Urban Principle of Water Sensitive Design in Kampung Kamboja at Pontianak City

N Hasriyanti¹ and E Ryanti²

¹Department of Architecture State Polytechnic of Pontianak
²Department of Civil Engineering State Polytechnic of Pontianak
A. Yani Street, Pontianak City 78124, Indonesia

E-mail: niexnoe@gmail.com

Abstract. This study will define the design principles of settlement area banks of the Kapuas Pontianak to approach the concept of water sensitive urban design (WSUD) in densely populated residential areas. Using a case study of a region densely located on the banks of the river with engineering literature to formulate the aspects taken into consideration and the components are arranged in the design, analysis descriptive paradigm rationalistic to identify the characteristics of residential areas riverbank with consideration of elements WSUD and formulate design principles residential area that is sensitive to water. This research is important to do because of problems related to the water management system in the settlement bank of the river in the city of Pontianak do not maximize. So that the primacy of this study contains several objectives to be achieved is to identify the characteristics of the settlement area riverbanks under consideration aspects areas design that is sensitive to water and principle areas design that will formulate the structure of the existing problems related to the needs of the community infrastructure facilities infrastructure neighborhoods and formulate and create guidelines for appropriate technology for integrated water management systems in the residential area of the riverbank and engineering design for the settlements are sensitive to water (WSUD). The final aim of the study is expected to achieve water management systems in residential areas by utilizing the abundant rainwater availability by using LID (Low Impact Development) through the concept of urban design that sensitive water

1. Introduction
The settlement is a complex problem associated with and related to the social, economic, cultural, ecological, and so on. Settlement banks of the river have the potential and the problems are diverse. The potential is directly related to the river banks to provide benefits for the surrounding community to use the river as a source of water for the fulfillment of activities and daily necessities. Along with population growth and increased economic activity, utilization and management of water in life face problems such as excessive water exploitation, reduce the function of the watershed as a water catchment areas and improving woke leads to the reduction of green open space. The result of all it is the occurrence of flooding in the settlements and the decline in water quality and quantity. The problem of water in residential areas is very important because it requires the integrated water management through the design of the city known as the Water Sensitive Urban Design (WSUD).
However, there are still things that have not implemented the concept WSUD, among others, yet it uses vegetation to absorb water and improve water quality, rain water is not used to irrigate the vegetation in the area, not the presence of the trenches to minimize run-off, and has not been used open space design that can withstand the flow of water in the area and others.

The purpose of this study is to formulate a design principle which is a guideline to achieve the implementation of the principle WSUD which basically aims to resist and absorb the water contained in the surface into the ground. Besides the application of this concept can also reduce runoff water so as to reduce flooding and flooding. Design principles to be formulated is the main purpose to establish a residential area that is sensitive to water.

WSUD is one part of the concept of green infrastructure approach. The goal of the approach is to approach the concept of urban planning and design related to water resources and environmental management and to minimize the impact caused by the presence of water in urban surfaces. WSUD concept focuses on sustainability management of the water cycle in the city where the management is the source of this concept approach. The forms of sustainable management of the water cycle, namely the management of drinking water, the water flow caused by rainwater quality, wastewater management and the water cycle (water conservation). (Yunus, 2007)

2. Methods
The method used is to make a field trip to obtain a picture of the condition, as well as the characteristics of the formulation of the problems related to water issues in the settlement area of the Kapuas river banks. Secondary data acquisition is done through literature studies and surveys related agencies. The analytical method used is qualitative descriptive analysis with a rationalistic paradigm to describe the approach to the concept of settlement WSUD on the riverbank, so that later can be formulated principles of settlement areas design.

3. Result and Discussion
LID is a way of designing region with a view to maintaining and imitating the hydrological characteristics of an area before development. Function hydrology, such as storage, infiltration and recharging groundwater or also the volume and frequency of surface flow will be maintained during use of handling storm water runoff on a small scale comprehensive and integrated, both retention and detention areas, reduction of impermeable surface and extending the flow of time concentration (Coffman in the United States Environmental Protection Agency, 2000). The basic concept that describes the core of LID is a regional plan must process thoroughly to achieve success and a plan that could hold. The basic concept is, among others (Department of Environmental Resources Maryland, 1999):

a. The use of hydrology as a framework work. Hydrology approach in the process Regional planning begins with identification and keep sensitive area effect on regional hydrology, including flow and buffer, floodplains, wetlands, slope, soil high permeability and protected areas. Schematic of the area to be built then evaluated to reduce, minimize the total impervious area of the region. Subsequent analysis is making watertight areas that cannot be avoided to minimize surface watertight interconnected directly. Biodefense area, extending the flow stream, local infiltration, drainage, area retention, and other practices can be used to control and change the impermeable area water. The end result of the use of hydrology in Regional planning is to maintain the conditions of the development hydrological characteristics other than it can add aesthetics and provide recreational areas.

b. The concept Micromanaging. The key to making LID is to concept micromanaging. It requires change our perspective in the approach area to be controlled (Micro-subsheds), by controlling (Micro-techniques), location and size and frequency control of the water flow rain-controlled. management techniques small scale is done on a small sub-watershed or in residential areas also on a public area, which provides the division controlling the flow of rainwater thoroughly the observation area. This gives the opportunity to maintain hydrological function regions such as infiltration, shallow bin, and the interception of rainwater as well as good in reducing the concentration time (Tc).
c. Control the flow of rain in the watershed. Key to the repair function hydrology is to minimize and reduced as a result of land-use change land in the area of the river. This matter based on the distribution strategy control in the watershed and implemented using the techniques of micromanaging on the whole region.

