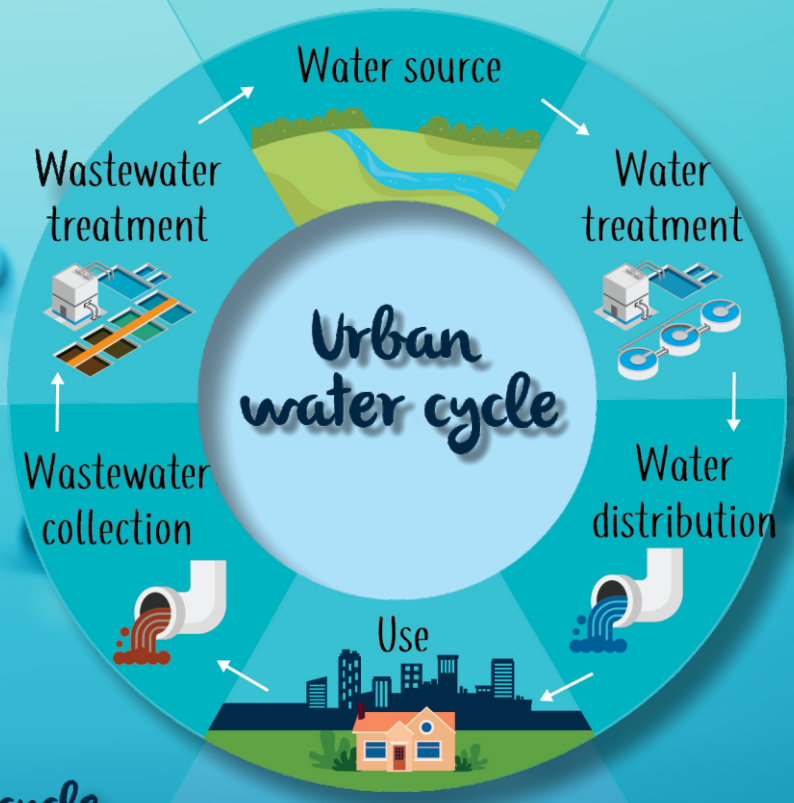
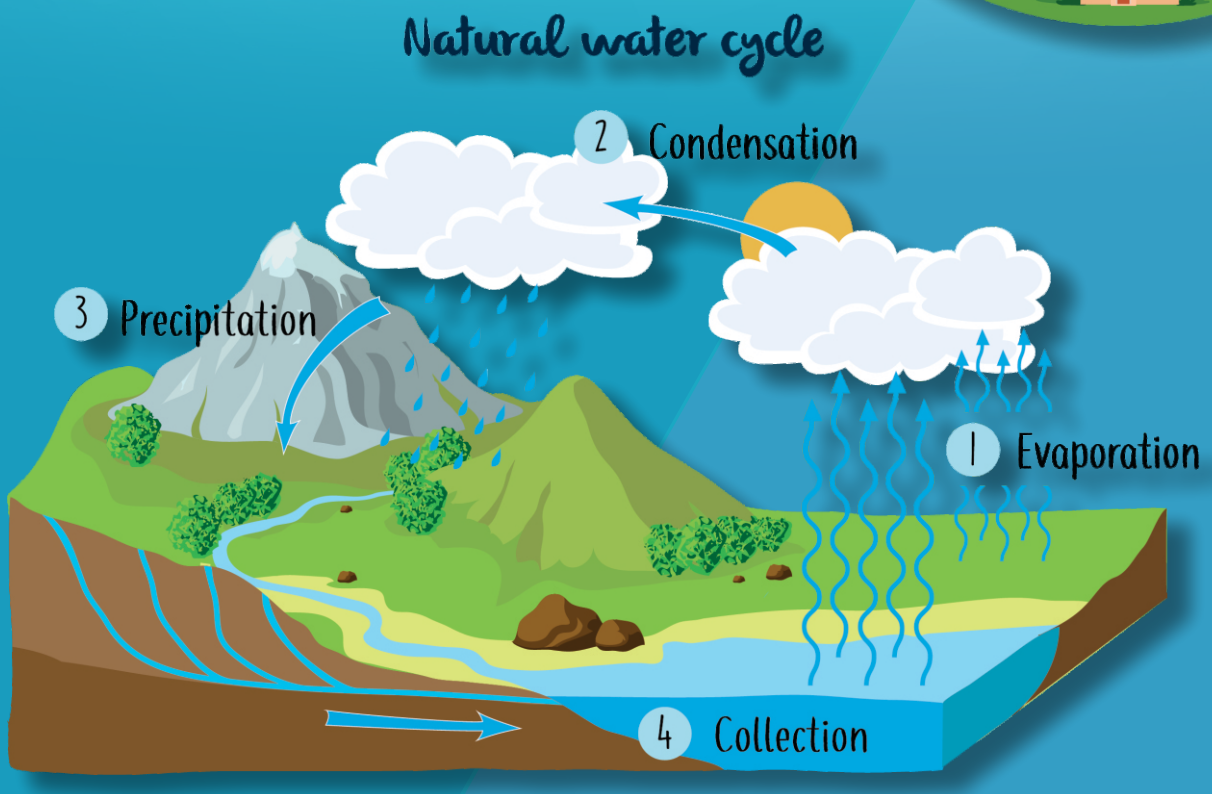
PUBLIC KNOWLEDGE OF WATER RE-USE AND OTHER WATER-RELATED ASPECTS

Sarah Slabbert and Nadja Green





WATER RESEARCH COMMISSION

TT 807/19

Public Knowledge of Water Re-use and other Water Related Aspects

Report to the Water Research Commission

by

Sarah Slabbert and Nadja Green

WRC Report No. TT 807/19

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EXECUTIVE SUMMARY

With a fast-growing population and recurring droughts, it has become critical for South Africa to plan for an increasing demand for freshwater. Water re-use is one of the strategies proposed in policy documents such as the National Water Resource Strategy and the National Water and Sanitation Master Plan.

The Water Research Commission (WRC) has done most of the research groundwork on the technical, financial and water quality aspects of water re-use. The WRC has also done several studies on social and cultural perceptions of water re-use, but the South African public's current awareness and understanding of aspects of water re-use and related aspects have not yet been tested.

Lack of understanding of the water cycle and treatment technology is cited in the literature to be correlated to negative perceptions on water re-use, and thus a major barrier to the implementation of water re-use, particularly direct potable re-use.

This report discusses the findings of a national survey which was conducted in September 2019 as part of the OMNIBUS syndicated survey of Nielsen South Africa. The survey tested South Africans' knowledge of several aspects of water re-use and related aspects. The survey also determined which actions South Africans are likely to support in times of a severe drought. The results of the survey will inform the development of a communication strategy for a sustainable public education programme on water re-use (WRC Project K5/2805).

The survey found that South Africans across all demographic groups have poor knowledge and understanding of the basic terminology that is needed for a meaningful public discourse on water re-use. For example, only 35% of South Africans know that greywater is the term for wastewater from bathing, washing clothes and dishes. Only 28,3% know what 'potable water' means.

The pilots of the study found that knowledge of terms like 'wastewater' and 'treated wastewater' was so poor that these terms had to be explained upfront in a showcard before respondents could be asked any questions.

South African's knowledge of water re-use and related aspects was tested with 18 statements. The composite result was presented as an index score out of 20. On average, South Africans scored 12 out of 20. Since the questions tested very basic knowledge, one would expect at least an average score of 14 out of 20 from an educated public. This result therefore indicates that public knowledge of water re-use and related aspects must be improved.

Even for the highest LSM (Living Standard Measure) group, LSM 8-10 and for people with a post Grade 12 qualification the average scores were 13,05 and 12,65 respectively. This implies that a public education campaign on water re-use should target all demographic groups.

There were some demographic differences on the overall knowledge index, but not all were significant. Findings across provinces were inconsistent, indicating that province is not a good predictor when it comes to knowledge of water re-use and related aspects. LSM and education levels, on the other hand, were good predictors of knowledge of water re-use and related aspects.

Three sub-indices were calculated. On these sub-indices, South Africans scored as follows:

- 1,32 out of 3 for knowledge of the water cycle. This indicates that South African's knowledge of the water cycle is particularly poor.
- 1,81 out of 3 for knowledge of safety aspects of water re-use. On some aspects, knowledge was good (75% or more); on other, knowledge was poor.
- 4,58 out of 6 for knowledge of water and wastewater treatment. This knowledge result is quite remarkable as it shows that respondents have applied the explanation that they got in the showcard.

The statement about *de facto* water re-use got a large number of "Not sure'' responses (35,19%). South Africans seem to be unsure if there might be re-treated wastewater in their drinking water.

The survey indicated that South Africans would support water re-use in a severe drought situation, including direct potable re-use. 48,5% of the population mentioned direct potable re-use as an action that they will support. As expected, the support for direct potable re-use was lower than the support for industrial and greywater re-use, but the difference was less than 10%.

Although the correlation was weak, the survey confirmed that knowledge of water re-use and related aspects correlates positively with support for water re-use. The study also found that general education levels seem to be related to support for water re-use. Respondents with a post Grade 12 qualification (54,6%) support direct potable re-use in a drought significantly more than respondents with only primary education (39%).

One can therefore expect that improved public knowledge will have a positive outcome.

Acknowledgements

The project team would like to thank Dr Nonhlanhla Kalebaila, our project manager from the WRC, for her enthusiasm and support for this study.

Thank you also to Mr Chris Swartz, who made the budget available from his WRC research project on *de facto* water re-use.

List of acronyms

DWS	Department of Water and Sanitation
LSM	Living Standard Measure
NW&SMP	National Water and Sanitation Master Plan
WRC	Water Research Commission

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1 BACKGROUND

With a fast-growing population and recurring droughts, it has become critical for South Africa to plan for an increasing water demand. The National Water Resource Strategy (DWS, 2013) proposes water re-use as one of the strategies to supplement South Africa's water resources. The National Water and Sanitation Master Plan (NW&SMP) (DWS, 2018/19:15) takes this proposal up in Action 1.1.5, which states that planning studies to achieve the optimal water mix (surface water, groundwater, re-use and desalination) are to be developed, updated and maintained. A national programme to support the adoption of alternative water resources such as desalination and water re-use is also proposed (DWS, 2018/19:60).

The Water Research Commission (WRC) has done most of the research groundwork on the technical, financial and water quality aspects of water re-use (for example, Swartz et al., 2015). The WRC has also done several studies on social and cultural perceptions of water re-use (Muanda et al., 2017; Tayob et al., 2015), but it has not yet addressed the public's awareness and understanding of water re-use.

Lack of understanding of the water cycle and treatment technology is cited in the literature (Dolnicar & Hurlimann, 2009; Marks et al., 2008; Macpherson & Slovic, 2008; Macpherson and Snyder, 2012) to be correlated to negative perceptions on water re-use and thus a major barrier to the implementation of water re-use, particularly direct potable re-use.

The National Strategy for Water Re-use (DWS, 2011) calls for the development of a communication strategy for water re-use and gives priority to addressing the lack of understanding of the water cycle and treatment technology mentioned above when it defines the objective of such a strategy: "to develop and entrench awareness of the different facets of water use and specifically water re-use" (DWS, 2011:12).

In 2018, the WRC commissioned a project (K5/2805//3) that takes up this call for a communication strategy for water re-use that focuses on a sustained public education programme. The proposed communication strategy will lay the foundation of public knowledge and understanding of water re-use in South Africa, on which implementing organisations can base public communication campaigns for specific projects.

However, as there was no baseline on the status of public knowledge of water re-use in South Africa, it was decided that a study to determine this baseline was needed before the above-mentioned communication strategy could be developed.

This document reports on the methodology and findings of the baseline assessment of public knowledge of water re-use and related aspects, which was undertaken in 2019.

2 METHODOLOGY

2.1 SYNDICATED SURVEY

Nielsen South Africa's syndicated OMNIBUS survey was selected for the baseline assessment as it was the most cost-effective way to do a national survey. A syndicated survey is a shared research instrument with shared costs: multiple clients buy space (questions) on a national survey, sharing the cost of the sampling and the fieldwork. Each client gets its own results for the questions that they have asked.

Cost is determined by the number and type of questions that a client selects. Types range from closed pre-coded questions, simple close-ended or Yes/No questions, grid-style questions to open-ended questions.

2.2 THE SAMPLE

The OMNIBUS survey covers adults, aged 15 years and over, from all race groups. An area-stratified, probability sample of 3 319 urban and rural households was drawn from the Nielsen Company's Customized Research computerised dwelling unit census. The sample included 1 661 females and 1 658 males. In each household, the male or female to be interviewed was chosen using a random selection grid.

The sample included 2 519 urban respondents (Metro and other urban) and 800 rural respondents. "Urban" is defined as areas of a community size of 8 000 and above. This includes cities and large and small towns.

The distribution of the sample (number of respondents) was as follows:

Race			
Black	Coloured	Indian	White
2113	393	169	644

Age				
15-24	25-34	35-44	45-54	55+
747	809	623	464	676

Income			
Less than R2999	R3000-R6999	R7000-R13999	R14000+
618	769	713	697

Education			
Primary school complete	Some high school	High school	Post grade 12/University
289	1013	1420	591

Living Standard Measure (LSM)		
Group 1-4	Group 5-7	Group 8-10
548	2389	382

Community size		
Metro	Other Urban	Rural
1596	923	800

For province, the distribution of the sample was as follows:

Province								
Western Cape	Eastern Cape	KwaZulu-Natal	Free State	North West	Northern Cape	Mpumalanga	Limpopo	Gauteng
524	356	580	160	204	80	219	247	949

The split for rural respondents across the provinces was as follows (depicted as a percentage):

Rural respondents								
Western Cape	Eastern Cape	KwaZulu-Natal	Free State	North West	Northern Cape	Mpumalanga	Limpopo	Gauteng
0%	18,4%	27,2%	3%	11,4%	1%	12%	24,7%	2,3%

2.3 QUESTIONNAIRE DESIGN

2.3.1 Structure of the questionnaire

The questionnaire was designed to cover as many aspects as possible within the available budget. It comprised two grid-style questions and one closed pre-coded question.

The second grid-style question included an ''Other'' option, which allowed for open responses.

