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The knowledge of water conservation and strategies for addressing water shortage in the Fairview community in Kwa-Zulu-Natal, South Africa

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Although South Africa is listed as a water-scarce country globally, reports suggest that the dire situation is exacerbated by wasteful water practices. As a result, sustainable water utilization and conservation measures must be implemented at all levels. This study examines community members' knowledge of water conservation and the strategies for addressing water shortages in the Fairview community in South Africa. Utilizing a mixed-methods approach and the concurrent explanatory design, the study involved questionnaire surveys of 110 households and interviews with eight managers from the Harry Gwala District Municipality. The findings reveal that age and gender significantly influenced 2 out of 5 items/beliefs about water conservation practices (χ^2 values 0.031 and 0.071), whereas other demographic factors, such as education and job type, did not show any relationships across the various items, as shown by (χ^2 values above 0.1). Community members generally possess a positive understanding of water conservation practices, with many actively engaging in water management behaviors. While water scarcity is a perennial problem in the community, this challenge presents opportunities to modernize water supply systems, adopt multi-stakeholder platforms to promote inclusivity, and effectively mobilize resources and ideas. In light of these findings, several recommendations are proposed: enhancing targeted educational programs to promote water-saving practices, establishing structured feedback systems to engage community members in decision-making, and providing incentives for adopting water-saving technologies. The study further underscores the importance of documenting and sharing case studies of successful water conservation practices to serve as a resource for Fairview and other regions facing water scarcity.

KEYWORDS
KAB model, knowledge–attitude–behavior model, South Africa, water conservation, water supply challenges

1 Introduction

South Africa's water crisis is dire, with over 20% of the population, predominantly in rural areas, struggling to access clean drinking water regularly, leading to the contraction of water-related diseases (Adom and Simatele, 2020) and sparking protests, as citizens rightfully exercise their constitutional right to safe water (Ishola et al., 2025). The world grapples with a freshwater shortage that threatens humanity's health, wellbeing, and development outcomes (Maskey et al., 2023). Global water demand is likely to surpass supply by more than 40% by 2030 (Mulwa et al., 2021) and the increasing demand and water stress levels are linked to increasing urbanization, population growth, food demand, rising living standards, increased global wealth, and the escalating effects of the climate catastrophe (FAO UN-Water, 2024; Njoku et al., 2022). This has the potential to derail achievement of the Agenda 2030, especially Sustainable Development Goal (SDG) 6, which calls for the provision of water and sanitation services and sustainable management of water to all citizens (FAO UN-Water, 2024). To date, progress has fallen short of what's needed to meet the eight targets of SDG 6 (FAO UN-Water, 2024). The World Economic Forum in 2020 identified water shortage as a major global threat and a defining challenge of the 21st century (Mulwa et al., 2021; Seretlo-Rangata et al., 2025; Wu et al., 2023). Water scarcity will have significant effects on numerous other SDGs, especially those related to gender equality, poverty, food, health, education, and environmental integrity (FAO UN-Water, 2024).

The water situation in sub-Saharan Africa is marked by scarcity, compromised quality from pollution, and inefficient water infrastructure, leading to unpredictable supply (Worasa et al., 2024). Water demand is projected to surpass water supply by more than 50% by 2030 in the developing countries, especially in Sub-Saharan Africa (Mulwa et al., 2021). South Africa is characterized by a semi-arid climate, which makes it a water-stressed and water-scarce country, and the 30th driest in the world (Kotze et al., 2024) and is already burdened by the prediction that by 2030, the country's water needs will surpass its supply (Njoku et al., 2022). South Africa's water situation has worsened compared to other arid African countries (Pamla et al., 2021), as the water consumption has tripled in the past 25 years due to rapid urbanization, international migration, and industrial development (Adom and Simatele, 2020). While South Africa has made strides in addressing urban water access, rural areas still struggle with inadequate household water services (Mbana and Sinthumule, 2024), with just 24% of South African rural households, if not fewer, having access to safe, piped water (Njoku et al., 2022). Ishola et al. (2025) put the figure at around 20% of the rural population. Access to water is also a problem in the Harry Gwala District Municipality, with approximately 33.24% of households lacking access to clean or piped water and a staggering 76.25% having no proper sanitation facilities (Harry Gwala District Municipality, 2022). Water access is identified as one of the four (sanitation, electricity provision, and road infrastructure) severe backlogs in HGDM (Harry Gwala District Municipality, 2022).

In addition to South Africa being a water-scarce country, Njoku et al. (2022) report that South African households continue to engage in wasteful water practices in both urban and rural areas. Sustainable utilization of water and water conservation measures must be implemented at all levels, starting from the household or community level (Njoku et al., 2022). Shahangian et al. (2024) explain that, while household freshwater demand accounts for a smaller share of overall water consumption, households can make a meaningful contribution to reducing overall water demand. Shahangian et al. (2024) emphasized that addressing water scarcity and wasteful water-use practices requires a comprehensive understanding of people's and households' water-use and conservation practices. Yu et al. (2013) further report that effective water management relies on public opinion and on understanding residents' perceptions, as these shape their behaviors, responses, and national policies and programs in the field of water management. Furthermore, local communities offer invaluable insights from their direct, long-term experience and detailed understanding of their environment. Oremo et al. (2019) state that challenges in water resource management are partially due to a lack of adequate knowledge and information regarding water issues, and addressing these challenges necessitates a clearer understanding of current knowledge, beliefs, and practices related to water management. In the field of water conservation research, scholars have emphasized the importance of developing programs tailored to address the perceptions and needs of the target audience (Silvert et al., 2024). Therefore, understanding households' knowledge, attitudes, and practices of water conservation can be important for developing and implementing contextually relevant sustainable water intervention strategies (Almulhim and Abubakar, 2024; Pamla et al., 2021), as it is not clear if water users translate their knowledge and positive intentions into actual water conservation behavior (Almulhim and Abubakar, 2024). There is a need for more studies on householders' knowledge and attitudes toward water conservation, as well as the extent to which they adopt water conservation practices at home (Almulhim and Abubakar, 2024). In light of this, this study aims to examine the Fairview community's knowledge of and practices regarding water conservation, as well as the strategies that can be adopted to address water shortages in the community. The following research objectives guide this study: (i) assess Fairview community members' knowledge of, attitudes, and behaviors toward water conservation; and (ii) identify strategies to address water shortages in the community.

1.1 Theoretical framework and hypotheses

This study utilized the knowledge–attitude–behavior (KAB) framework to examine the knowledge, attitudes, and practices of water conservation among Fairview community members (first objective). The KAB model posits that the accumulation or possession of knowledge in a certain domain will gradually influence an individual's attitude, subsequently driving a change in their behavior (Li et al., 2023; Recio-Román et al., 2024). This model has been frequently applied in various contexts, particularly in understanding pro-environmental behaviors (Recio-Román et al., 2024). According to this model, pro-environmental behaviors are based on a linear progression or possession of environmental knowledge leading to environmental awareness and concern (environmental attitudes), which in turn lead to pro-environmental behavior (Kollmuss and Agyeman, 2010; Nguyen et al., 2025; Zhang et al., 2025). Oremo et al. (2019) propose a similar model, the knowledge, attitude, and practice (KAP) model, which states that better knowledge and understanding of water resource management issues are a precondition for sustainable water resource management. According to the KAB model, individuals must possess adequate knowledge or be willing to learn about environmental issues before engaging in pro-environmental actions (Lee et al., 2022; Nguyen et al., 2025, 2017).

