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WELCOME SPEECH FROM THE CHAIRMAN

RISM 17th International Surveying Conference for Undergraduates (ISCU 2025)

بسم الله الرحمن الرحيم السلام

عليكم ورحمة الله وبركاته

Greetings to all,

It is with great pleasure that I welcome you to the 17th RISM International Surveying Conference for Undergraduates (ISCU 2025), themed “*Embracing Construction Revolution 4.0: Transforming Malaysia’s Built Environment.*” On behalf of the Royal Institution of Surveyors Malaysia (RISM), I also wish to express our sincere appreciation to Universiti Teknologi MARA (UiTM), Perak Campus, for graciously hosting this significant event.

As we navigate the era of the Fourth Industrial Revolution (IR4.0)—or in our context, Construction Revolution 4.0 (CR4.0)—we are witnessing transformative advancements across the global construction sector. Technologies such as Building Information Modelling (BIM), the Internet of Things (IoT), artificial intelligence (AI), robotics, big data analytics, and cloud computing are redefining the way we build, manage, and interact with our built environment. For Malaysia, embracing CR4.0 is a strategic imperative to achieve our socio-economic and environmental goals.

This conference serves as a vital platform to unite surveying undergraduates from various disciplines, fostering critical dialogue on industry challenges, enhancing professional networking, and preparing a new generation of talent for the rapidly evolving construction landscape. It is also an opportunity for employers to engage with and inspire our future professionals.

I would like to extend my heartfelt thanks to all industry speakers, paper presenters, judges, and participants for their time, contributions, and support in making ISCU 2025 a success. I also commend the organising committee for curating a meaningful and dynamic conference experience.

May the knowledge gained, connections formed, and ideas exchanged during this event inspire all participants to lead and innovate in their future endeavours.

Wishing everyone a productive and memorable conference.

Prof. Ts Sr Dr. Adi Irfan Bin Che Ani'

Chairman, Universities' Partnering Committee

RISM Session 2024/2025

May 2025

WELCOME SPEECH FROM CO-CHAIRMAN

RISM 17th International Surveying Conference for Undergraduates (ISCU 2025)

Bismillahirrahmanirrahim.

السلام عليكم ورحمة الله وبركاته and greetings to all.

It is my great pleasure to welcome everyone to the 17th International Surveyor Conference for Undergraduates (ISCU 2025), proudly hosted by Universiti Teknologi MARA (UiTM) Perak Branch in collaboration with the Royal Institution of Surveyors Malaysia (RISM). This event is a meaningful platform for students in the built environment to share ideas, showcase innovations, and build professional networks. We are honoured by your presence and enthusiastic participation, with 135 accepted papers and 78 poster presentations this year.

UiTM Perak, home to the College of Built Environment, has long been a hub for academic excellence in architecture, planning, and surveying. Our commitment remains strong in nurturing competent graduates who meet industry demands and contribute to nation-building.

While you're here, we invite you to experience the heritage and culture of Perak Tengah from the architectural richness of Rumah Kutai to the historical towns of Pasir Salak, Bota, and Kampung Gajah.

To all presenters and winners, congratulations on your achievements. Let your work today be a catalyst for future success and academic growth. We hope this conference will inspire you to explore new ideas, foster collaboration, and make lasting memories.

My deepest thanks to the Royal Institution of Surveyors Malaysia (RISM) and the organising committee for making this event a success.

We hope your experience here will be rewarding and unforgettable.

Thank you. Selamat datang dan selamat berjaya.

Associates Professor Dr. Nur Hisham Ibrahim, *PMP*

Co-Chairman, Universities' Partnering Committee

RISM Session 2024/2025

May 2025

WELCOME SPEECH FROM THE PROJECT DIRECTOR

RISM 17th International Surveying Conference for Undergraduates 2025

Alhamdulillah, all praise to Allah S.W.T. for His guidance and blessings in making the RISM 17th International Surveying Conference for Undergraduates (ISCU) 2025 a reality.

It is with great honour and gratitude that I welcome all participants, guests, academicians, and industry professionals to this prestigious event, proudly organized under the Royal Institution of Surveyors Malaysia (RISM). This 17th edition of ISCU stands as a proud testament to our collective dedication toward academic excellence, professional collaboration, and youth empowerment in the field of surveying.