The questionnaire was designed to cover knowledge that was identified in the literature review and the stakeholder consultations of WRC Project K5/2805 as essential for the public to have. This includes the following aspects:

- Knowledge of terminology such as 'wastewater', 'treatment', 'greywater' and 'potable water'
- Knowledge of the water cycle
- Knowledge of water and wastewater treatment and municipal responsibilities in this regard
- Knowledge of *de facto* water re-use
- Knowledge of safety aspects of water re-use
- Common myths and misconceptions
- Knowledge of the effect of climate change on the availability of water
- Knowledge of South Africa as a water-scarce country

2.3.2 Stakeholder consultation and pilots

The draft questionnaire was sent to the following people for their comments and input:

- Dr Nonhlanhla Kalebaila (project manager of WRC Project K5/2805);
- Mr Chris Swartz (project leader of WRC Project K5/2731);
- The Reference Group members of WRC Project K5/2805;
- Mr Tendani Nditwani (DWS);
- Mr Johann Lübbe (DBSA);
- Ms Coralie van Reenen (CSIR).

The questionnaire was adjusted and improved, based on the feedback received. It was subsequently piloted with six respondents and further adjusted.

2.3.3 Limitations of the questionnaire

The terms ''wastewater'' and ''treated and untreated wastewater'' formed the basis of many of the statements in the questionnaire. The pilots indicated that especially respondents from the lower LSMs (Living Standard Measure)[1] were not be familiar with these terms. Explanatory phrases would have made the statements very long and complex; it was therefore decided to add a showcard to the questionnaire. The showcard explains the concepts of wastewater, treatment and standards upfront to respondents. As a result, respondents' familiarity with these terms could not be tested. We believe though that it would be correct to assume that the majority of South Africans are not familiar with these terms.

2.3.4 Final version of the questionnaire

The final questionnaire appears below:

Questionnaire

As you know, we can't survive without water. Therefore, government must make plans so that everyone has water even in times of drought. Your answers will help them to make the necessary plans.

Please read the showcard. SHOW AND KEEP THIS SHOWCARD AVAILABLE FOR RESPONDENT TO REFER BACK TO.

> Wastewater means "water that is not clean because it has already been used in homes, businesses, factories or on farms".
>
> Wastewater treatment means "the process to clean wastewater".
>
> Wastewater can be treated to different standards. One of the highest standards is water that is safe to drink.

1. What is the name for wastewater from bathing, washing clothes and dishes? SHOWCARD. SINGLE MENTION.
    1. Greenwater
    2. Blackwater
    3. Greywater
    4. Reclaimed water
    5. Potable water
    6. Don't know

2. I am going to read out statements. Please tell me if the statement is true or false. Or, if you are not sure. This is not a test, so please tell me if you are not sure of the answer. Do not guess. (READ OUT STATEMENTS ONE BY ONE).

	Statement	**Not sure**	**True**	**False**
1	The amount of water on earth is getting less and less.			

[1] The Living Standards Measure (LSM) has been developed by the South African Advertising Research Foundation. It is a segmentation tool based on access to services and durables as determinants of standard of living. The tool uses 29 variables. These include water in home/on plot, hot running water and a flush toilet. There are 10 LSM groups, 10 being the highest living standard and 1 the lowest.

2	We still use the same water that plants and animals used thousands of years ago.			
3	It is safe to eat vegetables from plants that were watered with wastewater from bathing, washing clothes and dishes.			
4	Municipalities must treat water to the drinking water safety standard before they supply the water to you.			
5	Municipal tap water in the kitchen is the same as the water that goes into the water tank of the toilet.			
6	Municipalities must treat wastewater before they may discharge it into a river.			
7	We do not need to pay for water as it comes from rain.			
8	In many of our rivers, treated wastewater gets mixed with rainwater. Municipalities re-use this water as drinking water after treating it.			
9	Cattle will <u>not</u> get sick if they drink untreated wastewater.			
10	Children will get sick if they play in untreated wastewater.			
11	Seawater can be used for drinking or watering crops after it has been treated.			
12	Water costs money because it is expensive to treat and transport it.			
13	Potable water is dirty water.			
14	A very small percentage of the world's water is freshwater.			
15	Wastewater can be treated to a standard where it is drinkable.			
16	Climate change may affect how much water we have for our homes.			
17	South Africa does not have water scarcity problems.			

3. In the event of a severe drought, a city like Johannesburg can take different actions to ensure that people have enough drinking water. Select the actions that you will support. SHOWCARD. MULTIPLE MENTIONS.
    1. Make a rule on how much water a person is allowed to use per day
    2. Make water expensive for people who use more than the basic amount
    3. Drill for groundwater
    4. Encourage people to use their bathwater to flush toilets
    5. Cut off the supply of water for a few hours per day (load shedding for water)
    6. Treat wastewater to the drinking water safety standard and re-use it for drinking water
    7. Encourage factories to treat and recycle the water they use
    8. Another action (please specify)

2.4 INTERVIEWS

Personal at-home interviews were conducted in English[2]. The interviews were conducted using a structured questionnaire on a laptop (Computer Assisted Personal Interview or CAPI) and a showcard.

A 20% validation check was done personally or telephonically on the work of each interviewer.

2.5 DATA ANALYSIS

Nielsen South Africa post-weighted the data to estimated population proportions and did the cross-tabulations and tests for statistical significance and correlation. The data was presented in Excel according to standard demographic variables: race, age, province, gender, monthly household income, community size and Living Standards Measure (LSM). Statistical significance was indicated.

The research team of WRC Project K5/2805 double-checked the results against the raw data and did the analysis and reporting.

Additional analysis was requested to calculate a knowledge index out of 20 and three sub-indices. See the appendix for the details.

[2] Nielsen no longer translates questionnaires.

3 RESULTS

3.1 FAMILIARITY WITH TERMINOLOGY

3.1.1 Greywater

3.1.1.1 General findings

Question 1 tested the respondents' familiarity with the term 'greywater'. The results are depicted in Figure 1.

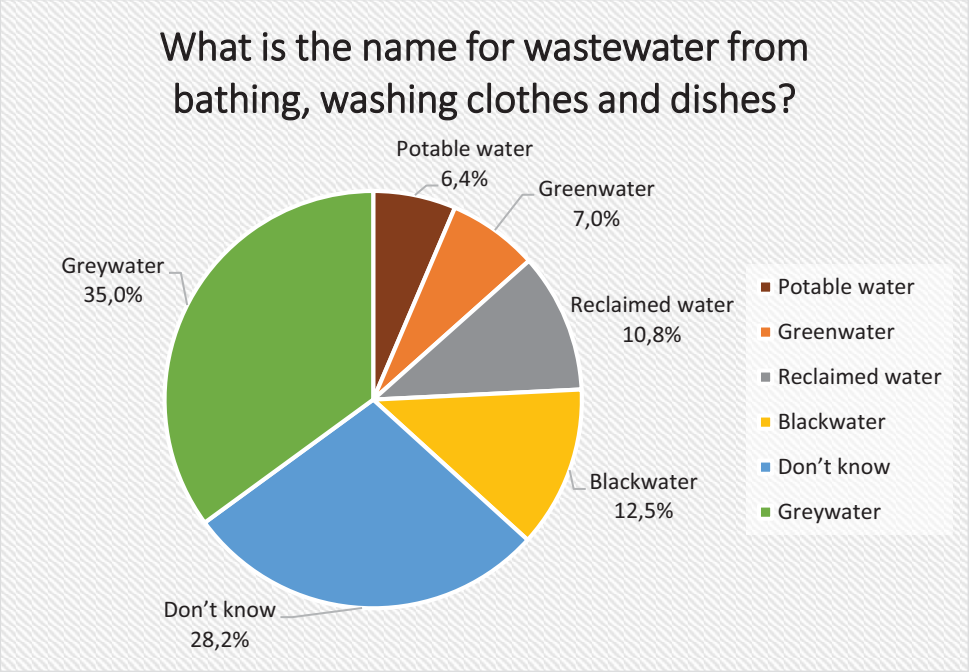

Figure 1: Familiarity with the term 'greywater'

Only 35% of South Africans named wastewater from bathing, washing clothes and dishes correctly as 'greywater'.

28,2% admitted that they don't know the "name for wastewater from bathing, washing clothes and dishes''.

Furthermore, South Africans are not familiar with the technical water terms that were listed as options, because 29,7% called wastewater from bathing, washing clothes and dishes 'potable water', 'blackwater' or 'reclaimed water'. 7% said it is 'greenwater'.

The impact of demographic variables is discussed below.

3.1.1.2 Provinces and community size

Provincial differences in people's familiarity with the term 'greywater' were statistically significant. See the figure below.

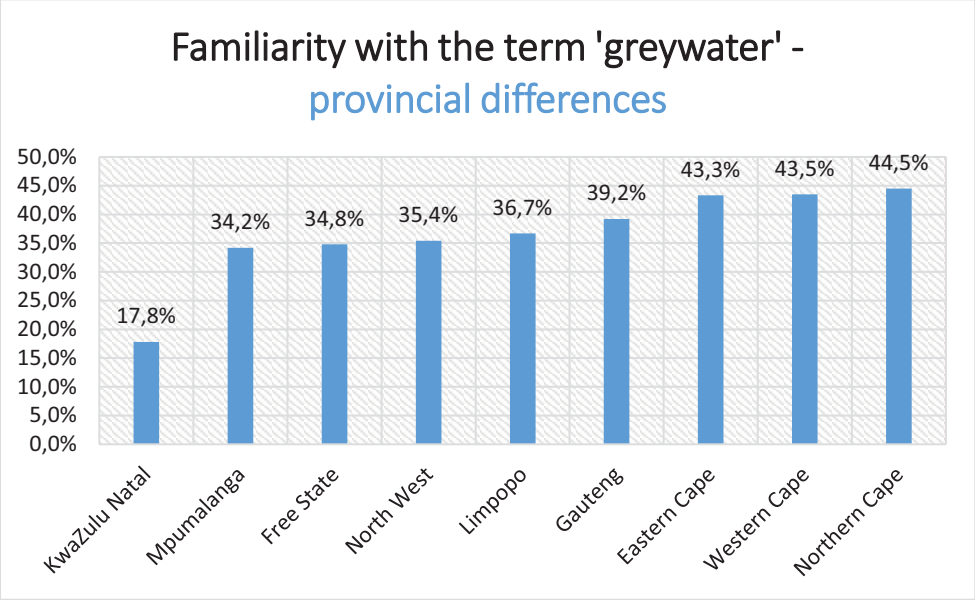

Figure 2: Familiarity with the term 'greywater' – provincial differences

The Northern Cape, the Western Cape and the Eastern Cape got the highest correct scores with 44,5%, 43,5% and 43,3% respectively. The term is the least known in KwaZulu-Natal; only 17,8% were familiar with the term.

The figure below compares the scores of urban versus rural.

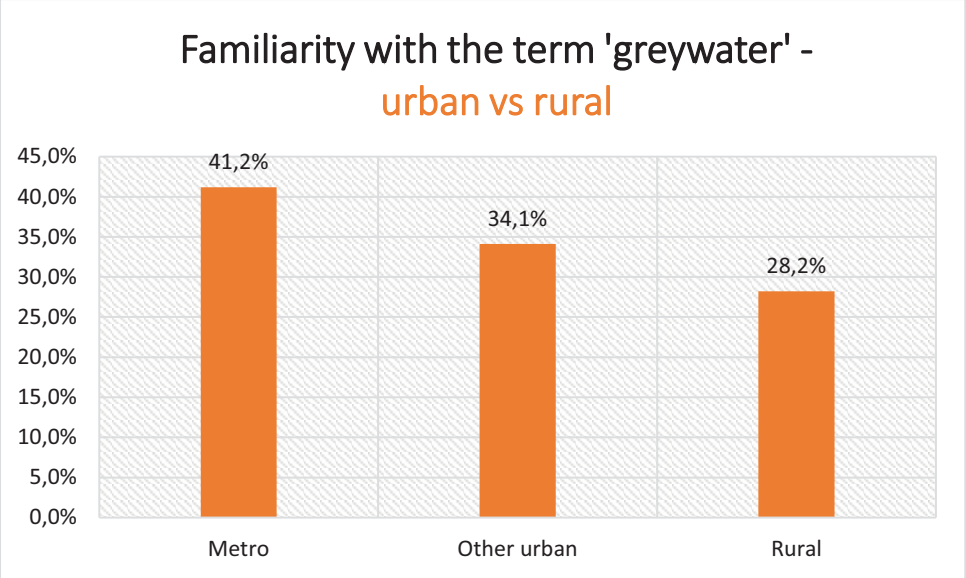

Figure 3: Familiarity with the term 'greywater' – urban vs rural

In the Metros, 41,2% of people know the term 'greywater'; in 'other urban areas', 34,1% of people know the term. Only 28,2% of the rural population know that wastewater from bathing, washing clothes and dishes is called 'greywater'. Differences were statistically significant.

3.1.1.3 Age and gender

Age and gender differences were not statistically significant as the figures below illustrate.

