Adding Clarity to the Murky World of Greywater Re-Use

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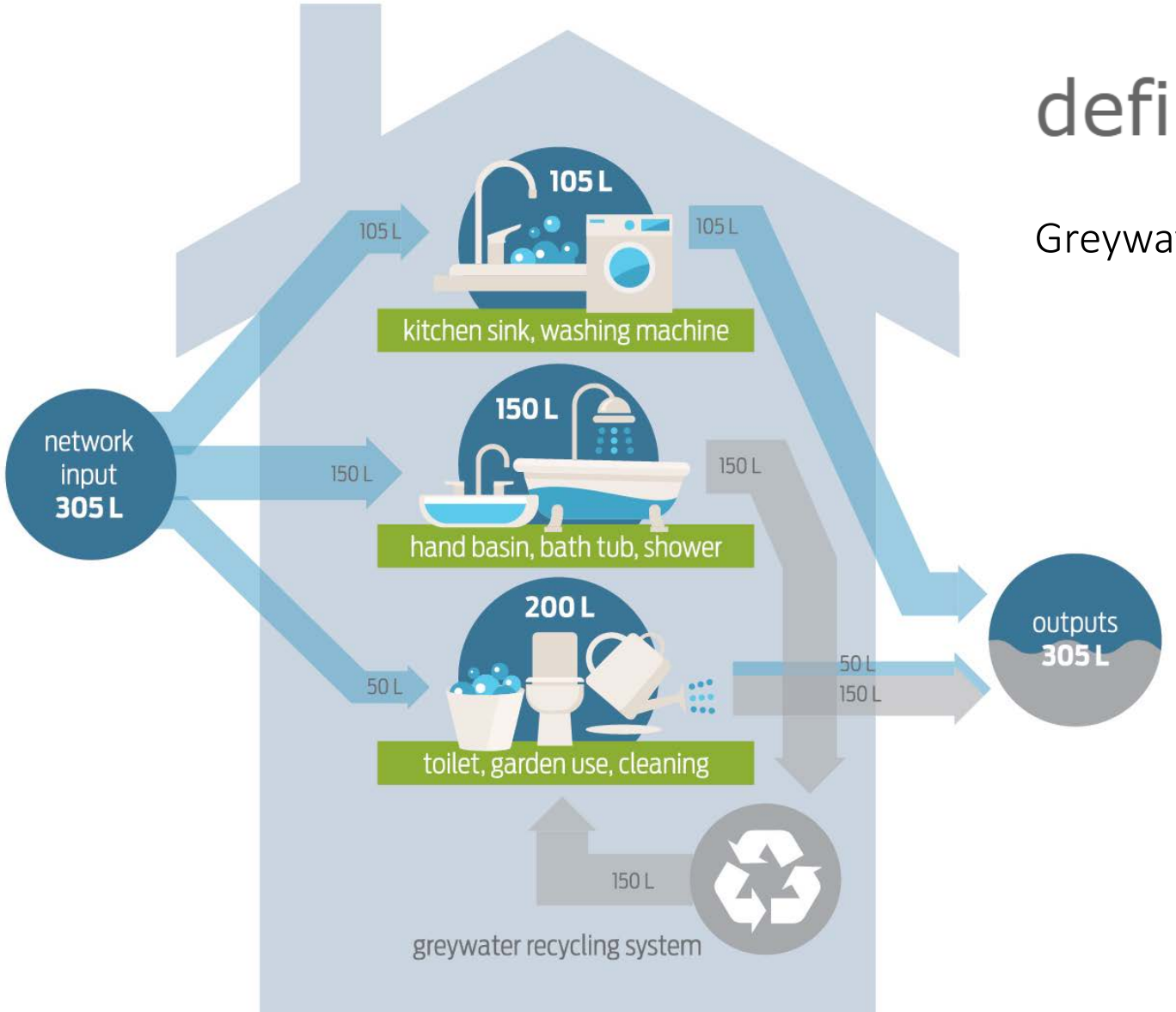
BRANZ

ESR Science for Communities

WATER ACTION DECADE

2018-2028

What is Greywater?



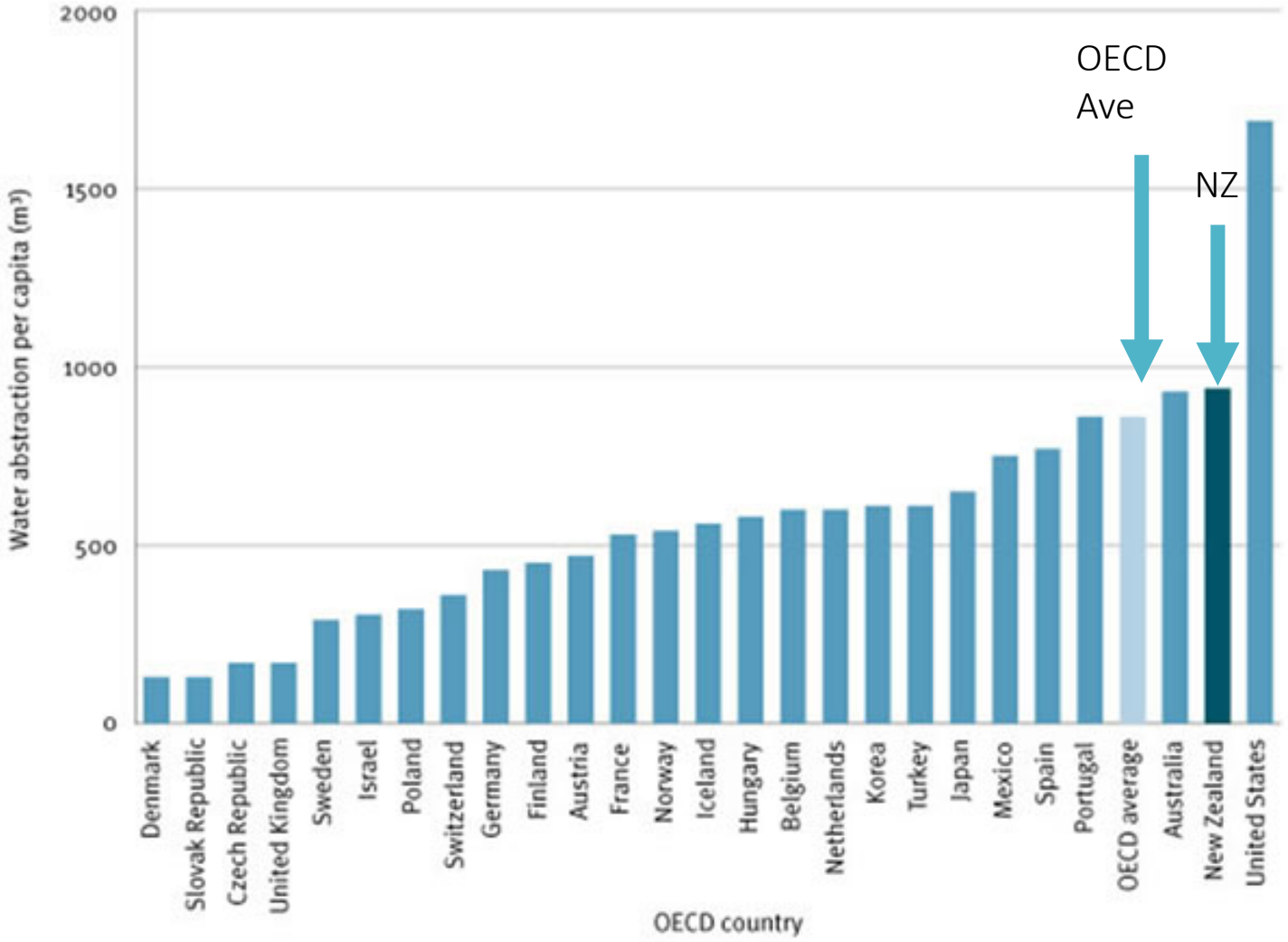
definition

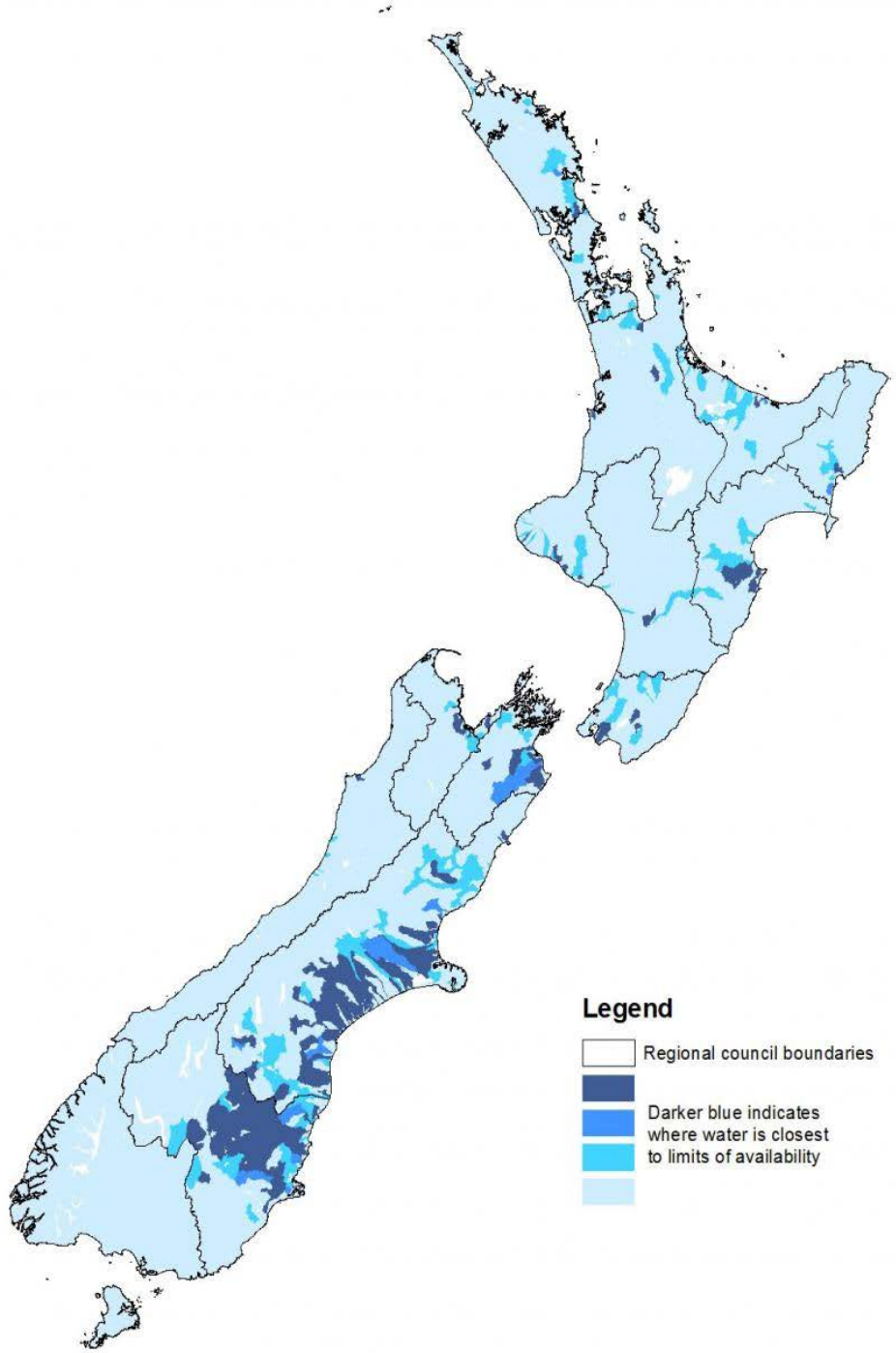
Greywater is <u>untreated wastewater</u> from a household

