

The Role of Public Spaces for Flood Management on the Mahakam Riverbank

Aliya Jauhari Hildayanti¹

¹ Department of Architecture, Universitas Islam Indonesia

¹ Email: 18512116@students.uii.ac.id

ABSTRAK: *Public spaces in urban areas are public spaces that are easy to adapt to relatively stable spatial planning patterns, but when facing climate change that has the potential to become extreme, these public spaces sometimes do not have the same adaptive capacity. Public space is an area that is vulnerable to climate, therefore public space requires relevant characteristics as an adaptation effort to the surrounding environment, this makes adaptation effective if it benefits the surrounding environment. The role of the public sphere and its benefits is as a gathering place for civilians, for social and economic exchange.*

This paper presents a challenge to analyze the role and function of the effectiveness of public spaces on the banks of the Mahakam river and how to manage floods there. This research was conducted using literature study and environmental observation methods such as collecting various data including documentation and learning from various books to papers that are used as a framework for overcoming various types of problems, issues, and crises in the public sphere in that place.

There are two important parts in this study. The first part contains the problem of flooding that has hit the banks of the Mahakam river in Samarinda City so that it has an impact on existing public spaces, while the second part tries to analyze existing data to find solutions in analyzing the role of public space in that place. It is hoped that through this paper we can understand how the role of the public space for flood prevention in rivers on the banks of rivers so that it can benefit the community in the present and in the future.

Keywords : Mahakam river, Public space, Flood Management

INTRODUCTION

The conditions in the landscape greatly determine the layout and spatial layout of a city to the part of the city's architectural formation. Spatial layout in public spaces adjacent to rivers is generally formed from the relation and context to the river which makes the structure of the urban environment. The river is one of the natural elements that have existed since the beginning of human civilization, which from this existence is used as an access space and a place for life activities around it. and human social life. A city is not an environment that is built in a short time but undergoes formation over a long period of time, as a whole it has undergone a transformation which cannot be separated from the accumulation at every stage of its development process.

The characteristics of the city are related to buildings and the rest are open spaces. What is meant by open spaces are zones that have never been built so that they can be developed by creating cities with sustainable themes, and some of them are zones related to public spaces. Public space that can be understood with two meanings, the first is the conceptual meaning, where this meaning is used in political and social science so that the public space can promote the life of the community around it, such as roads, sidewalks,

squares, coffee shops, parks, and Several places offer a wide range of useful services to their surroundings. Public space is a multidimensional space with a social, political, and cultural center as a spatial arrangement in the city. In the form of urban spatial planning, urban and spatial planners and landscape architecture understand very well the balance of nature and man-made by utilizing visuals, the environment and related to existing communities

The architecture of river cities in our country is thought to face 3 urban spatial problems, such as: First, the construction of river city architecture does not show the water base and the river context. Second, the density of urban space, especially in the city center, has disturbed river basins. Third, the threat of flooding due to poorly planned or systematize city drainage and increasing tides (rob) has affected river faces. Not only that, problems that often arise from the existence of public spaces near rivers are caused by human activities or human behavior which have a profound impact on spatial planning and natural changes, one of which is flooding. Floods can be caused by high rainfall, rising water levels, storms, environmental damage, silting rivers, the impact of sedimentation, and the narrowing of river channels.

This paper tries to analyze the important role of public spaces located on the river coast, and how or the role of these public spaces in responding to the handling of floods that often hit Samarinda, East Borneo. The variables of this research include the aspects of public space in the city to the surrounding environment and the flood management system which can be seen from the fast growth /density in the city, the lack of open land, and the capacity of the water surface in the city. The progress of urban development plays an important role in preventing or reducing damage due to flood disasters by managing existing public spaces to reduce existing vulnerabilities and integrate problems that have an environmental, social, and economic impact.

It is important to know some aspects of the problem that will be discussed in this paper to find out the solutions that will be available according to the data taken, in the form of social, ecological, and economic aspects such as how the social aspects affect the place so that it is avoided from flooding, how the ecological place is arranged so that can minimize the occurrence of flooding, and from an economic point of view, such as how the place uses materials to save the environment from flooding in the area's public space.