Oremo et al. (2019) state that the KAB and/or KAP models are useful for evaluating information on what is known, what is believed, and what is being done in relation to a particular issue, in this case, water conservation. Knowledge refers to what is known (declarative), how it is known (procedural), whereas attitude is defined as belief (Li et al., 2023). Acquiring knowledge results in the formation of either favorable or unfavorable opinions (attitudes) regarding a product. “Behaviour” is a positive or negative attitude translated into anti- or pro-environmental behaviors (Recio-Román et al., 2024). In the context of this study, knowledge is the awareness and understanding of water conservation practices and the methods used to convey them. Attitudes are positive or negative beliefs about water conservation, and behavior refers to pro- and/or anti-environmental actions related to water conservation. The members of the Fairview community are required to demonstrate and rate their knowledge of water conservation and attitudes toward specific water conservation practices on a Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree).

Studies on water conservation knowledge and behavior in emerging economies (including South Africa) remain scarce. Kleinhans et al. (2025) assessed communities' knowledge, attitudes, and practices regarding COVID-19 in Thabo Mofutsanyana District, South Africa. Owojori et al. (2022) examined rural students' knowledge, attitudes, and practices regarding solid waste management at the University of Venda in South Africa. One study applied the KAB in the water sector. However, the study assessed students' knowledge, attitudes, and practices (KAP) regarding water, sanitation, and hygiene issues in specific schools within the Vhembe District of South Africa (Sibiya and Gumbo, 2013). Considering this, research on individuals' or households' knowledge, attitudes, and practices regarding water conservation (Nguyen et al., 2025) is needed, especially applying the KAB framework.

The following hypothesis guides this study:

H0: There is no significant relationship between demographic factors (gender, age, education, job type) and the following beliefs: (1) water taps must be closed when not in use; (2) waste disposal must be done far away from water sources; (3) groundwater pollution must be avoided; and (4) water rationing is acceptable during water scarcity.

H1: There is a significant relationship between demographic factors (gender, age, education, job type) and the following beliefs: (1) water taps must be closed when not in use; (2) waste disposal must be done far away from water sources; (3) groundwater pollution must be avoided; and (4) water rationing is acceptable during water scarcity.

H0: There is no significant correlation between knowledge of conserving water and the following beliefs: (1) water taps must be closed when not in use; (2) waste disposal must be done far away from water sources; (3) groundwater pollution must be avoided; and (4) water rationing is acceptable during water scarcity.

H1: There is a significant correlation between knowledge of conserving water and the following beliefs: (1) water taps must be closed when not in use; (2) waste disposal must be done far away from water sources; (3) groundwater pollution must be avoided; and (4) water rationing is acceptable during water scarcity.

2 Research methodology

2.1 Study area

The study was conducted within the Fairview community, which falls under the authority of the Harry Gwala District Municipality (HGDM), located southwest of the South African province of KwaZulu-Natal (Figure 1). In 2019, the HGDM had a population of 505,220, accounting for 1.0% of South Africa's total, and between 2009 and 2019, its growth averaged 0.76% per year, roughly half the national rate of 1.61% (Harry Gwala District Municipality, 2020). The population breakdown revealed 96.88% Africans, 1.19% White, 1.56% Colored, and 0.36% Asian, while females constitute 52.65% and males 47.35% in the district. The HGDM is primarily rural, characterized by natural vegetation, and features small urban settlements surrounded by larger agricultural estates and commercial forestry plantations (Harry Gwala District Municipality, 2022). The most important economic activities are trade, followed by commercial agricultural enterprises, such as dairy farming, which supplies 10% of all milk consumed in South Africa, and 35% of Clover's total milk intake, and cash crops such as maize and potatoes (Harry Gwala District Municipality, 2020). Bulk water supply for numerous local municipalities within the district is a role and authority of district councils, such as HGDM. The HGDM in South Africa has inherited a historical legacy of significant water supply backlogs, standing at 36% as of 2022. The HGDM's mission emphasizes delivering sustainable water and sanitation services through collaboration with communities and stakeholders.

2.2 Research approach

This study adopted a mixed-methods research approach, specifically a concurrent explanatory design. Using this approach, quantitative data were collected first through a questionnaire to assess demographic information and knowledge of water conservation and its practices among Fairview community members. This allowed us to first describe demographic characteristics and responses to their knowledge of water conservation practices. Following the quantitative analysis, qualitative data were gathered through interviews with managers from the Department of Water Services at HGDM to further explore and explain the initial survey findings and their knowledge of opportunities arising from water scarcity in HGDM. By integrating both data types, the explanatory design enabled us to triangulate our findings and deepen our understanding of participants' attitudes and behaviors toward water conservation.

