Original Research Article

Study of waste water management and reuse among RO users: with special reference to Sharadha Nagar, Lucknow

Abstract

60 percent of the water for the drinking water of the capital Lucknow is purified from the Gomti river. The remaining 40% is obtained from land through tube wells and handpumps. But with the discharge of domestic and industrial wastes in the rivers, the river water got polluted due to increase in chloride, nitrate content. So, people became dependent on personal submersible and RO water treatment for clean drinking water. The houses which do not have this system are dependent on bottled water. That is, the load on the underground water source has increased for all types of water supply.

Based on the results obtained from the study, it was revealed that all types of LIG, MIG and HIG households except EWS households use municipal water supply as well as individual submersible pumps for water supply. LIG, MIG and HIG households consume additional water for activities such as plants, gardens, household washing, washing machines and vehicle washing.

While the waste water coming out of RO can be used for watering plants, gardens and for house washing, washing machine and vehicle washing which will reduce the pressure on the ground water source and make sustainable use of water. But as per the collected data, only 33% of the houses using RO use RO wastewater.

Key words: Water conservation, RO waste water reuse, RO waste water management, Water communication,

Introduction

For the drinking water of the capital Lucknow, 60 percent of the water is purified from the Gomti river. The remaining 40% is obtained from the ground by tube wells and hand pumps. However, this river is heavily contaminated as a result of the discharge of home and industrial waste through several drains, as well as a spike in chloride, nitrate, and overall hardness levels (Kumar et al., n.d.). Therefore, to get clean drinking water households became depend on RO purification or bottled water for drinking water along with the houses which have a good economic condition have started supplying water to their houses through personal submersible pumps also. Amidst the pollution of water sources, man has found a solution for some time with scientific technology, but if he does not use sustainable of water sources, then this science will prove to be a curse in future. Water is a natural resource, and it supports to keep balance of nature. Both blessings and curses are applied to scientific discoveries. Scientists developed RO technology to provide pure water, but its misuse is causing a water disaster (Muthu, 2020). Only 0.5% of the water on Earth is usable

Comment [A1]: River

and available freshwater, and climate change is threatening that supply. Water scarcity will put a burden on the food supply (Wake up to the looming water crisis, report warns, 2021). Lack of access to clean water is a major health concern in poor nations, where more than 2 billion people live without basic sanitation and millions die each year from waterborne infections. (SDG Report 2022, 2023).

People are wasting more drinking water than they use. This is happening when water shortage is a global issue and there is a lack of conservation for available water. Increasing temperatures and increasing water demand are putting more pressure, in such a situation there is a need to make people aware of water conservation and water reuse because life cannot be imagined without water. The problem of water pollution in urban areas is getting worse. Water sources have been polluted by the expansion of industrialization and urbanization. Pollutants include chemicals, trash, bacteria, and parasites (World Water Quality Alliance (WWQA) – a partnership effort, 2023). Contaminated water is generated during many human activities, which get into the water source through various means, these sources are considered to be a widespread cause of water pollution(Water Pollution, 2023). This is dangerous to health but 60% of people in the world are far from access to clean drinking water and results transmission of water and vector-borne diseases such as typhoid fever, cholera, malaria and yellow fever, so it is important to know your risk and protect your water sources.

This is the primary reason why people began relying on RO water purifiers to obtain clean water for their health. RO manufacturers have also shown in their advertisements how their product prevents people from contracting infections via water and provides clean water. Today, the global home water filtration unit market was valued at USD 10.85 billion in 2021 and is expected to expand at a compound annual growth rate (CAGR) of 10.5% from 2022 to 2030 (The Economic Times, 2023). In 1949, the University of California studied the effectiveness of semipermeable membranes (RO membranes) in the desalination (removal of salt) of seawater. Researchers successfully produced fresh water from brackish seawater in the mid-1950s (History of Reverse Osmosis, 2023). According to the World Health Organization (WHO) report, when R.O purifiers purify water, it removes good minerals along with bad minerals. RO system off course removes water impurities. But they also remove 92-99% of beneficial calcium and magnesium. This signifies that the minerals and vitamins obtained in meals are being urinated away. Less minerals taken combined with more minerals expelled results in substantial negative side effects and major health problems. As a result of changing lifestyles, particularly in urban regions, the business has gained enormous traction in recent years. Because of the shortage of drinking water and contamination, firms such as Eureka Forbes, Aqua guard, and other RO producers have emerged.