Blackwater

High organic waste content

The New Zealand Context



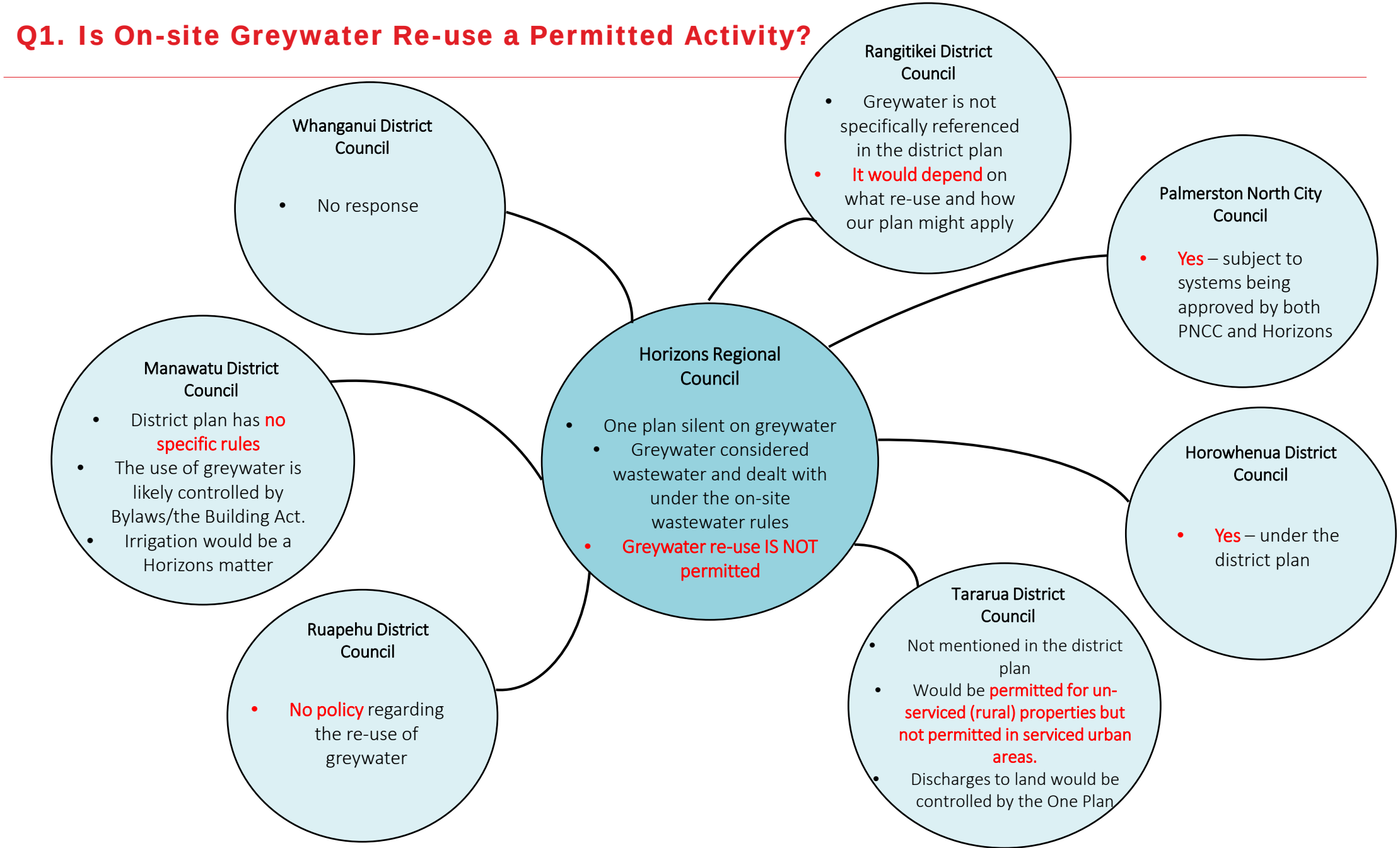


Council Greywater Re-use Survey

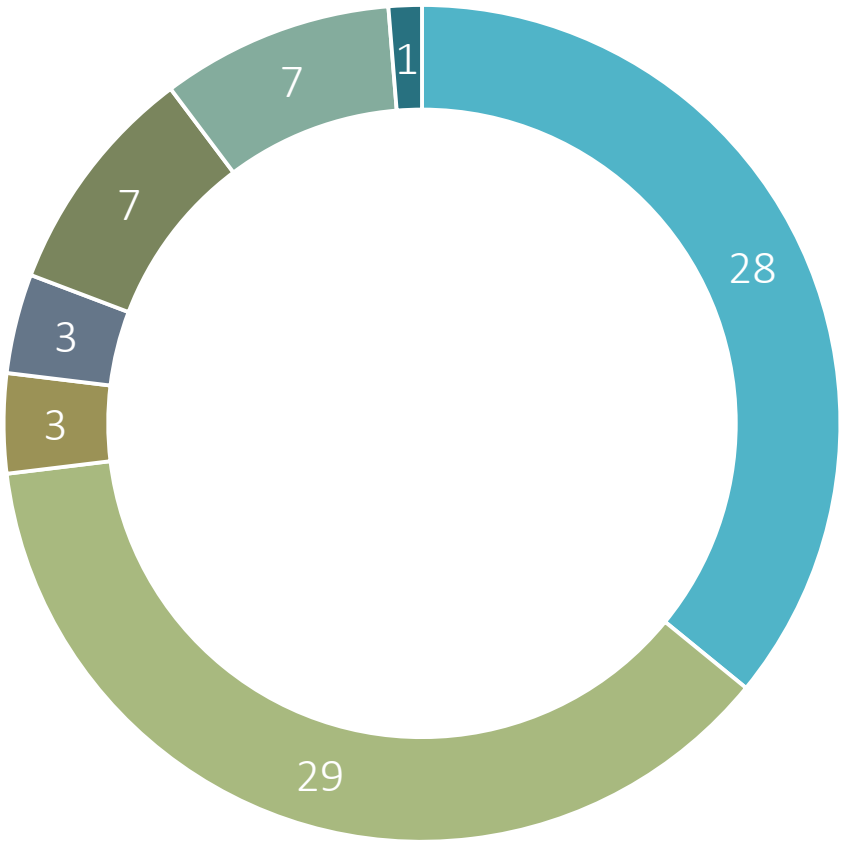
All Councils were asked:

1. Is on-site greywater re-use a permitted activity?
2. If so, how many houses have the systems?
3. If not a permitted activity how would a request be dealt with?
4. What limitations are their to increased uptake?

Q1. Is On-site Greywater Re-use a Permitted Activity?

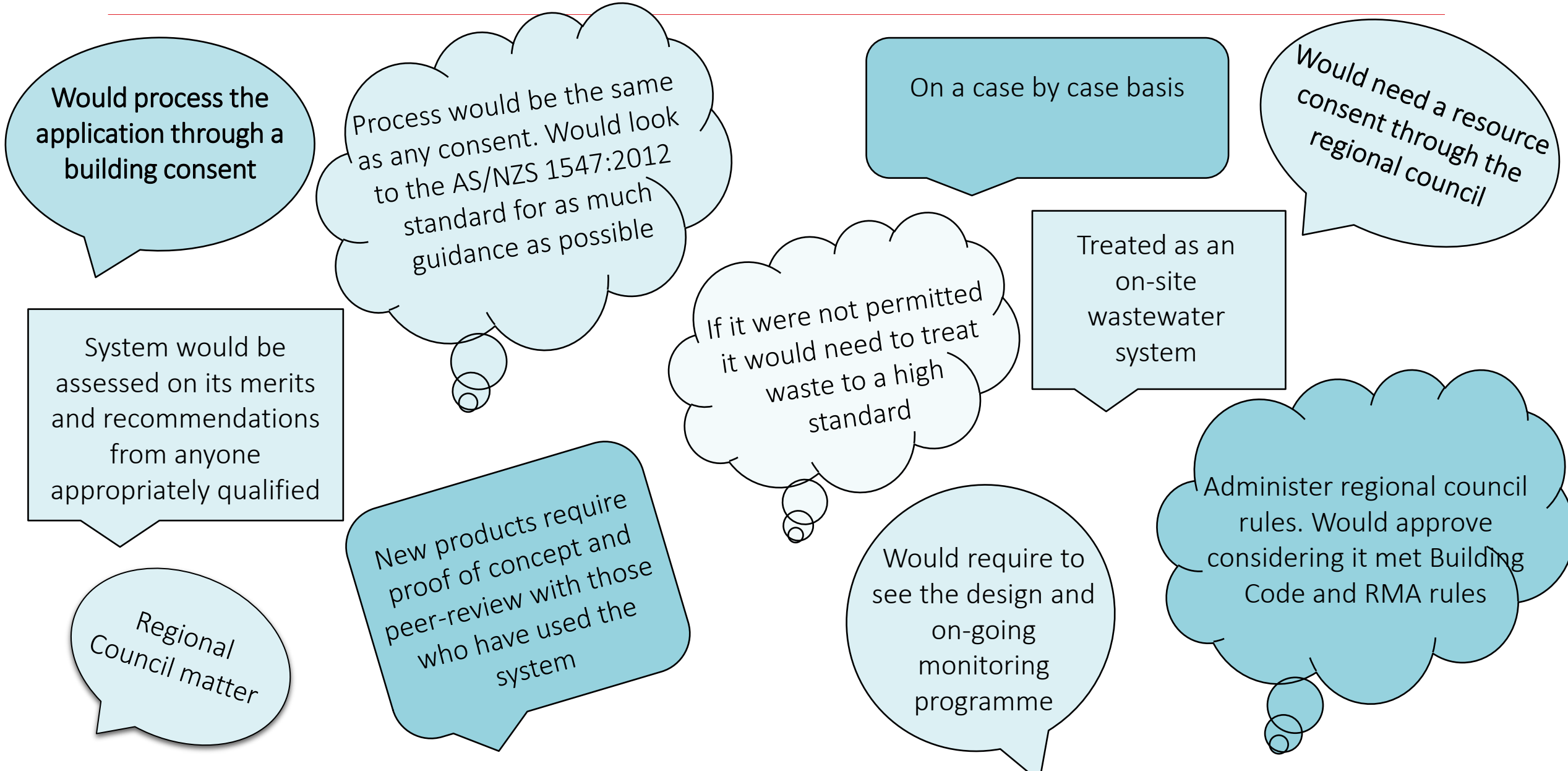


Q.2 How many houses have the systems?