The result of the research is hoping to provide benefits for Academic activists to enrich the architectural domain of the waterfront city (urban waterfront) in the case of the role of public spaces that can handle flooding and as a reference for practitioners in reference to architectural development that carries out local, ecological and sustainable physical-spatial design of cities, for development policies cities that have river basins in the middle of cities in Indonesia to face challenges in the future This paper tries to analyze the important role of public spaces located on the river coast, and how or the role of these public spaces in responding to the handling of floods that often hit Samarinda, East Borneo. The variables of this research include the aspects of public space in the city to the surrounding environment and the flood management system which can be seen from the fast growth /density in the city, the lack of open land, and the capacity of the water surface in the city. The progress of urban development plays an important role in preventing or reducing damage due to flood disasters by managing existing public spaces to reduce existing vulnerabilities and integrate problems that have an environmental, social, and economic impact.

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LITERATURE REVIEW

The Study of Public Spaces and Waterfront of Public Spaces

The definition of public space, in brief, is a space that functions for community activities related to social, economic, and cultural. Human attitudes and behavior that are influenced by technological developments also affect the typology of planned urban space. Public space accessories that must be provided are increasingly developing, both in terms of design quality, materials, and treatments (Ninie, 2010).

This space is in the form of a port, beach, riverbank, lake, or pier. This open space is located along the water flow route in the city which was developed as a park for the waterfront (Torre. L.A, 1989). The immeasurable design criteria are criteria that emphasize more on the qualitative aspects in the field, this design criterion is to measure the quality of the city environment. According to Shirvani. H (1985: 57), the intangible design criteria among others:

Access

Access provides convenience, comfort, and security for users to reach their destination with transportation facilities and infrastructure that support ease of accessibility which are planned and designed according to user needs so that they can provide comfort and convenience in carrying out their activities. Facilities for this accessibility should in planning and design pay attention to the order, location, and circulation, dimensions (Lynch, 1976).

View

Landscape deals with aspects of its clarity related to the human orientation towards buildings. The View can in the form of a landmark. This visual value can be obtained from the scale and pattern and color, texture, height, and magnitude.

Identity

Identity is a value created or raised by objects (buildings/humans) so that it can be captured and recognized by human senses or also known as images. (Darmawan, 2003).

The characteristic quality has criteria in public space that contribute to flood management. These aspects are described in more detail by Benson, John F., And Maggie H, Roe, among others.

- Ecological Aspects: Development runs in harmony with processes that pay attention to the surrounding environment, both through conservation and protection of natural resources.

- Social Aspects: Development increases individual control over their lives so that each individual has a sense of belonging to a place. Besides that, it also pays attention to the cultural concept in which everyone is involved.
- Economic Aspects: Development efficiently in terms of the use of materials, utilization of energy, conservation of natural resources, and minimizing maintenance and maintenance costs.

The Study of Flood

A flood is an event of water overflowing from the boundary of a riverbank in a relatively short period of time or an event of stagnating water on the ground surface until it exceeds the limit certain time that results in losses. In the regions in Indonesia, floods occur most frequently and recur every year, especially during the rainy season. Until now, the problem of flooding has not been resolved and has tended to increase in frequency, extent, depth, and duration (Suripin, 2004).

Flood disaster is influenced by 3 (three) elements, namely elements meteorology, the physical characteristic elements of watersheds, and human elements. For meteorological factors, which have the effect of causing flooding are rainfall intensity, rainfall distribution, frequency, and the duration of the rain. While the physical characteristics of the watershed influence the occurrence of flooding in the area of the watershed, slope land, land elevation, land use, and soil texture. And humans play a role in the acceleration of changes in physical characteristics DAS (Suherlan, 2001 in Suhardiman, 2012).