But An average RO purifier wastes approximately 3 litres of water for every 1 litre of filtered water. This means that just 25% of the water is cleaned and 75% of the water is wasted (Pure It, 2023). This means that with the growing market for water purifiers, the wastage of water is expected to increase. Which is the reason for a water crisis in future. This means that as the market for water purifiers expands, water waste is projected to rise. Which is the cause of a future water crisis? The waste water from the water purifier is used for a variety of different daily tasks such as

washing clothing, cleaning kitchenware and the house, and watering plants and gardens. But for this awareness has to be created among the people. It is the responsibility of the water purifier manufacturers to include the message of motivating people towards conserving the waste water coming out of the water purifier equipment in their advertisements.

Comment [A2]: to conserve

Background of study

Reusing wastewater is an important part of both wastewater management and water resource management. Agriculture expert Devinder Sharma says that in Ludhiana City, 15 million litres of water are wasted every day by RO water purifiers. This means that 450 million litres of good quality water are wasted every month in Ludhiana City alone (Singh, 2023) In this manner, 450 million litres of water per month can be reused from waste water management, quenching the thirst of people in locations where there is an urgent water shortage.

There are some remarkable cases for inspiring water conservation more than 100 women of Chhatarpur Angrotha village of Madhya Pradesh, along with a social worker organization, cut a 107-meter-long mountain in 18 months to make way for water. Due to this water has started being conserved in the village (Sen, 2023).

Similarly, Kamegowda, who lives in Mandavali, Karnataka, is a farmer by profession. After the scarcity of water, he decided to single-handedly dig a pond for the people of his village and got involved in this work. In today's time, he has dug 16 pounds so far (The Economic Times, 2023). He was called "Man Of Pond".

In his article *Planning a Wastewater Reuse Program in Nigeria*,(Adewumi & Oguntuase, 2023) writes wastewater reuse for both potable and non-potable uses needs to be brought to the forefront of global discussion in order to support sustainable and effective wastewater management. A crucial element of the success of wastewater reuse projects has been recognized as community support for the use of recycled water. Additionally, a lot of wastewater treatment plans in developing nations fail because they merely copy western treatment methods without taking the local culture, geography, and climate into account.

A study in Peru known as The Lima case study revealed that Peru's Ministry of Housing, Construction, and Sanitation has established a set of policy recommendations to encourage the reuse of wastewater for urban irrigation throughout the country. They are expanding on existing small-scale private wastewater treatment projects in the Lima area, with the aim of increasing wastewater treatment reuse at the city and national levels to make it a viable economic choice. This will be especially crucial along the Peruvian coast, where fresh water resources are scarce (The Lima case study, 2011).

(Bixio et al., 2006) present a report to examine European water reuse methods and provides a road map of water reclamation technology and applications. The results are based on a traditional literature review, an in-depth survey of a significant number of European water reuse projects, and the findings of a dedicated international workshop. Individuals, local communities, and businesses, as well as centralized laws and regulations, are critical to the success of an integrated water management policy. United Nations organization UNESCO, the drinking water crisis in India will

increase by 2025, and mentioned that due to the melting of glaciers, the flow of major Himalayan rivers like the Indus, Ganga, and Brahmaputra will decrease (Kumar, 2023).

(Wu et al., 2013) Statements in his research many countries throughout the world have widely utilized wastewater reuse for agriculture. It is mostly used for agricultural and landscape irrigation. Washing machine and kitchen sink waste has also been utilised to irrigate grass above and below ground, respectively. Most countries are working to improve their wastewater treatment systems in order to produce high-quality irrigation effluent.

Significance of the study

The current study goes beyond previous research by examining a wide range of household water conservation characteristics such as water consumption, reusing water, water saving habits, and water purifier equipment. As a result, the study provides the most complete evaluation of household water conservation factors to date, allowing an assessment of the relative importance of important predictors of household water usage established in previous studies. In the above literature review shows that the globe is in the grip of a water crisis. Many countries throughout the world are also working on water conservation and waste water reuse. However, in terms of calculating and conserving the water consumed in the home, this research will aid in the future of drinking water by analysing how water purifiers waste water at present, and how much awareness there is for their conservation. This research will help to solve the drinking water crisis in the future. In addition, the incentive for water reuse will alleviate the strain on water sources.

Research objectives

1. Investigating the water supply of households using RO.
2. To analyse RO customers' utilization of RO wastewater.
3. To conduct study of the households of RO users.

Comment [A3]: Analyzing

Comment [A4]: Conducting

Research questions

1. What are the water sources in the homes of RO users?
2. Do RO users reuse RO waste water?
3. In which houses RO waste water is reused?
4. How does RO waste water be reused?

