ISSN No:-2456-2165

Healthy Homes through an Ecological Architecture Approach (Case Study: House on the Banks of the Krukut River, Central Jakarta)

Vanessa Yulianti Hasman[1], Ramos Pasaribu[2]
Master of Architecture Student of Universitas Kristen Indonesia[1]
Lecturer of Ecological Architecture, Master of Architecture Study Program,
Christian University of Indonesia[2]

Abstract:- Population growth from year to year is increasing so that people need a place to live. Residents use the land beside the river to build houses. On the banks of the Krukut river, permanent wild houses were also built. One of the houses used as a case study has problems in terms of ecological architecture. This problem is seen in the aspects of design, function, and technology. The design problem can be seen from the messy shape of the house, the making of makeshift insulation from plywood, and the walls of rusty tin. Functional problems can be seen from the absence of green land in the area of the house that is used as greenery. All land is made of pavement. In addition, the function of the window as ventilation and natural lighting looks very minimal so that the house becomes dark and humid. The technological aspect is also not visible in the house, causing a negative impact on the surrounding environment. The purpose of this study is to humanize humans both in the house and around the house. The solution in the concept of ecological architecture is to design buildings that are good for humans as residents and relationships with the surrounding environment. It is important to note that the relationship between buildings, humans, and the surrounding environment runs harmoniously.

Keywords:- *River side house, Eco- architecture concepts.*

I. INTRODUCTION

Population growth in Indonesia is increasing from year to year, especially in the DKI Jakarta area, the capital of the country. According to the DKI Jakarta Statistics Management Unit, the total population of DKI Jakarta in 2019 reached 11,063,324 people with an area of 662.33 km^2. The most populous area is in the Central Jakarta area with an area of only 48.12 km^2 with a population of 1,149,176 people. So that the population density in Central Jakarta reaches 23,877 people / km^2.

With a fairly high population density in Central Jakarta, the need for residential housing has also increased. The increasing need for residential houses has caused many poor people to make houses in any place, one of which is on the banks of the Krukut river. According to the Regulation of the Minister of Public Works and Public Housing of the Republic of Indonesia Number 28 / PRT / M / 2015 concerning the Determination of the River Boundary Line and the Lake Boundary Line, Article 7 which reads "*The boundary line of the river is interlocked within the perkutaan area as intended in Article 4 paragraph (2) letter c, is determined to be at least 3 (three) meters from the outer bank of the foot of the embankment along the river*" and Article 15 paragraph 1 which reads " *In the event that the results of the study as referred to in Article 14, show that there are buildings within the river border, the buildings are declared in the status quo and must gradually be put in order to restore the function of the river border.*"

The beds built independently by the residents use only makeshift materials. The bedhouse was built without thinking about the architectural aspects. Window openings are so minimal that air and light are difficult to get into the room. The partitions of the rooms use weathered plywood material. This is very uncomfortable and endangering its residents.

In addition to the inconvenience factor and endangering the residents, the bed house also has an impact on the environment. Because this bed house was built without a mature design, the sewage water and air disposal system is very disturbing to the environment and surrounding residents. Wastewater is simply thrown into the river, garbage is placed on the river embankment and even thrown into the river. The use of an already fragile plywood bulkhead also causes the sound from inside to be heard coming out.

To improve the quality of human life in the Krukut riverside house, it is necessary to analyze the quality of the house through an ecological architecture approach. By analyzing the house, it is hoped that it can be a solution so that humans can live more decently in the house. In addition, in order to create harmony between the riverside house and the surrounding ecosystem.

ISSN No:-2456-2165

II. FOCUS AND SCOPE

This research will focus on 1 (one) house on Jalan Pembangunan, North Petojo Village, Gambir District, Central Jakarta. The house measures 20 meters x 12 meters, consisting of 2 floors. The house functions as a boarding house for singles and families. The location of the house is right beside the Krukut River.

