47)	2000s	0.76–0.87	\$2.1B	\$2.4B to \$2.7B
Effluent Guidelines				
Centralized Waste Treatment	2000	0.07–0.23	\$4M to \$14M	\$60M
Landfills	2000	0.00	<\$0.1M	\$13M
Transportation Equipment Cleaning	2000	0.11–0.33	\$3M to \$9M	\$27M
Waste Combustors	2000	0.15–0.5	\$0.3M to \$1M	\$2M
Coal Mining	2002	>1	\$22M to \$24M	\$0M
Iron and Steel Manufacturing	2002	0.11–0.58	\$2M to \$11M	\$19M
Concentrated Animal Feeding Operations	2003	0.61–1.06	\$320M to \$557M	\$526M
Metal Products and Machinery	2003	0.09	\$2M	\$22M
Concentrated Aquatic Animal Production	2004	0.05	\$0.1M	\$2M
Meat and Poultry Products	2004	0.05	\$4M	\$86M
Construction and Development	2009	0.39	\$429M	\$1,108M
Steam Electric	2015	0.94–1.18	\$464M to \$582M	\$493M



\$ to clean up
rivers, lakes, and
other surface
waters



\$ to clean up air
pollution



MWLR Water Quality Valuation

Stated preference survey – choice experiment.

Nationally representative (online) survey.

Specifically focus on policy applications.

- Water quality variables are both targeted by policy and relevant to people.
- Survey uses changes in water quality that are reasonable/realistic.





Water Quality Endpoints

Clarity – avg. clarity level in Regional Council

- General recreation experience.

Nutrients - % of waterbodies meeting their nutrient criteria

- Focus on habitat/ecosystem.

E. Coli - % of waterbodies meeting E. Coli Criteria

- Swimming/health



Choice Experiments

Respondents choose between policies.

Show water quality outcomes and cost.

Which outcome do you prefer for rivers and streams in your regional council area?

	Outcomes by 2025		
	Outcome A	Outcome B	Outcome C
Nutrients <i>Increase in the percent of rivers and streams with acceptable levels.</i> <i>For example, a change from 25% of rivers and streams to 27% is a change of +2 percentage points</i>	No change	+ 5 percentage points	+ 1 percentage points
Water Clarity <i>Increase in average visibility in rivers and streams</i>	No change	+ 1 metre	+ 0.5 metre
E. coli <i>Increase in the percent of rivers and streams suitable for swimming, wading, and fishing.</i> <i>For example, a change from 32% of rivers and streams to 35% is a change of +3 percentage points</i>	No change	+ 6 percentage points	+ 8 percentage points
Permanent Increase in the Cost of Living for your Household	\$0 per month	\$6 per month (\$72 per year)	\$3 per month (\$36 per year)
Your Choice	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Please select your preferred outcome	Outcome A (No change)	Outcome B	Outcome C



Policy Changes Presented

Takatsuka et al (2009)

Attributes	Levels	Definitions
Greenhouse Gas Emissions	Big Reduction	50% reduction from the current emission level
	Small Reduction	20% reduction from the current emission level
	No Change	Maintain current emission level
Nitrate Leaching	Big Reduction	50% reduction in nitrate leaching to streams
	Small Reduction	20% reduction in nitrate leaching to streams
	No Change	Maintain current nitrate leaching to streams
Soil Quality	Small Change	Soil organic matter and structure are retained over 25 years
	No Change	Maintain current slow rate of soil degradation
Scenic Views	More Variety	More trees, hedgerows and birds and a greater variety of crops on cropping farms
	No change	Maintain the current cropping farm landscape
Cost to Household	10; 30; 60; 100	Annual payment to a regional council for the next 5 years (NZ\$)



Baskaran et al 2009

	Alternative 1	Alternative 2	Status Quo
Methane emissions	10% reduction	30% reduction	No change
Nitrate Leaching	10% reduction	30% reduction	No change
Water Use for Irrigation	10% reduction	10% reduction	No change
Scenic Views	No change	30% more trees, hedges, plantations	No change
Loss of your household income (\$ per year for the next 5 years)	\$30	\$60	\$0

Option A

Option B

Option C

Fig. 1 Example of a choice card from the questionnaire.