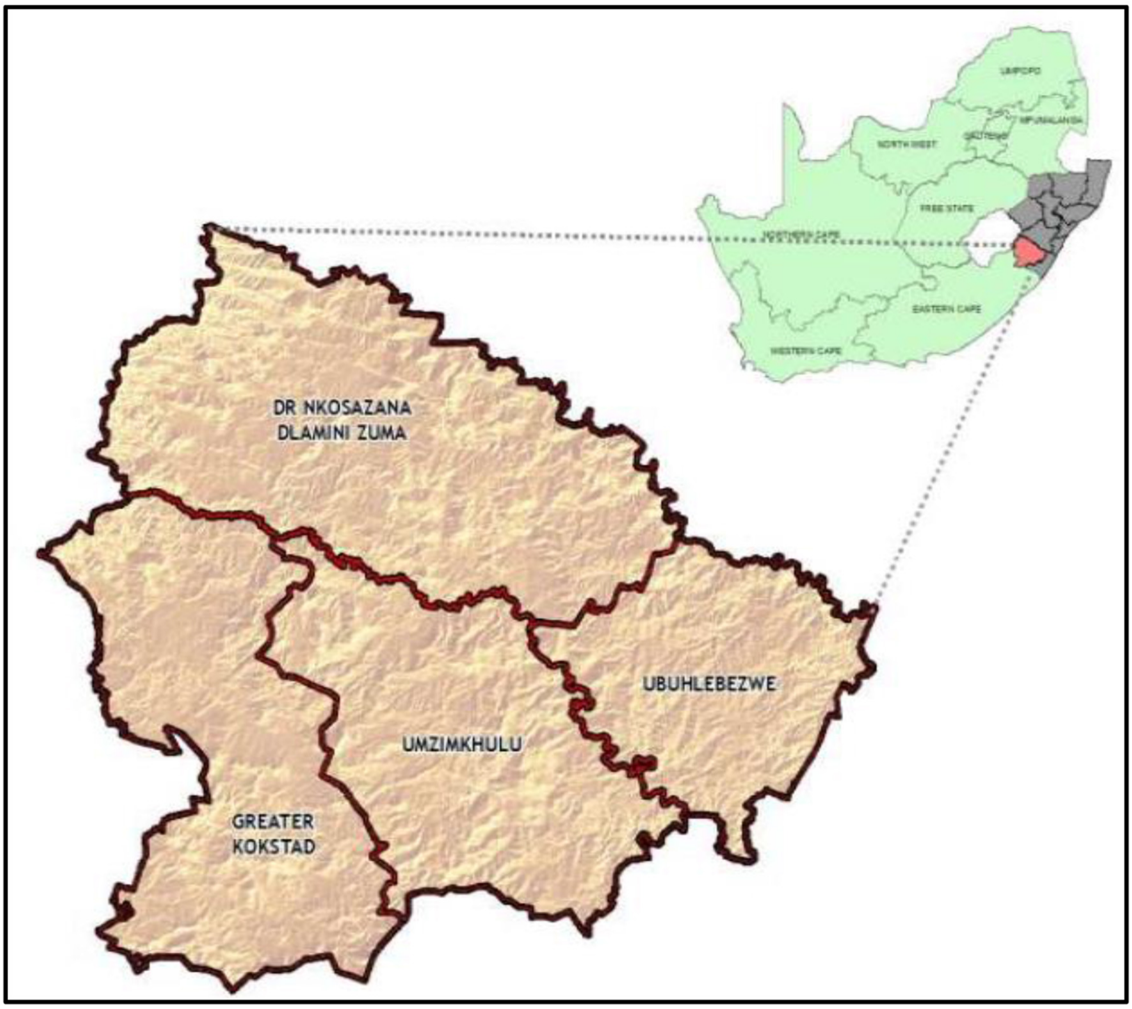

FIGURE 1
HGDM map. Source: Harry Gwala District Municipality (2022).

2.3 Population and sampling

The study employed systematic sampling to select 120 Fairview households from a target population of 6,000 households. The XLSTAT sample size calculator was used to determine the optimal sample size, balancing practicality and representativeness. To do this, the researchers used a sampling interval of 50 by dividing the population of 6,000 by the intended sample size of 120. They then chose a starting household at random from the list to participate in the survey and selected every 50th household thereafter. The study uses systematic sampling to avoid bias and ensure representative results. These households were given questionnaires; 110 returned them, yielding a 91.7% response rate. The remaining nine were due to non-response, and one had missing details on the socio-demographic section and responses on knowledge of water conservation. The high response rate was achieved through the provision of the researcher's contact details or those of affiliated institutions for any doubts or queries, clear and straightforward instructions for completing the questionnaire, and the use of the local language in the questionnaire. The target population of key informants for this study, who were to provide qualitative data, consisted of 12 managerial employees from the Department of Water Affairs at the HGDM. The sample population consisted of eight managers ($n = 8$) who were willing to participate. Preliminary data collection also revealed that data saturation was reached at eight participants, a figure that coincided with the number of participants willing to participate in the study.

2.4 Data collection

The quantitative section of the study employed a questionnaire survey consisting of multiple-choice questions. Questionnaires were the primary source of data in this study from 25 September 2021 to 30 November 2021. The authors obtained a register and contact numbers for Fairview community residents/water customers from the HGDM Water Services Department, as the former used these contacts to communicate water bills and other municipal issues. The researchers predominantly used online questionnaires to collect data from the Fairview community to prevent the spread of COVID-19. However, for community members without internet access, researchers used telephone calls to determine the preferred method for receiving questionnaires. The few who had internet access problems chose paper-based questionnaires, and these were posted to the respondents' addresses as obtained from the HGDM register. After completing the questionnaires, they had to send them via PostNet at the researcher's cost. Verification of respondents' membership in the Fairview community was conducted using screening questions in the questionnaire, such as "how long have you lived in this community?" and "what water services do you use?" Age verification was conducted to ensure that all respondents were adults by including a mandatory question that required participants to indicate their age group. Responses from those aged 18 and older were the only accepted responses, while those from under 18 were disregarded to ensure compliance with ethical standards.

They contained questions about the assessment of community members' knowledge of water conservation, which was conducted via a survey questionnaire. A pilot study was conducted by purposively selecting two senior employees from the HGDM and 10 members of the Fairview community. Respondents indicated their level of agreement with the five statements on a 5-point Likert scale, providing a quantitative measure of their perceptions regarding water conservation. They were to choose from: Strongly Agree (SA), Agree (A), Uncertain (U), Disagree (D), and Strongly Disagree (SD). Statement 1 assessed declarative knowledge among Fairview community members and aligned with the "Knowledge" element of the KAB model. Statement 2–5 measured the "Attitude" component of the model.

They were written in three languages, IsiZulu, isiXhosa, and English, since the study was done in a predominantly rural setting where some residents might not be conversant with English. The questionnaire included the author's contact details and institutional affiliation to ensure that respondents who had queries could contact the author or the affiliated institution.

The study's qualitative component used standardized and in-depth interviews to collect data from the eight HGDM managers in the Water Services department. All eight managers had valuable perspectives stemming from their extensive experience, ranging from 5 to 15 years, in different sections of the Water Services Department. Open-ended questions in the interview schedule focused on collecting information about water conservation practices, especially procedural knowledge and pro-water-conservation behaviors among the Fairview community (Table 1). These responses address the "Knowledge" component of the KAB model. The study also collected data from HGDM managers on strategies to address administrative deficiencies in the Water Services Department to alleviate chronic water shortages in the Fairview community. Online interviews were used to avoid putting researchers or participants at risk of contracting COVID-19. The managers had the option to choose a telephone interview, Skype, Teams, Zoom, or Google Hangouts to avoid direct contact and maintain social distancing. If participants agreed to online interviews, prior permission was sought to audio-record them. Additionally, measures were taken to securely store and manage the data in line with POPIA requirements. During the telephone interview, the researchers explained the purpose of the study and ensured the participant's consent to record the conversation and take notes. The researcher transcribed the manager's interviews verbatim to maintain the accuracy and integrity of the data.

TABLE 1 Metrics used to assess elements of the KAB model.

Item	Category in the KAB model
1: I have knowledge of water conservation practices	Knowledge
2: Water taps should be closed when not in use	Attitude
3: Waste disposal should be sited far away from water sources	Attitude
4: Groundwater pollution should be prevented	Attitude
5: Water rationing should be promoted when water is scarce	Attitude
Confirmatory responses by HGDM	-Knowledge (procedural knowledge/methods to convey water conservation knowledge) -Behavior (pro-water conservation behavior by the Fairview community)

2.5 Ethical consideration

The study adhered to various ethical practices and principles by providing information regarding the research's objectives, the rights, and their responsibilities to the Fairview community and HGDM's managers. The researcher sought permission to conduct research in the area from both HGDM and local leaders. The participants were also informed of their right to voluntarily participate in the research and to withdraw at any time. Participants were invited to participate in the research after formally indicating their consent by signing a consent form. Confidentiality was safeguarded by placing all research materials in an office and a cupboard under lock and key, and by storing data on a password-protected computer, whilst anonymity was ensured by using pseudonyms for the respondents. Respondents were given pseudonyms based on letters of the alphabet.