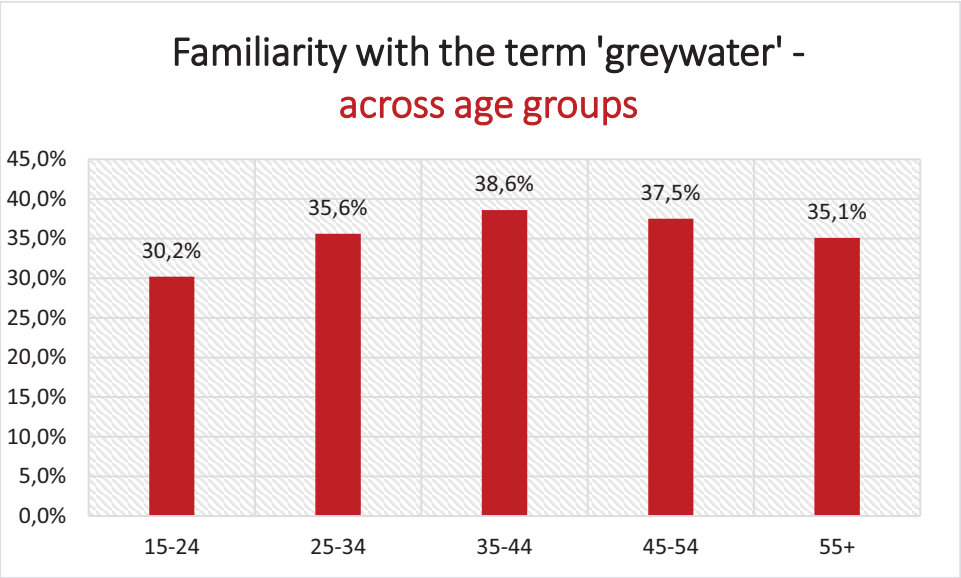

Figure 4: Familiarity with the term 'greywater' – across age groups

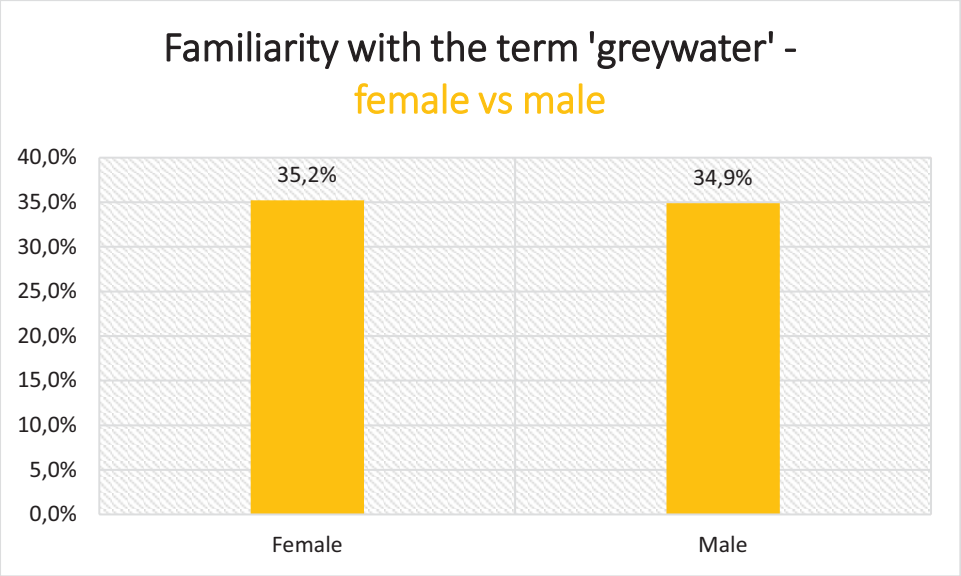

Figure 5: Familiarity with the term 'greywater' – female vs male

3.1.1.4 Race

The figure below depicts differences in the familiarity with the term 'greywater' across racial groups.

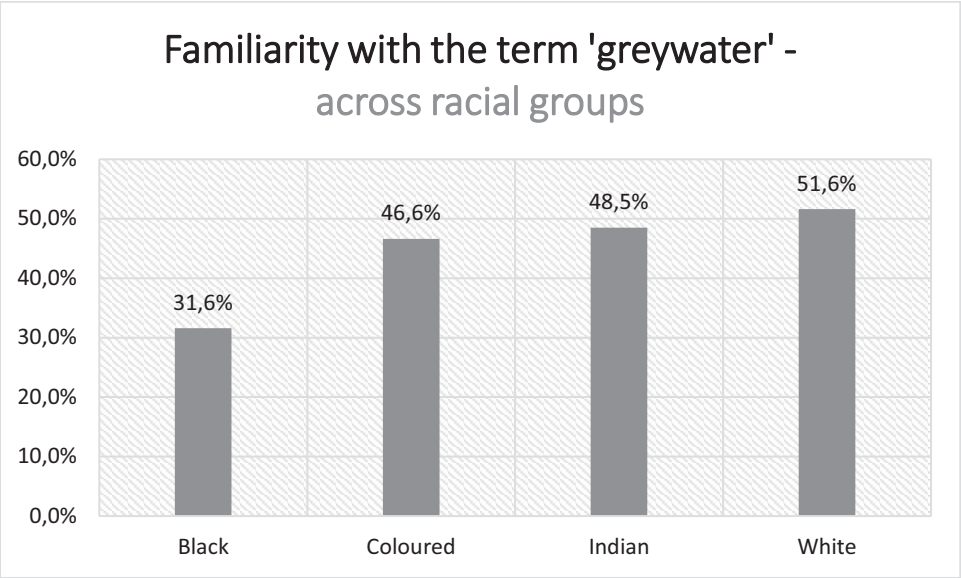

Figure 6: Familiarity with the term 'greywater' – across racial groups

The Coloured, Indian and White populations had the highest correct scores (46,6%, 48,5% and 51,6% respectively). The Black population scored significantly lower (31,6% correct answers), but it is likely that some respondents were not familiar with the English term 'greywater'.

3.1.1.5 Income and LSM group

The figures below show people's familiarity with the term 'greywater' according to their monthly household income and their LSM group. Knowledge of the term corresponds with people with a higher monthly household income (R14 000+) and those in the higher LSM groups (8-10). These groups scored the best with 46,7% and 50,5% respectively and differences were statistically significant.

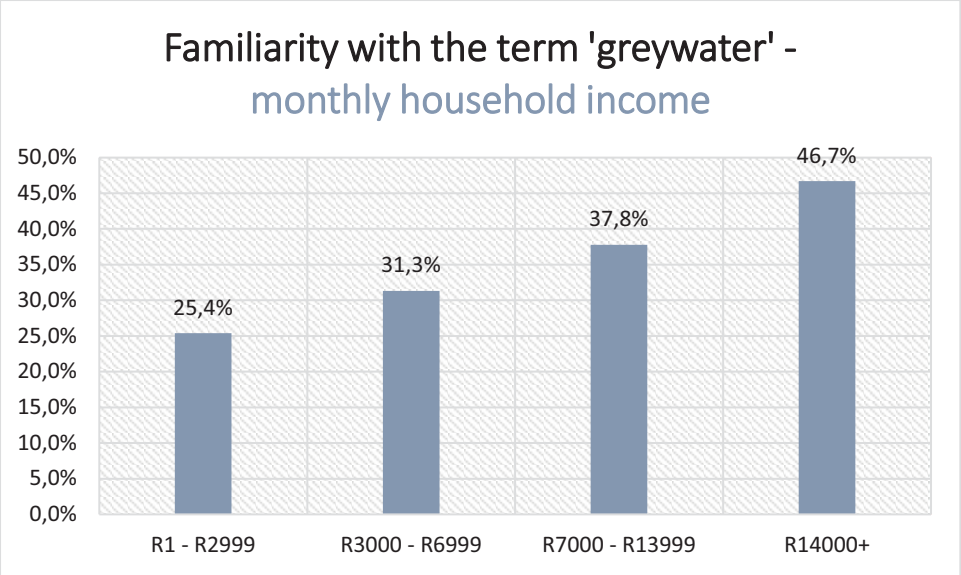

Figure 7: Familiarity with the term 'greywater' – monthly household income

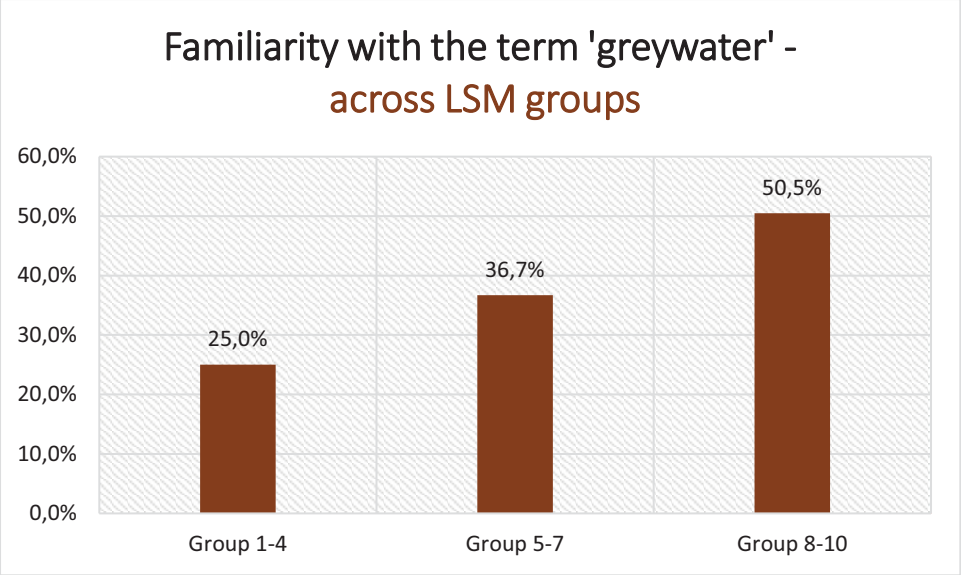

Figure 8: Familiarity with the term 'greywater' – LSM group

3.1.1.6 Education

People with some high school education, a matric or a post-matric qualification are significantly more familiar with the term 'greywater' than people with only primary school education. See the chart below for the percentages.

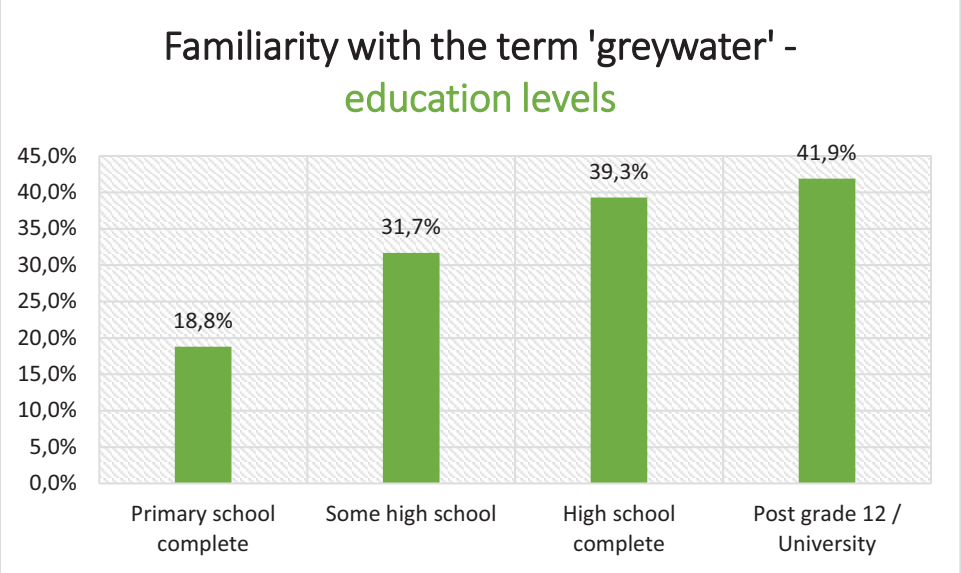

Figure 9: Familiarity with the term 'greywater' per education level

3.1.2 Potable water

3.1.2.1 General findings

Knowledge and understanding of the term 'potable' were tested with a false statement: ''Potable water is dirty water'' (statement 13). Only 28,3% of the population said that the statement was false. The rest thought that it was true, or they were unsure.

This implies that less than 30% of the population is familiar with the term ''potable''.

Of the 17 statements, the statement about potable water also had the highest percentage of 'Not sure' answers (35,5%).

The impact of demographic variables is discussed below.

3.1.2.2 Provinces and community size

The provincial picture is almost the opposite of the picture for the term 'greywater'. Where the Eastern Cape and the Northern Cape scored the highest on 'greywater', they scored among the lowest for 'potable'. 'Potable' is also not a term that people in the Free State are familiar with.

The relatively good scores of Mpumalanga and North West might be result of water awareness campaigns.

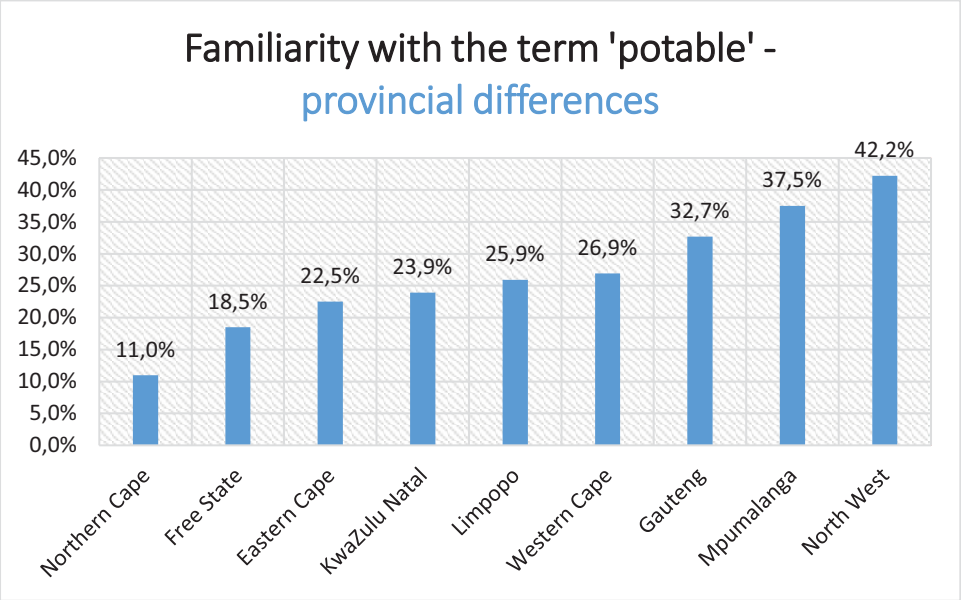

Figure 10: Familiarity with the term 'potable' – provincial differences

Contrary to the result for 'greywater', people from 'other urban areas' are more familiar with the term 'potable' than people from the Metros (31,6% versus 27,8%). The difference was not statistically significant. Rural people got the lowest number of correct answers, namely 26,4%.