- Don't record this info/ don’t know
- No reply
- Territorial Authority matter
- Regional Council matter
- No systems
- Estimated under 20 systems
- Estimated more than 50 systems

Q.3 If it's not permitted how would it be dealt with?



Q.4 What limitations are there to increased uptake?

Potential Benefits

Reducing high demand during peak periods

Resilience in the case of an natural disaster/emergency

Freeing up capacity in wastewater and water supply for future growth

- Extending the time period for costly upgrades

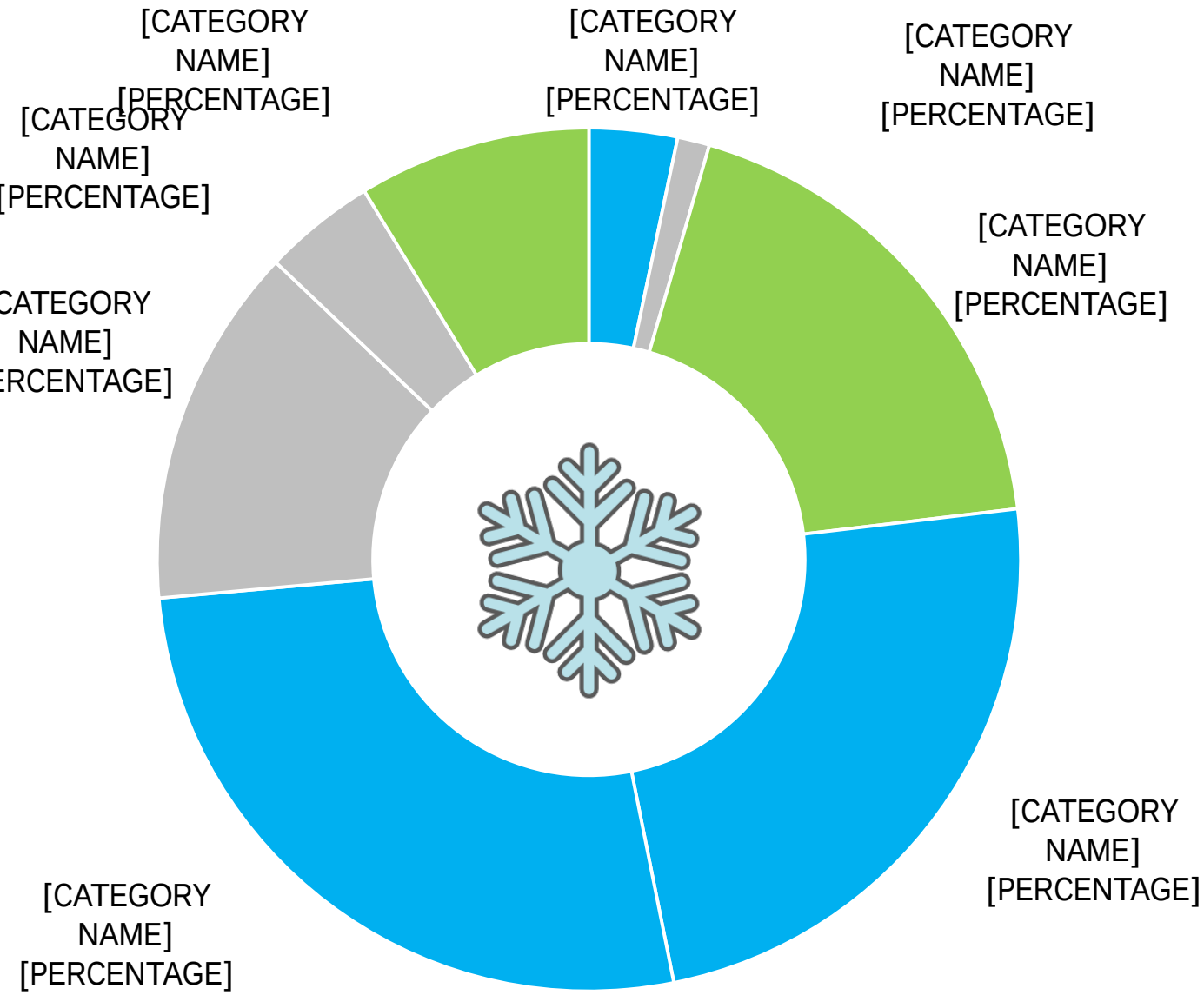
Supports garden irrigation year round (e.g. during irrigation bans)

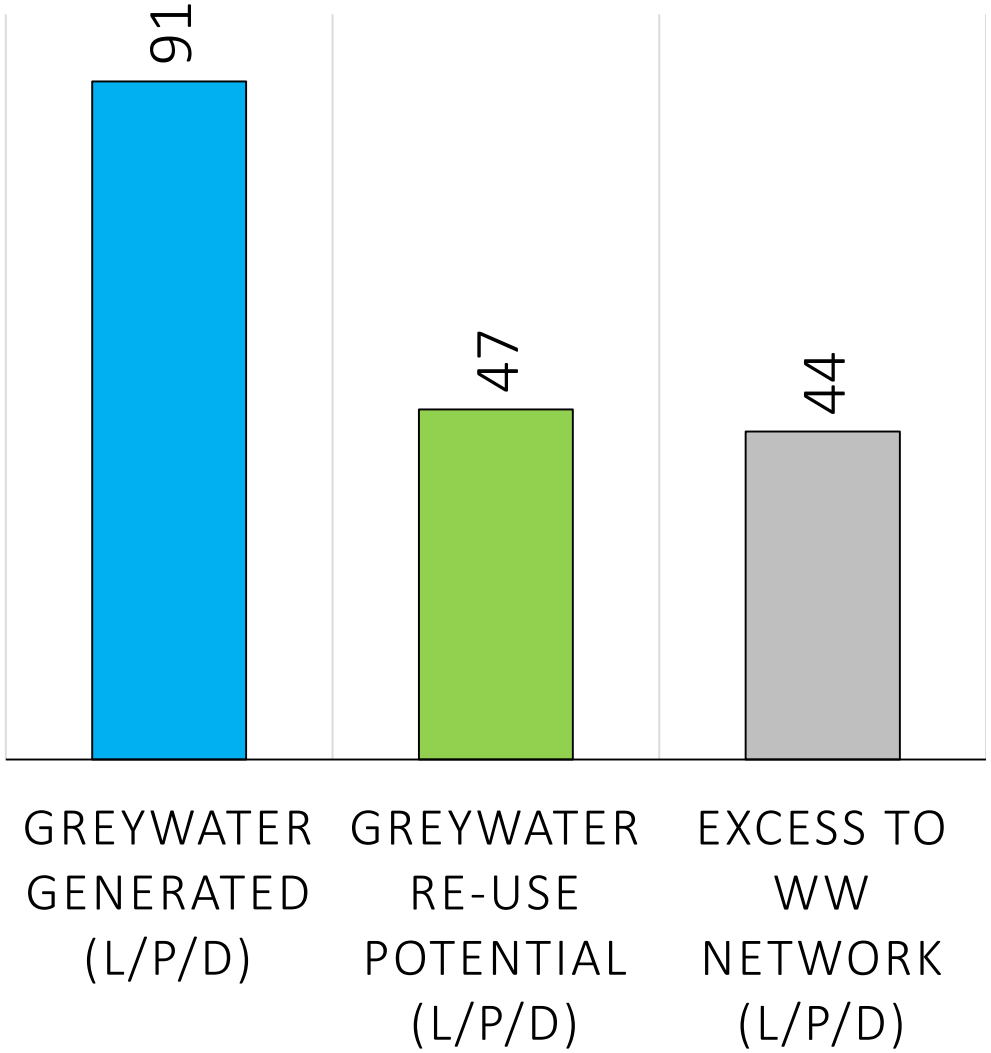
Save on the household water bill (if metered)