Fig. 1: The location of the case study

Source: https://maps.google.com Analyzed Author

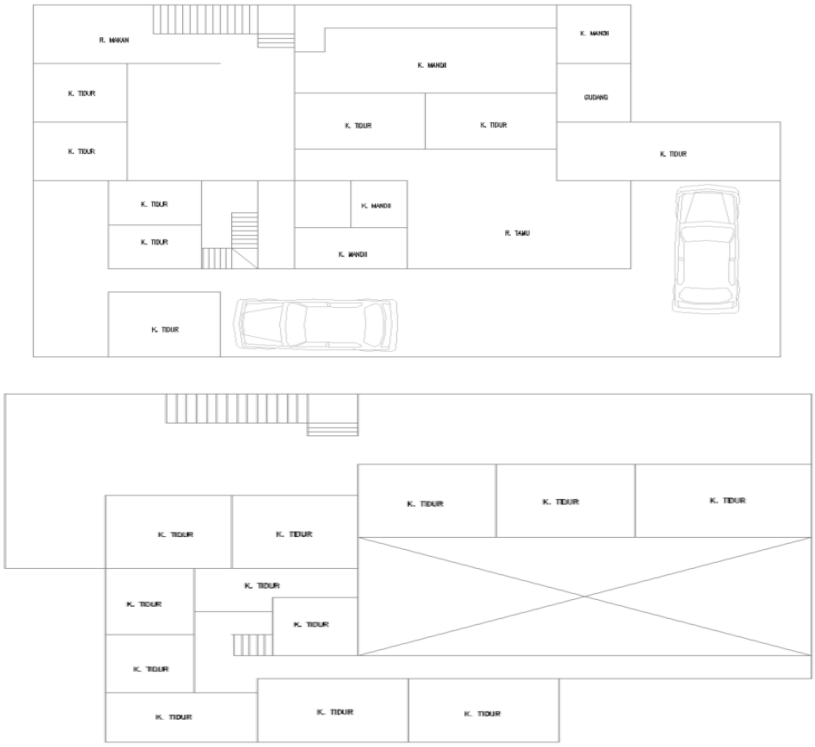


Fig. 2: 1st floor and 2nd floor plans

Source: personal documentation

The research was conducted through an ecological architecture principle approach to analyze krukut riverside houses. According to Heinz Frick, There are 4 elements of ecological architecture, namely Air, Water, Earth, and fire. So in this study will review the problems of healthy and ecological buildings, including:

- Design Aspects
- Aspects of Function
- Technology Aspects

ISSN No:-2456-2165

III. LITERATURE REVIEW

Amos Rappoport says that "Architecture is a space in which people live, which is more than just physical, but also concerns basic cultural institutions." Meanwhile, according to N.H.T. Siahaan in his book entitled Environmental Law and Development Ecology (2004), "ecology is a branch of science that finds out the relationship of organisms or living things to the surrounding environment." So ecological architecture can be interpreted as a science of planning and designing a building / area that in its design pays attention to the conditions of the surrounding environment in order to create a harmony between the building / area and the surrounding environment.

According to Heinz Frich, ecological architecture cannot determine what happens in the field of architecture, because in it there are no special binding properties as a certain standard. Ecological architecture is the harmony of the relationship between humans and the surrounding nature.

The criteria for healthy and ecological buildings based on Heinz Frick include:

- Creating a green area between building areas
- Choosing a building site that suits its designation
- Using locally made building materials
- Using natural ventilation inside buildings
- Choosing the surface of the walls and ceiling of the building that can drain moisture
- Ensuring buildings do not have a negative impact on the environment
- Using renewable energy
- Creating buildings that can be used by all ages

IV. RESEARCH METHOD

This research method uses qualitative descriptive methods. The first stage is to designate and review the location of the case study. During the review, primary data collection was carried out related to physical conditions and the surrounding environment. The data obtained will be studied micro-scale problems, namely the relationship that occurs in the house and the impact of the house on the surrounding environment. The second stage is the collection of secondary data in the form of a review of theories related to riverside houses and the theory of ecological architecture. Secondary data can be from books, journals, articles, and official websites. The third stage is the process of analyzing case studies with an ecological architecture approach and finding the best solution to overcome problems on a micro scale.

V. RESULTS AND DISCUSSION

In analyzing the case study of this study, 5 of the 8 principles of healthy and ecological building based on Heinz Frick were used.

A. Creating green areas between building areas

Green areas in residential houses have been listed in Presidential Regulation no. 60 of 2020 concerning urban area spatial plans point 38 which reads "The Green Area Coefficient, hereinafter abbreviated as KDH, is a percentage of the comparison between the area of all open space outside the building intended for landscaping/greening and the area of mapping land/planning areas that are controlled according to spatial plans and building and environmental plans."

The case study site has no green land at all. The front of the house is given a pavement that is used for parking motor vehicles. This has violated the existing rules where each house must have a Green Land Coefficient of at least 10% of the total land area.