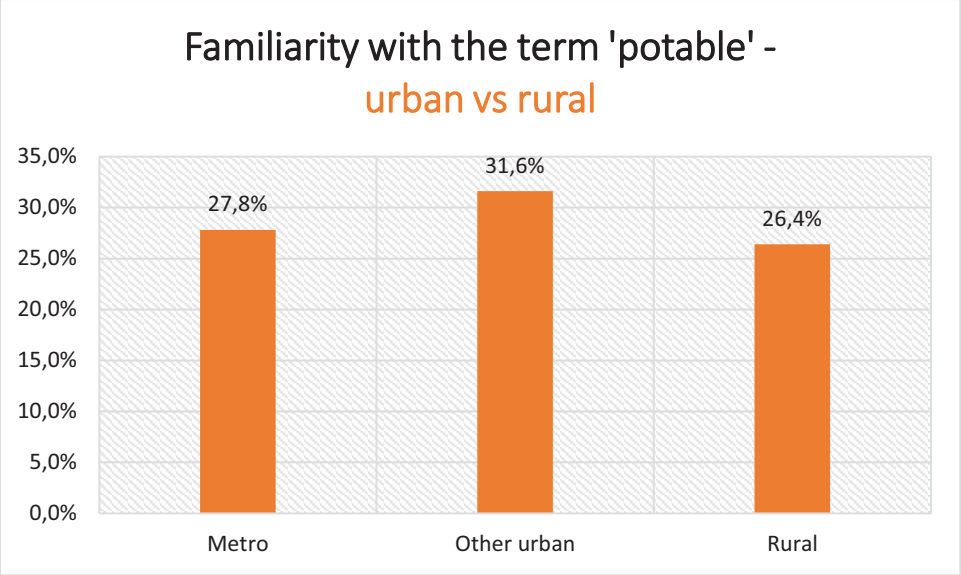

Figure 11: Familiarity with the term 'potable' – urban vs rural

3.1.2.3 LSM group and income

People from higher LSM groups are more familiar with the term 'potable' than those from lower LSM groups. The score of LSM group 8-10 (33,6%) was significantly higher than the scores of LSM group 1-4 (25%) as the figure below illustrates; however, all the percentages were below 40%.

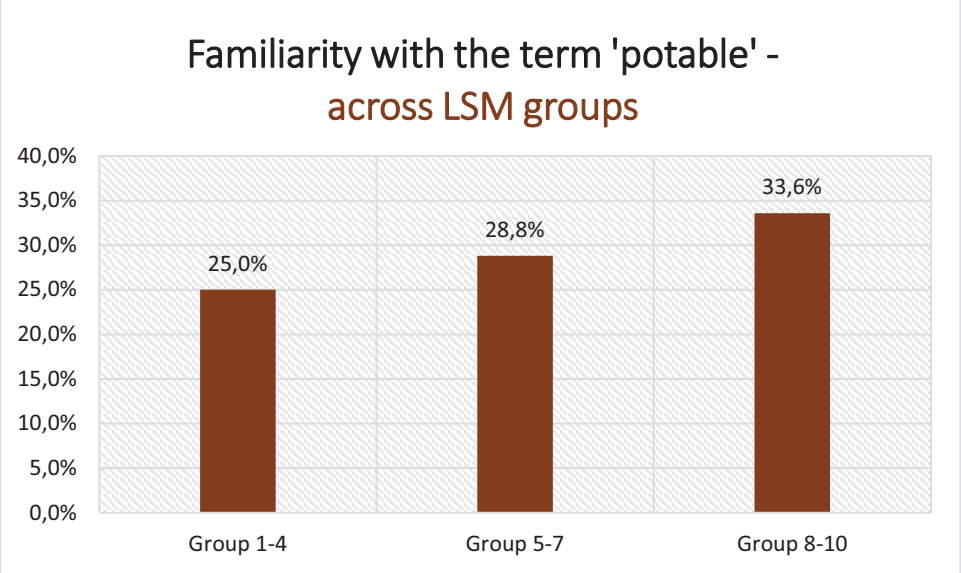

Figure 12: Familiarity with the term 'potable' – across LSM groups

Contrary to the finding for 'greywater', the percentage of people who are familiar with the term 'potable water' showed no significant differences between income groups.

3.1.2.4 Age and gender

There were significant differences between gender groups for knowledge of the term 'potable' water (males 31,2%; females 25,5%).

The age groups had an interesting result. The oldest age group (55+) was the least familiar with the term 'potable'; only 24,6% knew the term. On the other hand, the youngest age group (15-24) was

the most familiar with the term; 30,9% knew the term. The use of the term in current school curricula and even on social media could be contributing factors.

3.2 KNOWLEDGE OF VARIOUS ASPECTS OF WATER RE-USE

3.2.1 Findings for each of the aspects

Question 2 tested respondents' knowledge of various aspects of water re-use. The interviewers read 17 statements to the respondents, randomly ordered – see section 2.3.4 for the questionnaire. The statements were read one-by-one and respondents had to say whether the statement is true or false. Respondents were encouraged not to guess, but to select 'Not sure' if they were not certain.

The statements tested knowledge of the following aspects:

- Knowledge of the water cycle (statements 1, 2, 14)
- Knowledge of water and wastewater treatment and municipal responsibilities in this regard (statements 4, 6, 11, 12, 15)
- Knowledge of *de facto* water re-use (statement 8)
- Knowledge of safety aspects of water re-use (statements 3, 9, 10)
- Common myths and misconceptions (statements 5, 7)
- Knowledge of the effect of climate change on the availability of water (statement 16)
- Knowledge of South Africa as a water-scarce country (statement 17).

The figure below ranks the percentage correct answers for these aspects.

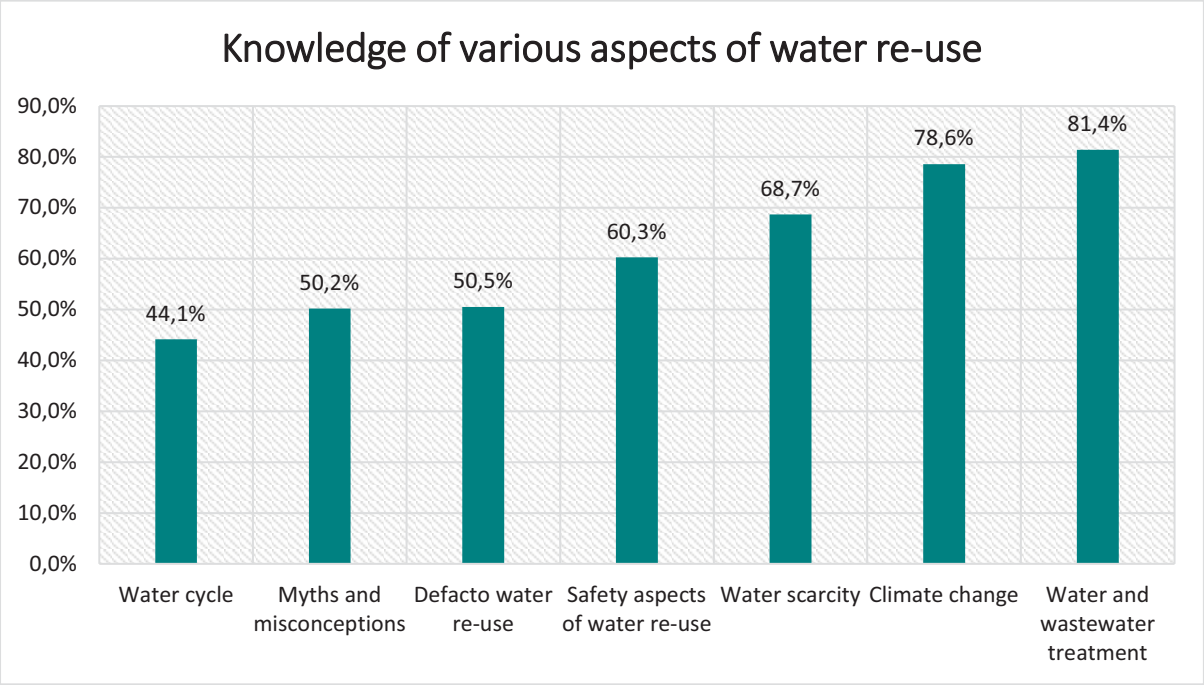

Figure 13: Knowledge of various aspects – percentage correct answers for the total population

Since the questions test very basic knowledge, a result of less than 70% correct answers was regarded as having insufficient knowledge.

The low percentage of correct answers for statements 1, 2 and 14 indicate a lack of knowledge of the water cycle. From the pilots it was clear that respondents interpreted messages of water scarcity, and even climate change, as indicative that the earth's water is becoming less.

The statements on myths and misconceptions got mixed results:

- 47,6% of people believe that water should be free because it comes from the rain (statement 7).
- 66,5% of people know that the municipal tap water in the kitchen is the same as the water that is in the toilet's water tank (statement 5).

South Africans seem to be unsure of the realities of *de facto* re-use. Only 50,5% of people marked the statement that treated wastewater gets mixed with rainwater in many of our rivers and that municipalities re-use this water as drinking water after treating it (statement 8) as true. See also the chart below for the 'Not sure' responses on this statement.

Knowledge of the safety of water re-use varied. The safe use of greywater got low scores: 46,1% correct responses for the statement: *It is safe to eat vegetables from plants that were watered with wastewater from bathing, washing clothes and dishes*. However, with 90% correct answers for statement 10, one could say that most South Africans know that is not safe for children to play in untreated wastewater.

Four of the five statements on water and wastewater treatment (statements 4, 6, 12 and 15) scored surprisingly well (78% and more correct answers). The showcard was probably a learning experience, contributing to the relatively high percentage of correct responses to these statements. Statement 11 did not score as well; it got 68,5% correct answers. The lower score for this statement could indicate that people are unsure if seawater could be treated to the drinking water standard.

Statement 16 about climate change's effect on the availability of water had 78.6% correct answers. Climate change is consistently in the news; this could have attributed to the high score. On the other hand, the results for statement 17 show that 68,7% (that is 10% less) of people think that it is true that South Africa has water scarcity problems. In stakeholder interviews that they project team conducted as part of Project K5/2805, it was mentioned that it is difficult to convince particularly urban consumers of water scarcity when they have water in their taps.

The figure below shows the percentage of 'Not sure' answers for each group of statements. (These responses are not weighted to the population)

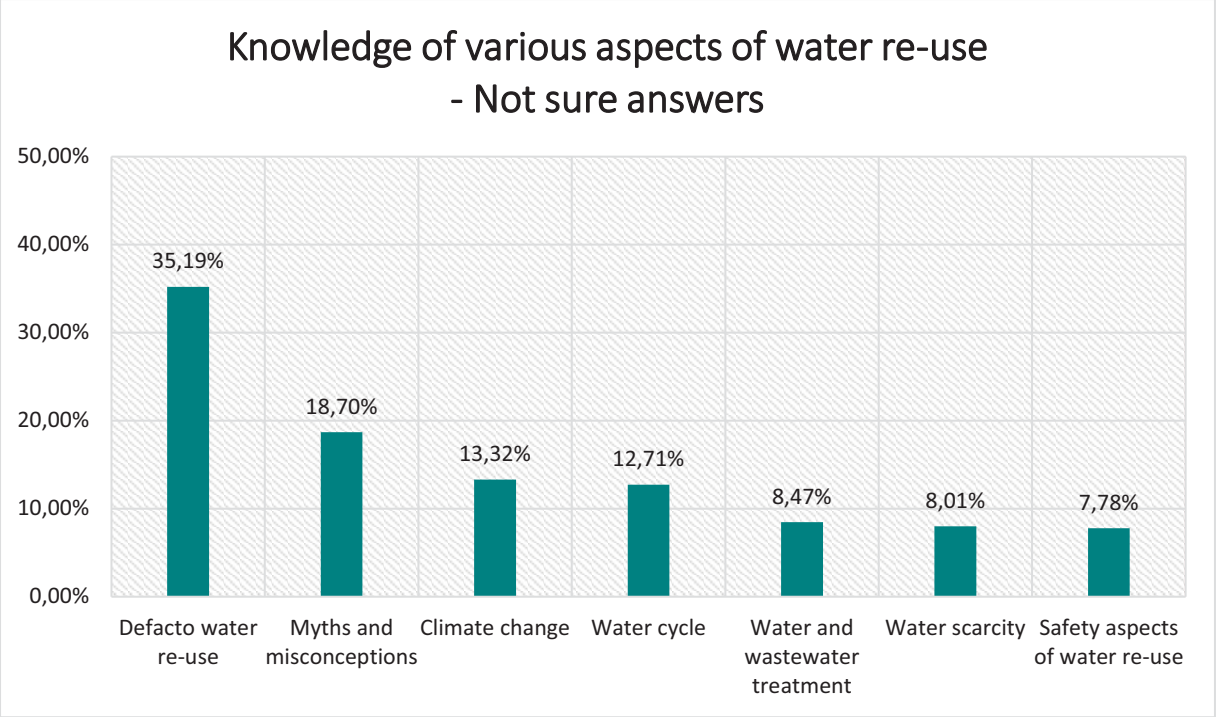

Figure 14: Knowledge of various aspects of water re-use – percentage 'Not sure' answers

On average, 14,88% of responses were 'Not sure'. More than a third of respondents were uncertain about the truthfulness of the statement about de facto re-use. Respondents were also uncertain about the truthfulness of the myths and misconception statements, but the percentage is much less (18,7%).

3.2.2 Overall knowledge index

The results of Questions 1 and 2 were converted into an overall knowledge index out of 20 as set out in the Methodology section (section 2). See the appendix for the calculation.

On average, South Africans scored 12 out of 20 on the index.

This means that, on average, South Africans have insufficient knowledge of water re-use and related aspects.

The figure below shows a normal distribution for the overall knowledge index.