Reducing the volume of wastewater to be treated

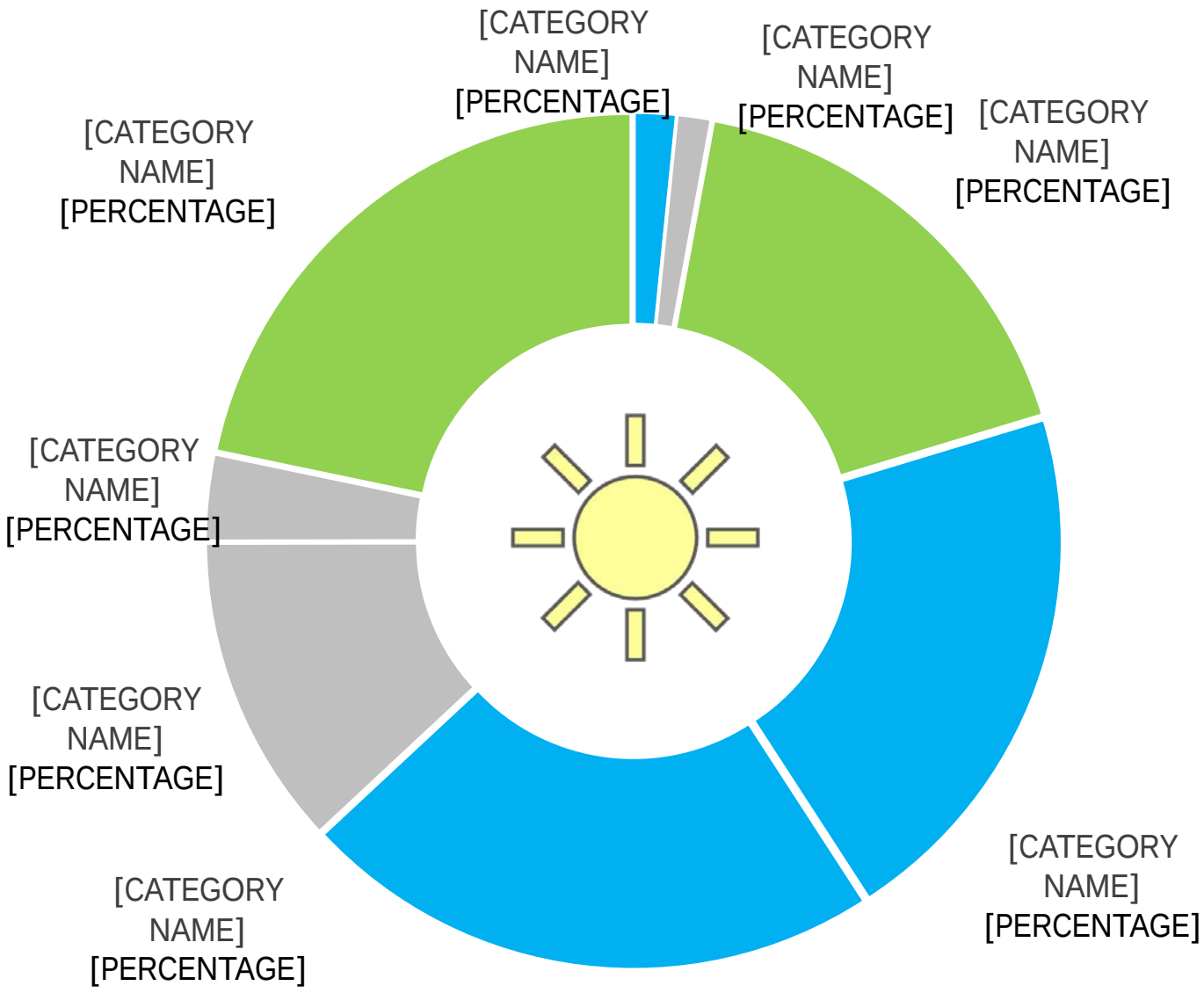
- Financial and environmental benefits

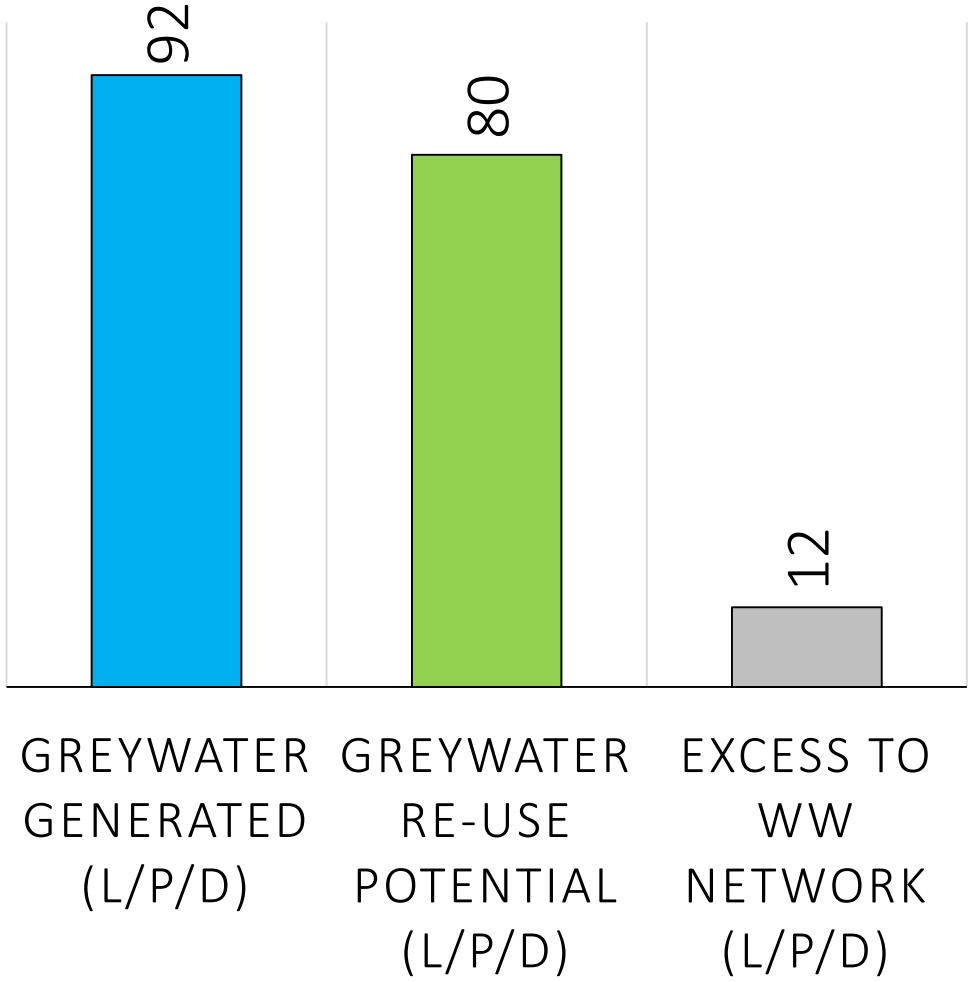
Context: Kapiti Coast Water Use Study – WINTER