2.6 Data analysis

For quantitative data analysis, a statistician was sought to assist. Descriptive statistics were calculated using SPSS (Version 24; IBM Corp., Armonk, NY, USA). SPPS was also used to conduct chi-square and correlation tests on the relationship between socio-demographic factors and the five items measuring knowledge and attitudes toward water conservation behaviors. For qualitative data analysis, the transcripts/audios from the eight managers were uploaded into Atlas. TI 25 software for analysis. Segments of interest were created and coded manually and concurrently. The study employed inductive coding. These codes were grouped into themes.

2.7 Reliability of quantitative data

The questionnaire's reliability (ability to obtain consistent results when the study is repeated) as a tool for collecting quantitative data was assessed using Cronbach's alpha coefficient, calculated in SPSS (Table 1). Generally, a reliability value of 0.60 or higher indicates that the instrument or scale measures the construct consistently and reliably. The overall reliability coefficient was 0.780, suggesting that the five items (on water conservation knowledge) effectively measured the constructs in a consistent and reliable manner.

2.8 Validity of quantitative data

The validity of the quantitative data was also evaluated. Validity assesses how accurately and truthfully research findings represent the reality being investigated. Bartlett's test and the Kaiser-Meyer-Olkin (KMO) test were employed to assess the suitability of the data for factor analysis. Bartlett's test yielded a value of 0.000, indicating that the data were appropriate for factor analysis, while the KMO score was 0.794. If the value of Bartlett's Test of Sphericity is less than 0.05 and the KMO Measure of Sampling Adequacy is 0.50 or higher, the results of the factor analysis are considered valuable and valid. Again, Principal Component Analysis was performed using the five variable (item) scores, which ranged from a moderate positive loading (0.651) to a strong positive loading (0.833). This suggests that the underlying theme was positively related to its variables.

2.9 Reliability and credibility of qualitative data

To ensure qualitative data reliability, researchers utilized standardized in-depth interview schedules, ensuring that key informants received the same types of questions. Additionally, researchers underwent internal training on interview techniques. To enhance the credibility of the study's findings, interview transcripts were shared with participants for their feedback on whether the identified themes and concepts truly reflected their viewpoints. Researchers built rapport and trust with respondents by engaging in extensive discussions about the research items, which helped alleviate concerns that might have led respondents to withhold crucial information.

TABLE 2 Demographic profile of Fairview residents.

Age (years)		Gender		Total
		Male	Female	
18–35	Count	14	3	17
	% within age	82.4%	17.6%	100.0%
	% within gender	25.9%	5.4%	15.5%
	% of total	12.7%	2.7%	15.5%
25–34	Count	16	29	45
	% within age	35.6%	64.4%	100.0%
	% within gender	29.6%	51.8%	40.9%
	% of total	14.5%	26.4%	40.9%
35–44	Count	11	16	27
	% within age	40.7%	59.3%	100.0%
	% within gender	20.4%	28.6%	24.5%
	% of total	10.0%	14.5%	24.5%
45–54	Count	9	4	13
	% within age	69.2%	30.8%	100.0%
	% within gender	16.7%	7.1%	11.8%
	% of total	8.2%	3.6%	11.8%
55–64	Count	3	1	4
	% within age	75.0%	25.0%	100.0%
	% within gender	5.6%	1.8%	3.6%
	% of total	2.7%	0.9%	3.6%
65 and above	Count	1	3	4
	% within age	25.0%	75.0%	100.0%
	% within gender	1.9%	5.4%	3.6%
	% of total	0.9%	2.7%	3.6%
Total	Count	54	56	110
	% within age	49.1%	50.9%	100.0%
	% within gender	100.0%	100.0%	100.0%
	% of total	49.1%	50.9%	100.0%

3 Findings

3.1 Demographic profile of the participants

The data in Table 2 reveal significant insights into the demographics, which are important factors in influencing knowledge of water conservation practices and other beliefs. The most dominant group is the 18–35 age group, indicating that younger adults are likely to be more engaged with water conservation issues, as they are fresh from formal educational programs or initiatives focused on sustainable water practices. The majority of respondents are female, suggesting gender bias or an interest in community engagement on water conservation.

The demographic characteristics of managers from HGDM provide important insights into their professional backgrounds and qualifications (Table 3). The manager's group has a balanced gender distribution, reflecting an equitable representation of managerial roles within HGDM's Water Services department. The experience within the Water Services department varied among participants, ranging from 5 to 15 years, and participant 7 has the

TABLE 3 Demographic profiles of the managers from HGDM.

Participant	Gender	Position in the organization	Experience in a management position	Experience in the municipality	Age	Highest level of education
Participant 1	Female	Finance executive	5	15	47	Degree
Participant 2	Male	Infrastructure services	8	6	42	Post degree
Participant 3	Female	IDP implementation-water	5	5	38	B. Com
Participant 4	Male	Administrative services -water treatment	9	3	49	Degree
Participant 5	Female	Senior manager-water supply	6	6	56	M.Com
Participant 6	Male	Management	9	7	39	ACCA, Hons Degree. MBA
Participant 7	Female	Project management and technical services for bundled water treatment and plant projects	15	9	46	MBA HRM
Participant 8	Male	Community Liaison	13	6	47	Degree

highest managerial experience of 15 years, indicating a wealth of knowledge in technical water services. The age distribution shows a blend of relatively young and more experienced water service professionals, which contributes to diverse perspectives in water services discussions. The equal representation of all genders, the blend of different experience levels, and educational qualifications suggest a managerial team aiming to address challenges in water management and infrastructure within the HGDM.

3.2 Perceptions of residents and HGDM managers on the former's knowledge of water conservation practices

This section presents and triangulates views from Fairview community and HGDM managers on their knowledge about water conservation, as water is scarce in this municipality. Community members were to choose from Strongly Agree (SA), Agree (A), Uncertain (U), Disagree (D), and Strongly Disagree (SD). Table 4 presents the results of a survey conducted among Fairview community members regarding their knowledge of water conservation, along with descriptive statistics. This provides information on the "Knowledge" component (declarative knowledge) of the KAB model. Item 1 has a mean score of 3.95 (falling within the "Agree" category), suggesting that, on average, the Fairview community was positively inclined toward the statement that they have knowledge of conservation practices. The median of 5 indicates that at least half of the respondents chose "strongly agree," and the mode of 5 further reinforces this strong consensus. The standard deviation of 1.48 suggests that a minority of residents express differing opinions; hence, the residents have knowledge of water conservation practices. These findings are confirmed by one of the managers from HGDM's water department, who stated:

> *Generally, community members in this area of Fairview are somewhat advanced in terms of conserving water.* (Manager 1)

The statement by one of the managers that community members in Fairview are "somehow advanced" in conserving water suggests a level of improvement or awareness that may not be consistent across the entire community. It implies that there might be significant gaps in knowledge or implementation. Further investigation into the extent of water conservation practices within the Fairview community is needed.