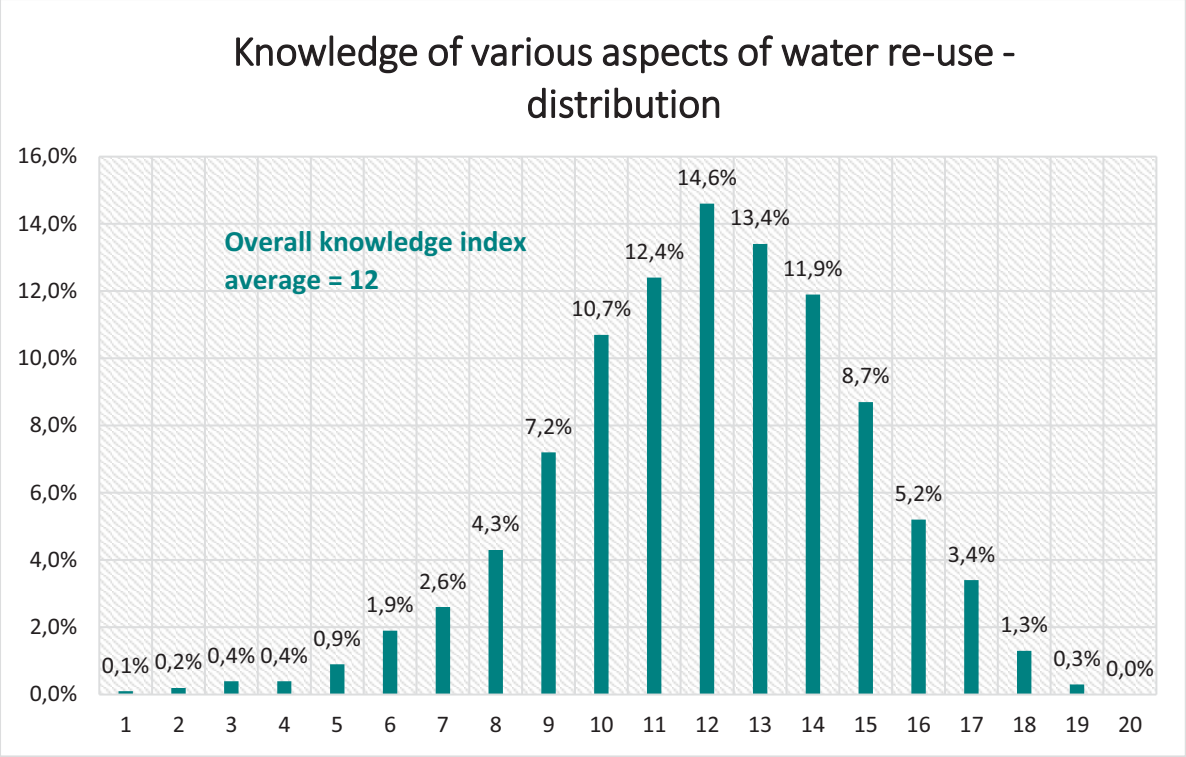

Figure 15: Knowledge of various aspects of water re-use – distribution

3.2.2.1 The impact of demographic variables

The survey found that the demographic variables had some impact on the overall knowledge index (see also the figures below):

- There are no significant differences between the provinces. The scores range between 11 and 12,65.
- Rural respondents (11) scored lower than Metro and other urban respondents (12,61 and 12,32 respectively).
- LSM group 8-10 scored 13,05, LSM group 5-7 scored 12,27 and LSM group 1-4 scored 10,8.
- The knowledge index scores increased steadily as education levels increase, from 11,14 for respondents with only primary education to 12,65 for respondents with a post Grade 12 qualification.

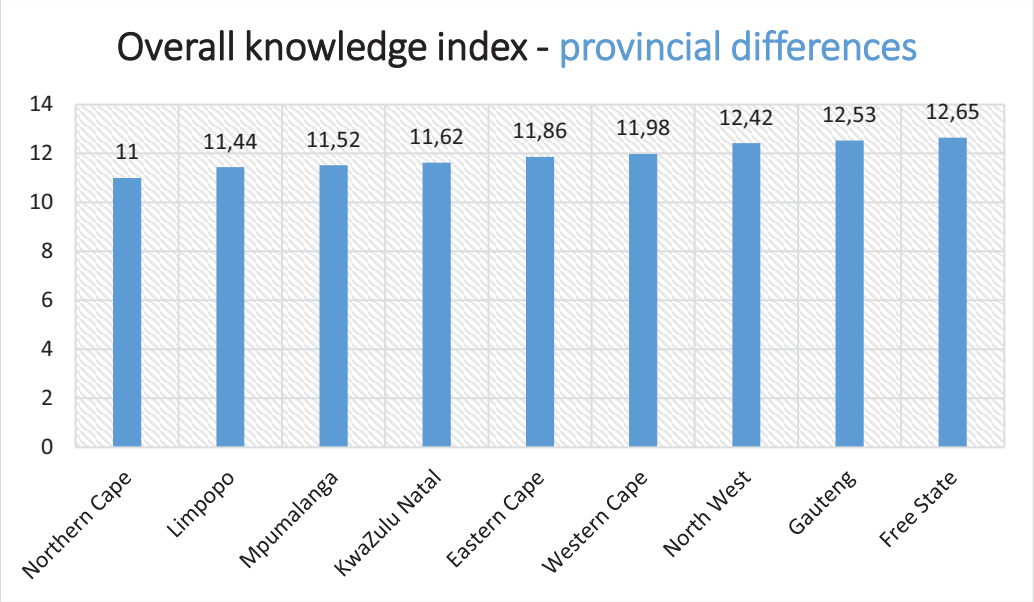

Figure 16: Overall knowledge index – provincial differences

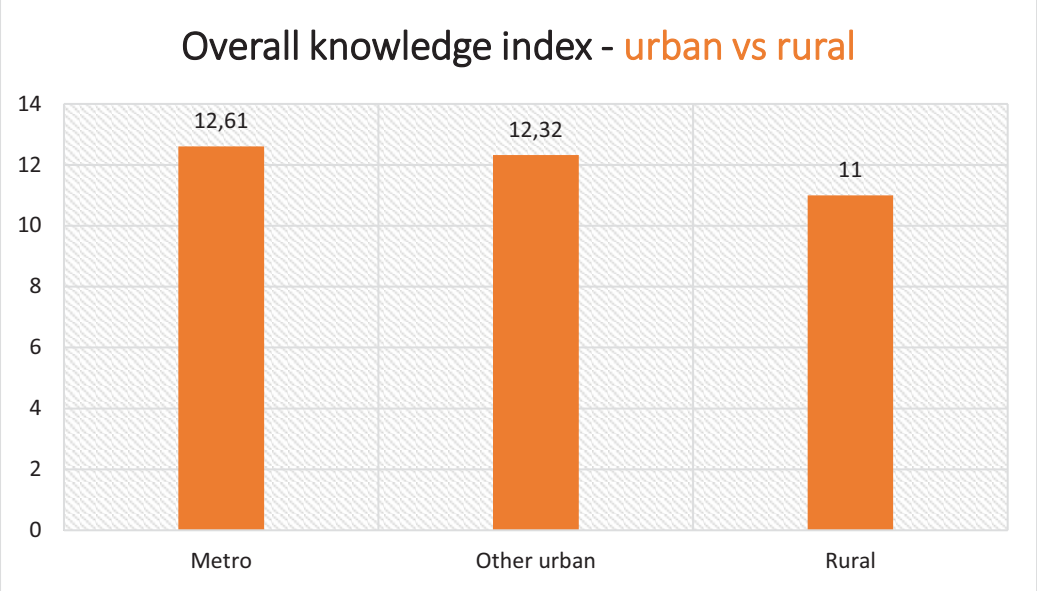

Figure 17: Overall knowledge index – urban vs rural

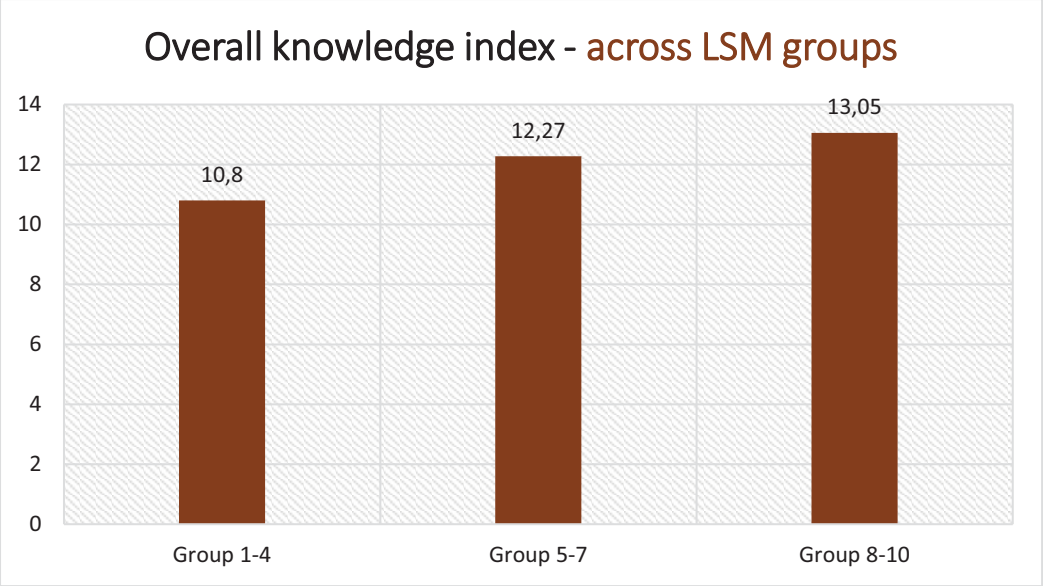

Figure 18: Overall knowledge index – across LSM groups

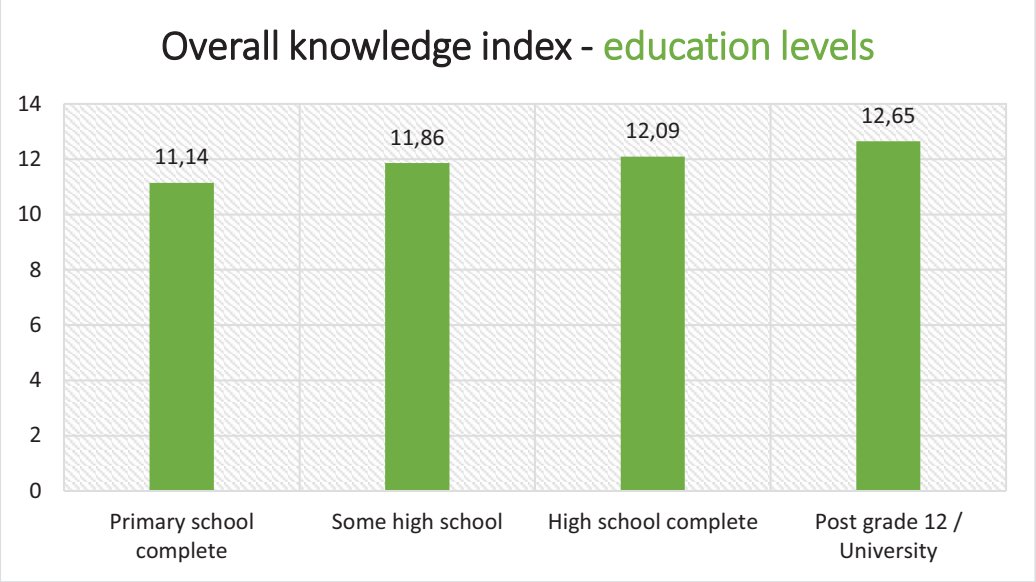

Figure 19: Overall knowledge index – education levels

Age and gender differences were very small. See the figures below.

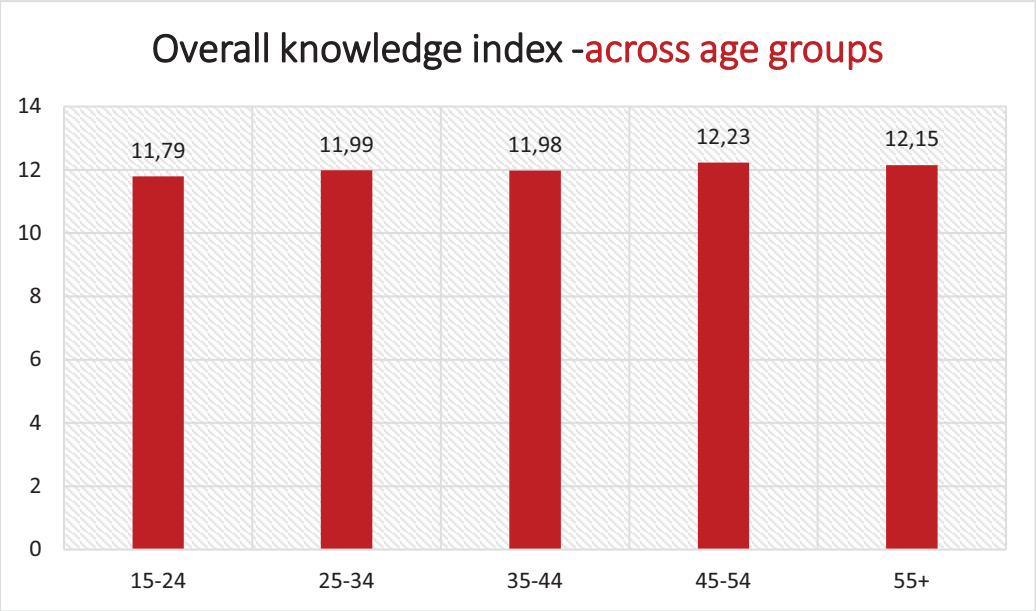

Figure 20: Overall knowledge index – across age groups

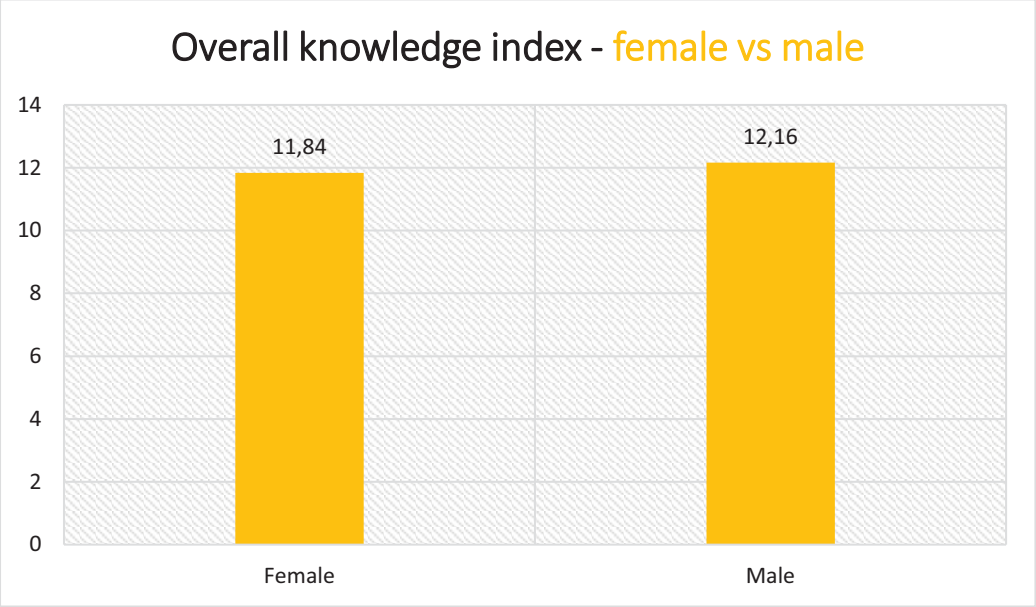

Figure 21: Overall knowledge index – female vs male

3.2.3 Knowledge sub-indices

Knowledge index scores were also calculated for three sub-aspects of water re-use, namely knowledge of the water cycle, knowledge of safety aspects of water re-use and knowledge of water and wastewater treatment.