I extend my heartfelt appreciation to RISM for its unwavering support, to the hardworking ISCU 2025 Organising Committee, and to all 16 partnering universities across Malaysia for their commitment and contributions. Your efforts have shaped this conference into a dynamic platform for knowledge exchange, innovation, and professional growth.

To the academicians and practitioners present, your insights are invaluable in bridging the gap between academic theory and real-world practice. To our undergraduate participants, your passion, curiosity, and commitment are the very foundation of our future. May this conference not only deepen your academic journey but also ignite a spirit of leadership, integrity, and sustainable thinking.

Let this gathering serve as more than an academic milestone. May it foster lifelong networks, inspire transformative ideas, and chart new directions in our shared professional journey.

Wishing everyone a rewarding and inspiring conference experience.

Sr Dr. Nurul Fadzila Zahari

Project Director

RISM 17th ISCU 2025

SUSTAINABLE WATER MANAGEMENT FOR URBAN HOUSING DEVELOPMENT IN MALAYSIA

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ABSTRACT

Effective water management plays a crucial role in sustainable urban development, particularly in Malaysia, where rapid urbanization and climate change have exacerbated flood risks and water scarcity. This research evaluates the effectiveness of key strategies such as flood mitigation, water recycling, and rainwater harvesting in promoting long-term water sustainability in the region. Through an analysis of case studies and policy frameworks, the research highlights both the achievements and challenges associated with implementing sustainable water management solutions in Malaysia. The findings indicate that significant infrastructure projects, such as the SMART Tunnel, have substantially mitigated flood risks. However, the adoption of rainwater harvesting and water recycling practices remains limited due to policy deficiencies and prohibitive implementation costs. While principles of Water Sensitive Urban Design (WSUD) and Malaysia's National Water Resources Policy (2021) provide a robust framework for action, effective enforcement continues to be a critical barrier. In order to facilitate the broader adoption of sustainable water management practices, this research advocates for enhanced policy reform, the introduction of financial incentives, and comprehensive public awareness campaigns. These recommendations aim to bridge the existing gap between policy and practice, ultimately fostering a resilient and water-secure urban future for Malaysia.

Keywords: Sustainable Water Management, Urban Resilience, Rainwater Harvesting, Flood Mitigation

I. INTRODUCTION

Effective water management is a cornerstone of sustainable urban development, particularly in regions experiencing rapid urbanization and environmental challenges. In Malaysia, the combination of urban expansion and climate change has heightened the risks of both flooding and water scarcity, posing significant threats to the nation's long-term sustainability. As urban areas continue to grow, the need for comprehensive water management strategies has become increasingly urgent. This research focuses on evaluating the effectiveness of several key strategies, including flood mitigation, water recycling, and rainwater harvesting, in addressing the water-related challenges faced by Malaysian cities.

By examining various case studies and policy frameworks, this study explores the successes and limitations of these strategies in promoting long-term water sustainability. Notable infrastructure initiatives, such as the SMART Tunnel, have made substantial progress in mitigating flood risks, yet the broader implementation of water recycling and rainwater harvesting remains constrained by policy challenges and financial barriers. Despite the robust policy frameworks provided by Malaysia's National Water Resources Policy (2021) and the principles of Water Sensitive Urban Design (WSUD), gaps in enforcement and practical application persist. This research highlights these issues while offering recommendations aimed at overcoming these obstacles, including policy reforms, financial incentives, and public awareness campaigns. Through these efforts, the study aims to contribute to the creation of a more resilient and water-secure urban future for Malaysia.

II. LITERATURE REVIEW

A. Flood Mitigation

Flooding is a recurring issue in Malaysia, exacerbated by urbanization, deforestation, and changing weather patterns due to climate change. Various strategies have been implemented to mitigate flood risks, with notable examples including infrastructure projects like the SMART Tunnel in Kuala Lumpur, designed to divert floodwaters while providing a dual-use tunnel for traffic. Research by Ahmad & Fairullazi Ayob (2023), evaluated

the effectiveness of the SMART Tunnel in flood mitigation, concluding that it has significantly reduced flood occurrences in the city. Moreover, Green et al. (2021), emphasized the importance of integrating green infrastructure, such as wetlands and floodplain restoration, into flood management strategies to enhance resilience to extreme weather events.