According to Suripin (2004), the causes of flooding can be divided into 3 (three) types, such as:

- Flood of shipments
Flood flow that comes from upstream areas outside the area which was inundated. This happens if rain occurs in the upstream area causing a flood flow that exceeds the capacity of the river or existing canal floods, resulting in a runoff.
- Local flood (flood inundation)
The puddle that arises from the rain that falls in the area alone. This can happen if the rain that occurs exceeds the capacity of the existing drainage system. In local floods, the inundation height is between 0.2 - 0.7 m and the inundation period is 1 - 8 hours. This flood is found in low areas.
- Tob flood (high tide flood)
Floods can occur due to direct flow from high tide or vice versa, namely the return of water from drainage channels caused by obstruction by high tide.

Asdak (1995) states that the usual watershed is divided into upstream, middle, and downstream areas. An upstream area characterized as a conservation area, having drainage uptake higher, is the area with more slope large (greater than 15%), not a flooded area, the water use regulation is determined by the drainage pattern. While the downstream area of the watershed is an area of use, the density of drainage smaller, is an area with a small to very small slope (less than 8%), in some places is an area flood (puddle).

The Study Drainage for Flood Management Environmentally Friendly Drainage

Drainage management does not cause an impact that is detrimental to the environment. There are 2 (two) patterns commonly used to manage drainage in an environmentally friendly manner:

- a. Detention patterns (temporarily holding water), for example, with creating a detention pool holding pool.
- b. Retention patterns (infiltrate), among others, by making wells infiltration, infiltration channel, infiltration area, or infiltration pond retention pool.

A river is a channel on the surface of the land through which the surface runoff has a river basin (DAS), which flows from a high place towards the mouth of the sea. A river flows part of the water as a base flow from a collection of springs in its watershed starting from the mountainous area to the coast (sea). River Basin Unit is a stretch of the earth's surface that is flowed by a river which is determined by regulation.

Rivers and Channels

The channel through which water flows on the ground surface or below ground level.

- a. Rivers occur due to natural events in which water flows according to the morphology and in general, the flow is unsteady flow (flow that is not fixed).
- b. Whereas a channel is a flow where water is intentionally made by humans, in general, the flow is a flow steady flow (steady flow).

Urban Drainage System

It can be viewed from the following 2 sides:

- a. A river basin unit is a collection of tributaries located in a river basin unit which is classified as micro on the river order level 2 or 3 which are fully within the Urban administrative boundary.
- b. Urban Administrative is a collection of children's networks rivers and channels in each watershed where handling is the authority of the Regency Government or even the City Government as the capital of the Province.

Flood Control

Can be divided into the following 2 areas:

- a. For urban areas is an attempt to control flow floods the river that crosses the city so that the floodwater level does not beyond the right embankment and the left embankment
- b. (overflowed) which will cause flooding/puddle in the city.
- c. For watersheds is an attempt to avoid the occurrence of flooding on productive lands.

Urban Drainage Function

- a. Drying the part of the city area where the land surface is lower than inundation so that it does not cause a negative impact in the form of damage to city infrastructure and property public property.

- b. Drain excess surface water into nearby bodies of water as quickly as possible so as not to flood or inundate a City that can damage other than community property as well as infrastructure urban.
- c. Controlling some of the surface water due to rain which can be utilized for water supply and aquatic life.
- d. Infiltrate surface water to preserve groundwater.

Based on the division of authority, management, and service functions for urban drainage systems use the term as follows:

Local Drainage System (Minor Urban Drainage)

A local drainage system (minor) is a network of drainage systems that serve a particular city area such as complex settlements, commercial areas, offices and industrial areas, market and tourism areas. Approximately this system will serve an area of 10 hectares. The management of the local drainage system is the responsibility of the community, developer, or agency in each area.

Major Urban Drainage

The main urban drainage system is a drainage network system structurally consisting of primary channels that accommodate the flow from the secondary channels. The secondary channel accommodates the flow from the tertiary channels. Tertiary channels accommodate flow from their respective watersheds. The local drainage network can flow directly into the primary, secondary and tertiary channels.