Comment [A5]: can

Methodology

Descriptive research has been adopted to achieve the objectives of the research paper. For which the researcher made a survey questionnaire and collected data related to RO waste water management and reuse from RO users from the localities under Sharda Nagar of Lucknow city. The researcher has chosen Sharda Nagar of Lucknow city, the capital of Uttar Pradesh state of India as the study area for this research paper. There are a total of 17 localities in Sharda Nagar, whose names are as follows –

Srl. No.	**Name of localities**	**???**	**???**
1	BHADRUKH	**10**	RAJNI KHAND
2	USARI	**11**	SANIK NAGAR
3	SALEH NAGAR	**12**	SENANI VIHAR

4	FIRANGI KHEDA	**13**	SOUTH CITY
5	DEVI KHERA	**14**	ELDECO-II
6	SARPOT GANJ	**15**	PIPROWLI
7	ELDECO-I	**16**	SHEETAL KHERA
8	RUCHI KHAND	**17**	RATNAKAR KHAND
9	RASHMI KHAND		

Table 1: Name of localities, Shardha Nagar, Lucknow

The researcher selected five localities using random sampling from Table1.names are as follows
List 1. Selected five study area localities.

Srl. No.	**Selected localities**
1	RAJNI KHAND
2	RATNAKAR KHAND
3	SALEH NAGAR
4	SOUTH CITY
5	RATNAKAR KHAND

From the selected localities the researcher selected 20 such respondents from each locality on the basis of purposive sampling who use RO for water treatment. Households who did not open the door, who were not interested in the survey, who did not have RO in their house, and who did not want to report the questions like household income, employment, education, etc. we're not included. Microsoft Excel has been used for data analysis.

About research area

The study was done on residents of Lucknow's Sharda Nagar on the topic of *Study of waste water management and reuse among RO users: with special reference to Sharadha Nagar, Lucknow*. The study included Sharda Nagar households who now use RO for water purification. At present, Lucknow is the capital of the most populous state of India, Uttar Pradesh. It is also called the city of Nawabs. In ancient times, Lucknow was known as Laxmanpur and Lakhanpur. Situated on the banks of river Gomti, the city is known for its rich culture and ancient heritage.

According to the Lucknow Municipal Corporation website, there are a total of 110 wards in the city of Lucknow. In which there are a total of 1077 localities (Lucknow Nagar Nigam, 2023).This study work is focused on Sharad Nagar in Lucknow. There are 17 localities in all. According to the methodology, 5 of the 17 localities were chosen for the study.

Finding and Analyzing

	Frequency	Percent	Valid Percent	Cumulative Percent
Rajni khand	20	20.2	20.2	20.2
Ratan khand	19	19.2	19.2	39.4
Ratnakar khand	20	20.2	20.2	59.6
Saleh nagar	20	20.2	20.2	79.8
South city	20	20.2	20.2	100.0
Total	99	100.0	100.0	

Table 2 : Respondents according localities

As per the data shown in Table 2, 20 households are included as respondents from each locality. But due to error in the one household data of the 20 households selected from Ratan Khand area, total of 19 households from this locality included as respondents.

	Frequency	Percent	Valid Percent	Cumulative Percent
18-28	47	47.5	47.5	47.5
29-39	38	38.4	38.4	85.9
40-50	14	14.1	14.1	100.0
Total	99	100.0	100.0	

Table 3 : Age groups of respondents

According to the statistics in Table 3, the age range of 18 to 28 has the highest proportion of respondents. The second number is between the ages of 29 and 39 and 40 to 50 years old respondents' number are 14.

	Frequency	Percent	Valid Percent	Cumulative Percent
EWS	26	26.3	26.3	26.3
HIG	34	34.3	34.3	60.6
LIG	17	17.2	17.2	77.8
MIG	22	22.2	22.2	100.0
Total	99	100.0	100.0	

Table 4:Type of household of the respondents

EWS, LIG, MIG, and HIG households were chosen as responders, and their information is mention in Table 4.

- EWS – Economically Weaker Section
- LIG – Low Income Group
- MIG – Middle Income Group
- HIG – Highest Income Group

Question 1. What are the water sources in the homes of RO users?