Despite these advancements, Haziq Sarhan Rosmadi et al. (2023), noted that flood management in Malaysia faces challenges such as inadequate drainage systems, urban sprawl, and a lack of comprehensive risk assessment frameworks at local government levels. These issues hinder the full potential of flood mitigation strategies and point to the need for more integrated, policy-driven solutions.

B. *Water Recycling*

Water recycling is another critical component of sustainable water management. In Malaysia, the concept of recycled water has gained attention in response to water scarcity and growing demand in urban areas. The Ministry of Natural Resources and Environment Malaysia (2012), emphasizes water recycling as a key strategy for ensuring long-term water security. However, research by Zhang et al. (2021), and Sarkar (2022) indicates that while the technological capacity for water recycling exists, the practice remains limited due to high implementation costs, a lack of public awareness, and insufficient regulatory frameworks. For instance, despite the availability of treatment plants and recycled water systems in industrial zones, adoption rates in residential areas remain low due to financial and technical barriers. Furthermore, Setia City Mall has adopted this method of water saving to promote sustainable practices in commercial infrastructure (Kamar & Bahardin, Nur Fadhilah, 2023).

Research done by Lee et al. (2016), explored the potential of decentralized water recycling systems, which could provide more affordable solutions for urban areas, but emphasized the need for greater policy support and incentives for private sector involvement. The review suggests that integrating water recycling into national and local policies, alongside financial incentives, could enhance the practice's adoption across Malaysia.

C. *Rainwater Harvesting*

Rainwater harvesting (RWH) offers an alternative water supply source, particularly in urban areas where conventional water resources are stressed. In Malaysia, RWH systems have been implemented at the household and institutional levels, with the Government of Malaysia promoting rainwater harvesting through policies and guidelines such as the Guidelines for Rainwater Harvesting System (2006). As Fan in 2020 and 2018 researched study, highlights Diamond Building water conservation strategies. However, Lee et al. (2016), observed that despite policy incentives, the uptake of RWH remains slow. Barriers include insufficient infrastructure, lack of standardization, and a general lack of awareness about the potential benefits of rainwater harvesting. As well as, to successfully implement RWH, multiple layers of guidelines application and approval must be completed as shown in Table 1.0. Water Safety is also one of the contributing factors that halts RWH mass implementation on residential housing because of the costs associated with water treatment and machine installations (Juiani et al., 2023).

Table 1.0 RWHS related Guidelines Malaysia

No	Guidelines	Department/Agency	Year
1	Guidelines for Installing a Rainwater Collection and Utilization System	Ministry of Housing and Local Government	1999
2	Rainwater Harvesting: Guidebook on Planning and Design	Department of Irrigation and Drainage Malaysia	2009
3	Guideline on Eco-Efficiency in Water Infrastructure for public Buildings in Malaysia	National Water Research Institute of Malaysia	2011
4	Urban Stormwater Management Manual for Malaysia, MSMA 2nd Edition	Department of Irrigation and Drainage Malaysia	2012
5	Green Neighborhood Development Initiative Implementation Guide – Rainwater Collection and Reuse System	Federal Town and Country Planning Department	2012
6	Green Neighborhood Planning Guidelines	Federal Town and Country Planning Department	2012
7	Rainwater Collection and Use System Guidelines	Federal Town and Country Planning Department, Ministry of Urban Wellbeing, Housing and Local Government	2013
8	Urban Stormwater Management – Part 6: Rainwater Harvesting, MS2526-6:2014	Department of Standards Malaysia	2014
9	Rainwater Harvesting System Design	Public Work Department	
10	DBKL Rainwater Harvesting Guidelines	DBKL	2014
11	NAHRIM Technical Guide No.2 - The Design Guide for Rainwater Harvesting Systems	National Water Research Institute of Malaysia	2015

Source: Adapted from Juiani, S. F. et. al. (2023)

Study done by Hafizi Md Lani et al. (2018), emphasize that the integration of rainwater harvesting systems into new urban developments and retrofitting existing buildings with these systems could significantly reduce pressure on conventional water resources. However, Hafizi Md Lani et al. (2018), also highlighted that for RWH to be effective, a combination of technical, social, and policy-driven interventions is necessary, including clear guidelines, community engagement, and financial incentives for homeowners and developers. Table 2.0 shows the benefits of RWHS (Rainwater Harvesting Systems) from all around the world. Malaysia is also included in the table below.