Based on the physical, the drainage system consists of primary channels, secondary, tertiary as follows:

Primary Channel System

The primary channel is the channel that receives the input stream from secondary channels. The primary channel is relatively large because of the location of the most downstream channel. The flow from the primary channel is directly streamed to a body of water.

Secondary Channel System

An open or closed channel that functions to receive water flow from the tertiary channels and forward the flow to the primary channel.

Tertiary Channel System

Drainage channels that receive water flow directly from the sewers of houses. Generally, this tertiary channel is the left and right channel of the residential road. For water cities such as Palembang, Banjarmasin, and Pontianak it is rather difficult to determine and distinguish which rivers and drainage channels. Because the flow which is influenced by high tides sometimes rotates the direction of the flow. (Ari etc.,2015)

Flood Management Case Studies



Figure 1. Wave-breakers designed by Beth Gali, Architect, at the Zona de Banys del Fòrum in Barcelona.

Image credits: Maria Matos Silva, 26 April 2014.

There are cases of using several breakwaters, such as the one in the Zona de Banys del Forum in Barcelona, this place is understood as a multifunctional public space, as it not only requires an infrastructure function that can alleviate the sunagi waves but also includes the possibility of using it as a route for sightseeing and management the occurrence of flooding, these functions can be combined so that the design in aesthetically attractive sculptures can also save the environment.

In considering flood events, things are expected to increase in the extreme weather in the future. Public spaces that have designs taking into account these values provide an opportunity to connect people with water, which indirectly awakens the public to dare to be involved in loving nature, such as taking part in preserving the environment to minimize the risk of flooding. For Asley et al, the challenge of proper drainage systems for a changing climate is as important as technology.

Regional Characteristic

The study location is a bank area of the Mahakam River in the city of Samarinda with the following characteristics:

Geographically, Samarinda City is located at positions 116 15 36 -117 2416 east longitude and 0 21 18 -1 09 16 south latitude. The city is split by the Mahakam River, and has an area of 71,800 hectares with the following boundaries:

North boundary: Muara Badak and Tenggarong districts.

Eastern Borders: Kec. Anggana

Southern boundaries: Kec. Sanga - Sanga and Loa Janan.

Western boundaries: Kec. Loa Kulu and Tenggarong.

The Mahakam Watershed (DAS) is one of the areas in East Kalimantan which has an area of 8.2 million hectares or about 41% of the area of East Kalimantan Province. The Mahakam Watershed (DAS) covers an area of 77,095,460 ha covering the districts of West Kutai, East Kutai, Malinau, Kutai Kertanegara, and Samarinda city. Mahakam River is located in the Samarinda area of East Kalimantan. The Mahakam River has located at latitude 0o 35'0 "S 117o 17'0" E and the length of this river reach 920 km with an area of 149,227 km² and has a width of between 300-500 meters This river passes through the upstream West Kutai district to the Kutai Kertanegara district and Samarinda downstream.

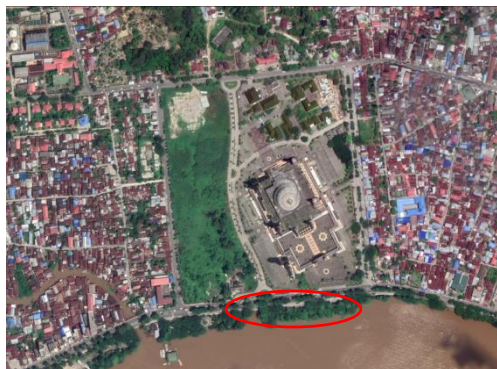
The Mahakam Watershed is the center of the activities of many parties, from the industrial sector, agriculture, forestry, mining, to the center of community economic activity. In addition, the Mahakam river, which is the center point of the Mahakam watershed, is the lifeblood of most of the people of East Kalimantan, especially those who are active and live in the watershed area Mahakam. The Mahakam River has played an important role in the lives of the surrounding communities as a source of water, fisheries potential, and transportation infrastructure. Besides that, the beautiful Mahakam river flow can be enjoyed by a number of tourist objects where we can be seen fauna such as porpoises and freshwater dolphins. Based on the RTRW of Samarinda City 2014-2034 Article 4 regarding the river border policy as referred to in paragraph (1) letter a: the Mahakam River border area with a width of 15 meters from the foot of the outer embankment is located in Sungai Kukung, Samarinda Seberang, Sambutan and Palaran Districts.

