CHAPTER 1. INTRODUCTION

1.1. BACKGROUND OF STUDY

Malaysia is situated in a region characterized by generally stable geological and climatic conditions, with limited exposure to major natural disasters. However, floods remain the most frequent and damaging natural hazard affecting the country (Mumtaz, 2022). Floods are defined as temporary conditions where large volumes of runoff water rapidly accumulate and overflow from upstream to downstream areas, inundating land that is typically dry. These events are primarily triggered by intense rainfall and can cause severe damage to infrastructure, the environment, and, in extreme cases, result in loss of life (Marimin et al., 2018).

The country's equatorial location contributes to a consistent climate throughout the year, characterized by high humidity, heavy rainfall, and warm temperatures. This climatic pattern often results in excessive rainfall, which can trigger flash floods, especially in urban or low-lying areas lacking adequate drainage systems or where river channels are insufficient to handle increased runoff (AlMahasneh et al., 2023). In general, 9% of Malaysia's land area, or about 29,800 km² is vulnerable to flood disasters and the country experiences several flood events annually. Floods typically happen over a few hours or days depending on river conditions and geographic considerations (Amin & Othman, 2018).

The Batu Pahat District, encompassing 196,632 hectares or 10.35% of Johor, features predominantly low-lying terrain, with 98.66% of its area below 150 meters above mean sea level. This geographical characteristic, combined with heavy rainfall, high tides, and siltation of waterways, has made the district highly vulnerable to frequent flooding. Flooding is often exacerbated by river overflows from the main Batu Pahat River and its tributaries, including Simpang Kanan River, Simpang Kiri River, Bekok River, and Sembrong River (Jurutera Perunding Putra, 2024).