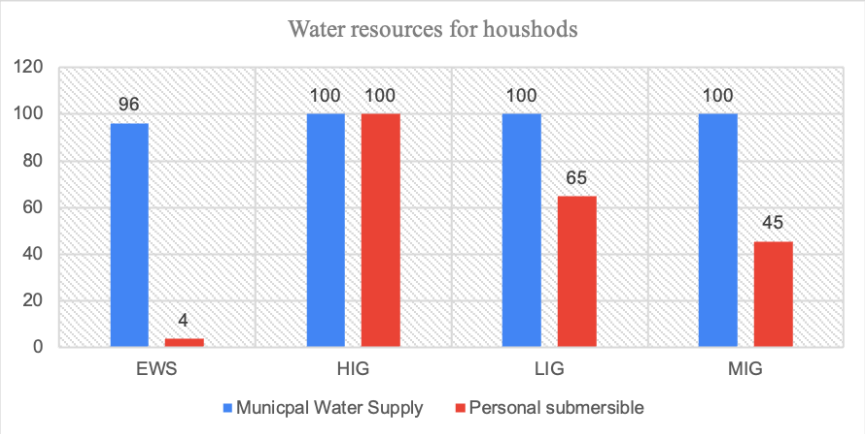

Figure 1: Types of houses and their water sources

Figure 1 shows the data gathered from respondents in response to question1. In which there are two water sources for water supply in the selected respondents' homes. Municipal water supply and personal submersible. Municipal water supplies are available to all types of residences, although some families use personal water sources, as illustrated in Figure 1. Only 4% of EWS households have personal submersibles. 65 % of LIG houses and 41 % of MIG houses uses personal submersibles. Whereas personal submersible is used for water supply in each of the HIG houses.

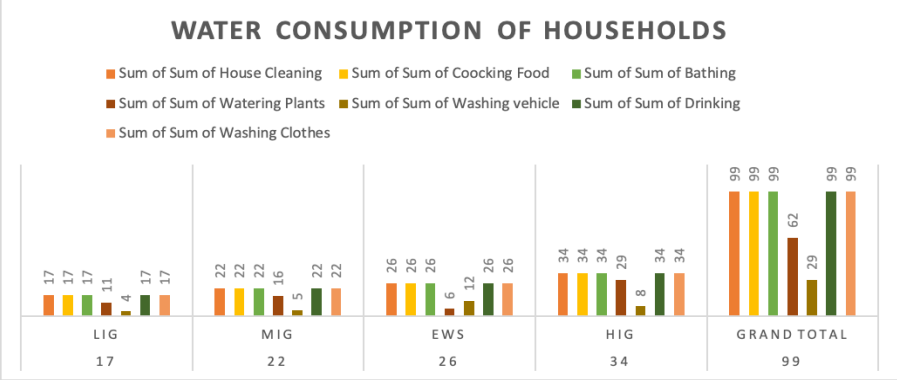

Figure 2 Water consumption of households

Both household water consumption and water sources were assessed in Figure 2. Water is required in every house for cooking, drinking, bathing, cleaning. While the water requirement depends on the type of house. According to the data in Figure 2, additional water consumption by type of household is for watering plants, irrigating the garden, washing the house, washing the vehicle, and washing clothes as well as washing dishes.

From the conclusion drawn on the basis of these figures, it can be said that additional water consumption depends on the income of the family.Figure 3 shows the different types of households on the basis of their income. Families with an annual income of Rs 1-3 lakh live in EWS houses. Those with an annual income of Rs 3-4 lakh live in LIG and those with an annual

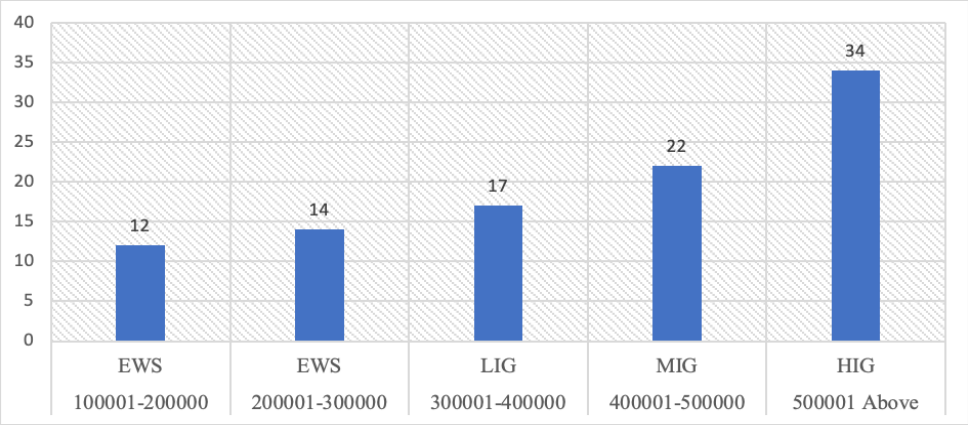

Figure 3:Households Income

income of Rs 4-5 lakh live in MIG houses. While people with an annual income of Rs 5 lakh or more live in HIG houses.

The additional water consumption depends on the type of houses, details are presented in figure 4. 46% households of EWS is used for washing automobiles, 23% for watering plants, and 8% for watering gardens. Although such dwellings lack a garden, a little garden has been constructed in the government unoccupied space in front of the house erected on the side of the road. In such a house, 5-6 flower plants are planted in a pot.

Which require very less water. Excess water is used for washing vehicles in the houses of persons working as drivers by profession. HIG homes have ample space for plants and gardens, where 21% households, consumed water for gardening, 85% households for plants and 24% for washing vehicles. While LIG 65 % households lose additional water consumed by plants and 24% by washing vehicles. While 73% of the families living in MIG consume extra water to water the plants. While 23% households use extra water for gardening and washing vehicles.