RESEARCH METHODS

This research was conducted with a literature study, how the understanding of public space can contribute to reducing the risk of flooding. This study is based on journals related to waterfront city architecture in Borneo, the role of public spaces in flood management, and adaptation to floods and climate change potential public spaces in urban areas. From the study of this journal, it was found that public spaces can be proven to prevent and reduce flooding that hit the area.

In addition, the researcher also conducted data observations to collect some data in the form of several pictures taking in the Islamic Center Park area to match things related to the criteria for location and flood management, where this data will be processed and adjusted based on the literature information that has been collected.

RESULT AND DISCUSSION



Source: Google Earth

The research scope at a green open space called Taman Tepian Islamic Center on the banks of the Mahakam river, Samarinda city with a length of 215m. Observations were made on the social, economic, ecological, activity patterns and socioeconomic aspects of the community related to the procurement and accessibility of infrastructure and facilities for green open spaces on the banks of the Mahakam river which could result in relationships in flood management based on risk management of the magnitude of flooding and flood vulnerability. Study locations are limited from:

a) West Boundary: Bus Stop Slamet Riyadi.



b) Eastern boundary: East Motorcycle Parking Area of Taman Islamic Center.



c) North boundary: Islamic Center Mosque.



d) Southern boundary: Mahakam River

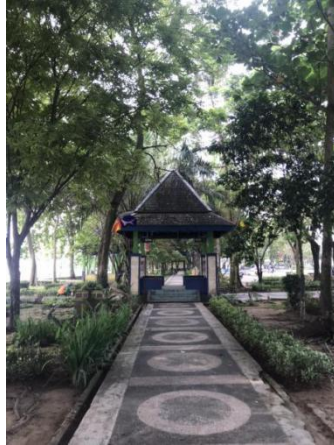


Source : Writer Documentation

Study Aspect Criteria

Social	There is a link between the landscape and the surrounding environment.	Economy	Landscape with attention on the selection of materials used.
Criteria	Green Open Space should pay attention to the social, cultural, and economic conditions owned by the local community.	Criteria	The use of vegetation compared to the use of concrete materials in order to increase the water catchment area. Open Space Green must pay attention to safety and comfort and be able to accommodate every human activity in it.
Ecological	A landscape that can influence the life and interactions of the people who live in it.		
Criteria	Development must run in harmony with processes that pay attention to the surrounding environment, through conservation as well as protection of natural resources such as the use of proper drainage for flood prevention.		

From the social aspect in Taman Islamic Center area pay attention to social culture, located in how this place provides gazebo as a place for gather community people, and the shape of it in accordance with the typical Kalimantan roof architecture that uses a triangle shape as a regional value of this place.



Source: Writer Documentation

Not only that, there are also several places provided such as a bench to sit and relax, with a view overlooking the Mahakam river as a linkage place and surrounding.



Source: Writer Documentation

In laying out a place for socializing, we can see a difference in height, this strategy serves to avoid flood waters to reach social area.

From the economic aspect this place there is a sign that it is prohibited to sell, this helps to preserve the existing garden so that it is kept clean.



Some of the pavements in this park use hardscape in the form of cement and some are custom made from gravel in a pattern so that it saves economically in the manufacture and maintenance of this place because this material is very economical and durable.



Source: Writer Documentation

And there is a softscape area as an area to absorb rainwater and some plants to trees that make this place more beautiful.



Source: Writer Documentation

This is evident from the difference in pavement used and the difference in height as a strategy for flood management. For pavement materials located in the lower area near the Mahakam river, cement is used, apart from being economical, durable, and highly resistant to water.