Item 2 in Table 4 measures the Fairview community's attitude toward closing water taps when not in use. This component measures the "Attitude" component in the KAB model. The mean score for Item 2 is 4.22, suggesting that Fairview community members again leaned positively toward the statement. The median and mode scores were 5, indicating that at least half of the Fairview community members strongly agreed with this practice. The standard deviation is 1.35, indicating that while many members strongly agree with the statement, some expressed differing opinions, particularly in the lower categories of agreement.

TABLE 4 Knowledge and attitude toward water conservation practices.

Item	SA%	A%	U%	D%	SD%	Mean	Median	Mode	Standard deviation
Chronbach's $\alpha = 0.780$									
1: I have knowledge of water conservation practices	57.9	15	6.5	5.6	15	3.95 (A)	5 (SA)	5 (SA)	1.48
2: Water taps should be closed when not in use	68.2	12.1	3.7	5.7	10.3	4.22 (A)	5 (SA)	5 (SA)	1.35
3: Waste disposal should be sited far away from water sources	70.1	14	4.7	4.7	6.5	4.37 (A)	5 (SA)	5 (SA)	1.17
4: Groundwater pollution should be prevented	62.6	17.8	3.7	6.5	9.4	4.18 (A)	5 (SA)	5 (SA)	1.31
5: Water rationing should be promoted when water is scarce	50.5	19.6	8.4	10.3	11.2	3.89 (A)	5 (SA)	5 (SA)	1.40

Manager 1 from HGDM also revealed:

> *Generally, community members in this area of Fairview are somewhat advanced in terms of conserving water. For example, they always remind each other to teach their children to turn off water taps after fetching water, and this is commendable.* (Manager 1)

Another manager from HGDM said:

> *There is a culture in the community whereby all water taps are closed during the night as a measure to reduce incidences of children or mischievous people opening taps for pleasure or for annoying some people. (Manager 8)*

These views align with the "Behaviour" element of the KAB model, as the Fairview community demonstrates pro-water-conservation behaviors: adult residents not only practice water-saving habits but also instill these values in youth. Efforts to teach the youths on water conservation practices address the "K" or procedural knowledge and "Bevahiour" component of the KAB model by inculcating the importance of closing water taps and one pro-water conservation method to the youth respectively. This cultural reinforcement underscores a community-oriented approach to water conservation. Another manager from HGDM stated:

> *There are notices encouraging community members to use water wisely and to close communal water taps, which has increased their level of water conservation awareness.* (Manager 3)

The issuance of these notices by the HGDM water department underscores the need for improved, regular communication on water conservation practices. This practice constitutes the "knowledge" or procedural knowledge component of the KAB model, as notices given promote awareness of sustainable water use. The views also suggest that while community members acknowledge the importance of water conservation, there may have been gaps in awareness of and actions on water conservation practices prior to the implementation of these initiatives.

Item 3 focused on the views of the Fairview community on the siting of waste disposal facilities in relation to water sources. This item measured the "Attitude" component of the KAB model regarding the siting of waste disposal zones relative to water sources. Table 4 shows a mean score of 4.37, a median and mode of 5, indicating that at least half of the members of the Fairview community strongly agree with siting waste disposal facilities far from water sources. The calculated standard deviation is 1.17, indicating moderate variability in responses. Overall, the results reflect a predominantly positive view and attitude toward siting waste disposal facilities far from water sources. All genders largely have a positive attitude toward siting waste disposal facilities away from water sources, reflecting a shared commitment to protecting water quality, although there are some differences, particularly among female residents. The residents of Fairview were described by one manager as responsible individuals who are adopting pro-environmental behaviors to protect water quality. Manager 4 said:

> *In terms of water conservation, these community members are doing a good job. There are days when they allocate duties to each other to clear garbage and waste around the water tap areas. They have also built separate drinking water troughs for cattle, far away from community tap areas. (Manager 4)*

The above views highlight pro-water-conservation and management behaviors among the Fairview community in protecting water quality. The community is going beyond the conservation of scarce water resources to protecting the quality of that resource. This constitutes the "Behaviour" element of the KAB model, as households translate water conservation knowledge into positive attitudes, which subsequently lead to pro-environmental behaviors. However, it also raises a key issue: a potential disconnect between these commendable practices and broader water conservation strategies. Although the community's efforts are beneficial, they do not necessarily address the underlying issues of water scarcity or inefficient usage.

Item 4 measures Fairview residents' attitudes toward protecting the quality of groundwater sources. Item 4 has a mean score of 4.18, indicating that the community has a positive inclination toward preventing groundwater pollution. Both the median and mode were 5, indicating strong consensus, as at least half of the respondents selected "strongly agree" for item 4. The standard deviation is 1.31, indicating moderate variability in responses. A strong majority of both male (82.7%) and female (78.2%) residents support preventing groundwater pollution, although there are minor differences of opinion, particularly among female residents. So, findings from these descriptive statistics show that the Fairview community has a positive attitude toward this item.

Item 5 further measures the Fairview community's attitude toward adopting water rationing during a water shortage. Results for Item 5 further show a mean score of 3.89, with a median and mode score of 5, indicating a strong consensus among many community members that promoting water rationing during times of water scarcity is warranted. The standard deviation was approximately 1.40, indicating a notable level of variability in responses. All genders have positive attitudes toward promoting water rationing during scarcity, though there is a minor disagreement, slightly higher among male residents than among female residents. This indicates a marginally more favorable attitude toward water rationing among female residents. This is supported by women who went an extra mile by adopting water reuse during water rationing days. One of the managers stated:

> *Most women in the community ensure they do not waste water after washing clothes; instead, they reuse it for flushing toilets or watering gardens.* (Manager 7)

The above statement on water conservation behaviors aligns with positive views on adopting water rationing, reusing, and recycling when water is scarce. It further highlights women's resourcefulness and ingenuity in water conservation by finding alternative uses for water that would otherwise be discarded. Women are not only minimizing waste but also maximizing the utility of available scarce water resources. Their proactive behavior reflects not only their responsibility toward sustainable household water use but also their potential leadership in promoting conservation practices. Overall, HGDM managers confirm the community's positive engagement with water conservation practices, which aligns with residents' positive attitude toward them, though there may be a disconnect between the depth of knowledge and the diversity of these practices. Table 5 provides a summary of knowledge, attitudes, and pro-water-conservation behavior, guided by the KAB model and obtained from residents and HGDM.

3.3 The relationship between socio-demographic factors and knowledge of water conservation and other attitudes toward water conservation practices

This section presents the results of an inferential statistical analysis examining the relationship between socio-demographic factors and knowledge of water conservation, related attitudes, and behaviors. Chi-square and correlation tests were performed to examine the association between these variables. Table 6 summarizes the results of the Chi-square tests. The results show that socio-demographic factors, gender, education, and job type have no significant relationship with knowledge of water conservation practices and attitudes regarding the importance of closing taps. Again, these demographic factors do not influence attitudes toward the placement of waste disposal relative to water sources. However, age shows significant relationships with Items 1, 2, and 5, indicating that knowledge of water conservation practices, attitudes toward the importance of closing taps, and the adoption of water rationing during water-scarce days vary across age groups.