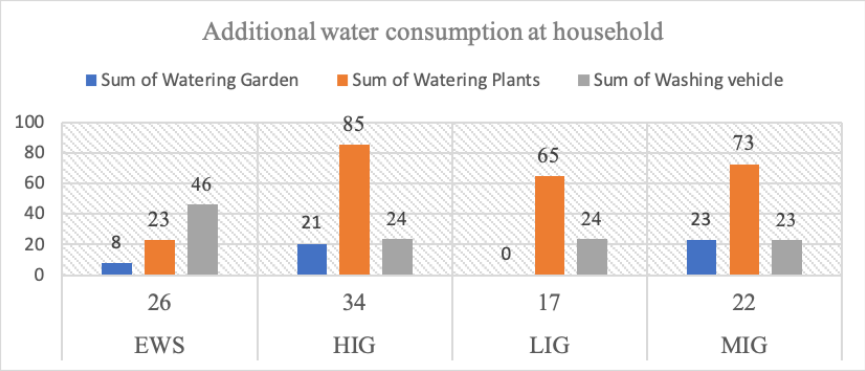

Figure 4: Additional water consumption at household (Multipole Respondent)

Question 2. Do RO users reuse RO waste water?

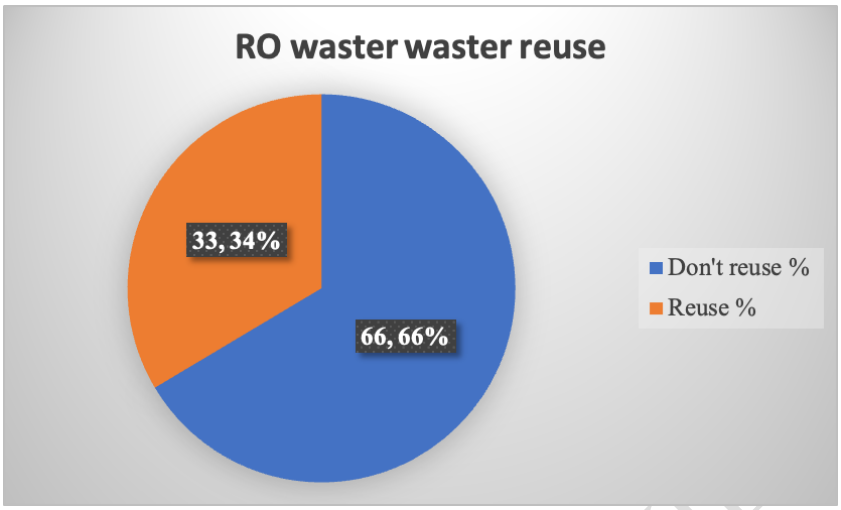

Figure 5: RO waste water reuse response

According to the information provided in response to question 2, only 33% of RO-using households use RO waste water. Whereas 66% of households discard the RO water that comes out.

Question 3. In which houses RO waste water is reused?

With reference to question number 3, it is concluded from the figure 6 data that the decision to reuse RO waste water is dependent on the type of house. According to the data shown in Figure 6, just 38% EWS household use waste water, while 62% do not. Similarly, just 29% of LIG households utilize waste water, while 71% do not.Similarly, 55% of MIG houses have RO waste water reuse while 45% of houses do not.

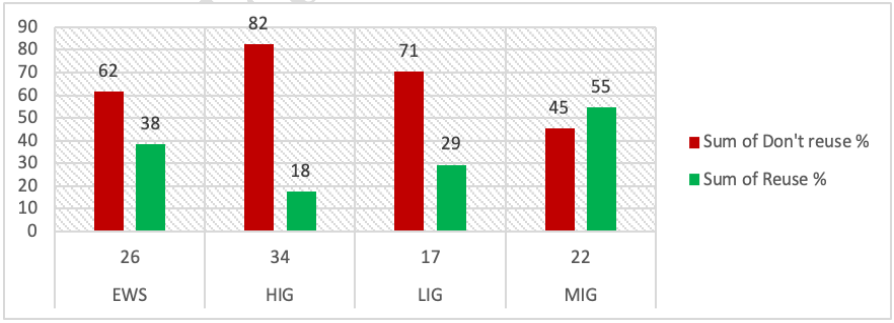

Figure 6 : waste water reuse among RO users

Wherein 82% HIG houses do not use RO waste water, only 18% houses reuse RO waste water.

Question 4. How does RO waste water be reused?

Based on the data collected for question 4, it is concluded that multiple households handle and utilize RO waste water in different ways. But the behaviour of the householders towards the waste water coming out of RO water treatment used at home is shown in the figure7.

