1. INTRODUCTION

1.1 Background

Floods are one of the major disasters affecting many countries in the world year after year. It is an inevitable natural phenomenon occurring from time to time in all rivers and natural drainage systems. It causes damage to lives, natural resources and environment as well as the loss of economy and health.

According to Islam (2002), in recent decades, floods losses have increased worldwide. This can be linked to socio-economic, hydrological and climatic factors. An increase of flood risk is also foreseen for the future. Several landuse changes, such as deforestation and urbanization, reduce the available water storage capacity and increase the flood hazard.

Flood is becoming an increasing major contributor to personal and to property damage worldwide and in many places strikes without warning. Increasing population pressure and economic activities has led to the development of extensive infrastructures near the rivers. These economic activities and land use changed increase the risk of future inundations.

Floods represent complex problems because of its variety. Therefore, this variety cannot be studied or controlled only by one or two specific methods. In this case, flood has been viewed as a system that integrates any discipline by including social discipline.

In Indonesia, climate change especially of extreme rainfall, caused by La Nina effect contributes extensively to flooding process. Problems related to flood
have greatly increased and there is a need for effective modeling and understanding of the problem to help mitigate the worst effects of flood disasters and the need for developing a system to understand the threatened areas. The understanding of process will help in flood hazard assessment and in giving insights to various ways of dealing with the hazard and disaster problems.

Ciliwung River is one of the biggest rivers which passes Jakarta and eventually causes flood in Jakarta. In the first year of 1996, Ciliwung River causes flood in Jakarta and damage. In year 2002 the flood event was bigger than previously and causing damage about 40 % of Jakarta area (BPS Jakarta).

The land use of Ciliwung watershed has been changed in the last 25 years. This change increases runoff of about 54 %. This runoff change has high correlation with the land use change in the Ciliwung watershed (Fakhrudin, 2003).

Land use change affects hydrological characteristics such as infiltration, surface storage, and evapotranspiration. The decrease of infiltration will increase runoff. This condition is potential to cause flood in the wet season while causes drought in the dry seasons. Surface storage has a correlation with time lag of runoff. The decrease of surface storage will increase runoff flow which means the water has no time to infiltrate but directly flows to the river and causes flood in low places.

Flood is a dynamic system because flood process is time dependent. Dynamic system is described by time-differential equations; therefore, the future response of the system is determined by the present state of the system
(the initial conditions) and the present input. Thus, a dynamic system may continue to have a time-varying response after the inputs are held constant.

As a dynamic process flood event can be forecasted. One method to forecast flood events is by considering flood process as a system. As a system, flood process has component such as input, process, output, feedback process, environment, and boundary. The important factor from system is its behavior. The behavior will provide the explanation of flood event and bring it to the solution. By changing the value of variables during simulation it also gives the effect degree of each component. This is very important to make decision related to the action in the field.

Geographic information system (GIS) provides a broad range of tools for determining area affected by floods and for forecasting areas that are likely to be flooded due to high water level in a river. Prahasta (2001) also mentioned that GIS is the nucleus of the environmental information system. Most of the information needed to operate an urban is geo-referenced, i.e. it is referenced to specific geographic location. Information about zoning, properties, roads, rivers, administration boundary are connected to geographic locations.

Based on the explanation above, this research will study hydrology response to land use change and modeling flood event by using system dynamic approach. The benefit of this model is that the model can explain flood process and its behavior and can be used to evaluate watershed system. This model will be used as a tool to evaluate the effect of land use change to the water level in the watergate station which are indicated flood.
1.2 Objectives

The objectives of this research are:

- To understand the process of flood events and its interaction with hydrometeorological components.
- To develop flood model for watershed management
- To determine the effect of land use change to watershed discharge which indicates flood event.

1.3 Hypothesis

- Land use change influence discharge in the outlet.

1.4 Thesis Structure

The thesis consists of six consecutive chapters. The contents of each chapter are described below:

- Chapter I introduces the research by focusing on the background such as introduction, objectives, hypothesis, and thesis organization.
- Chapter II provides comprehensive summary of related work ranging from watershed, process-based hydrological modeling, flood, and landuse management.
- Chapter III introduces the study area, materials and methods.
- Chapter IV focuses on the results and discussion. This chapter includes an overview of characteristics of study area, model structure, discussion
of study area characteristics and model structure, model calibration, and model profile.

- Chapter V consists of Conclusion and Recommendation.