CHAPTER 1. INTRODUCTION

1.1. BACKGROUND OF STUDY

Seri Medan is a rural area located within the Batu Pahat District in Johor, Malaysia, characterized by low-lying terrain with 98.66% of its land area situated below 150 meters above mean sea level. This geographical feature, coupled with heavy rainfall, high tides, and sedimentation from the main river like Batu Pahat River and its tributaries including Simpang Kanan River, Simpang Kiri River, Bekok River, and Sembrong River.makes the area highly susceptible to frequent flooding. The river systems, while essential for local water resources and agriculture, face sedimentation challenges that reduce their capacity to manage water flow, exacerbating the flood risk, especially during the monsoon season. Despite various flood mitigation efforts, flooding remains a recurring issue in Seri Medan, highlighting the need for effective sediment transport management and further investigation into the region's hydrological dynamics.

Rivers are constantly influenced by natural processes and human activities including changing flow conditions, land use, and sediment supply. Managing the sediment transport is important to prevent flooding and maintain the quality of water and ensure the function of flood control infrastructure. Improper management of sediment transport can lead to erosion or increased sedimentation in reservoirs, bridges, and navigation channels, while also affecting aquatic habitats and flood risk. Furthermore, in many cases, sediment transport data is limited, and simulation tools like HEC-RAS can provide a more integrated approach.

The application of HEC-RAS is important to understanding the complex interaction between water flow and sediment movement. This tool has been adapted to make simulation of sediment transport under various flow and sediment conditions to provide valuable insights of river behavior, erosion and the affect related to sedimentation

1.2. OBJECTIVES AND BENEFITS

1.2.1. Objectives of Study

The objectives of this study are:

a. To simulate sediment transport rates in the river by using HEC-RAS software.

b. To identify the flow characteristics influencing sediment transport within the river.

c. To identify areas of significant sediment deposition and erosion along the river channel.

1.2.2. Benefits of Study

This study holds significant importance in advancing the understanding and management of sediment transport in river systems, with a specific focus on the Simpang Kiri River. Effective management of sediment transport is essential for ensuring the river's functionality, mitigating flood risks, and preserving aquatic ecosystems. By analyzing sediment transport and its impact on riverbed elevation, the research provides critical insights into how sedimentation affects the river's capacity to handle high water flows, particularly during heavy rainfall, thereby supporting flood risk mitigation efforts.

The study also contributes to the protection of critical infrastructure, such as bridges, reservoirs, and navigation channels, by identifying areas prone to erosion or excessive sediment deposition. These findings aid in the design and maintenance of infrastructure to prevent damage and maintain operational efficiency. Furthermore, the research supports sustainable river management by offering a detailed understanding of the interactions between hydrodynamic factors and sediment transport, enabling the development of long-term strategies to maintain water quality and river morphology.

By utilizing HEC-RAS, the study enhances predictive modeling capabilities for sediment transport, providing engineers and planners with valuable tools to address sediment-related challenges in river systems. Additionally, the results can inform policymakers and stakeholders, offering a scientific basis for implementing effective flood control and river management measures. Beyond these practical applications, the study has environmental and ecological benefits, contributing to the preservation of aquatic habitats and maintaining ecological balance, which is vital for the biodiversity of the Simpang Kiri River ecosystem. Overall, this research bridges the gap between theoretical modeling and practical river management, providing a comprehensive approach to addressing sediment transport challenges.

1.3. SCOPE OF STUDY

This study focuses on applying HEC-RAS (Hydrologic Engineering Center's River Analysis System) to simulate and analyze sediment transport processes in the Seri Medan area of Batu Pahat, Johor, Malaysia. The research requires field data that provided by the Department of Irrigation and Drainage (DID), such as flow velocity, water depth, and discharge, alongside sediment characteristics like grain size and concentration, to simulate both bedload transport under various flow conditions. The main aim of this study is to establish how the hydrodynamics factors influence sediment movement and transport within the river system. The study also focuses on applying HEC-RAS modeling software to simulate the quantity of sediment that is moved by the flow within the river.

This study is limited to a specific segment of the Simpang Kiri River located in Seri Medan and is conducted using quasi-unsteady flow simulation within the HEC-RAS environment. The simulation utilizes flow and sediment data provided by the Department of Irrigation and Drainage (DID) Malaysia. Although the data are essential, their spatial and temporal resolution is limited, which may reduce the ability to fully capture natural variability across the entire river system. The model relies on digital elevation data (DEM) with a resolution of 30 meters, which may not accurately represent detailed riverbed features in narrow or steep sections.

Furthermore, due to limitations in the availability of cross-sectional data, this study concentrates its analysis on the middle segment of the river. Although this segment is geographically located in the middle reach, it is considered the downstream section within the context of river normalization planning. In addition, the model calibration is constrained by the availability of detailed field validation data. The study focuses on short-term sediment transport behavior rather than long-term morphological evolution. Nonetheless, the findings offer valuable insight into sediment movement patterns and contribute to improving sediment management in the study area.

1.4. REPORT STRUCTURE

This study is organized into five chapters, each systematically structured to address the objectives of the research and present the findings clearly:

- **Chapter 1: Introduction**

This chapter provides the background of the study, outlining the geographical and hydrological context of Seri Medan and the sediment-related challenges faced in the Simpang Kiri River. It also includes the problem statement, the objectives and benefits of the study, the scope of research, and this systematic overview of the thesis.

- **Chapter 2: Literature Review**

This chapter presents a review of previous studies and theoretical foundations relevant to sediment transport, river hydrodynamics, and modeling techniques. It includes discussions on sediment transport mechanisms, types of sediment loads, and an overview of HEC-RAS as a modeling tool, along with comparisons to other methods.

- **Chapter 3: Methodology**

This chapter explains the research methodology, including data collection, model setup, and simulation procedures. It details the study area, the use of quasi-unsteady flow, the types of input data from DID (flow and sediment data), the selection of sediment transport functions, and the calibration and simulation process in HEC-RAS.

- **Chapter 4: Results and Discussion**

This chapter presents the simulation results and interprets the findings based on the study objectives. It analyzes flow characteristics, areas of erosion and deposition, sediment concentrations, and evaluates the effectiveness of the HEC-RAS model in representing sediment transport dynamics in the study area.

- **Chapter 5: Conclusion and Recommendation**

This chapter summarizes the key findings and concludes the study. It provides recommendations for future work, discusses the limitations encountered, and offers suggestions for improving sediment transport modeling and river management practices in Simpang Kiri River.