Econometric analysis of survey results

Sociodemographic variables

- Income
- Education
- Population



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Regional Council/water characteristics

- Number/length of waterbodies
- Percent rural vs urban
- Existing average quality



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User recreation types (active/passive, etc...)



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User recreation types

- Contact vs non-contact vs passive users



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N=835

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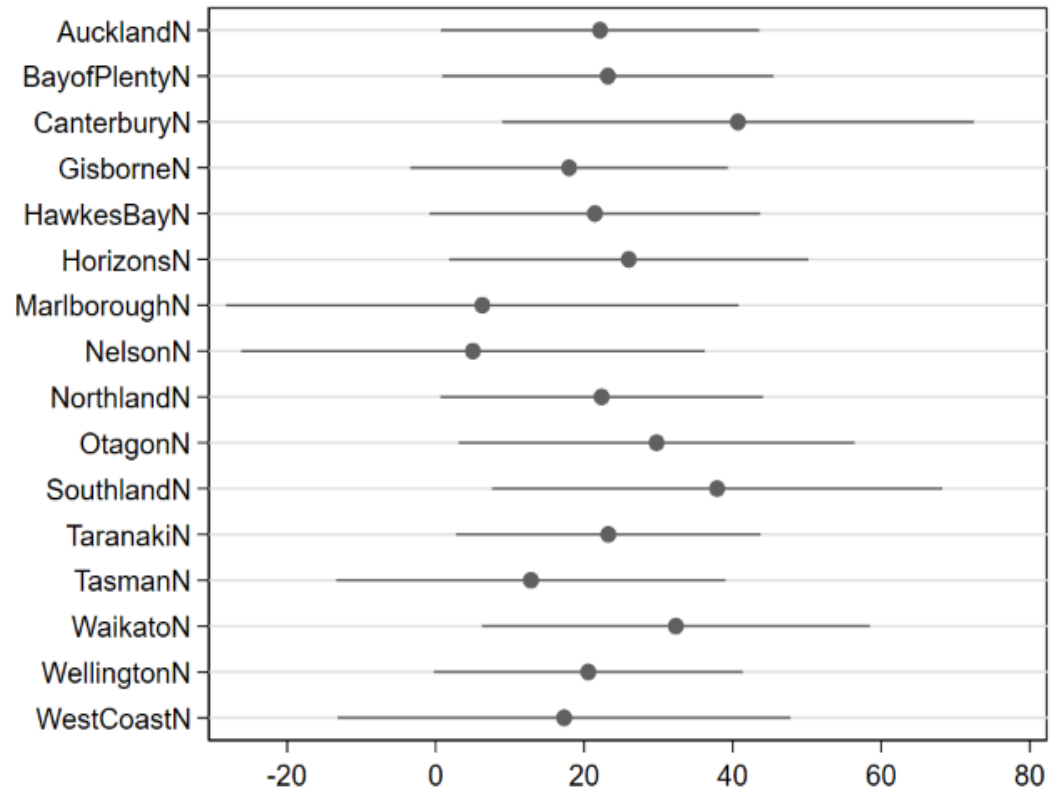
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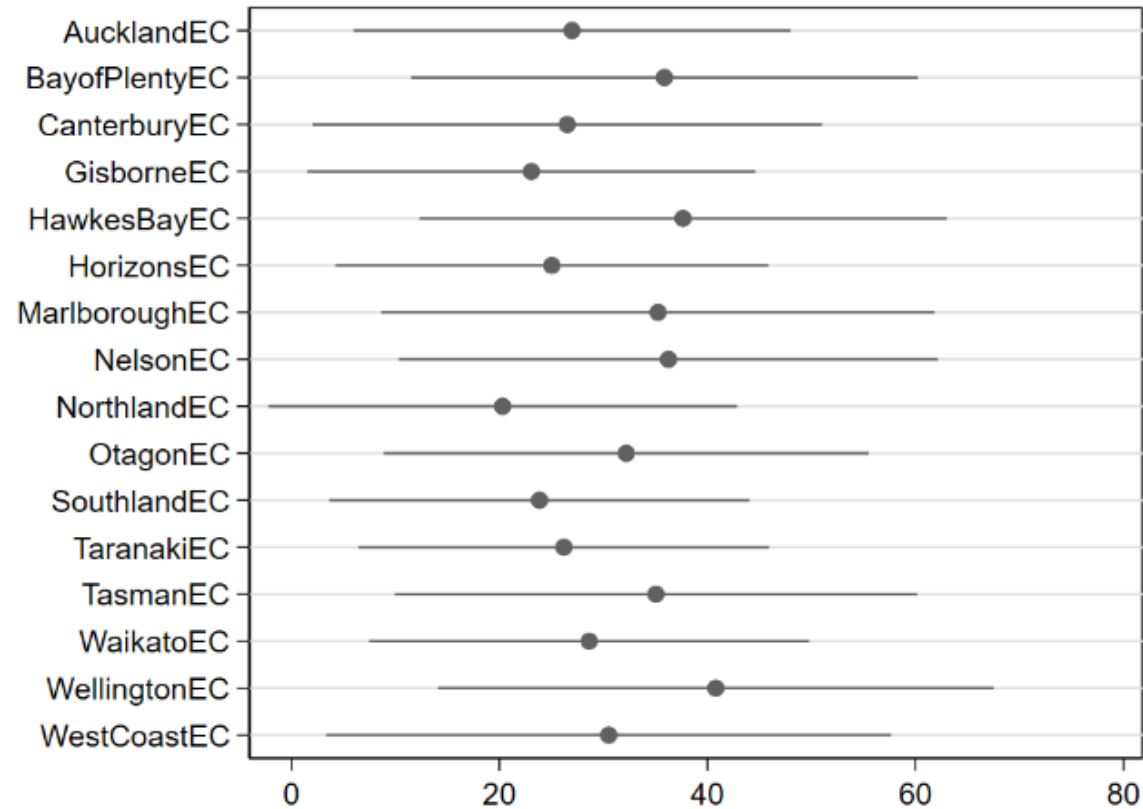
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Results