South Africans scored as follows for the sub-aspects of water re-use:

- 1,32 out of 3 for knowledge of the water cycle (statements 1, 2 and 14)
- 1,81 out of 3 for knowledge of safety aspects of water re-use (statements 3, 9 and 10)
- 4,58 out of 6 for knowledge of aspects of water and wastewater treatment (statements 4, 6, 8, 11, 12, 15).

The figures below show the distribution of the three sub-indices.

Only 3,8% scored full marks (3 out of 3) for sub-index 1 (knowledge of the water cycle), whereas 22,1% scored full marks for sub-index 2 (knowledge of safety aspects of water re-use). 23,9% of people got full marks for sub-index 3, which tested knowledge of aspects of water and wastewater treatment.

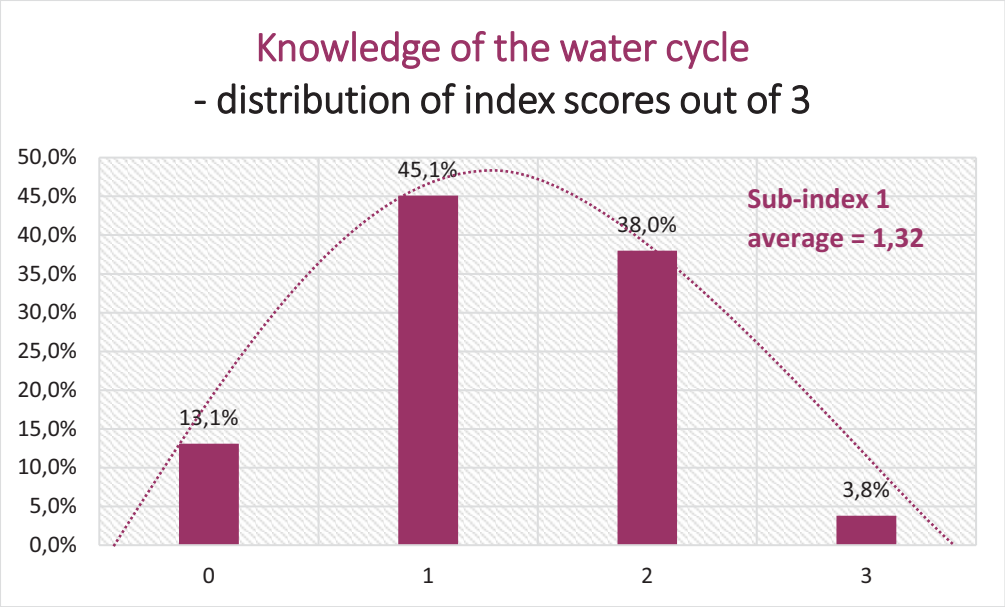

Figure 22: Knowledge of the water cycle- distribution of index scores out of 3

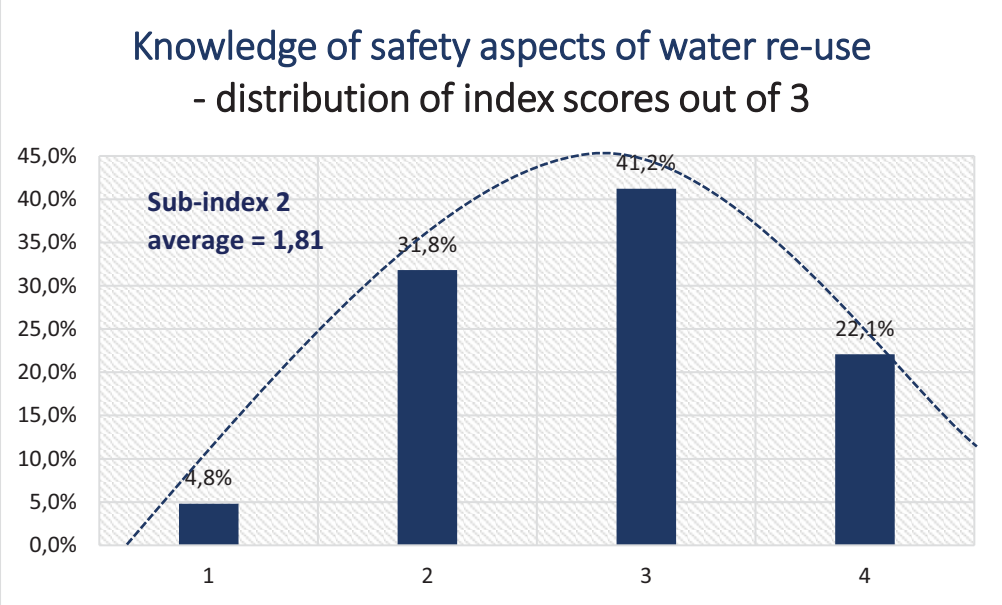

Figure 23: Knowledge of safety aspects of water re-use- distribution of index scores out of 3

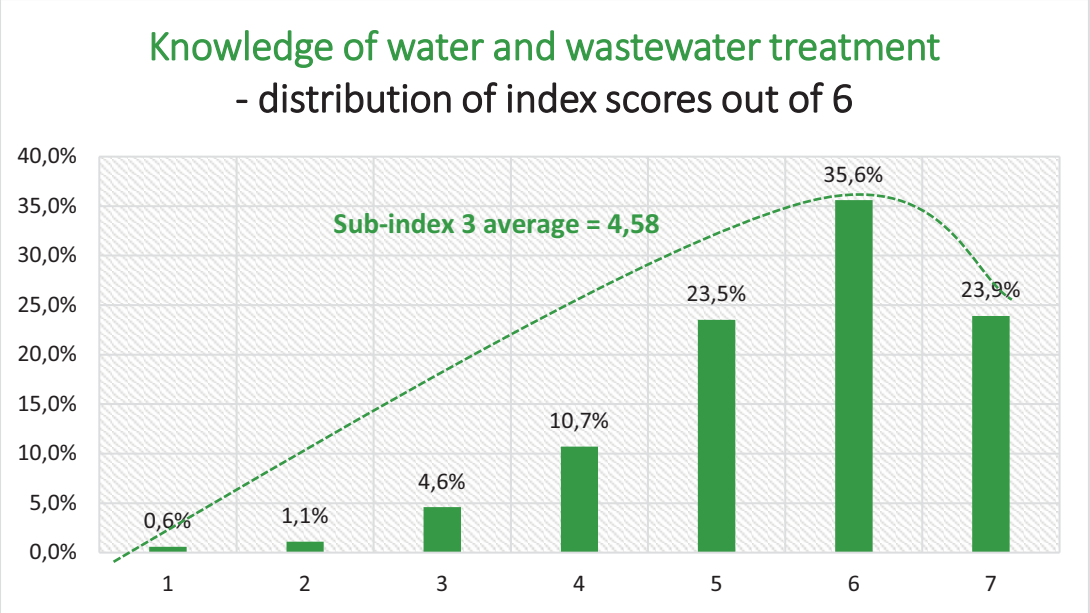

Figure 24: Knowledge of aspects of water and wastewater treatment – distribution of index scores out of 6

The distribution of the first two sub-indices follow a normal distribution; the distribution of the third sub-index is skewed towards correct answers.

3.3 SUPPORT FOR PARTICULAR ACTIONS IN A DROUGHT SITUATION

3.3.1 Findings

Question 3 asked respondents which actions they would support in the event of a severe drought in a city like Johannesburg. Respondents could select multiple responses from the eight options:

1. Make a rule on how much water a person is allowed to use per day
2. Make water expensive for people who use more than the basic amount
3. Drill for groundwater
4. Encourage people to use their bathwater to flush toilets
5. Cut off the supply of water for a few hours per day (load shedding for water)
6. Treat wastewater to the drinking water safety standard and re-use it for drinking water
7. Encourage factories to treat and recycle the water they use
8. Another action (please specify)

On average, respondents selected three actions. The figure below shows the findings. The actions marked with an exclamation mark are punitive actions; the actions marked with a water drop are related to water re-use.

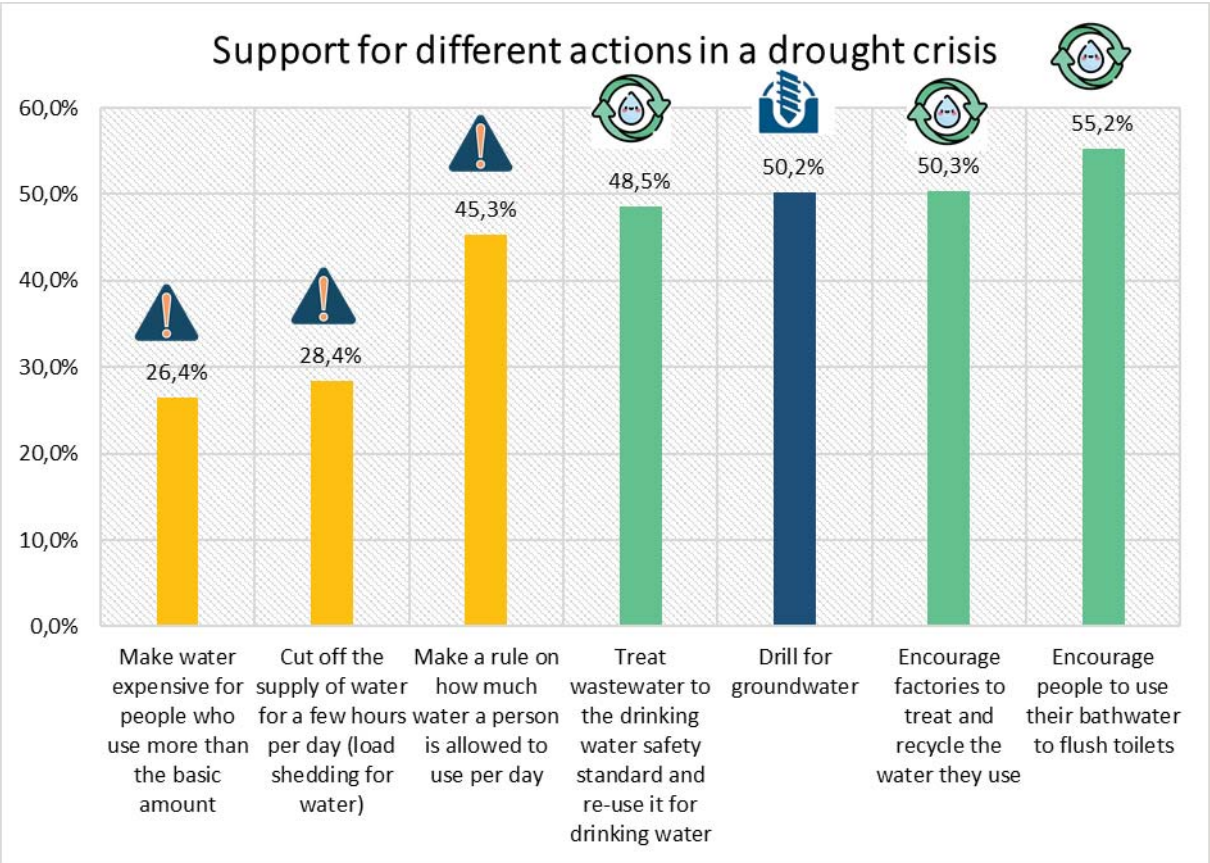

Figure 25: Support for different actions in a drought situation

Certain punitive actions were obviously unpopular. Only 26,4% of South Africans support the action "Making water more expensive for people who use more than the basic amount". The action "Load shedding for water" received 28,4% support. On the other hand, 45,3% of South Africans support making a rule on how much water a person is allowed to use per day.

Water re-use got good support. Direct potable re-use in a drought situation was supported by 48,5% of South Africans. The other two actions that relate to water re-use, namely encouraging factories to treat and recycle water and encouraging people to use their bathwater to flush toilets, received 50,3% and 55,2% support respectively. These two actions got the highest support.

The action "Drill for groundwater" was supported by 50,2% of South Africans.

3.3.2 Other suggestions

52 respondents out of the 3319 mentioned an action in the open response category. The following suggestions for actions in a time of drought had multiple mentions:

- Save in water tanks/supply JoJo tanks for each household
- People must report leaks
- Repair leaking pipes in time
- Make sure that taps are properly closed
- Don't let water run while brushing teeth
- The government must build more dams.

Single mentions included:

- Family members should bath in the same bath water
- Install pre-paid meters for every household
- Make sure children do not play with water
- Educate people on how water can be saved
- Encourage people to use borehole water
- Use water from the ocean for daily non-drinking purposes.

3.3.3 Support for water re-use actions versus support for punitive actions

The figure below compares South Africans' support for water re-use actions with their support for punitive actions.

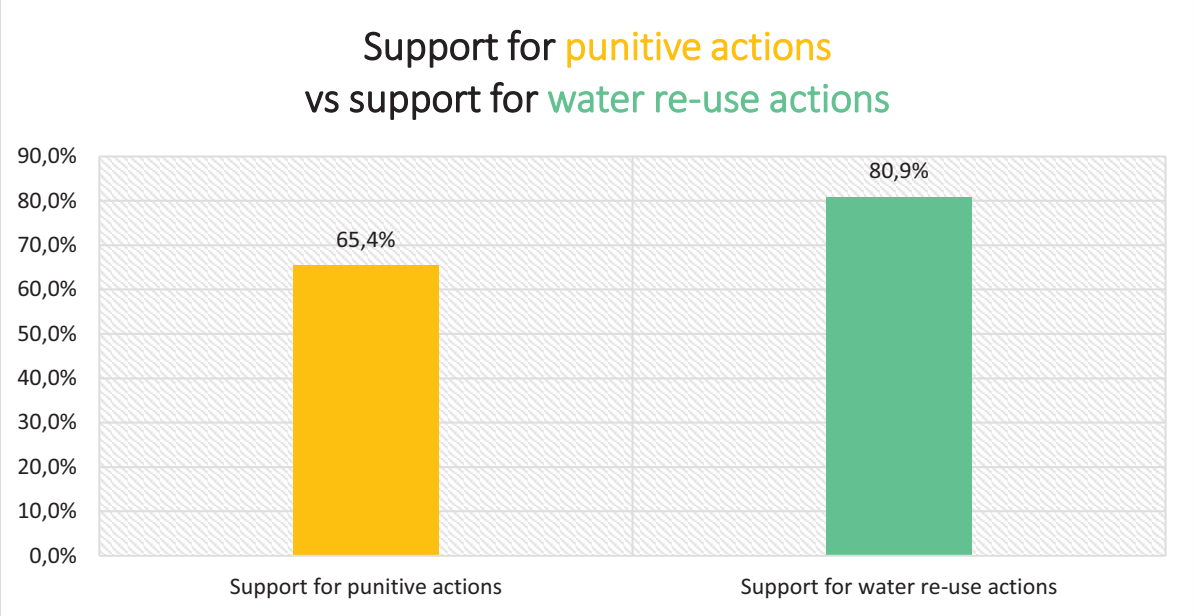

Figure 26: Support for punitive actions vs support for water re-use actions

80,9% of South Africans support at least one of the water re-use actions (greywater, industrial recycling or direct potable re-use) mentioned, and 65,4% support at least one punitive action.