Context: Kapiti Coast Water Use Study - SUMMER



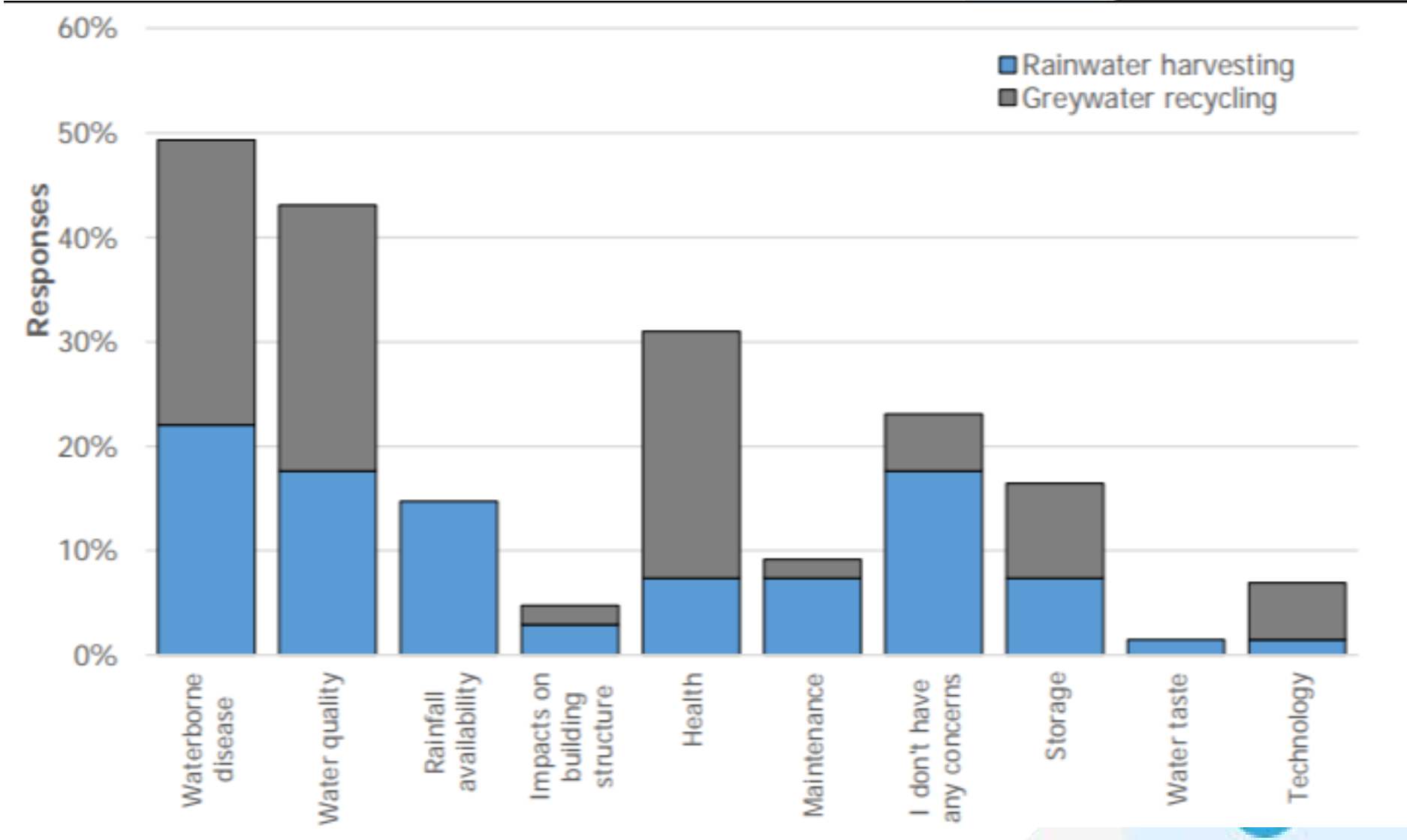


Barriers

2016 Survey found:

1. Waterborne Disease
2. Water Quality
3. Risk to human health

= Biggest barriers to uptake

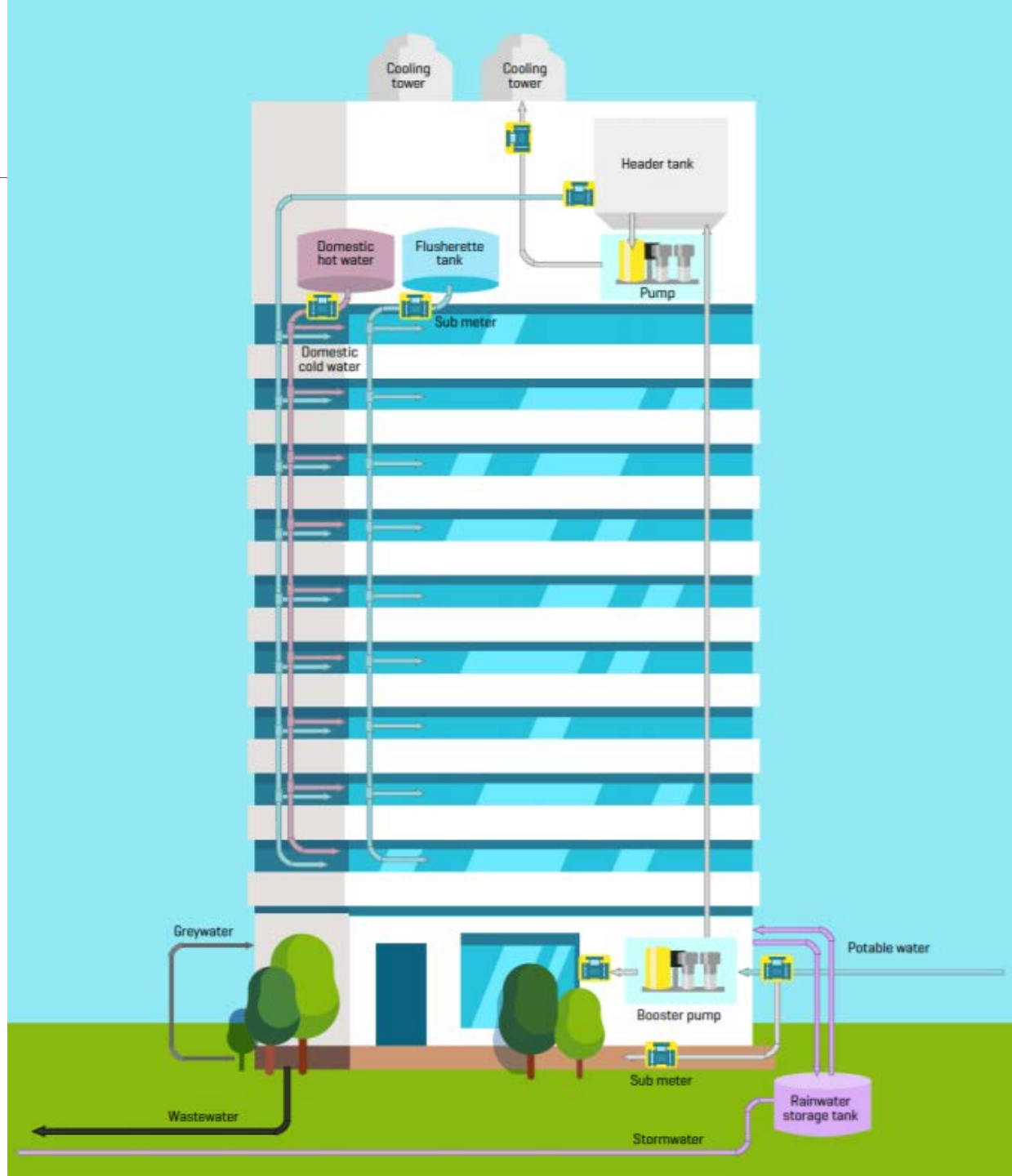


Previous Greywater Quality Testing

B1	*Escherichia coli* MPN/100mL
Guideline limit	1
Detection limit	1
Sampled range	0–2,400
Samples detected	3/24

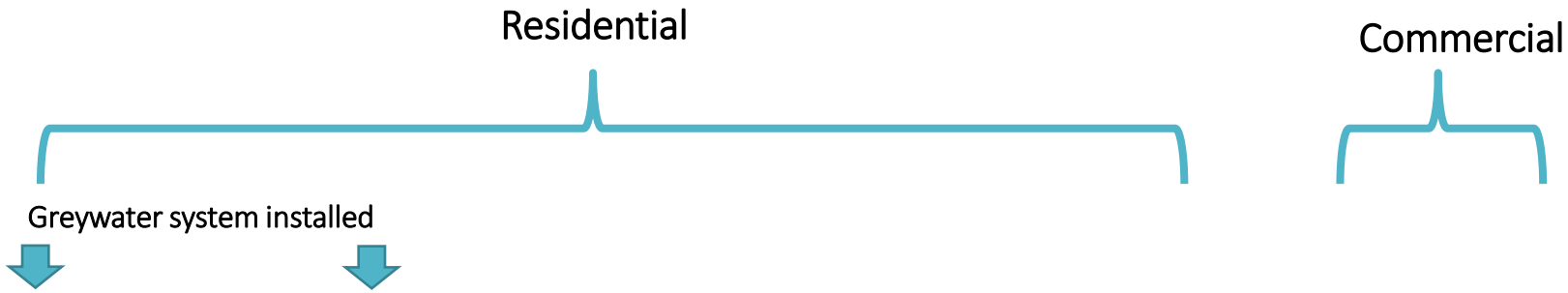
Overall, the quality of greywater in this single case study building was better than expected.

More work is required to make this statement representative, through investigation of a much larger sample.



What did we do?
Participants

Science for Communities



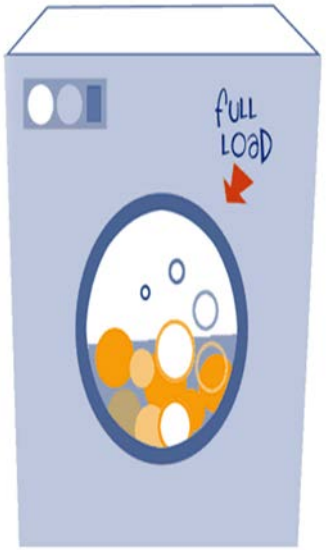
Property	1	2	3	4	5	6	7	8	9	10
Shower sample	19	12	11	13						
Hand Basin sample		12		13	7	7	8	9	14	12
Laundry sample					5		6	1		

Table 1 Participant identifiers and corresponding samples collected

What did we do?

Sample Collection

RESIDENTIAL



COMMERCIAL

What did we do?

Experimental Design

Residential Samples

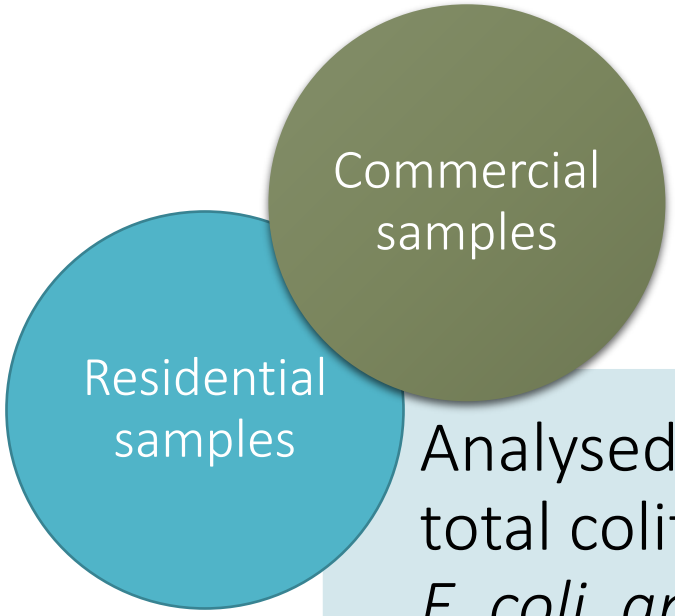
Analysed individually

Commercial Samples

Combined to make one composite sample

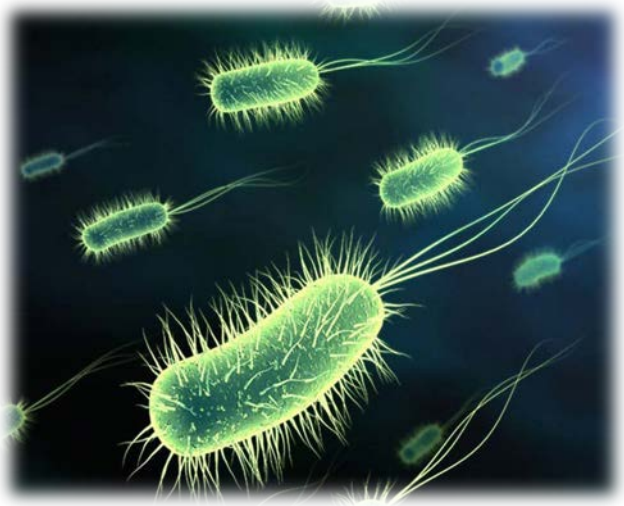
What did we do?

Laboratory Analysis



Analysed for total coliforms, *E. coli, and P. aeruginosa*

Escherichia coli



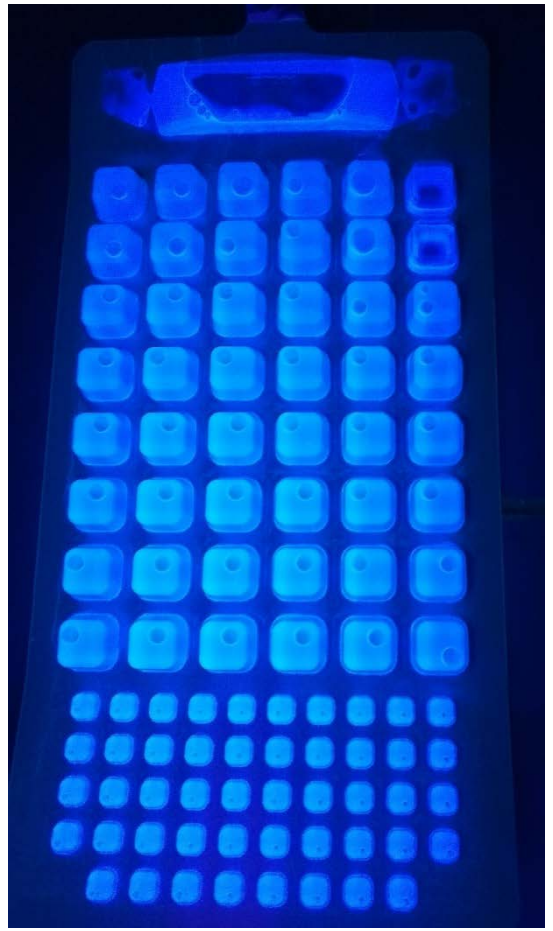
Pseudomonas aeruginosa

What did we do?

Laboratory Analysis

Greywater sample sourced from Hand Basin

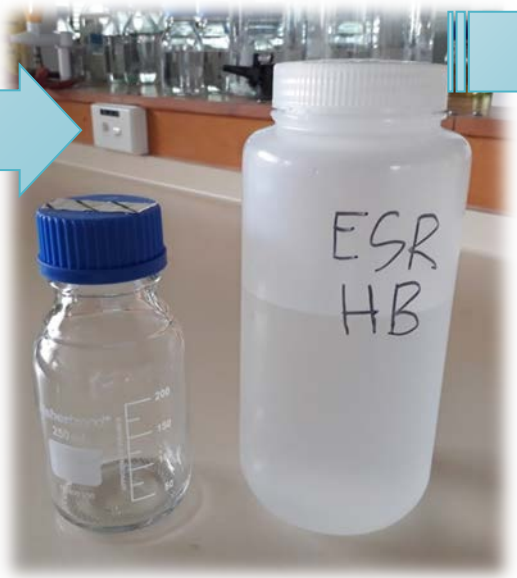
Colilert and Pseudalert Quanti-trays under the UV light



What did we do?

Laboratory Analysis

Colilert and Pseudalert testing method



What did we do?