Fig. 3: The front of the building case study

Source: personal documentation

ISSN No:-2456-2165

B. Using locally made building materials

The case study building uses simple materials that are around or perhaps also used items that are reused. The 2nd floor of the building is just like a bed with room partitions. The outside uses Zinc material, the room partitions use plywood, the ceiling also uses plywood, and the roof uses clay tiles.

Fig. 4: Side view of the case study building

Source: Personal documentation

The zinc condition is already very rusty. Rusty zinc is brittle and easily soluble. The chemical compounds in rusty zinc will be carried away by the wind and spread. Rust compounds carried by the wind can stick to food and be swallowed by humans. This can cause health problems in humans such as abdominal pain. If it rains, rainwater will carry chemical compounds in rust and can spread to the surrounding environment, especially absorbed into the soil and can cause the soil to become poisoned and make plants not thrive.

Inside the room partitions use plywood. Plywood is also easily damaged. The ceiling also uses plywood material. We can see that the plywood installed on the ceiling is damaged and fragile. This endangers residents because at any time the ceiling can collapse and fall. In the rainy time, there was also a leak in the house.

Fig. 5: The condition of the ceiling that has been damaged

Source: personal documentation

C. Using natural ventilation in buildings

A case study building is a building that is made as is and without good design. So that in the building it feels very stuffy because the ventilation system is not designed properly. The rooms are hermetically sealed or there are few openings.

Fig. 6: Wrong condition 1 bedroom

Source: personal documentation

ISSN No:-2456-2165

In addition to air, ventilation openings can also function for the entry of sunlight into the room. Sunlight is great for humans and room conditions. A room that gets enough sunlight will reduce air humidification, reduce mold, and the room becomes brighter and more comfortable. In the case study room, there is only a slight opening with the rooster. The position of the rooster is on the very top side of the wall. This makes the direction of the sun orientation unable to enter the room properly.

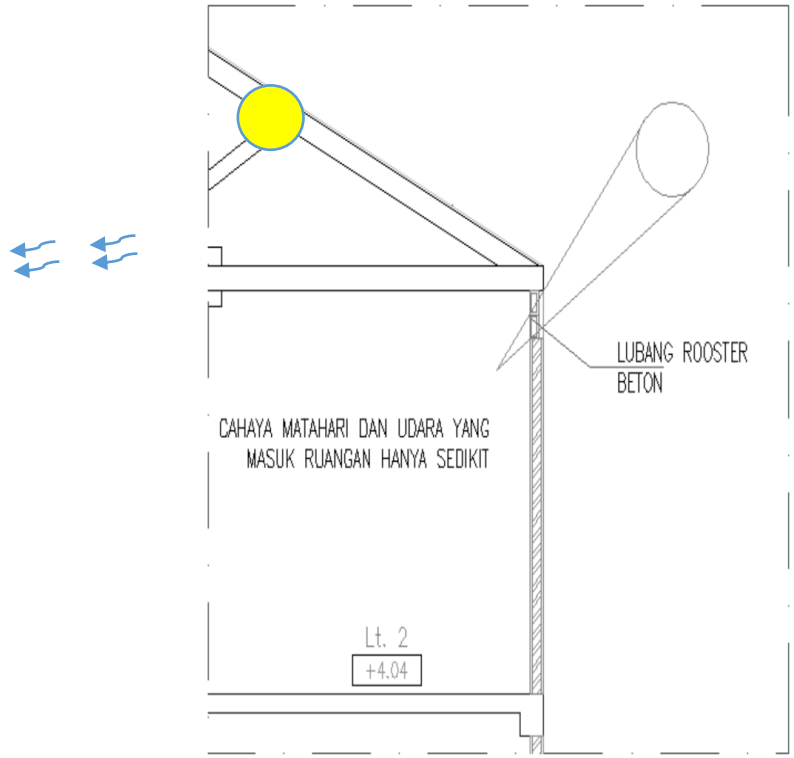


Fig. 7: Very minimal air ventilation & lighting

Source: personal documentation

ISSN No:-2456-2165

D. Ensuring that the building does not cause environmental problems

A good building will not harm the surrounding environment. In this case study building, there are several things that have a serious impact on the surrounding environment, especially the problem of waste disposal.

The first is the disposal of household waste. This garbage waste is dumped by the river and left alone. Sometimes, garbage is also thrown into the river. This is not very good for the environment. In rivers and sides of rivers full of garbage can cause flooding.