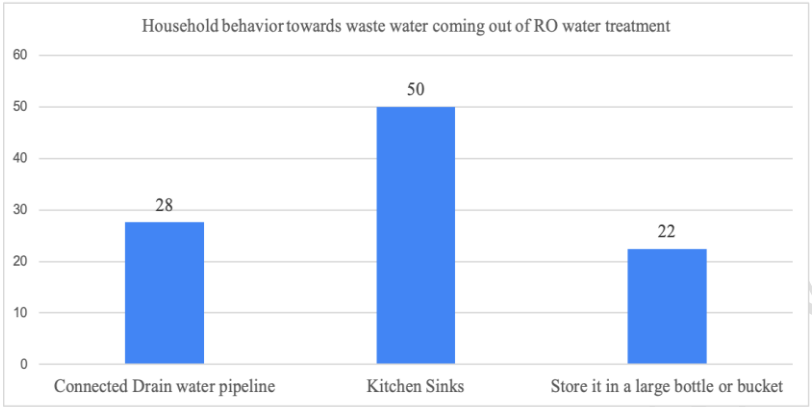

Figure7:Household behaviour towards RO waste water

According to statistics, in 50% of the houses, the waste water coming out of the RO machine goes into the kitchen sink, while in 28% of the houses it is directly connected to the drainage pipeline, resulting in a total of 78% of the households wasting the RO (Rejected water) waste water. While in 22% of residences, RO waste water is collected in a bucket or large bottle and reused.

According to the received data, but it is shown in Figure 8 that 22% of the houses where RO waste water is reused. what are their types

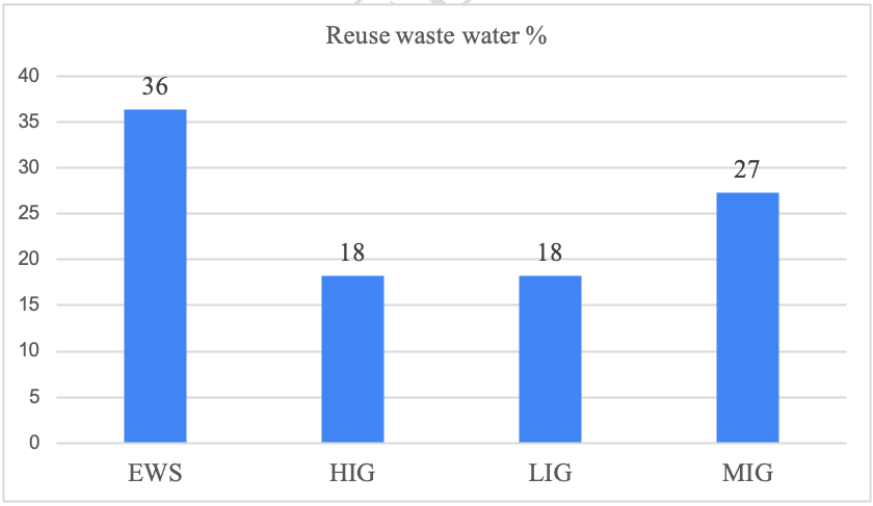

***Figure 8** : Households reusing waste water (N = 22)*

Only 22 households manage and reuse RO waste water in this way. This contains 36% EWS homes, 18-18% LIG - HIG homes, and 27% MIG homes.

Discussion of Finding

There is no doubt that tremendous progress has been made in terms of access to safe drinking water. However, the demand for water has risen. Rapid modernization and the exploitation of uncontrollable natural resources provide a significant problem. Water is also one of them. At the moment, the way water management has been neglected and unregulated exploitation has resulted in climate change. In this background, the United Nations reported in a statement that drought is a hidden global disaster that threatens to become the "next pandemic" if countries do not take immediate action on water and land management as well as addressing the climate emergency (Harvey, 2021). Water crisis is a global issue every country is facing it either in the form of drought or excess rainfall and floods. One in every three persons in the world today lacks access to sanitation. Every day, 700 children under the age 5 die from diseases caused by contaminated water and sanitation (Meetings Coverage and Press Releases, 2021). Based on the information presented above, it is evident that there is a need for water management and conservation on a drop-by-drop basis. Whereas millions of liters of water are wasted in residences utilizing RO, people die due to a shortage of even a single drop. The amount of water released during the (reverse osmosis) RO process is concerned about those who utilize it, because filtering technology wastes over 70% of the water used to clean just one liter of water. This RO waste water can be used for various purposes such as washing vehicles, cleaning toilets, watering plants, washing clothes, etc(Vyas & Solomon, 2023).