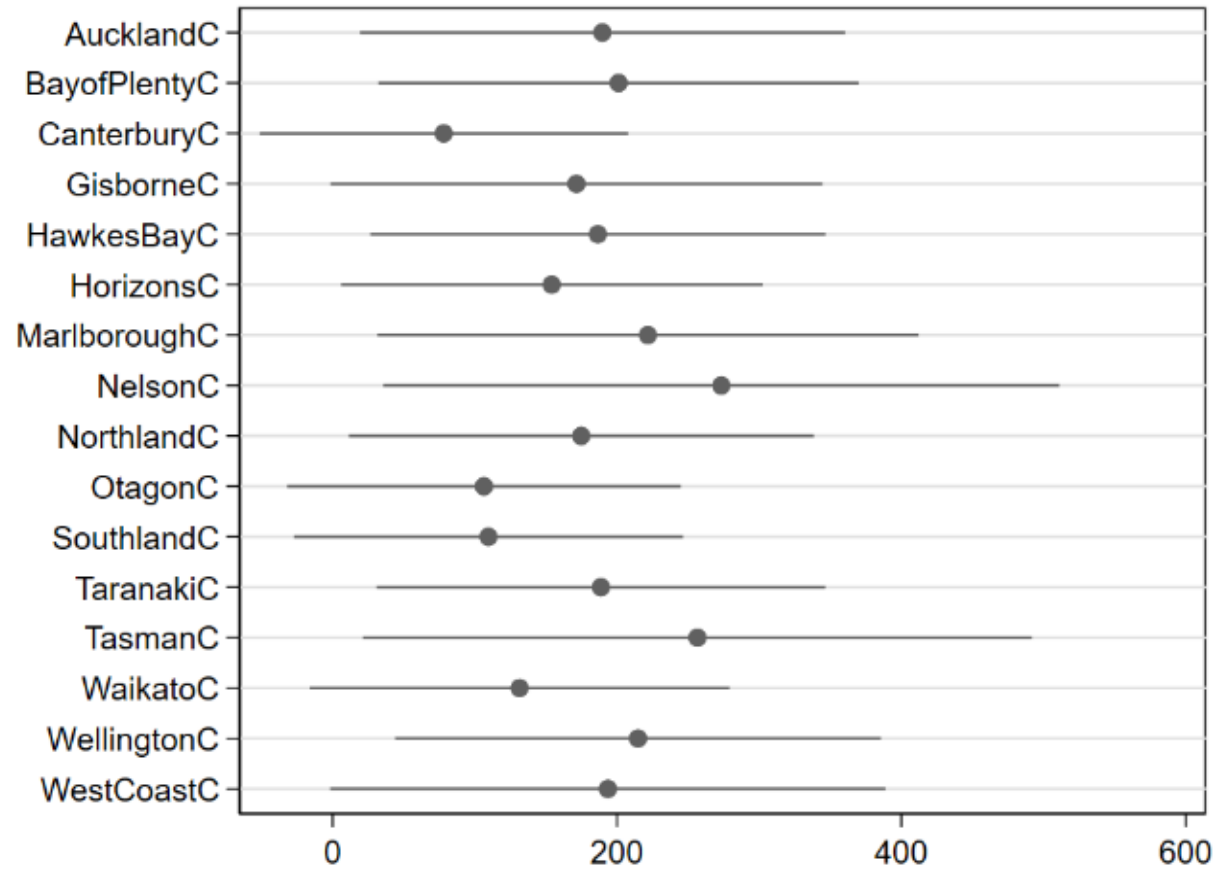
Marginal Willingness to Pay (MWTP) for a 1% increase in Regional Council waterbodies meeting their nutrient criteria



