

## **Assessment of Drainage System and Waterlogging in Malwani During the Monsoon Season**

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### **ABSTRACT**

*This research paper investigates the drainage system and waterlogging issues in the Malwani Church area of Malad West, Mumbai, during the monsoon season. Through a combination of field surveys, face-to-face interactions, and data analysis, the study highlights the severe impact of inadequate drainage infrastructure on residents. The findings reveal frequent waterlogging due to poor maintenance, leading to property damage, health issues, and disruptions to daily life. The study emphasizes the need for improved drainage design, regular maintenance, and proactive measures by local authorities to prevent these recurring issues and enhance community resilience during the monsoon.*

**Keywords:** *Waterlogging, Drainage System, Monsoon, Urban Flooding*

### **INTRODUCTION**

Mumbai, often referred to as the dream city, frequently experiences severe waterlogging during the rainy season. This recurrent issue is primarily due to inadequate drainage systems, leading to significant traffic congestion, accidents, and various other challenges every monsoon. A well-maintained drainage system is crucial to prevent waterlogging, making it essential for local authorities to ensure these systems are in good condition before the monsoon arrives. Proper maintenance by local administration is key to mitigating waterlogging problems.

Waterlogging has both physical and mental impacts on residents. Densely populated areas are particularly vulnerable, with the main causes being improper drainage systems, especially in low-lying regions and areas with uneven terrain. This paper examines the waterlogging and drainage issues in Malwani, a suburban area of Mumbai. The persistent waterlogging in Mumbai hampers transportation, causing delays for people commuting to work, school, and meetings. The combination of heavy rainfall and a high population density makes the problem of waterlogging and drainage a continuous challenge in the city.

### **REVIEW OF LITERATURE**

Conducted a study in Vithalwadi, Ulhasnagar, highlighting the increasing issue of waterlogging each year due to unplanned construction. Their research revealed that the city experiences severe waterlogging annually, resulting in significant losses, estimated at approximately 80 lakhs per year, including both life and property damage. GIS technology was a primary tool used in this study, demonstrating its efficacy in managing and mitigating waterlogging issues (Qureshi and Rizvi, 2023).

Concluded that Mumbai's high population density necessitates proactive measures to prevent disasters. Their study pointed out a significant gap in the city's flood monitoring and forecasting systems. They suggested that providing early warnings to residents could enhance decision-making and preparedness. The researchers recommended using Twitter, WhatsApp, and Google Forms to disseminate mitigation strategies, leveraging the widespread use of social media to alert citizens about impending heavy rains and storms. These early warnings could help Mumbaikars prepare and potentially relocate, thereby reducing the impact of such events (Hrabani and Sailaja, 2023).

Suggested that an effective stormwater management system is crucial to prevent waterlogging. Using the rational method, the study examined various regions and concluded that tailored water management and drainage systems, considering the local slope, would be beneficial. It also recommended holding point designs to mitigate waterlogging and highlighted inefficiencies in existing drainage pipes, often clogged with waste, which exacerbate congestion and runoff issues (Tilatkar, 2021).

Observed that waterlogging in the Moyna basin occurs annually from August to November, primarily due to the surrounding rivers. This seasonal issue has led many inhabitants to relocate to less affected areas. However, some residents have turned this challenge into an economic advantage by engaging in fishing and other activities. The study noted that waterlogging is prevalent in low-lying regions, exacerbated by increasing urbanization and population density (Sankar and Sahu, 2014).

Found that effective drainage systems are crucial to preventing waterlogging in paddy fields. Properly spaced drain pipes at the right altitude improve water flow and reduce congestion. The study emphasized the importance of pipe placement, soil capacity, and maintenance. Using appropriately sized pipes and ensuring their proper installation are essential to prevent waterlogging and protect paddy fields (Kathirvel and Manikandan 2021).

Used GIS and remote sensing to study waterlogging in Dhaka, focusing on different housing types and vulnerability zones. The research identified slums as highly susceptible to waterlogging due to their dense populations. It recommended that the local government maintain the existing canal system to mitigate waterlogging and criticized the lack of proper drainage planning in slum areas. The study concluded that future urban planning should account for population density and drainage needs to improve city infrastructure (Alam, 2021).

Examined waterlogging issues in Nadiad city, identifying the railway underpass as a highly vulnerable area. They noted that waterlogging led to vehicle congestion, traffic problems, and transportation difficulties. Additionally, it contributed to health issues such as dengue and malaria. The study recommended implementing a proper drainage system in low-lying areas to address these challenges (Panchal and Bhavsar 2019).