For items 3 and 4, socio-demographic factors such as age, education, and job type show no significant relationships with attitudes toward siting waste disposal zones near water sources and toward preventing groundwater pollution. Only gender has a significant relationship with these attitudes. In summary, these findings show that age and gender significantly influence some items, whereas other demographic factors, such as education and job type, do not show any relationships across the various beliefs about water conservation practices.

Table 7 summarizes the results of the Spearman correlation tests. Overall, the findings highlight weak to moderate positive correlations between knowledge of water conservation and various beliefs about water conservation practices. This suggests that increasing knowledge about water conservation may influence individuals to adopt more positive attitudes toward responsible water use and management.

3.4 Perceptions of HGDM managers on strategies of addressing water services department deficiencies

HGDM managers were asked to share their views on opportunities arising from the water supply challenges in Fairview. Diverse responses were collected and grouped into three themes.

3.4.1 Strategies for promoting continuous improvement of water supply service quality

Water shortages in the Fairview community present challenges but also offer opportunities for growth, innovation, and sustainable development, according to water managers.

TABLE 5 Summary of knowledge, attitudes, and pro-water-conservation behavior components.

Knowledge of water conservation	Water conservation attitudes	Water conservation practices
-Residents possess knowledge of water conservation practices. -There are notices encouraging community members to use water wisely. -Residents teach children to turn off water taps after fetching water.	-Residents have a positive attitude toward closing water taps when not in use. -Residents have a positive attitude toward siting waste disposal far away from water sources. -Residents have a positive attitude toward the protection of groundwater. -Residents have a positive attitude toward water rationing when water is scarce.	-Residents remind each other to turn off water taps after fetching water. -Residents teach their children to turn off water taps after fetching water. - Community, close all water taps during the night. -Allocation of days in a month to clear garbage and waste around the water points. -The community built separate drinking water troughs for cattle. -The community women reuse water for flushing toilets or watering gardens.

TABLE 6 Results of chi-square tests.

Item	Gender		Age		Education		Job type	
	χ^2 value	p-value	χ^2 value	p-value	χ^2 value	p-value	χ^2 value	p-value
1: I have knowledge of water conservation practices	0.567	0.967	33.347	0.031	15.374	0.497	14.410	0.275
2: Water taps should be closed when not in use	5.890	0.207	55.910	0.000	21.271	0.168	6.860	0.867
3: Waste disposal should be sited far away from water sources	8.622	0.071	17.409	0.626	10.501	0.839	10.297	0.590
4: Groundwater pollution should be prevented	10.120	0.038	19.409	0.495	12.001	0.744	10.823	0.544
5: Water rationing should be promoted when water is scarce	2.067	0.724	28.654	0.095	22.781	0.120	10.723	0.553

> *We must continually improve our responsiveness to community complaints. One of the most common complaints from the community has been our lack of or poor response to the water supply challenges. In my view, the municipality needs to craft and implement systems that make us highly responsive and ensure prompt responses to the water supply challenges facing the Fairview community. (Manager 1)*

Another manager had this to say:

> *Our municipal workflow systems and response mechanisms to the challenges our people face need to be regularly reviewed and improved to ensure a reliable water supply. We promptly address residents' complaints. We are courteous, humble, and competent in all that we do. We, therefore, need to instill confidence in our people by demonstrating that we are competent to address water challenges and that we provide services in a manner that assures residents that we stand with them.* (Manager 6)

Judging from the above views, there is a recognition of the need for continual improvement in service quality and an acknowledgment of existing deficiencies in the current water supply system. Secondly, the emphasis on improving the municipality's responsiveness to community complaints highlights a significant concern about the current inadequacy of the municipality's water complaints response mechanisms and the disconnect between the water supplier and the community. The manager discusses the need for HGDM to craft and implement systems to improve responsiveness, highlighting the need for structural changes within the organization, as current processes may be insufficient or inefficient in handling complaints and addressing water supply issues. The focus on "prompt responses" stresses the importance of timely action in addressing water supply challenges, leading to greater satisfaction among residents. One of the managers further stated:

> *We need to change the way we operate at the municipality, particularly in the water department. In my opinion, it's not only in Fairview, but also in many other areas, where our service standards have been unsatisfactory. The*

TABLE 7 Results of the correlation test.

Spearman's rho	I am highly knowledgeable about conserving water	
Water taps must be closed when not in use	Correlation coefficient	0.445
	Sig. (2-tailed)	0.000
	N	107
Waste disposal must be done far away from water sources	Correlation coefficient	0.198
	Sig. (2-tailed)	0.041
	N	107
Groundwater pollution must be avoided	Correlation coefficient	0.336
	Sig. (2-tailed)	0.000
	N	107
Water rationing is acceptable during water scarcity	Correlation coefficient	0.354
	Sig. (2-tailed)	0.000
	N	107

> *municipality needs to change the culture of doing things and unfreeze old behaviors followed by introducing new behaviors that lead to the provision of people-centered responses that result in the speedy resolution of community challenges, followed by the creation of a culture that helps to improve service quality and associated reliable services to the people. (Manager 8)*

The views of Manager 8 further underscore the need for a cultural shift and a revision of entrenched water-supply practices within HGDM, suggesting that existing operational water-supply methods may be outdated or ineffective. The phrase "change the culture of doing things" suggests a deeper underlying issue related to organizational inertia and resistance to change. The manager discusses adopting "people-centered responses," emphasizing the need to prioritize community needs and perspectives in water service delivery. This shift suggests a move away from a purely administrative approach to water service delivery toward one that values direct engagement with residents, active listening, and, subsequently, addressing their specific water challenges. Therefore, HGDM not only aims to resolve immediate issues but also seeks to establish water supply systems and practices that ensure ongoing enhancement of water service standards in the long term.

3.4.2 Modernizing water supply

Some managers from HGDM's water department revealed a compelling opportunity to modernize water supply systems. One manager had this to say:

> *In fact, as management, we need to brainstorm ways to modernize our water harvesting and reticulation systems so we can develop the capacity to supply water to areas like Fairview on a continuous basis. I think it's time we move away from the current arrangement of supplementing the water supply with Bowsers, which is not always sustainable, and adopt automated metering infrastructure, pressure management systems, s, and water apps and sensor networks for real-time water quality monitoring. (Manager 2)*

Another manager from HGDM's water department stated:

> *Communities and households should complement HGDM's efforts by adopting new techniques, such as installing rainwater harvesting tanks and modern technologies for accessing deep underground water, such as* solar-powered water pumps, *combined with innovative methods for managing ecosystems, which need to be explored and utilized.* (Manager 4)

The above views indicate that current water supply systems are not adequately equipped to meet demand in areas like Fairview, thereby affecting the reliability and sustainability of water delivery. Supplementing the water supply with water bowsers is viewed as unsustainable and short-term; therefore, water challenges offer an opportunity to pursue long-term, more permanent, and more effective water infrastructure improvements. The need for innovation in water sourcing methods extends beyond providing technical solutions to also encompass strategic decisions that indicate a broader vision for enhancing water supply. The mention of "innovative ways of managing ecosystems" brings to attention the need for a holistic approach to water management that includes maintaining the surrounding ecosystems. This dual focus on water sourcing and ecosystem management highlights the interconnectedness of natural resources and underscores the need to balance water needs with environmental integrity. This is followed by a call for collaboration among all levels of management in HGDM's water department, a recognition of the need for a collective managerial effort in water supply decision-making.