MWTP for a 1% increase in Regional Council waterbodies meeting their E. Coli criteria

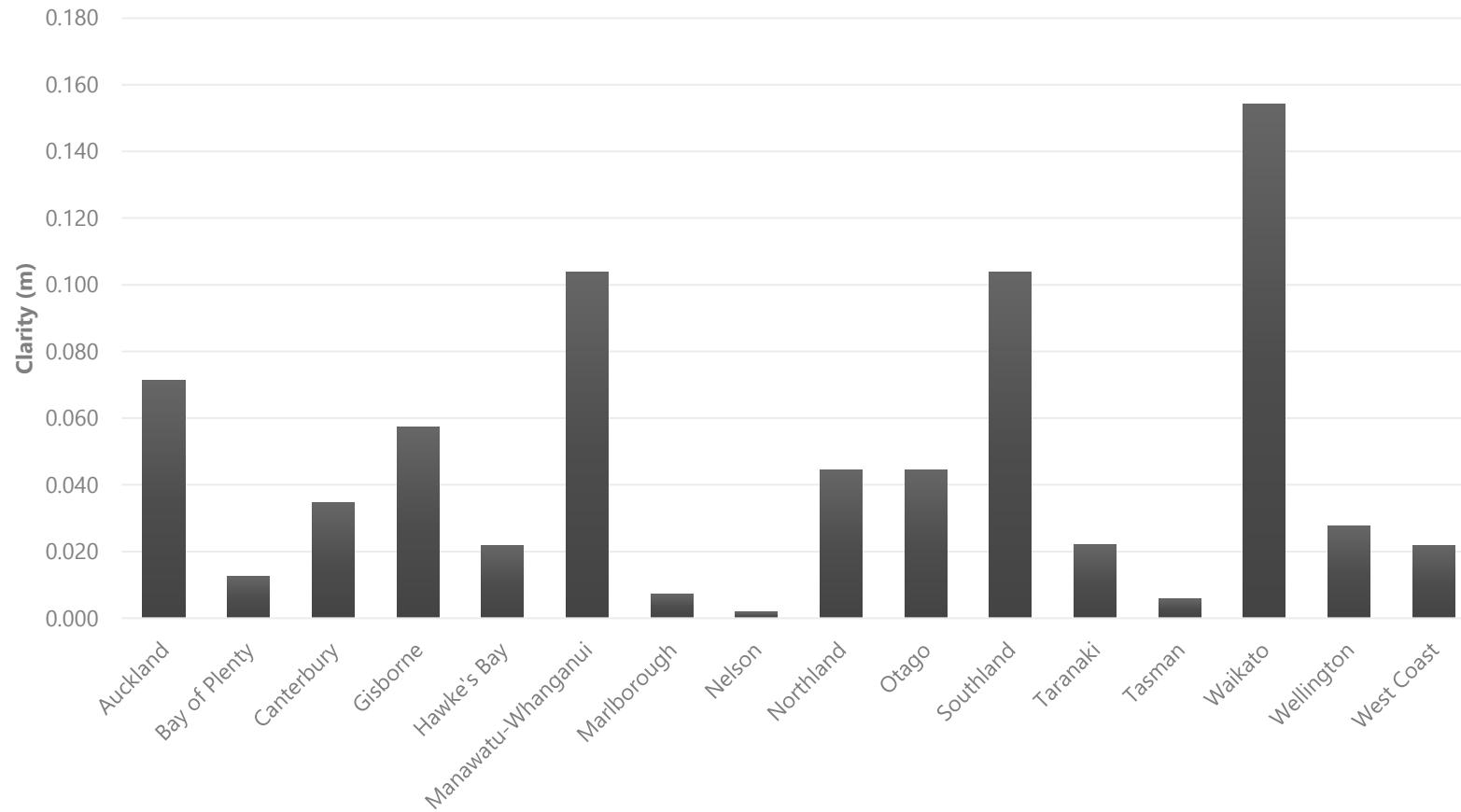


MWTP for a 10 cm increase in average Regional Council clarity





Policy Example



Adapt Hicks et al.
(NIWA 2019).
Sediment report –
Focus on Clarity
instead of
sediment.



Region	Annual Benefits
Auckland	7,642,326
Bay of Plenty	328,938
Canterbury	708,682
Gisborne	185,538
Hawke's Bay	274,724
Manawatu-Whanganui	1,663,055
Marlborough	36,841
Nelson	10,957
Northland	639,400
Otago	498,199
Southland	511,195
Taranaki	209,976
Tasman	36,335
Waikato	4,103,769
Wellington	1,229,154
West Coast	74,845
Total	18,153,933



Benefits over 50 years

Model	4% Discount Rate	6% Discount Rate
Total NPV	499,332,352	357,901,472





Compare to Auckland's Water Quality

Targeted rate

Council – an average valued home would pay \$66 per year.



Compare to Auckland's Water Quality Targeted rate

Auckland Region – 2017 voted on a targeted rate for water quality improvement.
Council – an average valued home would pay \$66 per year.





Conclusion and Discussion

Hard to estimate the benefits of water quality policies.

MWLR conducted a national survey to improve literature.

Robust positive values for water quality found.

Plan to redo the survey in 1-2 years to explore the stability of values over time.



Additional Work in progress: Valuing native vegetation

- A Choice experiment survey was conducted to assess New Zealanders' preferences for
 - Restoring wetlands
 - Restoring lowland forest
 - Restoring hill country forest
 - Protecting native vegetation via covenanting.
- This information can be used to prioritise, target and evaluate conservation and restoration programs
- Watch this space...