Studied waterlogging in Siliguri city, noting that rapid population growth has strained the existing drainage system, particularly in low-lying areas like the city centre and slums. The study highlighted issues such as poor maintenance, congestion in drainage pipes, and significant plastic waste, which exacerbate waterlogging. It concluded that effective drainage planning must consider future population growth to prevent these problems (Roy,

Bose, and Singha 2021).

Investigated waterlogging issues at the SJ CET campus, attributing problems to a poor drainage system and soil infiltration. The study recommended regular cleaning and maintenance of the existing drainage system, increasing its capacity to prevent congestion, and replacing it with a system better suited to the campus's population and water flow needs (Abhishek, 2022).

Emphasized the need for well-defined storm water management policies and effective construction designs to prevent waterlogging. Their study, conducted in Karve Nagar, Maharashtra, used GIS methods and highlighted the importance of advanced infrastructure planning and conservation projects (Shelar and Gavhane 2022).

### **OBJECTIVES OF THE RESEARCH**

- To investigate and understand the conditions of houses during the rainy season.
- To analyze the losses incurred by residents due to water entering their houses.
- To recommend measures for preventing damage and losses to residents during the rainy season.

### **RESEARCH HYPOTHESIS**

Ho-Maximum number of people have faced loss due to waterlogging during the rainy season.

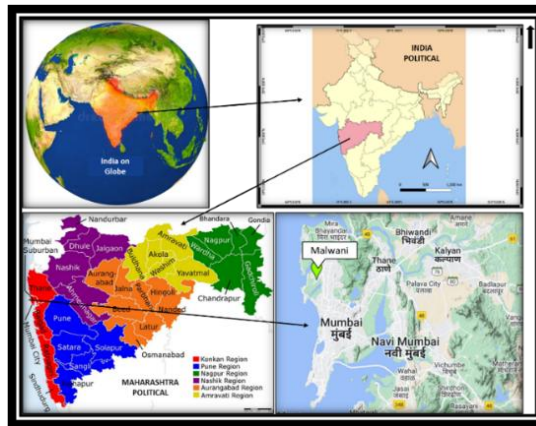
H1-Maximum number of people did not face any loss due to logging during the rainy season.

### **RESEARCH METHODOLOGY**

This study employed a combination of field visits and direct face-to-face interactions to gather data. The survey was conducted in the Malwani Church area, located in Malad West, Mumbai – 400095. A total of 100 respondents participated in the survey. Following data collection, the responses were analysed to derive insights and conclusions regarding the drainage and waterlogging issues in the area.

#### **Coverage**

Mumbai, located in Maharashtra, India spans a total area of 603.4 square kilometers. The survey focused on the Malwani Church area in Malad West a prominent locality in this bustling city. Known as a “dream city” for millions of residents, Mumbai faces various urban challenges including waterlogging. Malwani is a densely populated suburb located in Malad West, Mumbai, Maharashtra. It is part of the Mumbai Suburban District and covers a significant portion of western coastline of the city. The area is known for its vibrant community, diverse demographics, and mixed land use, including residential, commercial, and recreational spaces. Malwani's geographical layout features a mix of low-lying and elevated areas, which impacts its susceptibility to waterlogging. The proximity to the Arabian Sea The area's population includes a broad spectrum of socio-economic and the city's drainage infrastructure further complicates the situation. backgrounds, contributing to varied impacts of waterlogging.



## METHODOLOGY

**Pre-Field:** The literature review was conducted using a range of online sources, including various websites, to study existing research and case studies on waterlogging and drainage issues in different regions. This comprehensive review informed the approach to the research conducted in Malwani Church, Mumbai. Participants' responses were collected via Google Forms to gather data for the study.

**On-Field:** Primary data was collected through face-to-face interactions with residents of Malwani Church, Malad West, Mumbai 400095. The survey included participants from various age groups, with a total of 100 respondents. The tool used for data collection is a mixed type of questionnaire and the method employed is survey method. The questionnaire has been prepared using Google Forms for the ease of data collection.

**Post-field:** The data was then collected, stored and data analysis was done on the basis of the responses of the respondents.

## RESULTS, ANALYSIS AND DISCUSSION

The data shows that 58.1% of respondents own the property they reside in, while 41.9% do not own their current property.

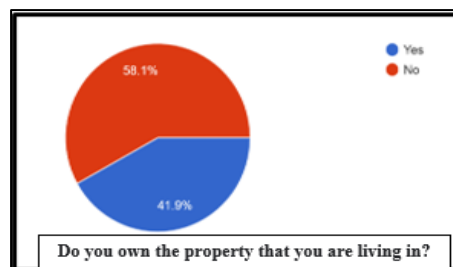
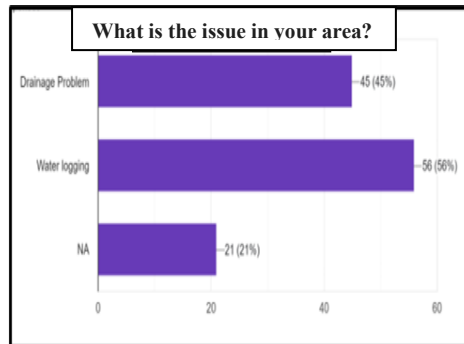


Figure 1

Residents of Malwani Church face significant issues with drainage and waterlogging.