Case Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Water consumption	99	100.0%	0	0.0%	99	100.0%

Water consumption Frequencies

		Responses		
		N	Percent	Percent of Cases
Households water requirement	Drinking	99	16.5%	100.0%
	Cooking Food	99	16.5%	100.0%
	Washing Clothes	99	16.5%	100.0%
	Bathing	99	16.5%	100.0%
	Watering Garden	14	2.3%	14.1%
	Watering Plants	62	10.3%	62.6%
	Washing vehicle	29	4.8%	29.3%
	House Cleaning	99	16.5%	100.0%
Total		600	100.0%	606.1%

Table 5 : *Households water consumption*

The data given in Table 5 shows the daily water requirement of each household for purposes such as cleaning, drinking, cooking, washing clothes and bathing. Along with this, if there are plants, pots, garden or vehicles like bike, car in the house, then water is also required to clean them. For all these works, the pressure of water supply falls on the water source. The minimum amount of water recommended by the United Nations for each person is 50 liters per person. According to the data in **Figure 1**, the municipality provides water to practically every family in urban areas. Individual submersibles give water to HIG, MIG, and LIG homes.

Family member

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1-2 member	14	14.1	14.1	14.1
	3-4 member	56	56.6	56.6	70.7
	5-6 member	29	29.3	29.3	100.0
	Total	99	100.0	100.0	

Table 6 : Households family member

Based on the statistics in Table 6, it is concluded that larger households should be more vulnerable to water preservation. Because RO wastes 3 liters of water for 1 liter of water treatment. While the World Health Organization recommends 3 liters of water each day. In this case, a person requires 90 liters of drinking water per month, and RO wastes 270 liters for rectification if this rejected water is not reused in RO-using homes.

Based on these numbers, the responsibility of water conservation increases on the basis of the members of the houses; if this does not occur, the pressure of water supply increases on the water source, which is a symptom of future danger.

Conclusion

On the basis of analysis and research review of the above data, it is concluded that only 33% of the houses using RO in Sharda Nagar locality of Lucknow are sensitive to water conservation. On the other hand, higher income and more educated families pay little attention to this, while their homes have more options to manage and use RO wastewater. RO waste water in HIG and MIG dwellings can be utilized for washing clothing, washing vehicles, cleaning houses, and watering plants and gardens, assuring the long-term sustainability of the water source.But according to the statistics, disappointing results have been found in these houses towards water conservation.Water usage is also high in MIG and LIG Residences as a result of large family sizes and modern living.

Data availability

During this study, analysis of the data of the residents of the locality under Sharda Nagar of Lucknow city, such as type of houses, employment, age, annual income, which is available in the research paper, has been analysed. The names and emails etc. of the respondents cannot be published publicly. Data may be made available upon reasonable request and with permission from the respective respondents.

Reference:

Adewumi, J. R., & Oguntuase, A. M. (2023). *Planning of Wastewater Reuse Programme in Nigeria*.

Bixio, D., Thoeye, C., De Koning, J., Joksimovic, D., Savic, D., Wintgens, T., & Melin, T. (2006). Wastewater reuse in Europe. *Desalination*, *187*(1–3), 89–101. https://doi.org/10.1016/j.desal.2005.04.070

Kumar, D., Verma, A., Dhusia, N., & More, N. (n.d.). *Water Quality Assessment of River Gomti in Lucknow*.

Vyas, P., & Solomon, S. G. (2023). Knowledge regarding reverse osmosis (R.O) waste water utilization among general public in urban areas. *Southeast Asian Journal of Case Report and Review*, *10*(1), 13–19. https://doi.org/10.18231/j.sajcrr.2023.003

Wu, T. Y., Mohammad, A. W., Lim, S. L., Lim, P. N., & Hay, J. X. W. (2013). Recent Advances in the Reuse of Wastewaters for Promoting Sustainable Development. In S. K. Sharma & R. Sanghi (Eds.), *Wastewater Reuse and Management* (pp. 47–103). Springer Netherlands. https://doi.org/10.1007/978-94-007-4942-9_3

Works Cited

(2013, April 28). Retrieved from UNESCO: https://www.unesco.org/en/articles/imminent-risk-global-water-crisis-warns-un-world-water-development-report-2023#:~:text=Globally%2C%202%20billion%20people%20(26,Water%20Conference%20in%20New%20York.