3.4.3 Strategies for mobilizing resources using a multi-stakeholder approach

Some managers from HGDM's water department revealed that water supply challenges in the Fairview community present an opportunity to mobilize resources, harness diverse expertise, and innovative solutions through engaging diverse stakeholders. One manager stated:

> *Opportunities do exist for convincing the donor community, central government, investors, and many other stakeholders for the mobilization of funds so that additional dams, reservoirs, and relevant infrastructure can be put in place to address the challenges of water supply in this community. (Manager 3)*

Another manager from HGDM's water department further revealed that:

> *There is a need for municipalities to strengthen coordination among stakeholders to mobilize both ideas and financial resources to expand water provision capacity. (Manager 5)*

The above views suggest that HGDM's existing resources are insufficient to meet the community's water supply demands, necessitating external support and collaboration to increase water supply capacity. It is also an indication that a fragmented and/or statist-dominated approach to water supply is hindering effective resource mobilization and pooling. This indicates a need for a holistic approach that integrates diverse perspectives and expertise to develop comprehensive strategies for improving water provision capacity.

4 Discussion

This study examined the Fairview community's knowledge of water conservation practices and the strategies that can be used to address organizational deficiencies that lead to water shortages. Study findings indicate that Fairview community members generally possess knowledge of water conservation practices, with strong consensus among residents across all genders. Fanteso and Yessoufou (2022) and Almulhim and Abubakar (2024) state that water scarcity fosters a shared responsibility between men and women in conserving water, developing water resources, and implementing rainwater harvesting systems. The findings of this study reveal that the Fairview community's understanding of water conservation practices is notably higher than previously reported in similar contexts, particularly in Vietnam, where knowledge levels were found to be below average (Nguyen et al., 2025) and in the Tsavo sub-catchment in Kenya, where knowledge of Integrated Water Resources Management principles was similarly limited Oremo et al. (2019). This highlights the importance of knowledge provision as the first component of the KAB or KAP model.

Residents' positive knowledge of water conservation leads them to support and actively participate in protecting water quality from contamination by domestic animals and in implementing water-saving practices. Unlike previous studies, which indicated a lack of understanding of water conservation practices (Nguyen et al., 2025; Oremo et al., 2019), this study's findings illustrate that positive knowledge leads to pro-water conservation and quality protection actions. Findings in similar settings, i.e., in the rural areas of the Mbhashe and Mnquma local municipalities in South Africa, indicate that participants reported reusing bathwater for laundry, using laundry water for cleaning, and watering garden crops (Mapuka et al., 2024). The possession of knowledge about water conservation and participation in actual conservation practices, as reported earlier, can be linked to HGDM's efforts to disseminate information through notices on the importance of sustainable water management in the context of water scarcity. Almulhim and Abubakar (2024) note that awareness of water conservation typically leads to the adoption of conservation practices, whereas lower awareness tends to result in higher water consumption and wasteful use among households. Ataei et al. (2024) further argue that to encourage communities to adopt strategies to cope with water scarcity and conserve water, it is advisable to increase their awareness of both the adverse effects of water resource loss and degradation, as well as the benefits of implementing coping strategies for water scarcity. The engagement of the Fairview community through these notices not only increases their knowledge of water conservation but also promotes active participation in water conservation and contamination prevention behaviors. This aligns with the KAP model, which posits a linear relationship among knowledge access, attitude change, and the adoption of pro-environmental behaviors. However, in Waterloo Township, north of Durban in KwaZulu-Natal, findings indicate that while respondents had a high level of awareness about water conservation (94.4%), there was a notable gap of −20.3% between this knowledge and their actual water-saving behaviors (74.1%) (Thakur et al., 2022). The varying findings between the latter and the Fairview community highlight that programs to inculcate pro-environment behaviors need to be tailored to each community's local context, cultural values, unique characteristics, and needs. This study used a single-community case study design, which allowed for in-depth, context-specific insights into the community's water conservation knowledge and attitudes. However, because community characteristics vary, the findings from this case study may not be generalisable to other communities, as shown by the variance in levels of awareness in communities within the same country. Therefore, caution should be taken when generalizing these findings beyond the study site, as they are context-specific.

The study's Chi-square results further show that age and gender significantly influenced some beliefs about water conservation practices, whereas other demographic factors, such as education and job type, did not show any relationships across the various beliefs/items. The significant relationship between the first two socio-demographic factors and some beliefs about water conservation practices rejects the null hypothesis that "there is no significant relationship between demographic factors and the beliefs about water conservation practices." A study by Isaac revealed that the age and sex of respondents in Enyibe, Ermelo, Mpumalanga Province, South Africa, were significantly associated with the adoption of water conservation practices, while Fanteso and Yessoufou (2022) reported that knowledge and attitudes of water conservation are not affected by age or gender in Eastern Cape Province, South Africa. A study by Abdulaziz revealed that Chi-square results showed significant associations between age, income, education, household size, housing type, and nationality with household water conservation practices, while gender and marital status did not significantly influence these practices. These findings suggest that age and gender are consistent predictors of both beliefs and practices of water conservation, while other socio-demographic characteristics vary in their influence across places. This study has limitations as it explored the relationship between the four socio-demographic characteristics (age, gender, education, and job type), but did not include others (income, class, marital status, and household size), and omitting these factors can disregard important variables that can affect attitudes and practices of water conservation.

Study findings also show weak to moderate positive correlations between knowledge of water conservation and beliefs about conservation practices, suggesting that enhancing knowledge may lead individuals to develop more positive attitudes toward responsible water use and management. Residents of Waterloo Township, situated north of Durban in KwaZulu-Natal, also demonstrated a positive correlation between their understanding of water-saving techniques and their actual practice of implementing them (Thakur et al., 2022). However, a study done in Thohoyandou, South Africa, revealed that though rural households had a positive attitude toward water conservation, this was not linked to knowledge of water conservation practices but was a result of the scarcity of water in that rural area, as water availability influences water conservation attitude and behavior (Njoku et al., 2022). Building on this observation, Pamla et al. (2021) contend that in Makhanda, South Africa, the motivation for water conservation behaviors primarily stems from households' desire to avoid water shortages, rather than reflecting an understanding of water conservation or environmentally friendly practices. Again, the study's measures of knowledge, attitudes, and self-reported water conservation behaviors relied on participants' self-reports, which may have led them to overstate their pro-water conservation attitudes and behaviors to align with HGDM's expectations. This has the potential to lead to positive estimates of attitudes and actual behavior. Future studies can triangulate with objective measures, such as observational audits of water-saving practices and reduced water consumption/bills, to validate these self-reports.