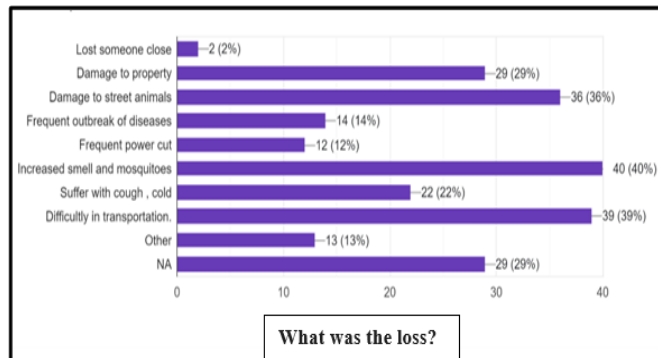
About 45% reported drainage problems, while 56% experienced waterlogging, mainly due to an inadequate and poorly maintained drainage system. The pipes are often unsanitized, causing blockages and water build-up. As the population and housing have increased over

the past 4-5 years, these problems have worsened, making rainy seasons particularly challenging.



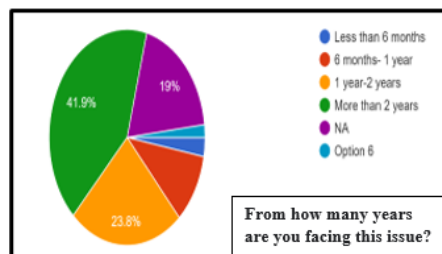
**Figure 2**

Most respondents have been dealing with drainage and waterlogging issues for over two years. Despite the rainy season lasting only 3-4 months, they prefer not to relocate due to their comfort with the area and good relationships with neighbours. However, 19% of respondents do not face these issues, likely because they live in higher areas or not on the ground floor.



**Figure 3**

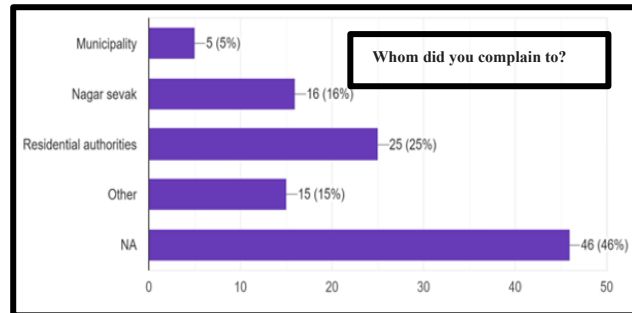
The graph highlights the losses faced by Malwani, Malad West residents. A tragic incident occurred where a 20-year-old boy died from electrocution while pumping out water during heavy rains. This was after complaints to the local administration about waterlogging went unaddressed. The area suffers from property damage, animal distress, foul smells, and increased mosquitoes leading to diseases like dengue and malaria. Last year, overflowing drains caused human waste to float on the roads. With only one route for transportation, residents struggle to navigate through waterlogged and sewage-filled streets during the rainy season.



**Figure 4**

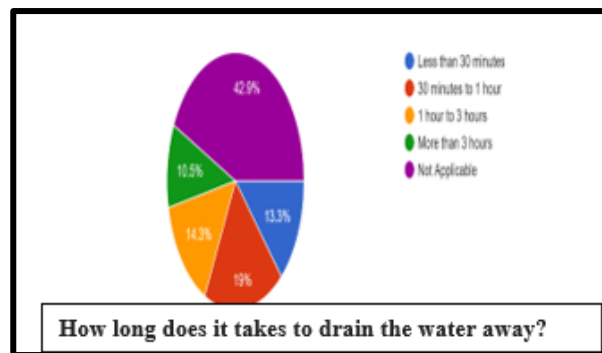
It was noted that 25% of respondents complained to residential authorities, 16% to the nagar sevak, and 5% to the municipality. Despite years of complaints, no solutions have been

provided. Hopefully, these authorities will address the issues in the future, as they cannot be neglected.