Result presentation

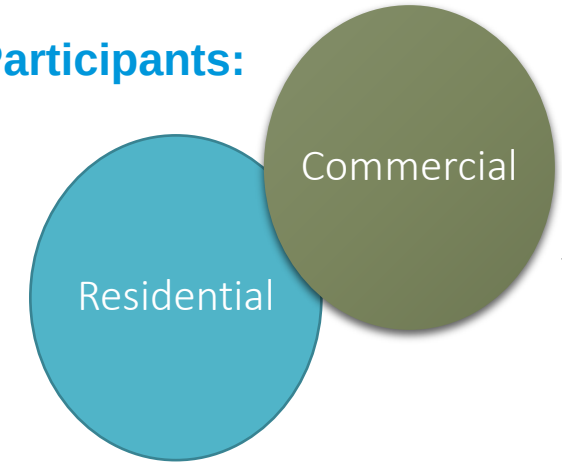
- High variability of the results therefore, each sampling event is displayed separately
- From this point on all result counts discussed are in MPN/100 mL. Which means Most probable number present in the 100 mL of sample tested.
- Results <1 MPN/100ml are represented as 0.1 MPN/100ml.
- Upper threshold of the IDEXX method for both E.coli and P. aeruginosa is >2419.6
- Results above 2419.6 were diluted at 1:100 for Colilert and 1:10 for Pseudalert and retested
- However there was a problem with Pseudalert dilutions. Many of the samples were negative when retested after dilution. Original samples were then confirmed as Pseudomonas aeruoginosa using classical biochemical tests. IDEXX are looking into this problem which is currently unexplained. Therefore majority of high pseudomonas counts are reported only as greater than 2419.6.

What did we find out?

How much *E. coli* is there?

Source:

Participants:



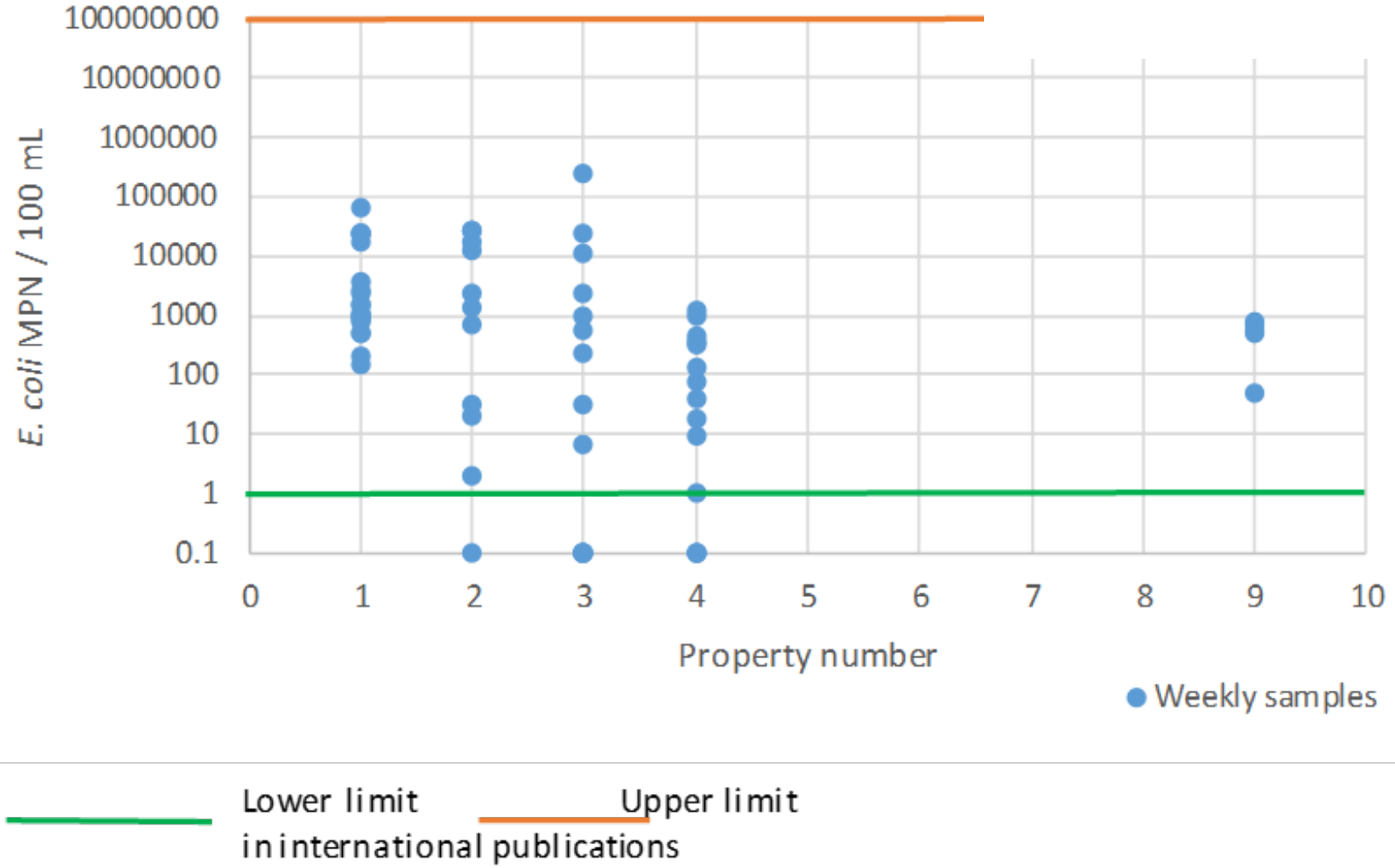


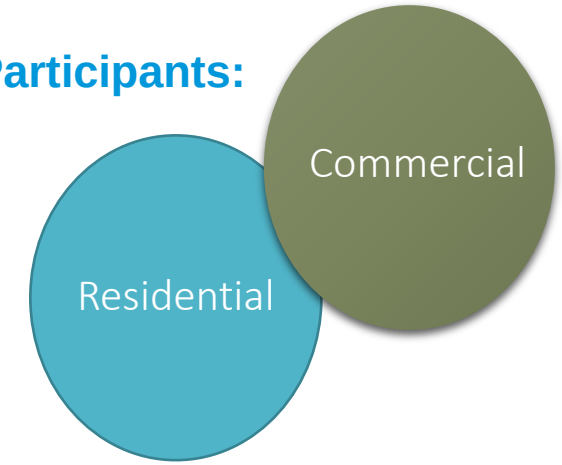
Figure 1 E. coli results from shower samples compared with international publication lower and upper findings (Leonard and Kikkert, 2006).

What did we find out?

How much *P. aeruginosa* is there?

Source:

Participants:



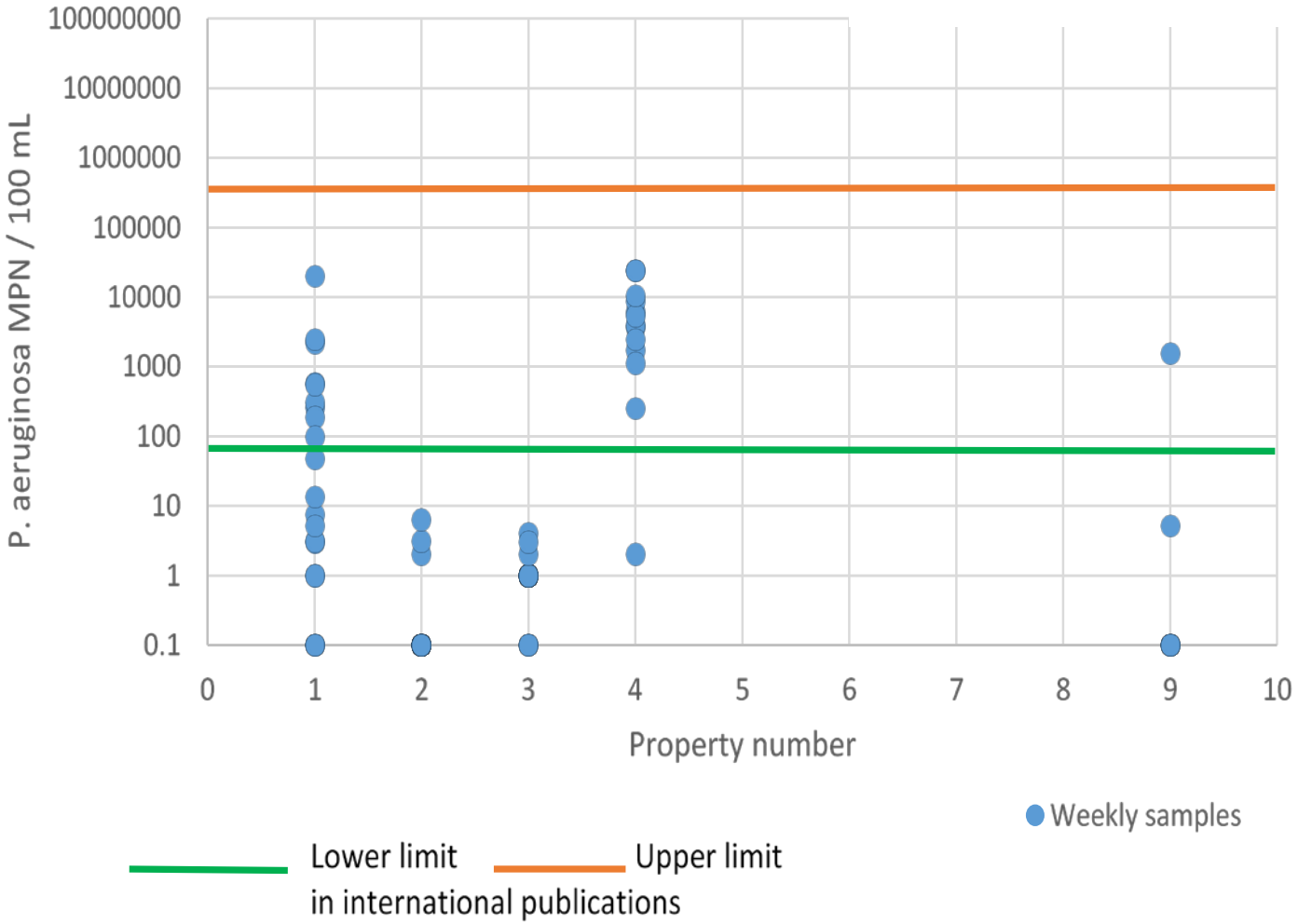


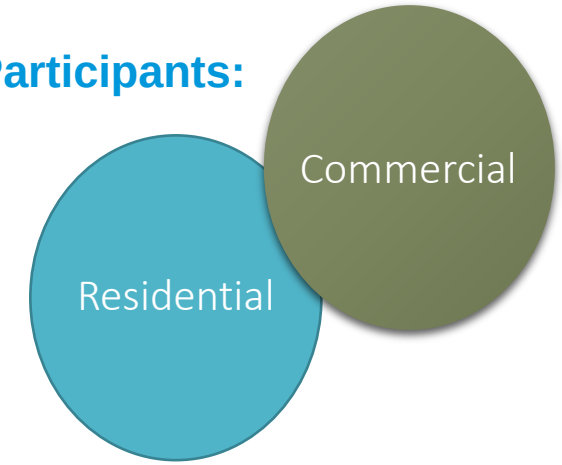
Figure 2 P. aeruginosa results from shower samples compared with international publication lower and upper findings (Benami et al 2016; Casanova et al 2001).