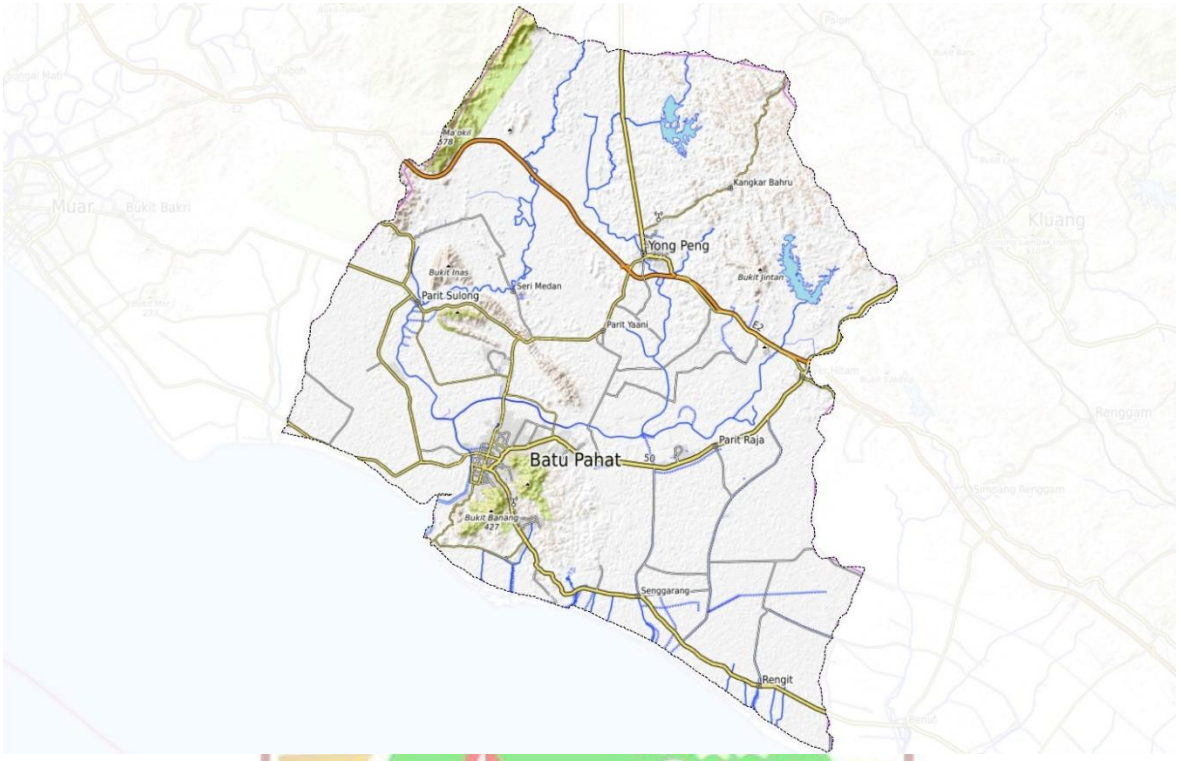

Figure 1.1 *Topographic Map of Batu Pahat Distrct (Source: Paintmaps.com)*

Despite various flood mitigation projects, flooding remains a recurring issue, particularly in the Seri Medan area, necessitating further hydrological and hydraulic investigation. Most areas in Seri Medan are susceptible to recurrent flooding due to their very flat topography. About 40% of the total land mass is prone to flooding. In certain villages, flooding is an annual affair, but the level is usually less than 0.5 m. However, Nevertheless, the area has also experienced severe floods, notably in December 1982, December 2006 to January 2007, January 2011, and more recently in January 2021 (Jurutera Perunding Putra, 2024).

Figure 1.2 *Floodwaters at Seri Medan, Batu Pahat (Source: ummahtoday.com.my)*

Given the recurring nature and severity of flood events, it is essential to assess river hydraulic behavior to better understand flood risks and design appropriate mitigation strategies. One effective method is through hydraulic modeling, which simulates river responses to various flood scenarios. The Hydrologic Engineering Center's River Analysis System (HEC-RAS) is a widely used tool that enables detailed analysis of water surface profiles, flow velocities, and flood extents. This modeling approach provides critical insights into the capacity of river systems to manage floodwaters.

1.2. OBJECTIVES AND BENEFITS

1.2.1. Objectives of Study

The objectives of this study are:

a. To analyze the rainfall and flood discharge within the study area.

b. To model the hydraulic behavior of the Simpang Kiri River using HEC-RAS under various flood scenarios.

c. To evaluate the river's capacity to convey flood discharge.

1.2.2. Benefits of Study

This study contributes to a deeper understanding of the hydraulic performance of the Simpang Kiri River in mitigating flood risks within the Seri Medan area, Batu Pahat District. By using HEC-RAS modeling to simulate flood behavior under various return periods, this research provides reliable data on the river's capacity to convey floodwaters and identifies critical inundation zones. Such insights are essential for guiding local authorities, planners, and engineers in designing more effective structural and non-structural flood mitigation measures.

In addition, this study provides academic and practical value by demonstrating how hydraulic modeling can be used to evaluate the adequacy of river channels in low-lying, flood-prone regions. The approach integrates rainfall data, discharge analysis, and spatial characteristics of the river to simulate real-world flood scenarios, offering a systematic and data-driven method for assessing flood risks. Moreover, the study serves as a reference for similar hydrological and hydraulic assessments in other parts of Malaysia and beyond, contributing to broader efforts in sustainable watershed and disaster risk management.

1.3. SCOPE OF STUDY

This study focuses on analyzing the hydraulic capacity of the Simpang Kiri River, which stretches approximately 16 kilometers within Mukim Seri Medan, Batu Pahat. The analysis is limited to the main river channel, excluding contributions from tributaries beyond the defined upstream boundary. The research includes the analysis of rainfall data and the estimation of flood discharges. Due to the lack of rainfall stations within the Simpang Kiri River Basin, rainfall data from the Empangan Sg. Sembrong station (Station ID: 1931003), the nearest station with reliable IDF data, was used.

Using HEC-RAS modeling, the study simulates the hydraulic behavior of the river during flood events to evaluate its current capacity to convey floodwaters. The model incorporates river geometry, boundary conditions, and flow data, and is run under various flood scenarios, including the 20-year and 100-year return periods, as well as those adjusted with Climate Change Factors (CCF). This study will focus on assessing the water surface of the Simpang Kiri River hydraulic section without taking land use and sediment transport into calculation.

1.4. WRITING SYSTEMATIC

The systematics of writing in this final project is divided into several chapters as follows:

CHAPTER I INTRODUCTION

Chapter I consists of the background, objectives, benefits, and scope of the study, as well as the systematics of writing in this final project.

CHAPTER II LITERATURE REVIEW

In chapter II, namely the literature review which will discuss the theories used as the basis or foundation for this final project.

CHAPTER III METHODOLOGY

In chapter III, the research methodology will discuss the stages of this final project research.

CHAPTER IV RESULTS AND DISCUSSION

In chapter IV this will describe all discussions regarding the research conducted and also the presentation of the research results that have been carried out.

CHAPTER V CONCLUSIONS AND RECOMMENDATIONS

In chapter V, it contains conclusions and recommendations regarding the the results of the final project research.