Managers from HGDM believe that water shortages in Fairview present opportunities to address organizational deficiencies in the Water Service department, modernize water supply systems, and explore new techniques for water supply and conservation to improve service quality. A study by Fanteso and Yessoufou (2022) revealed that water scarcity in the Eastern Cape province led communities to forgo traditional technologies for rainwater conservation and harvesting, as these were now unreliable and unsafe. The provincial government is investing in modern groundwater abstraction technologies in rural communities. The adoption of new technologies is likely preferred because they can be implemented more easily through single events, unlike the "willpower" required for water curtailment strategies (Hunt and Shahab, 2021). While modernized water supply systems offer long-term benefits, they require significant capital to train the workforce, purchase and install technologies, and support software and hardware updates and servicing. This also requires examining opportunities to fund the costs of adopting new technologies, such as public-private partnerships or cost-recovery mechanisms. Furthermore, current adaptive responses to water scarcity in many cases fail because they mainly or exclusively emphasize technological solutions, overlooking the importance of behavioral factors (Almulhim and Abubakar, 2024). Moreover, the technical aspects of water supply function within the ever-changing realms of non-technical environments/contexts (Woldesenbet and Kebede, 2020). Demand-side water conservation and curtailment are recognized as cheaper (no costs for energy to purify, pump, and maintain existing and new water supply infrastructure) compared to constructing new water supplies (Hunt and Shahab, 2021). Water conservation through community-based reduction efforts can be implemented swiftly without requiring significant water infrastructure investments.

The managers also stressed the importance of changing entrenched water supply practices, adopting people-centered responses, and being responsive to community complaints to address water scarcity, as supply-side and technological innovations are fallible. The limited involvement of water users may contribute to the ineffectiveness of existing approaches to addressing water scarcity (Hunt and Shahab, 2021). This has led to a lack of public support, which is one of the major barriers to the effectiveness of water conservation policies and programs (Almulhim and Abubakar, 2024). So, managers from HGDM recognize the need for structural changes within the municipality to enhance complaint management and community engagement, ensuring timely interventions, resident satisfaction, and participation in water conservation behaviors. Involving water users in the development of water management plans is increasingly recognized by a diverse group of water-sector scientists as essential for addressing current water resource challenges (Gwapedza et al., 2024).

The study's key informants also reported that water shortages in Fairview present opportunities for a multi-stakeholder approach to mobilize resources and ideas for improving water infrastructure. The essential tenet of a multi-stakeholder platform is to unite government, civil society, and the private sector to tackle complex development challenges that no single entity has the capacity, resources, or expertise to address effectively on its own (Sigalla et al., 2021). Multi-stakeholder platforms in the water sector are designed to complement rather than replace the role of governments in achieving sustainable water resource management, as they support the implementation of IWRM principles and contribute to SDG 17, which acknowledges multi-stakeholder partnerships as vital for mobilizing resources to help countries fulfill SDG commitments (Sigalla et al., 2021). However, Hove et al. (2021) argue that engaging stakeholders in water governance, encompassing priority setting, planning, decision-making, and implementation, has been challenging in South Africa, despite the presence of supportive legislation that incorporates Integrated Water Resource Management principles and a strong theoretical and policy backing for community and stakeholder involvement in managing water resources. South Africa's water services are predominantly state-driven, leaving limited opportunities for civic and private entities to engage and serve in the water sector (Motloung, 2024). The technical and non-technical facets of water supply cannot be effectively managed solely through government actions but require the active engagement of multi-stakeholders (Woldesenbet and Kebede, 2020). The provision of water services is most effective when all stakeholders are actively engaged (Moreira et al., 2024). When water resources are managed and governed holistically, systematically, and in a consultative manner, promoting collaboration and interdependence, it can unlock new technologies, innovative solutions, and funding (Adom and Simatele, 2025). However, the benefits of involving a range of stakeholders are not always fully achieved (Hong et al., 2024). Moreira et al. (2024) further state that although the participation of stakeholders and diverse viewpoints is acknowledged, coordinating their efforts to create and sustain the infrastructure and water governance needed to ensure reliable access to clean water for all remains challenging. It is also not unusual for certain influential stakeholders to occasionally dominate the process due to their contributions of resources, statutory authority, or contemporary influence (Sigalla et al., 2021). Hong et al. (2024) further assert that poor implementation of stakeholder engagement can diminish the quality and legitimacy of the final decision, harm stakeholder relationships, and decrease motivation to involve stakeholders in future decision-making processes.

5 Conclusion

The findings of this study reveal a commendable level of awareness of water conservation practices among the residents of Fairview. Survey results also indicate that residents generally have a positive attitude toward water conservation, leading them to actively participate in water-quality improvement and conservation practices. The study's Chi-square results further show that age and gender significantly influenced some beliefs about water conservation practices, whereas other demographic factors, such as education and job type, did not show any relationships across the various beliefs/items. While socio-demographic factors influence components of the Knowledge–Attitude–Behavior (KAB) model, future research should explore additional factors, such as household size, income, marital status, and contextual factors, and their associations with knowledge, attitudes, and behaviors related to water conservation. Furthermore, while this study provides contextually rich insights into water conservation knowledge and attitudes within the Fairview community, its reliance on a single-case design and self-reported knowledge, attitudes, and behaviors limits the generalisability of its findings. Future research should conduct other studies across diverse communities and triangulate self-reports with objective water conservation or consumption measures to produce more generalisable findings.

Additionally, the study identifies strategies to address organizational deficiencies in the provision of water services, such as modernizing water infrastructure and adopting community-centered approaches and multi-stakeholder engagement to address water resource challenges. This underscores the fact that the technical aspects of water supply operate within the ever-changing realm of non-technical environments. To sustain existing knowledge of water conservation, targeted educational programs are needed that focus on practices tailored to various demographics within the Fairview community. Water practitioners need to establish structured feedback systems that enable community members to report concerns and offer suggestions regarding water supply and conservation practices, ensuring that residents are actively engaged in the decision-making process. To sustain knowledge translated into water-saving practices, water authorities can consider providing incentives for households and businesses to adopt and install water-saving measures and technologies, respectively. There is a need to document and share case studies of successful water conservation practices from Fairview and similar communities, serving as a resource for regions facing water scarcity.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving humans were approved by the Research Ethics Committee (Human), Nelson Mandela University, South Africa on 01 May 2020 with the protocol number H/21/HUM/PML-004. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study. Written informed consent was obtained from the Fairview community and HGDM managers for the publication of any potentially identifiable images or data included in this article.

Author contributions

NM: Methodology, Data curation, Conceptualization, Validation, Writing – original draft, Investigation, Formal analysis, Resources. GM: Validation, Formal analysis, Writing – original draft, Writing – review & editing, Visualization. BN: Writing – review & editing, Formal analysis, Supervision, Investigation, Data curation, Conceptualization, Visualization, Validation.

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