What did we find out?

How much *E. coli* is there?

Source:

Participants:



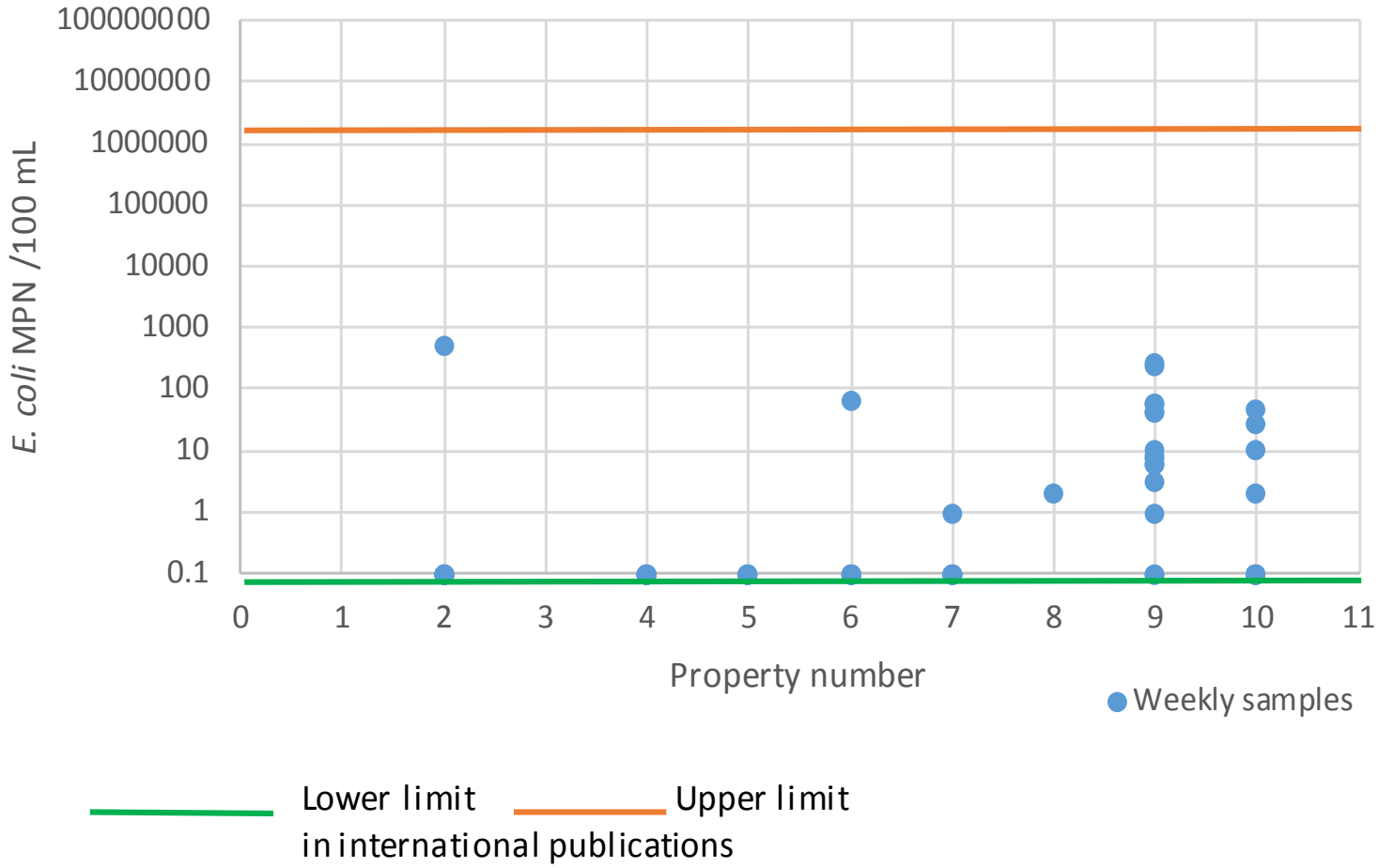


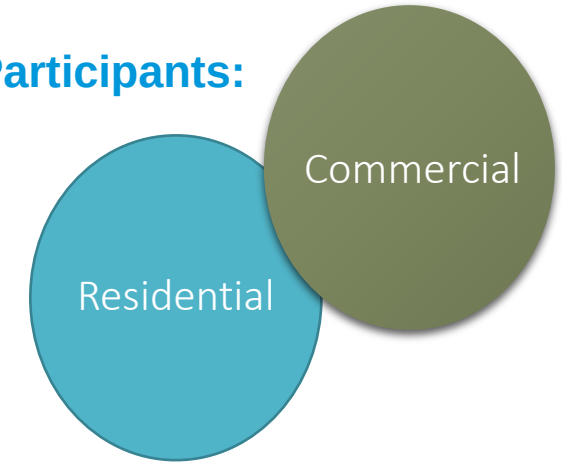
Figure 3 E. coli results from hand-basin samples compared with international publication lower and upper findings (Birks et al, 2004).

What did we find out?

How much *P. aeruginosa* is there?

Source:

Participants:



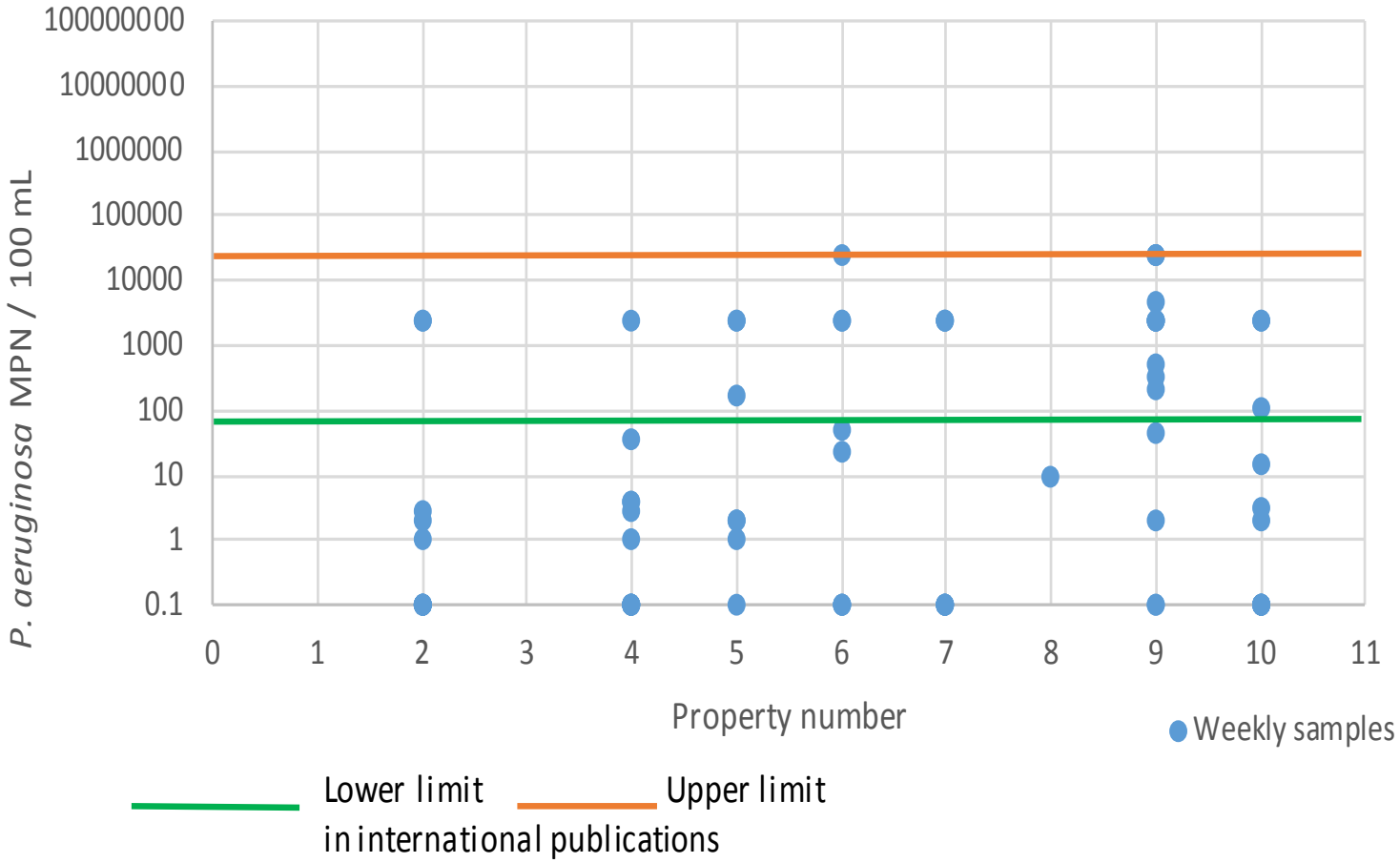
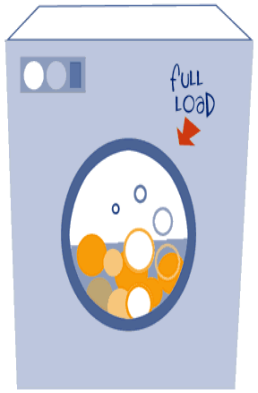


Figure 4 P. aeruginosa results from hand-basin samples compared with international publication lower and upper findings (Benami et al 2016).

What did we find out?

How much *E.coli* is there?