3.3.3.1 The impact of demographic variables

The most noteworthy differences between support for water re-use versus support for punitive actions are discussed below. High percentages in both categories indicate that respondents selected multiple actions.

The provincial differences for support for water re-use versus support for punitive actions are captured in the figure below. Gauteng had the highest support for water re-use actions with 87,8%

and North West the lowest support with 72,3%. The Northern Cape had the highest support for punitive actions with 82%. Punitive actions were the least supported by North West with 56,5%.

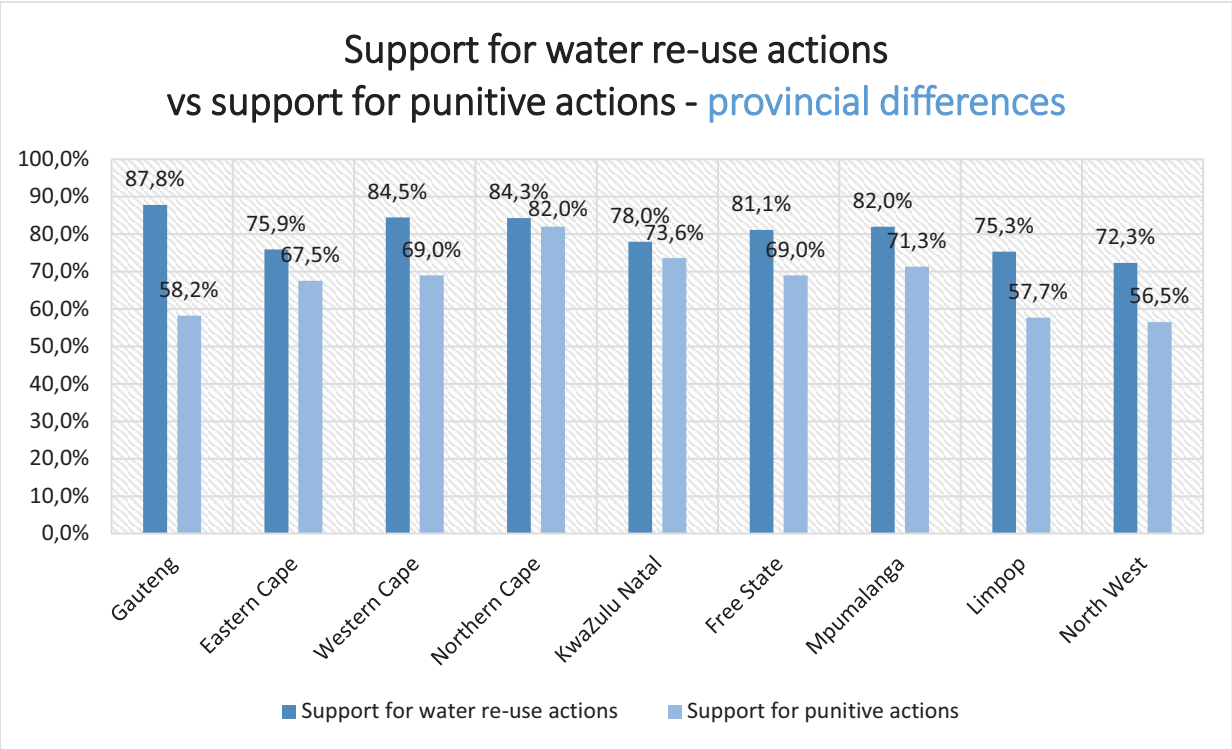

Figure 27: Support for water re-use actions vs support for punitive actions – provincial differences

The figure below shows support for water re-use actions versus support for punitive actions across the racial groups. The Indian population had the highest support for both water re-use actions (89,5,2%) and punitive actions (71,6%). Water re-use got the lowest support from the Black population (79,4%). Only 64,9% of the Black population and 65,6% of the Coloured population supported punitive actions.

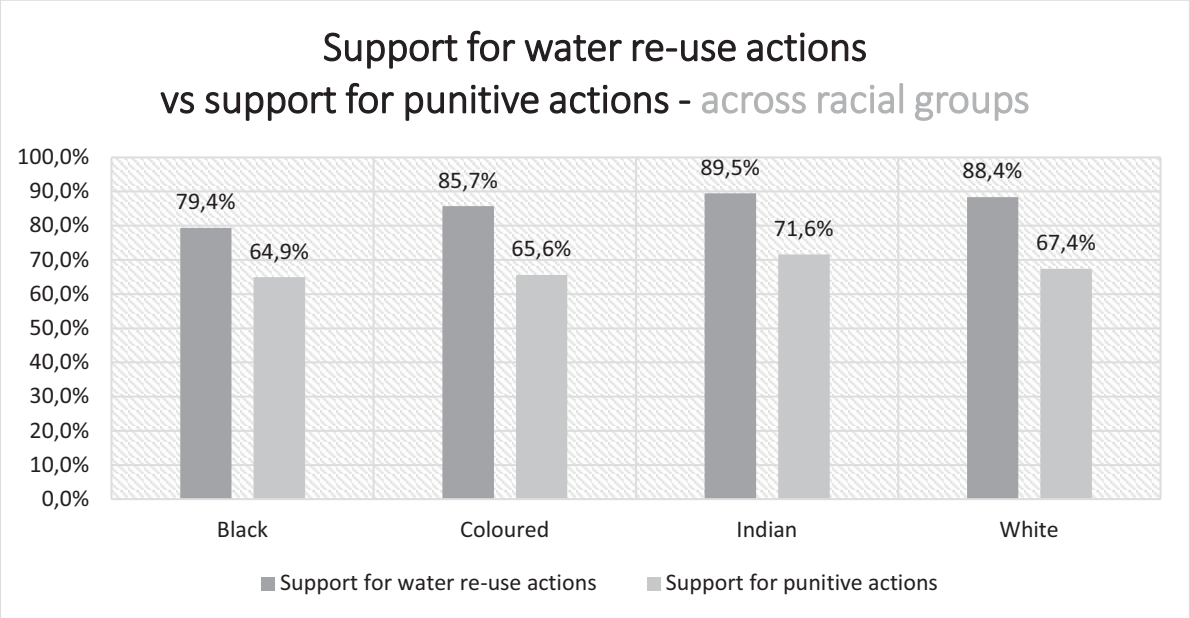

Figure 28: Support for water re-use actions vs support for punitive actions – across racial groups

The figure below shows that the support for water re-use increases steadily with education level attained. On the other hand, education level attained does not seem to affect support for punitive actions.

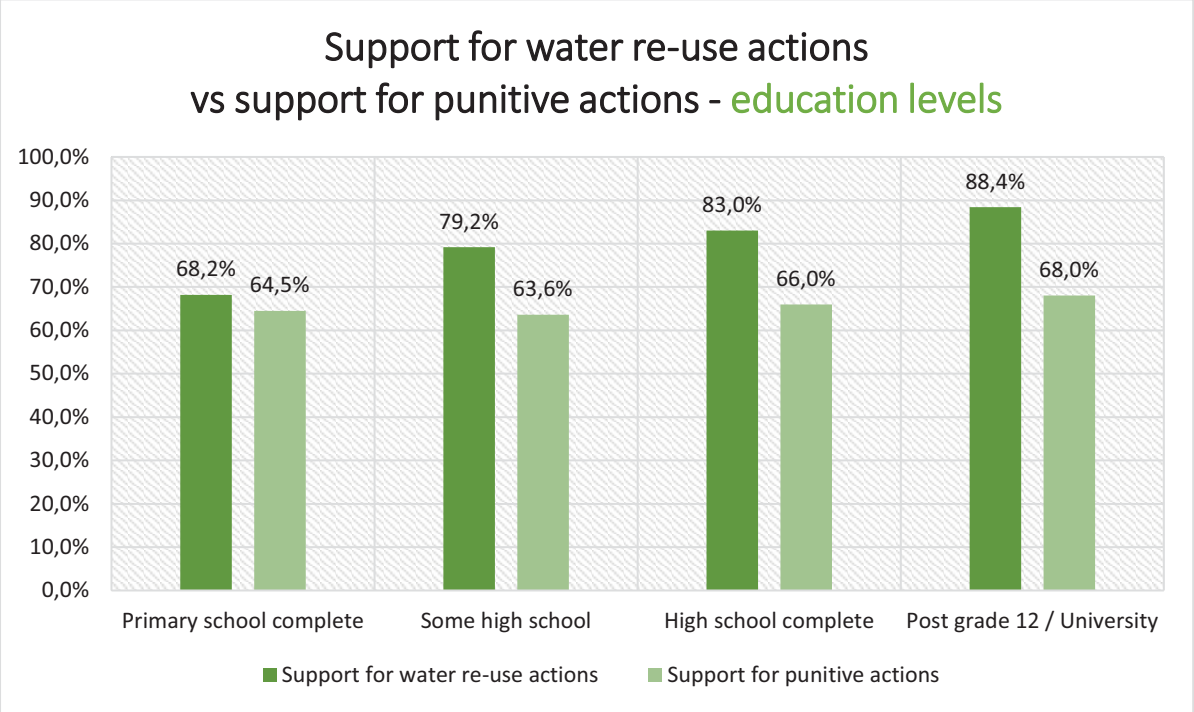

Figure 29: Support across education levels

3.3.4 Support for direct potable re-use of water: the impact of demographic variables

The figures below show the impact of selected demographic variables on support for direct potable re-use of water as an action in a drought situation. On average, 48,5% of South Africans supported the direct potable re-use of water in a drought situation.

The Western Cape showed the most support for the direct potable re-use of water with 57%. The least support came from the Eastern Cape province with 40,7%.

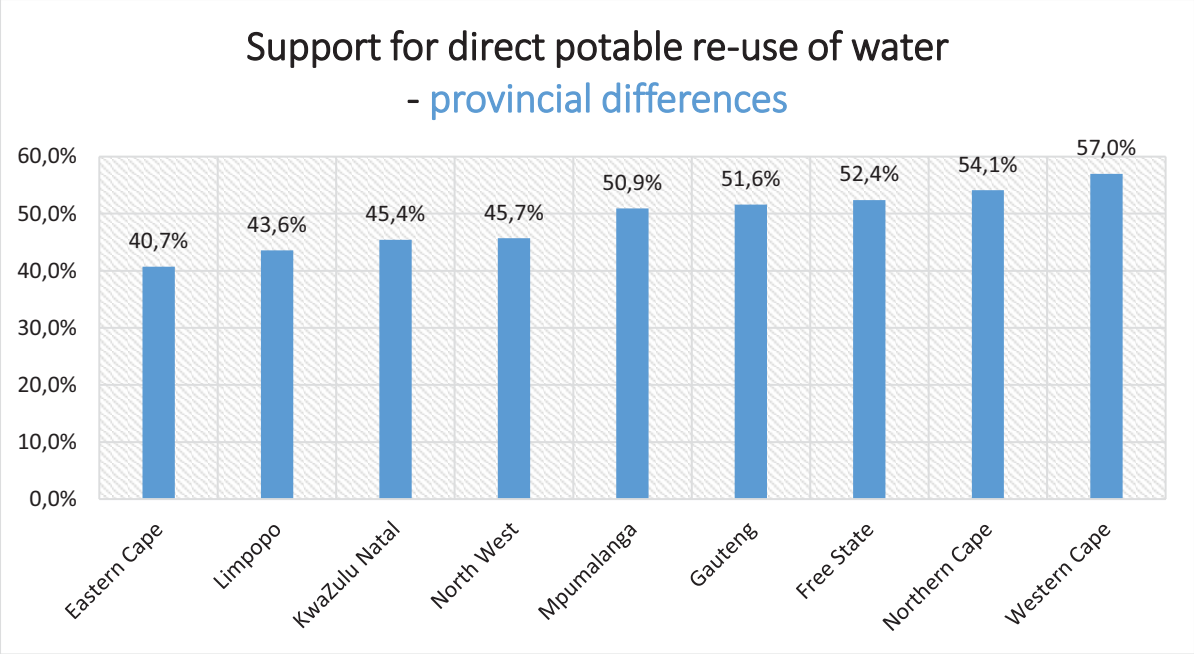

Figure 30: Support for direct potable re-use of water – provincial differences

People from Metro and other urban areas showed slightly more support for direct potable re-use of water than those from rural areas as the figure below illustrates.

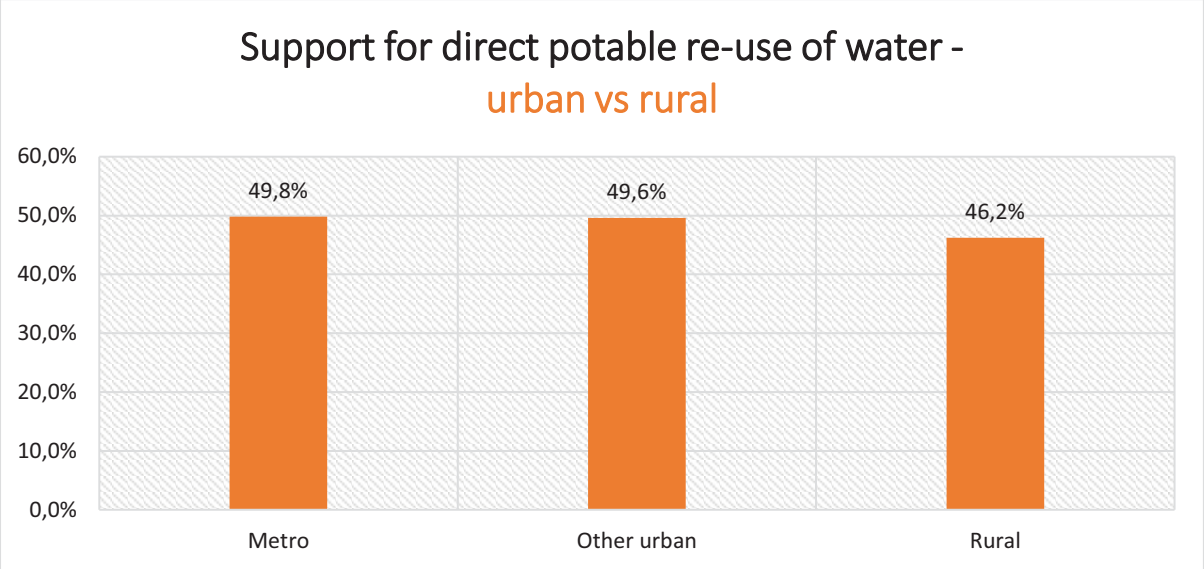

Figure 31: Support for direct potable re-use of water – urban vs rural

People from higher LSM groups showed more support for the direct potable re-use of water (53.8% for LSM groups 8-10 compared to 42,5% for LSM groups 1-4).