WSUD is one part of the concept of green infrastructure approach. The aim of this concept approach to urban planning and design approach that related to water resources and environmental management and to minimize impact posed by the presence of water in urban surfaces. Initially, this concept appears motivated by the role of water in the life of the city, which requires setting up a harmonized between city development and the need for water. The concept focuses on the WSUD sustainable management of the water cycle in the city where the management is the source of approach to this concept. The forms of sustainable water cycle management are the management of water drinking, water flow caused by rain, water quality, wastewater management and the water cycle (Water conservation). (Yunus, 2007)

In this concept for the Kapuas River Settlements of integration between the management and the sustainability of the water cycle designing cities to adopt urban design techniques that are sensitive to water. Could concluded that the keyword of this concept is the integration. It is mentioned more clearly the principles of the concept WSUD. Those principles mentioned in Urban Stormwater (2009), namely: protecting the natural systems one of which is a natural water systems through the development of the city; integrating prevention methods rainwater into urban design; protect water quality and improve the quality of irrigation water system; reduce the flow of water by flowing water runoff either rain or flooding and to integrate landscape into the environment; utilizing water runoff for various needs; give the value of land by minimizing the cost of infrastructure one of them is drainage infrastructure.

Such principles can be applied in a region at Kapuas River Settlements actually in Kampung Kamboja with analysis first. Required are three kinds of analysis, ie the analysis of the site, and the land use planning capability land. Footprint analysis is useful to identify and explain the state of the (existing) which occurred at the site. What is needed is a data topography, drainage networks, soil type, land cover data on the size, the sensitive regions, and the water flow corridors. By doing all three analyses They can be found where the development concept needs to be applied with WSUD the impact to a minimum.

This concept has several important elements, namely the use of water (water reuse) and water treatment (water treatment). Rainwater and wastewater is one of the water note on this concept. In practice, this concept sees rain water management and water effluent as an opportunity to design a city and not as waste. Element The lowered to urban design elements to consider in the application of WSUD are: land that can absorb water (precinct wide infiltration basins); swales or ditches; road design; ponds; gutter; water storage tanks; similarity roof; type forming material is porous pavement (porous pavements); type of drainage cover material; sand filter; retaining walls of water flow; types of vegetation including vegetation covering the waterfront; city Forest. Based on this, the engineering LID eligible to apply is as follows.

a. Biodefense, Biodefense form in the bin aquifer combined with vegetation built around the environment buildings were still empty and got enough sunlight
b. Channel impregnation, Impregnating channel built in the neighbourhood around the building which is empty but not getting enough sunlight.

c. Rainwater tank, or Bak, was built to accommodate the flowing rainwater from the roof of the building and later can be used for raw water sources, especially for flushing toilets.
d. These new tools will LID implemented in the future adapt to the development settlement infrastructure and River Laboratories.
4. Conclusions
The discussion in advance can conclude matters as follows.

a. LID engineering that could be applied to a model of this study is to implement a drainage system is slow, and other engineering is like the making bio-retention pools and water tanks rain which will be held on next time.

b. By using a simulation program EPA-SWMM, estimated channel drainage and an existing storage of Environment Settlement at the River Centre treated as a drainage system slow for the research model can lowering the peak discharge flow surface becomes 1/16.

c. Models and the combination means LID slow drainage can lower peak discharge into a 0.018 m³/s compared to the channel conditions flowed freely, drain water with discharge of 0.34 m³/s.

d. The effectiveness of the channel is slow to lowering the peak discharge flow surface can be enhanced by expense occurs puddle the surface of the land, until the high limit and a certain duration.

With the above conclusion suggested several cases as follows.

a. The need for efforts to change the paradigm long associated with drainage environment, namely from wasting water as quickly and as much as possible be hold water as long as possible along does not cause an environmental disturbance.

b. The need for the implementation of drainage systems slows in a residential neighbourhood as realization paradigm change at the top.

c. It should be observed that the model is intensive in order to obtain parameters for designing dimensional drainage is slow and LID means more.

References
[1] Department of Environmental Resources (DERPGC) *Low Impact Development Modeling Programs In Prince George’s County, Maryland*
[2] Department of Environmental Resources (DERPGC) 1999 *Low Impact Development Design Strategies* Integrated Design Approach (Maryland: Prince George’s County)
[3] Coffman L 2000 *Low-Impact Development Design Strategies* An Integrated Design Approach (Maryland: Prince George’s County)
[4] Committee on Reducing Stormwater Discharge Contributions to Water Pollution National Research Council 2009 *Urban Stormwater Management in the United States.* (United States: National Academies Press)
[5] Darsono S 2007 Sistem Pengelolaan Air Hujan Lokal Yang Ramah Lingkungan *Berkala Ilmiah Teknik Keairan* Vol. 13, No. 4-Desember 2007
[6] EPA 2000. *Low Impact Development (LID) A Literature Review* (Washington DC: Office of Water)