(14 April 2023). *PROPOSAL FOR THE PROCLAMATION BY THE UNITED NATIONS OF 2025 AS AN INTERNATIONAL YEAR OF QUANTUM SCIENCE AND TECHNOLOGYSUMMARY.* PARIS: UNESCO. Retrieved from https://unesdoc.unesco.org/ark:/48223/pf0000385142

Kumar, v. (2023, 6 10). *Jalvayu*. Retrieved from Jan Chauk: https://janchowk.com/jalvayu/future-of-common-life-amid-water-crisis/

Sen, S. (2023, June 5). Retrieved from The Logical India : https://thelogicalindian.com/uplifting/mp-village-women-24055?infinitescroll=1

(2023, April 10). Retrieved from The Economic Times: https://economictimes.indiatimes.com/news/new-updates/pond-man-kamegowda-who-earned-praise-of-pm-for-water-conservation-dies/articleshow/94918149.cms

(2023, June 10). Retrieved from The Print: https://theprint.in/india/tap-water-quality-best-in-mumbai-most-unsafe-in-delhi-finds-bureau-of-indian-standards/322188/

Sukumar Pal, P. B. (2018). *HUMAN RIGHTS AND SOCIAL JUSTICE* . New Delhi: New Delhi Publishers.

Drinking Water. (2023, June 01). Retrieved from Centers for Disease Control and Prevention: https://www.cdc.gov/parasites/amebiasis/general-info.html

Water Pollution. (2023, April 10). Retrieved from WWF: https://wwf.panda.org/discover/knowledge_hub/teacher_resources/webfieldtrips/water_pollution/

Singh, M. (2023, 04 2). *Ludhiyana News*. Retrieved from Times of India: https://timesofindia.indiatimes.com/city/ludhiana/water-scarcity-city-wastes-786-m-litres-daily/articleshow/4650203.cms

(2023, June 19). Retrieved from NDTV: https://www.ndtv.com/world-news/himalayan-glaciers-melting-65-faster-than-previous-decade-study-4135528

(2023, june 10). Retrieved from Pure It: https://www.pureitwater.com/blog/post/worried-about-the-wastage-of-water-while-using-an-ro-meet-the-ro-water-purifiers-of-the-hour#:~:text=For%20every%201%20liter%20of,of%20the%20water%20is%20wasted.

Sibi, A. (JUNE 19, 2023). *Global Warming Could Shrink Himalayan Glaciers by Up to 80%, According to New Report.* BENGALURU: Timd magazine.

SDG Report 2022. (2023, April 12). Retrieved from United Nations Statistics Division Development Data and Outreach Branch: https://unstats.un.org/sdgs/report/2022/Goal-06/

World Water Quality Alliance (WWQA) – a partnership effort. (2023, 4 12). Retrieved from UN environment : https://www.unep.org/explore-topics/water/what-we-do/improving-and-assessing-world-water-quality-partnership-effort?gclid=CjwKCAjwqZSlBhBwEiwAfoZUIIhuSMdglZRDg_9TKG8GocKQwFQB-XouNMf2BFZiymrjuhu2PdtIaRoCG3YQAvD_BwE

History of Reverse Osmosis. (2023, May 10). Retrieved from Water filter Answers: https://waterfilteranswers.com/brief-history-reverse-osmosis-filtration-process/

GUPTA, A. (2021, 10 27). *Campus Voice* . Retrieved from The Print: https://theprint.in/campus-voice/9-1-crore-indians-dont-have-basic-water-supply-but-india-isnt-paying-attention/756384/

Muthu, V. (2020, August 9). *Dangers of Reverse Osmosis (RO) water*. Retrieved from Times of India: https://timesofindia.indiatimes.com/readersblog/ezhil/dangers-of-reverse-osmosis-ro-water-24279/

Wake up to the looming water crisis, report warns. (2021, October 5). Retrieved from World Metrological Orginization: https://public.wmo.int/en/media/press-release/wake-looming-water-crisis-report-warns

The Economic Times. (2023, April 29). Retrieved from 9 best-selling RO Water Purifiers in India (2023) : https://economictimes.indiatimes.com/top-trending-products/kitchen-dining/water-purifiers/best-selling-ro-water-purifiers-in-india/articleshow/99872672.cms

The Lima case study. (2011). Retrieved from LOFTUS 2011 Lima Peru. Reuse of Treated Wastewater for Urban Greening and Agriculture in Lima.pdf 1 : https://sswm.info/sites/default/files/reference_attachments/LOFTUS%202011%20Lima%20Peru.%20Reuse%20of%20Treated%20Wastewater%20for%20Urban%20Greening%20and%20Agriculture%20in%20Lima.pdf

(2023, June 10). Retrieved from Lucknow Nagar Nigam: https://lmc.up.nic.in/pdf/ward_suchna_english.pdf

Harvey, F. (2021, june 18). *Climate crisis*. Retrieved from The Guardian: https://www.theguardian.com/environment/2021/jun/17/the-next-pandemic-drought-is-a-hidden-global-crisis-un-says

Meetings Coverage and Press Releases. (2021, November 16). Retrieved from United Nations: https://press.un.org/en/2021/sgsm21024.doc.htm