Table 2.0 Benefits of RWHS (Rainwater Harvesting Systems) Around the World

Categories	Finding	Location
Economy	RWHS in a dry and highly populated urban area is less attractive under the present low water tariff scenario but it becomes more promising with increasing tariff.	Barcelona, Spain
	Annual domestic cost saving up to \$240 per year per house.	Seven major cities in Australia including Gold Coast, Brisbane, Melbourne, Sydney, Adelaide, Perth, and Canberra
	The benefit of RWHS for water supply alone is less economical unless other benefits such as for flood control are considered.	United Kingdom
Environment	RWHS is predicted to reduce flooding by 10%.	Korea
	Prolong the water storage to be used during dry periods.	Abeokuta, Southwestern part of Nigeria
	RWHS is utilised widely in areas with poor water supplies.	North of Carolina, United States
	Reduce dependency on piped water and delay the development of new storage infrastructure.	The Lower Hunter and Central Coast region of New South Wales, Australia
	Large scale rainwater tank can reduce peak flow in sewer system.	Belgium
	Meet up to 34% of domestic water use and 10% reduction in peak discharge if all houses in the residential area are installed with RWHS.	Malaysia
Technology and Social	Effective control of stormwater and water conservation, as well as an alternative water resource.	Canada
	Improve household water management in rural area and reduce water-related health risks.	Uganda
	Supplement the existing groundwater and surface water resources. RW is cleaner than the existing supply.	Jordan

Source: Adapted from Hafizi Md Lani, N., Yusop, Z., & Syafiuddin, A. (2018)

While Malaysia has developed a solid policy foundation for water management, including the National Water Resources Policy (2021) and the Water Sensitive Urban Design (WSUD) principles, the effectiveness of these policies has been limited by several challenges. Saimy & Yusof (2013), argued that despite the existence of well-crafted policies, the enforcement of these policies remains weak at the local government level, undermining the potential of water management strategies. The public awareness on environmental issues is still low despite the efforts made the Acts and various campaigns.

Moreover, Lebu et al. (2024) highlighted that financial barrier, including the high upfront costs of implementing flood mitigation infrastructure, water recycling plants, and rainwater harvesting systems, limit their scalability. The lack of adequate public-private partnerships and financial incentives for businesses and individuals to adopt water-saving technologies further exacerbates this issue.

III. METHODOLOGY

This research focuses on analysing sustainable water management systems, including greywater and blackwater, and flood mitigation strategies in Malaysia through a combination of case study analysis and secondary data review. The study examines successful projects such as the SMART Tunnel (flood mitigation), Setia City Mall (water recycling), and Diamond Building (rainwater harvesting) to understand their implementation and effectiveness. Data for these case studies is gathered from project reports, technical documents, and publicly available information. Additionally, secondary data is collected from government reports, academic journals, industry publications, and articles to provide broader insights into water management practices and policies in Malaysia.

The analysis involves reviewing and synthesizing information from these sources to identify common themes, challenges, and best practices. The case studies are evaluated to highlight key strategies and outcomes, while the secondary data provides context and supports the findings. Ethical considerations, such as ensuring the accuracy of data and maintaining transparency in sourcing information, are prioritized throughout the study. However, limitations include potential gaps in publicly available data and the contextual specificity of the case studies, which may limit the generalizability of the findings. Despite these constraints, the methodology provides a clear and structured approach to understanding the implementation of sustainable water management systems in Malaysia. The next chapter presents the findings based on this analysis.