Source:



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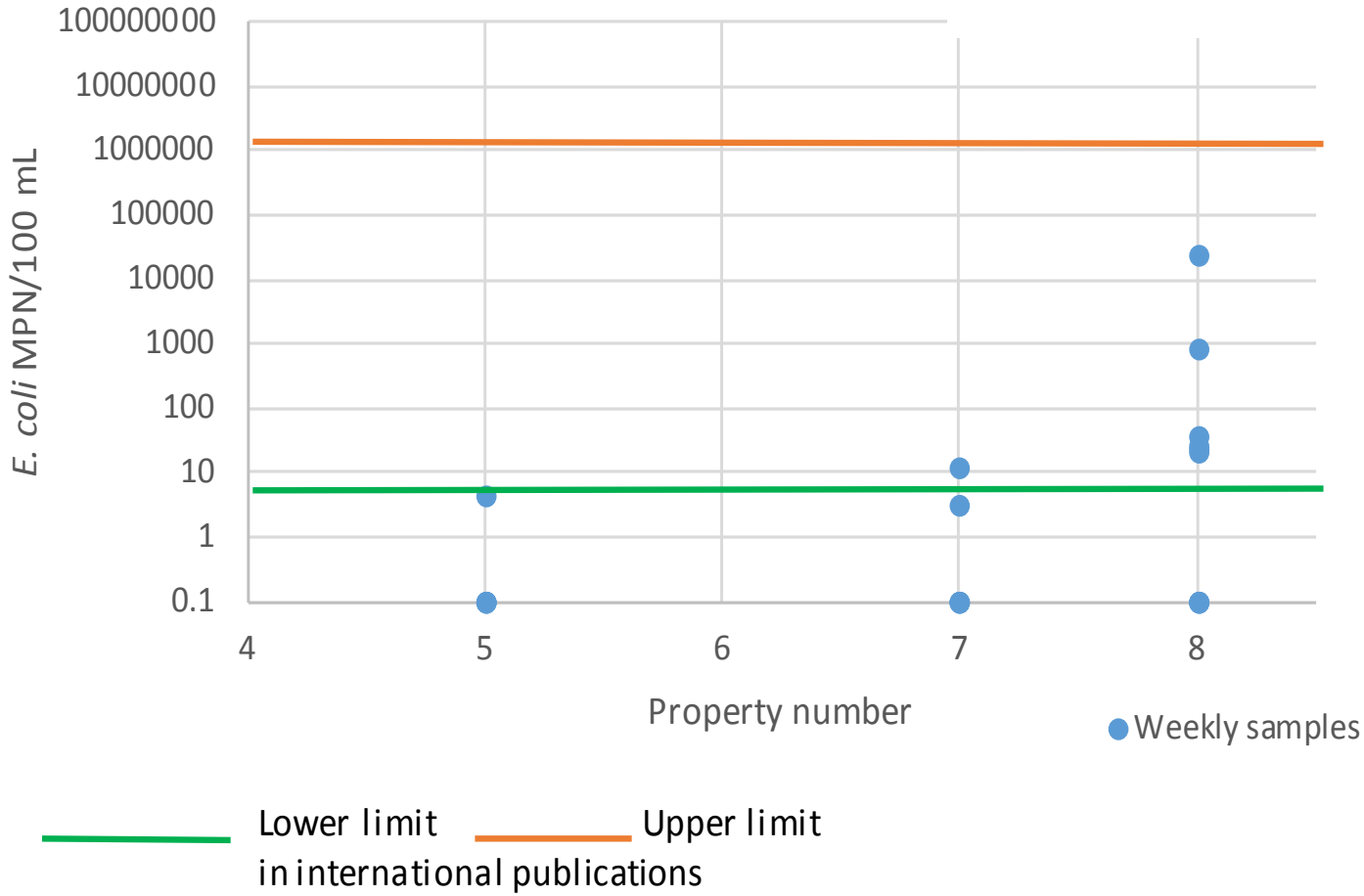
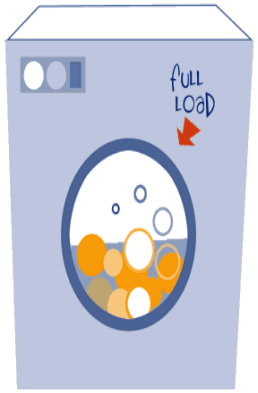


Figure 5 E. coli results from laundry samples compared with international publication lower and upper thresholds (O'Toole et al 2012)

What did we find out?

How much *P. aeruginosa* is there?

Source:



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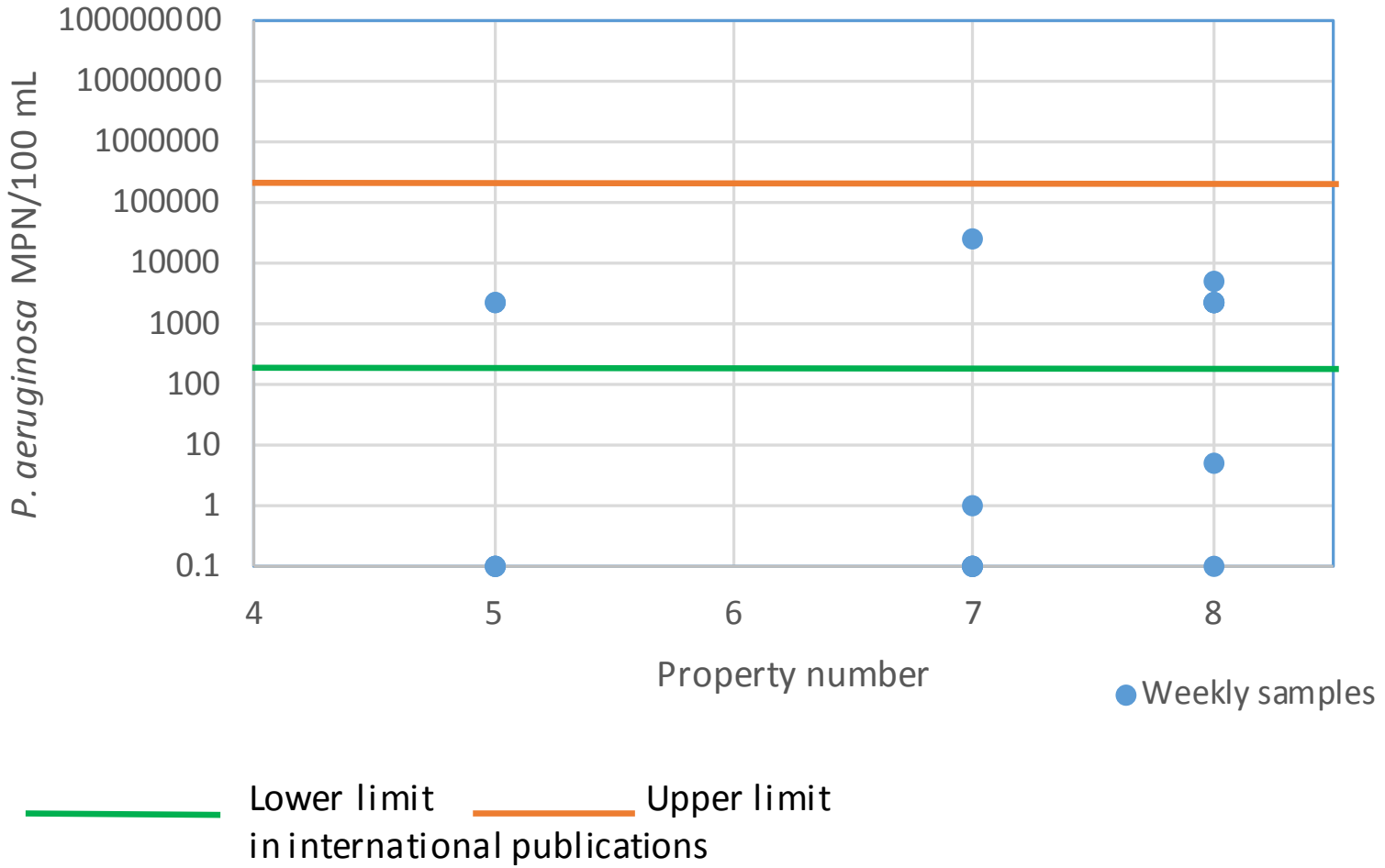


Figure 6 P. aeruginosa results from laundries compared with international publication lower and upper findings (Casanova et al 2001).

International Comparison: Southern Australian Reclaimed Water Use Guidelines (1999)

Class	Uses	Microbiological criteria E. coli/100ml (median)
A	Primary contact recreation	<10 Specific removal of viruses, protozoa and helminths may be required
	Residential non-potable	
	- garden watering	
	- toilet flushing	
	- car washing	
	- path/wall washing	
	Municipal use with public access/adjoining premises	
	Dust suppression with unrestricted access	
	Unrestricted crop irrigation	
B	Secondary contact recreation	<100 Specific removal of viruses, protozoa and helminths may be required
	Ornamental ponds with public access	
	Municipal use with restricted access	
	Restricted crop irrigation	
	Irrigation of pasture and fodder for grazing animals	
	Washdown and stock water	
	Dust suppression with restricted access	
	Fire fighting	
C	Passive recreation	<1,000 Specific removal of viruses, protozoa and helminths may be required
	Municipal use with restricted access	
	Restricted crop irrigation	
	Irrigation of pasture and fodder for grazing animals	
D	Restricted crop irrigation	<10,000 Specific removal of viruses, protozoa and helminths may be required
	Irrigation for turf production	
	Silviculture	
	Non-food chain aquaculture	

Property	1	2	3	4	5	6	7	8	9	10
Shower sample	X	X	X	X					X	
Basin sample		X		X	X	X	X	X	X	X
Laundry sample					X		X	X		

Important to Note:

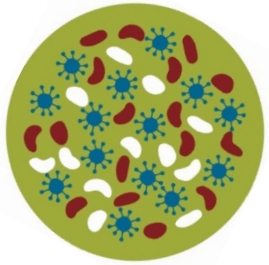
1. No testing was conducted for the other bacterial species, viruses, protozoa or helminths as required by the guidelines. Only *E. coli* was assessed. Thus, warranting further investigation to be conclusive.

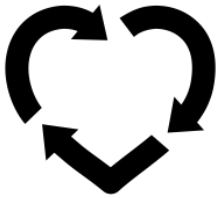
2. The guidelines classify based on the median sample – we noted large variation in results between properties and within the same property so would exercise caution.

3. The guidelines require all reused water to be treated – all samples taken as part of this study were taken pre-treatment. Suggesting that if treatment were implemented as required in South Australia the suitability of shower samples for reuse would likely increase.

Further Research Required

A larger microbial water quality study, that also assesses environmental indicators after repeat irrigation using greywater – to assess any **environmental impacts**





A comparison of eco-friendly and ‘normal’ household products and their effect on greywater quality. This would enable analysis of the effect of products with and without antimicrobial properties

<10	Specific removal of viruses, protozoa and helminths may be required

Further greywater testing to account for levels of other indicators referenced in the Southern Australian guidelines.

An investigation of active greywater systems and their maintenance schedules in relation to water quality.

Thank You, Questions?

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