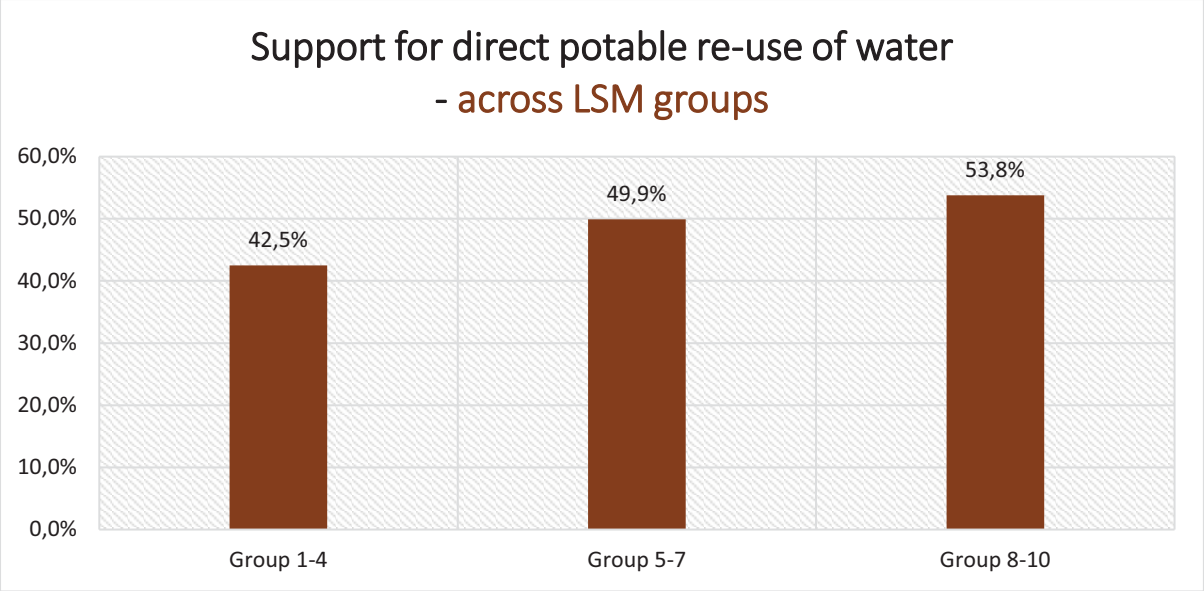

Figure 32: Support for direct potable re-use of water – across LSM groups

Respondents with a post Grade 12 qualification (54,6%) support direct potable re-use in a drought situation significantly more than respondents with only primary education (39%). **This is a very important finding.**

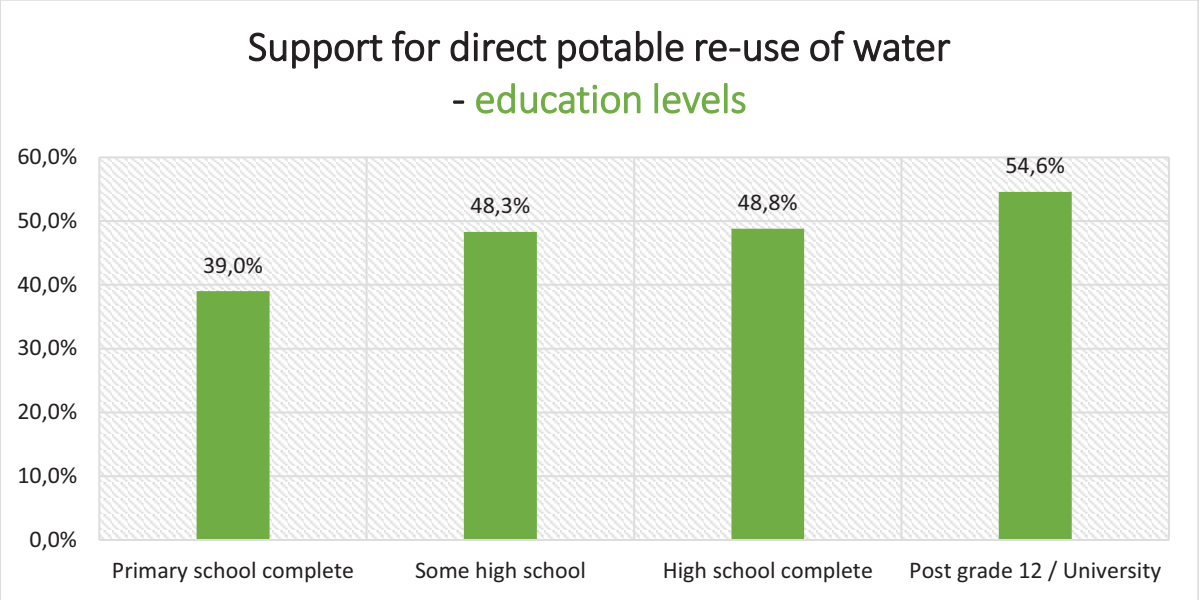

Figure 33: Support for direct potable re-use of water – across education levels

3.3.5 Ranking of support

Respondents were not asked to rank their support for the various actions. In retrospect, this would have been a useful addition to the question.

3.4 CORRELATION BETWEEN KNOWLEDGE AND SUPPORT FOR RE-USE

The Pearson correlation coefficient was used to determine if a relationship exists between:

1. Knowledge of various aspects of water re-use (overall knowledge index, score out of 20) and support for one of the water re-use actions (greywater re-use, industrial recycling, direct potable re-use);
2. Knowledge of water and wastewater treatment (sub-index 3, score out of 6) and support for one of the water re-use actions;
3. Knowledge of various aspects of water re-use (overall knowledge index, score out of 20) and support for direct potable re-use;
4. Knowledge of water and wastewater treatment (sub-index 3, score out of 6) and support for direct potable re-use.

The Pearson correlation coefficient is a statistical measure that calculates the strength of the relationship between the relative movements of two variables. The values range between -1.0 and 1.0. A correlation of -1.0 shows a perfect negative correlation, while a correlation of 1.0 shows a perfect positive correlation. A correlation of 0.0 shows no relationship between the movement of the two variables. A correlation of 0.8 (-0,8) and higher is considered a strong relationship (Ganti, 2019).

The results were as follows:

Correlations	**Pearson correlation coefficient**
Correlation 1 Knowledge of various aspects of water re-use (overall knowledge index) and support for re-use	0,329881 Rounded off to 0,33
Correlation 2 Knowledge of aspects of water and wastewater treatment (sub-index 3) and support for one of the water re-use actions	0,200061 Rounded off to 0,2
Correlation 3 Knowledge of various aspects of water re-use (overall knowledge index) and support for direct potable re-use	0,135474 Rounded off to 0,14
Correlation 4 Knowledge of aspects of water and wastewater treatment (sub-index 3) and support for direct potable re-use	0,146713 Rounded off to 0,15

The correlations are all positive, but they are weak. Correlation 1 is the strongest.

This finding supports the conclusions of Dolnicar and Hurlimann (2009), Marks et al. (2008), Macpherson and Slovic (2008) and Macpherson and Snyder (2012) that knowledge of water and wastewater treatment correlates positively with support for water re-use. If one considers that respondents acquired some of this knowledge through the showcard, the result is quite remarkable.

4 CONCLUSIONS

The study confirmed the predictions of several stakeholders that there are serious gaps in the South African public's knowledge of various aspects of water re-use and related aspects.

The results also give guidance to which knowledge areas should be addressed in a public education campaign and who are the key target groups.

Key knowledge areas to address are:

1. The terminology of water and wastewater: It would be important for meaningful discussion on water re-use and alternative water resources to find a common terminology that ordinary citizens are familiar with, that they can understand and that they can relate to.
2. The water cycle: The literature review of Project K5/2805 cites several sources that have found that understanding and acceptance of water re-use is grounded in an understanding of the basics of the water cycle.
3. The safety aspects of domestic water re-use: The literature review and the stakeholder consultations which formed part of Project K5/2805 emphasised that change in water use behaviour starts at home. However, it would be dangerous to encourage domestic water re-use without the public being properly informed about its safety aspects.

There were some demographic differences in the public's knowledge of water re-use and related aspects, but these differences were small. South Africans across LSM groups and education levels scored between 10 and 13 out of 20 (on average) on the overall knowledge index, indicating that a public education campaign on water re-use should target all demographic groups.

The survey indicated that South Africans will rather support water re-use than punitive measures in a severe drought situation, including direct potable re-use.

Although the correlation was weak, the survey confirmed that knowledge of aspects of water re-use correlates positively with support for water re-use. The study also found that general education levels seem to be related to support for water re-use. Respondents with a post Grade 12 qualification (54,6%) support direct potable re-use in a drought situation significantly more than respondents with only primary education (39%).

One can therefore expect that improved public knowledge will have a positive outcome.

5 REFERENCES

Department of Water and Sanitation. 2013. *National Water Resource Strategy*. 2nd ed. Pretoria: Department of Water Affairs.

Department of Water and Sanitation. 2018/19. *National Water and Sanitation Master Plan*, Volumes 1-3: Call to Action (final draft, version 9.4). Pretoria: Department of Water and Sanitation.

Dolnicar, S. & Hurlimann, A. 2009. Drinking water from alternative water sources: differences in beliefs, social norms and factors of perceived behavioural control across eight Australian locations. *Water Science and Technology*, 60(6):1433-1444.

European Commission. 2015. *TOOLKIT for the evaluation of the communication activities*. [Online] Downloaded from: https://ec.europa.eu/info/sites/info/files/communication-evaluation-toolkit_en.pdf.

Ganti, A. 2019. *Correlation Coefficient*. [Online] Available from: https://www.investopedia.com/terms/c/correlationcoefficient.asp.

Macpherson, L. & Slovic, P. 2008. *Talking about Water: Vocabulary and images that support informed decisions about water recycling and desalination*. Alexandria: Water Re-use Foundation.

Macpherson, L. & Snyder, S. 2012. *Effect of Prior Knowledge of Unplanned Potable Re-use on the acceptance of Planned Potable Re-use*. Alexandria: Water Re-use Foundation.

Marks, J., Martin, B. & Zadoroznyj, M. 2008. How Australians order acceptance of recycled water. *Journal of Sociology*, 44(1): 83-99.

Muanda, C., Cousins, D., Lagardien, A., Owen, G. & Goldin, J. 2017. *Direct Reclamation of Municipal Wastewater for Drinking Purposes – Volume 2: Investigation into institutional and social factors influencing public acceptance of reclaimed water for potable uses in South Africa*. WRC Report No. TT 734/17. Pretoria: Water Research Commission.

Swartz, C.D., Genthe, B., Menge, J.G., Coomans, C.J. & Offringa, G. 2015. *Direct Reclamation of Municipal Wastewater for Drinking Purposes – Volume 1: Guidance on Monitoring, Management and Communication of Water Quality*. WRC Report No. TT 641/15. Pretoria: Water Research Commission.

Tayob, A.I., Deedat, H. & Patel, A.R. 2015. *Islamic jurisprudence and conditions for acceptability of reclamation of wastewater for potable use by Muslim users*. WRC Report No. 2360/1/15. Pretoria: Water Research Commission.

Appendix

The requested analysis is set out below:

Reporting	Analysis required
1. Knowledge a. South Africans scored X out of 20 in a questionnaire on various aspects of water re-use b. South African scored as follows on specific sub-aspects of water re-use: i. X out of 3 for knowledge of the water cycle ii. X our of 3 for knowledge of safety aspects of water re-use iii. X our of 6 for knowledge of wastewater treatment PLUS, further analysis according to demographic variables	Q2: 1. Each statement (correct/incorrect +not sure) x demographic variables 2. Calculate **index out of 20**: Q1 (2 points for a correct answer), PLUS Q2 (18 points, 1 point for a correct answer; **NB** statement 12 gets 2 points). Incorrect and Not sure get no point. Cross tabulate with demographic variables. 3. Calculate **three sub-indexes**: i. Knowledge of the water cycle (points out of 3 – statements 1, 2 and 14) ii. Knowledge of the safety of aspects of re-use (points out of 3 – statements 3, 9, 10) iii. Knowledge of wastewater treatment (points out of 6 – statements 4, 6, 8, 11, 12 (only one point), 15) Cross-tabulate each sub-index with demographic variables.
2. Support for different actions in a drought a. Greywater/industrial recycling/direct potable re-use x demographic variables b. Punitive actions X demographic variables c. Support for re-use vs punitive actions. Is the difference statistically significant? d. Other suggestions	Q3: 1. Each response x demographic variables 2. Support for re-use (actions 4, 6, 7) x demographic variables 3. Support for punitive actions (actions 1, 2, 5) x demographic variables 4. Other suggestions (open response) we will code and analyse
3. Correlation of support for re-use and knowledge: general, water cycle, wastewater treatment a. Knowledge of aspects of re-use correlates/does not correlate with support for water re-use b. Knowledge of aspects of re-use correlates/does not correlate with support for direct reuse for drinking c. Knowledge of wastewater treatment correlates/does not correlate with support for direct re-use for drinking	Q2 and Q3 correlations: 1. Overall knowledge index score (out of 20) correlated with support for re-use (actions 4, 6, 7) 2. Sub-index score for knowledge of wastewater treatment (sub-index iii) correlated with support for water re-use (actions 4,6,7) 3. Overall knowledge index score (out of 20) correlated with support for direct re-use for drinking (action 6) 4. Sub-index score for knowledge of wastewater treatment (sub-index iii) correlated with support for direct re-use for drinking (action 6)