IV. ANALYSIS OF RESULTS

This systematic literature review reveals that while Malaysia has made significant progress in adopting strategies like flood mitigation, water recycling, and rainwater harvesting, the implementation of these strategies remains uneven and hampered by several challenges. The key barriers identified include high costs, lack of public awareness, insufficient policy enforcement, and limited technical expertise at the local government level.

Table 3.0 Comparative Framework of Sustainable Water Management between Singapore, Malaysia and Australia with Recommendations.

Criteria	Malaysia (Current Approach)	Singapore (Best Practice)	Australia (Best Practice – WSUD)	Recommendations for Malaysia
Policy & Governance	National Water Resources Policy (2021), WSUD guidelines exist but enforcement is weak.	PUB's ABC Waters Programme with strict enforcement.	Water Sensitive Urban Design (WSUD) integrated into urban planning regulations.	Strengthen enforcement & integrate WSUD into national urban policies.
Flood Mitigation	SMART Tunnel (successful but limited coverage).	Marina Barrage, integrated with urban planning.	Green infrastructure (wetlands, permeable pavements).	Expand flood mitigation using nature-based solutions.
Rainwater Harvesting	Encouraged but not mandatory in most developments.	Mandatory for new developments & supported by incentives.	Integrated with building codes & urban water reuse strategies.	Make rainwater harvesting mandatory for new buildings.
Water Recycling	Limited adoption beyond large developments (e.g., Setia City Mall).	Extensive greywater & blackwater recycling for non-potable use.	Decentralized water recycling at neighbourhood scale.	Provide subsidies for decentralized water recycling systems.
Public Engagement	Low public awareness: water conservation campaigns are sporadic.	Strong community engagement via ABC Waters outreach.	Education integrated into urban planning.	Launch nationwide awareness programs & school curriculum on water conservation.

Source: Luqmannul, H., Azman, N., & Ramli, S. (2025)

A. Flood Mitigation

The issue of flooding is one of the most pressing challenges faced by urban areas in Malaysia, especially with rapid urbanization, changes in land use, and the impact of climate change. Several studies highlight that while infrastructure-focused flood mitigation strategies, such as the SMART Tunnel in Kuala Lumpur, have successfully reduced flood risks in certain urban areas, their applicability to smaller cities and rural areas remains limited.

The findings of Haziq Sarhan Rosmadi et al. (2023), indicate that large-scale infrastructure projects are effective in reducing flood risks but require significant investment and long-term maintenance. Smaller-scale or more decentralized flood mitigation approaches, like the integration of green infrastructure such as wetlands, bio-swales, and permeable surfaces, have shown promise in addressing localized flooding but are not yet widely adopted.

Challenges such as urban sprawl and inadequate drainage systems contribute to continued flood risks in many urban areas. Thus, insufficient integration of nature-based solutions and green infrastructure into city planning, leading to missed opportunities for sustainable flood management. While large infrastructure solutions like the SMART Tunnel offer a critical short-term solution, a shift toward nature-based, low-cost solutions could reduce the overall flood risk in Malaysia's cities. Flood mitigation policies need better enforcement at the local level, particularly in rapidly growing urban centres and flood-prone regions.

B. Water Recycling

Water recycling, as a strategy for ensuring water sustainability in the face of growing demand and water scarcity, shows great promise in Malaysia. However, the implementation remains slow due to several barriers, including high costs, lack of infrastructure, and insufficient public awareness.

Findings from studies, Lee et al. (2016), reveal that while the technological capacity for water recycling exists, large-scale adoption is hindered by high initial costs for installation of treatment plants and the infrastructure required for residential and commercial sectors to recycle water. Challenges such as lack of clear policy frameworks and insufficient incentives for private sector involvement in water recycling projects. Apart from that, public reluctance due to lack of awareness regarding the benefits of recycled water and safety concerns over its use.

While there is an established capacity for water recycling, the cost remains prohibitive for wide-scale implementation, especially at the household level. Thus, increasing private sector involvement and introducing financial incentives could help mitigate the costs and promote the adoption of water recycling technologies. Additionally, more educational campaigns are needed to inform the public of the safety and benefits of using recycled water, particularly in areas where water scarcity is a growing concern.