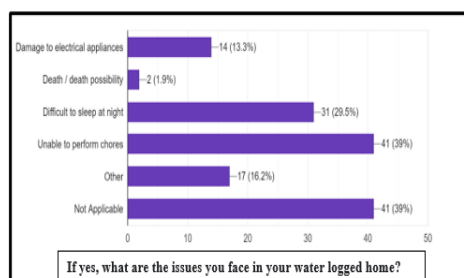
**Figure 5**

The graph shows the time it takes residents to drain water from their homes. About 13.3% of respondents can do it in under 30 minutes as they don't live in low-lying areas, while 10.5% take over 3 hours due to staying in sloped regions with more water accumulation. These residents suffer from waterborne illnesses and leg infections. They often face night-time waterlogging due to heavy rains and, despite raising their homes, the issue persists every rainy season.



**Figure 6**

Most respondents did not face issues, but 39% struggled with household chores due to waterlogging, focusing solely on draining water. Many suffered damage to furniture and found it difficult to sleep. Tragically, 1.9% experienced the loss of a loved one, including a 20-year-old boy who died from electrocution while using an electric motor to drain water. This highlights the serious waterlogging problem in Malwani, underscoring the local administration's failure to address the issue.



**Figure 7**

## MAJOR FINDINGS

- **Inadequate Drainage Capacity:** The existing drainage system is insufficient to handle the volume of water during the monsoon season, leading to frequent waterlogging and prolonged drainage issues.
- **Poor Maintenance:** Regular maintenance of the drainage infrastructure is lacking, causing blockages and inefficiencies. Accumulated debris and silt often contribute to reduced drainage capacity.
- **Increased Waterlogging:** Waterlogging is prevalent, with reports indicating that it takes between 30 minutes to 3 hours for water to drain from affected homes. This impacts residents' daily activities and overall quality of life.
- **Health Impacts:** Residents frequently suffer from health issues such as respiratory infections and leg ailments due to exposure to dirty, overflowing drainage water.
- **Construction and Development Issues:** New construction in low-lying or sloped areas has exacerbated waterlogging problems, as the drainage system has not been upgraded to match the increased demand.
- **Ineffective Drainage Design:** The design of the drainage system does not account for population growth or increased water flow, with narrow pipes and insufficient infrastructure contributing to frequent overflows.
- **Community and Animal Welfare:** The waterlogging affects not only residents but also street animals, who have no dry areas to rest. This impacts both human and animal well-being in the area.
- **Need for Improved Measures:** There is a need for proactive measures, including better planning, regular cleaning, and upgrading of the drainage system to address these recurring issues and improve resilience against future monsoon seasons.

## RECOMMENDATIONS

- A properly maintained drainage system can prevent waterlogging.
- To prevent waterlogging, drainage systems should be cleaned and sanitized before the rainy season to avoid water congestion.
- Local authorities and municipal officials should implement necessary measures before the monsoon to prevent such issues during the rainy season.
- Houses should be constructed properly, as building in low-lying or sloped areas can often lead to waterlogging.
- Drainage systems should be designed with population growth in mind, using larger pipes instead of narrower ones.
- New buildings and houses should be equipped with adequate drainage systems, considering future population increases in the area.
- Before the rainy season, each drainage pipe should be inspected and cleaned to prevent overflow during heavy rains, ensuring that municipal officials and authorities are well-prepared in advance.

## CONCLUSION

Ho-Maximum number of people have faced loss due to waterlogging during the rainy season.

H1-Maximum number of people did not face any loss due to logging during the rainy season.

		Waterlogging	Loss of people
Waterlogging	Spearman's Correlation Sig. (2-tailed) N	-0.05	0.01** 0.14 98
Loss of people	Spearman's Correlation Sig. (2-tailed) N	0.01** 0.14 98	-0.05

\*\*The Correlation is significant at the 0.05 level (95%)

The value of p at 95% confidence for 98 degrees of freedom is 0.14 which suggests that the value of r (-0.05) is lesser than the p value. This implies that the null hypothesis is accepted with 99% confidence. This further implies that maximum number of people did not face any loss due to logging during the rainy season.

The Malwani Church area frequently experiences both drainage issues and waterlogging, especially during the monsoon season. The main problem is an inadequate and poorly maintained drainage system, which leads to severe waterlogging. Despite these conditions, 29% of respondents choose to remain in their homes even though they face significant issues such as difficulty performing daily chores, trouble sleeping at night, transportation problems, and harm to street animals due to a lack of available space. Additionally, it can take anywhere from 30 minutes to 3 hours for the water to drain from their homes. This annual problem has not been addressed, making survival during the monsoon challenging. Residents often suffer from respiratory infections and leg ailments due to exposure to dirty drainage water. Recent construction in the area has exacerbated the problem, as the drainage system remains outdated, with no increase in capacity or installation of new pipes.

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