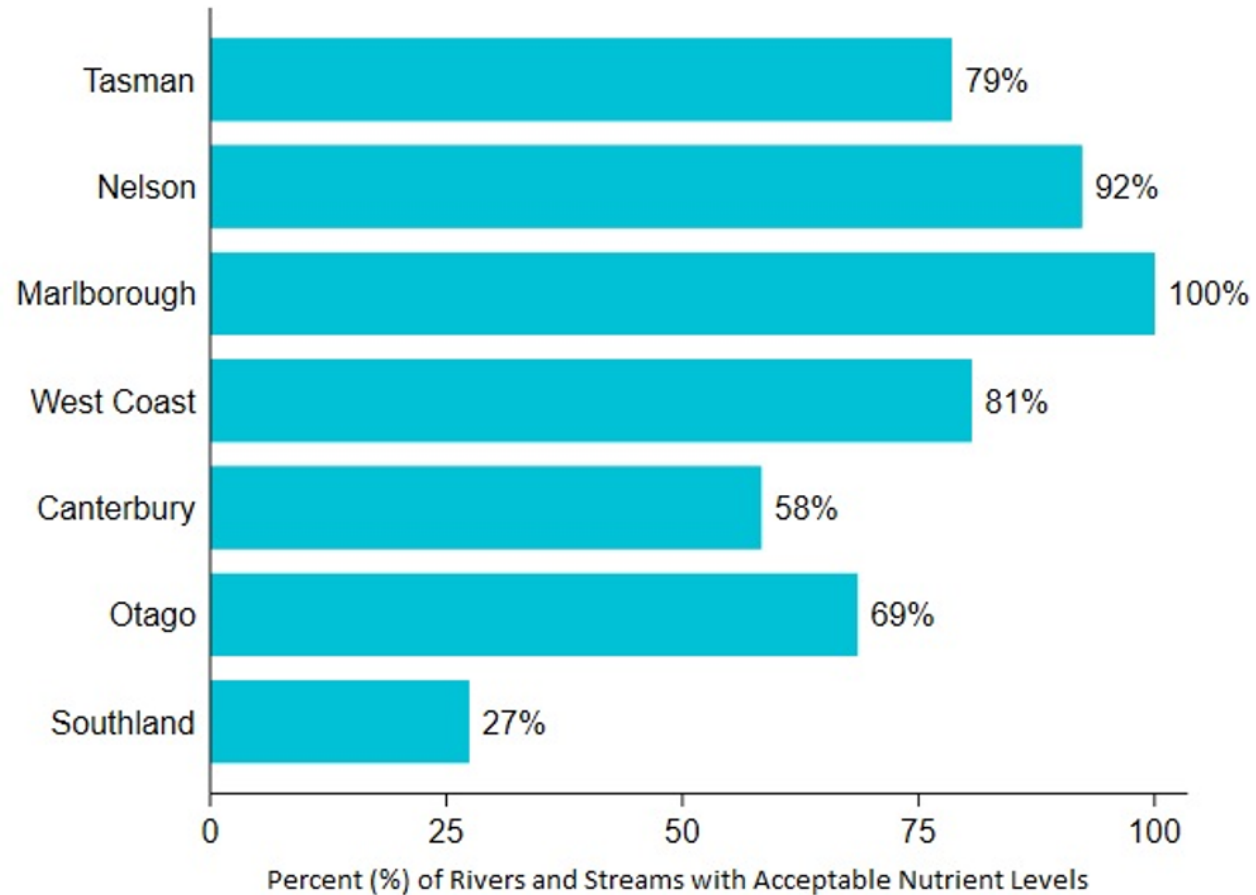
Thank you!