Source: Writer Documentation

From an ecological aspect, flood management used drainage as a dividend area between Taman Islamic Center and Mahakam river. There is 3 kind of drainage that provides in this area, such as :

-Retarding Basin



Source: Writer Documentation

-Polder Land



Source: Writer Documentation

-Special Drainage System Along River



Source: Writer Documentation

Retarding basins and polder land are included in the structural building for flood management it functions for risk reduction of the magnitude of flooding. For special drainage systems include structure system repair for reducing the risk of flood vulnerability.

From all the data that has been obtained, it can be seen that the Islamic Center Park is a public space located in the Mahakam Riverbank location so that it is included in the Waterfront public space category in accordance with Torre, LA's 1996 statement. There are several aspects that will be discussed regarding the design criteria that are not manifested in the public space, among others:

- Access

It can be seen that access to this place is very easy because it is strategic and located in the center of Samarinda, East Kalimantan. There is a car park along the side of the road, and a bicycle access path in front of the Taman Islamic Center road, not only that, vehicle access such as motorbike parking is also available at this place.

- View & Identity

For views, the Islamic Center Park has 2 landmark views that strongly show the regional identity of the city of Samarinda, namely the view towards the north-facing the Islamic Center, which is one of the largest mosques in Samarinda, and the Mahakam River which is in the south. the longest river in East Kalimantan.

In the discussion of floods that occurred in the Islamic Center Park area based on the literature obtained, this flood occurred because the location of this place was in the Mahakam River watershed, such as the intensity of rainfall and the length of rain. Based on Suripin, there are 3 types of causes of flooding, one of which is very suitable for the category of this area is Flood - Tob (tidal flood) because the direct flow of high tide causes this area to have the potential for flooding. The Mahakam River watershed is also included in the category of upstream areas characterized as conservation areas, has a higher drainage absorption, is an area with a greater slope (more than 15%), is not a flooded area, water use

regulation is determined by drainage patterns so that the location this is quite safe from frequent flooding.

In the discussion of drainage for flood management, environmentally friendly flood management can be seen from the detention pattern that lies between the boundaries of the Mahakam river and the Islamic Center Park, namely how three types of drainage can work together in flood management and retention patterns located in the parking area. This itself is how some open spaces have water catchment areas that can minimize the risk of flooding. The Mahakam River is included in the category of rivers occurring due to natural occurrences where water flows according to its morphology and in general, the flow is an unstable flow (irregular flow) because this river is not formed / man-made but has existed since ancient times, and is preserved until now. For this type of drainage in urban areas, DAS has the authority of the Regency Government or even the City Government as the capital of the Province.

Flood control is included in the DAS category because it is located in the Mahakam watershed, for the drainage function obtained on an urban scale is to drain excess surface water into the nearest water body as quickly as possible so as not to flood or inundate the City which can damage other than community property and urban infrastructure and infiltrate surface water to preserve groundwater.

Based on the function of authority, drainage in the Islamic Center Park is included in the Main Urban Drainage, because the drainage system with a local drainage network can flow directly to the primary, secondary and tertiary channels. The Islamic Park itself is included in a relatively large primary channel system because of the location of the most downstream channel. The flow from the primary channel flows directly to the water body.

CONCLUSION

Based on the conclusion drawn, floods that occur in public spaces in areas close to riverbanks occur due to rainfall intensity, duration of rain, and tidal flows that have the potential to cause flooding.

In controlling floods that occur in public spaces, it can be put in place how public spaces have a good drainage system on the boundaries of riverbanks, and in the public space itself.

A good public space is a public space that maximizes the use of its functions for the local community, if the public space is in an area prone to flooding, the local government must be responsive to issues in the area so that the public space can be enjoyed by its users. As an architect, of course, you can help think critically to understand the obstacles that occur and provide good solutions to solve problems in the area based on the scientific field that has been studied.

Recommendations and suggestions that can be given to future researchers are to examine how the next researcher can learn more about the various types of drainage suitable in each place to follow up on the same issue in different locations because different places can also have different solutions than the same problem in the public space.

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