Fig.8: Conditions of garbage disposal on the sides of the river and in the river
Source: personal documentation

The second is the disposal of dirty water waste. Dirty water waste is directly flowed into the sungat without any filter. This makes the river water cloudy and black. A pungent smell also wafted along the side of the river.

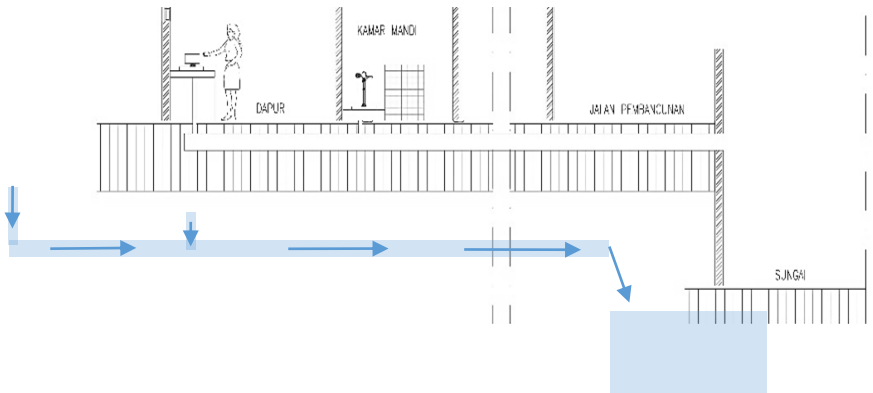


Fig. 9: Conditions of wastewater discharge in rivers

Source: Personal documentation

ISSN No:-2456-2165

The third is the removal of smoke. The inhabitants of the house actively emit smoke as a result of their activity. There are 3 types of smoke produced, namely cooking smoke, smoked smoke, and smoke from motor vehicles. The smoke spread to the surrounding environment and disturbed the comfort of the environment.

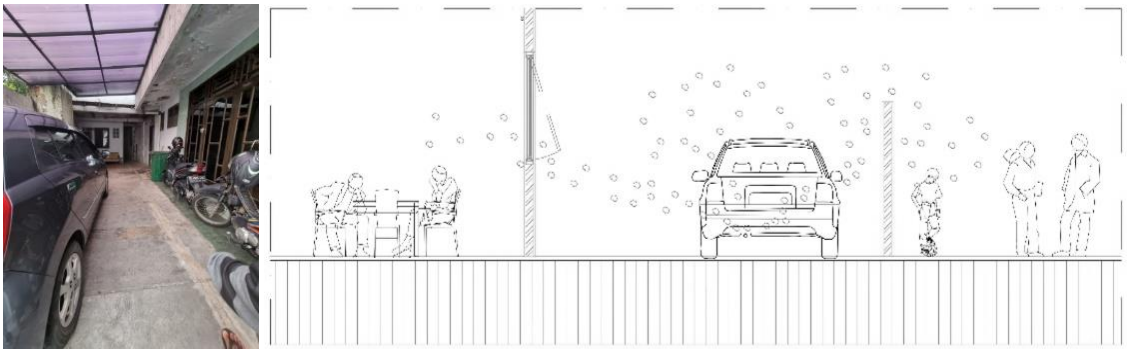


Fig. 10: Smoke removal conditions of motor vehicles

Source : personal documentation

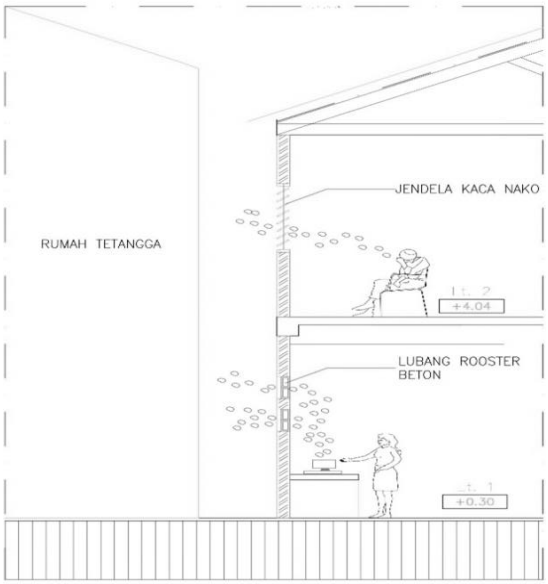


Fig. 11: Exhaust conditions of cooking smoke and cigarette smoke

Source: Personal documentation

ISSN No:-2456-2165

E. Choosing the appropriate building site

The location of the case study site is on the river bank and is less than 3 meters away. The river bank is a green area that is not allowed to be built buildings except for water resource infrastructure buildings. So this building is against the rules because it should be the site of this location is supposed to be the green open space (RTH) of the city.