South Island Nutrients



Rivers and Streams with Acceptable Nutrient Levels

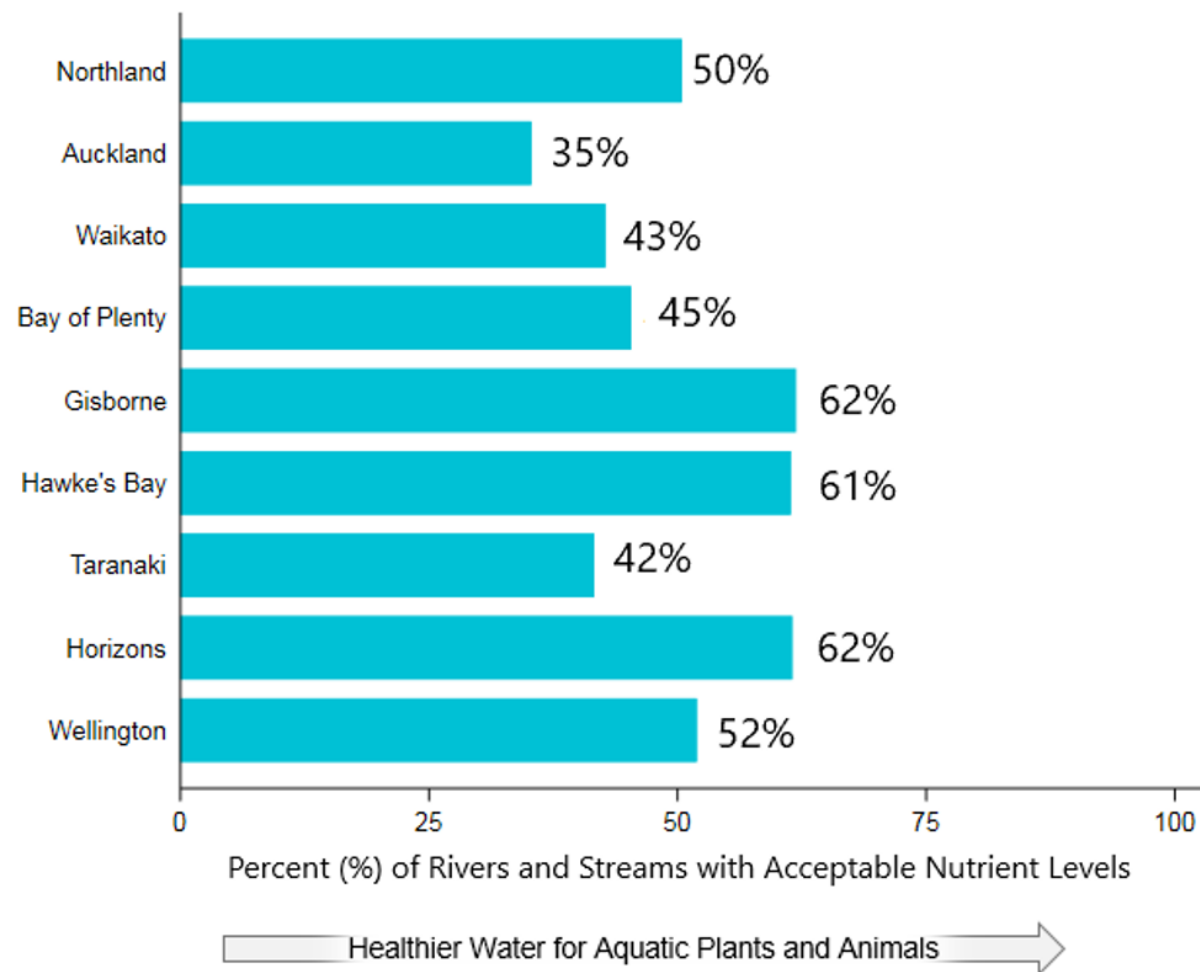


Healthier Water for Aquatic Plants and Animals →

North Island Nutrients



Rivers and Streams with Acceptable Nutrient Levels



North Island E Coli



Rivers and Streams with Acceptable E. Coli Levels for Swimming, Wading, and Fishing