C. Rainwater Harvesting

Rainwater harvesting (RWH) represents a low-cost, sustainable solution to water scarcity, especially for households and institutions. Malaysia's government has taken steps to encourage RWH through policy documents and guidelines, but uptake has been slow.

Studies from Lee et al. (2016), Juiani et al. (2023), and Hafizi Md Lani et al. (2018) indicate that despite the availability of incentives and guidelines, the practical adoption of rainwater harvesting remains limited due to infrastructural barriers, such as the lack of standardized systems for installing RWH at the household level. Thus, maintenance concerns by many urban residents worry about the long-term maintenance of RWH systems. Furthermore, absence of clear regulations at local levels, which could provide guidelines on system design, installation, and maintenance.

The challenges identified is the initial cost of setting up a rainwater harvesting system can be high, especially when retrofitting existing buildings. There is insufficient knowledge about how to maintain and maximize the benefits of a rainwater harvesting system. Thus, a lack of incentives for developers and homeowners to install RWH systems, despite policy guidelines encouraging their use.

RWH systems have significant potential to alleviate pressure on conventional water resources in urban areas, particularly during dry periods. The introduction of subsidies or tax incentives could significantly increase the adoption of RWH systems, making them more accessible to a broader population. Thus, local governments need to implement clear and consistent regulations and standards to facilitate RWH implementation at scale.

D. Policy Frameworks and Challenges

The National Water Resources Policy (2021) and Water Sensitive Urban Design (WSUD) principles have laid a solid foundation for sustainable water management in Malaysia. However, findings from SUKEREMAN et al. (2022), and YB DR. XAVIER JAYAKUMAR (2018), suggest that the gap between policy creation and actual implementation remains significant especially in the institutional, legal, governance and coordination between

developers and government.

Challenges identified is weak enforcement of water management policies at the local government level. Lack of inter-agency coordination, which limits the effectiveness of water management strategies across sectors. Thus, limited funding for water management infrastructure, particularly in smaller cities or rural areas.

Although national policies are in place, their success is hampered by ineffective enforcement and inconsistent application across different regions. Public-private partnerships (PPPs) could be a potential solution to overcome funding barriers and foster innovative, cost-effective solutions for water management. Thus, there is a need for stronger policy alignment between federal and local governments to ensure that water management objectives are consistently met.

V. DISCUSSION OF FINDINGS

The research indicates that while Malaysia has taken commendable steps toward improving water management, challenges persist that hinder the widespread adoption of sustainable practices. The findings emphasize the importance of integrating flood mitigation, water recycling, and rainwater harvesting into cohesive, multi-faceted policies that are enforced effectively at both national and local levels.

The main barriers identified across the strategies include:

- 1) **Financial constraints:** High implementation costs for infrastructure and technology, especially for water recycling and rainwater harvesting.
- 2) **Policy enforcement issues:** A lack of effective monitoring and enforcement at the local government level, which undermines the success of existing policies.
- 3) **Public and private sector involvement:** The limited involvement of the private sector and insufficient public awareness of water management practices, both of which are critical for widespread adoption of water-saving technologies.

CONCLUSION

This systematic literature review reveals that while Malaysia has made significant progress in adopting strategies like flood mitigation, water recycling, and rainwater harvesting, the implementation of these strategies remains uneven and hampered by several challenges. The key barriers identified include high costs, lack of public awareness, insufficient policy enforcement, and limited technical expertise at the local government level. In order to overcome these challenges, this review recommends several improvements on policy reform and enforcement by strengthening the enforcement of water management policies and ensuring that local governments have the capacity and resources to implement these policies effectively. Thus, financial incentives by introducing financial incentives, such as subsidies or tax breaks, in order to encourage businesses and individuals to adopt water-saving technologies and sustainable practices. Furthermore, public awareness campaigns through launching public awareness campaigns to educate the public about the benefits of water recycling, rainwater harvesting, and other sustainable water management strategies. Apart from that, integrated planning by encouraging the integration of water management strategies into urban planning and development projects to ensure that water management practices are embedded in the design of cities. By addressing these gaps, Malaysia can move closer to achieving a resilient and sustainable urban future where water resources are effectively managed to meet the needs of all its citizens.

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