VI. DESIGN SOLUTIONS, FUNCTIONS, TECHNOLOGIES

One of the roles of the architect is to apply the principle of humanizing people and creating environmentally friendly buildings. To overcome problems in case study buildings, solutions can be given from the design aspect, function aspects, and technology aspects. Solutions to aspects of design, function, and technology can be summarized in the table below:

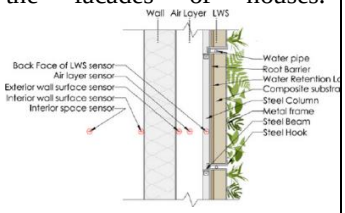
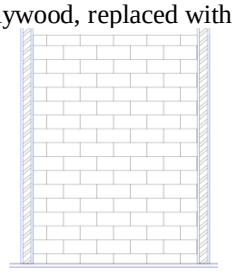
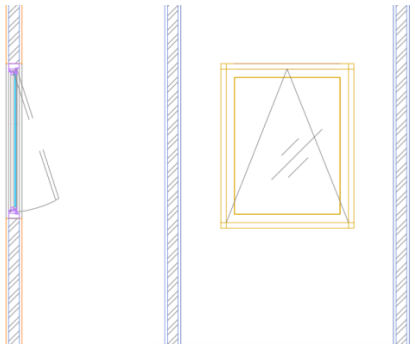
Problems in case studies	Design Solutions	Function Solutions	Technology Solutions
No KDH	Creation of a garden on the lawn. 	The function of creating a garden on the front lawn is as a greenery. The pavement part is also changed to a paving block, its function is so that water can seep into the ground	The latest technology of making vertical gardens on the facades of houses.  West Sumatra : google.com
Hazardous building materials	Zinc, plywood, replaced with bricks 	The function of bricks will make the building more sturdy.	There is a new technology that is to use mud for construction concrete. But it is necessary to test the river mud to be used as concrete for buildings. (e.g.: sidoarjo mud)
Lack of ventilation / openings	Rooster replaced with windows 	Rooster is replaced with swing windows and clear glass, so that its function is more optimal, namely to make sunlight and fresh air will enter inside.	Installed exhaust fan as an artificial technology to suck or remove air from the room.
Does not cause environmental problems	Made wastewater treatment system  West Sumatra : google.com	The function of wastewater treatment is so as not to pollute the river.	Wastewater treatment systems are one of the modern technologies used to reduce environmental pollution.

Table 1: Solutions to design, function, and technology aspects

Source: personal documentation

ISSN No:-2456-2165

VII. CONCLUSION

In this analysis, it can be concluded that the building in the case study is not a good and healthy building. The building still has a bad impact on the residents in it as well as for the surrounding environment. In the design aspect, it looks like a patchwork building and not well designed. The solution is to design well to make residents and the surrounding environment feel safe and comfortable. In terms of function, it can also be done by providing greening to the front yard of the house so that the greening function can be achieved. In addition, pavement on the lawn can be replaced by paving in order to absorb water. The function of windows that have not been seen in the house, can be improved by making openings that are large enough so that sunlight and air can enter inside freely. Meanwhile, in the technological function, it can be proposed to install a water filter so that the water discharged becomes safe for the environment and the installation of an exohaust fan so that air exchange occurs better. With an approach from the concept of ecological architecture, it is hoped that it can better humanize the humans in it and can minimize negative impacts on the surrounding environment.

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Author CV1

Name : Vanessa YuliantiHasman, S.Ars

Date of Birth: Jakarta July 13, 1991

Office Address: BPK Penabur. Jl. PangeranDiponegoro No.78, RT.2 /RW.6, Kenari, Kec. Senen, Central Jakarta City, Special Capital Region of Jakarta 10430

Contact : 081932374508

Email : vanessa.yulianti@gmail.com

Author CV 2

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Name : Dr. Ramos P Pasaribu. ST., MT.

Place of Birth date : Jakarta 09 December 1968

Address : Jl. Dr.Muwardi II D No.8 Grogol Jakarta Barat 11450

Contact : 081293462236

Email : ramos.arsitekview@yahoo.com