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CONCEPT OF ECOLOGICAL ARCHITECTURE ON THE DESIGN AND CONSERVATION OF LAKE ISTN JAKARTA

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Abstract: Within the life of the academic community on campus, especially for students, there are various activities in addition to the main activities, lectures. These other activities require facilities that support continuity of activities that can also increase the development of students' interest, passion, and talent. One of the locations on the National Institute of Science and Technology (ISTN) campus that can be used for one of the activities is a lake located in the middle of the campus but has not been designed to be able to utilize the potential of the lake optimally. Moreover, the position of the ISTN lake located in the urban area of South Jakarta is expected to be maintained as a water catchment and physically classified as natural reservoir. As a consideration for the design, it is necessary to pay attention to the condition of the lake that is starting to be concerning because the shallower the depth of the lake and the smaller the area of the lake due to the absence of plastering while paying attention to the ecosystem. How would the design be able to utilize the potential of the lake for various activities, as well as lake conservation in order to maintain it as a natural water catchment and reservoir. For this reason, lake design is directed to the utilization of lake potential and lake conservation aimed at seeking the use of the lake for academic and community activities and the realization of the sustainability of biological natural resources and the balance of ecosystems. In the design above will be implemented the concept of Ecological Architecture that seeks to do environmental arrangement by utilizing the potential or natural resources and use of technology based on environmentally friendly ethical management

Keyword: Conservation, Lake, Ecological architecture

INTRODUCTION

The environment of the National Institute of Science and Technology (ISTN) campus located in Jagakarsa sub-district, South Jakarta, has a lake area of 3 hectare, which is currently maintained as a water catchment area. In addition, lake ISTN is one of the lakes that are well maintained, such as Setu Babakan and Setu Mangga Bolong which are located not far from lake ISTN. The existence of this lake is very important, because it indirectly also serves as the green 'lungs' of Jakarta, especially South Jakarta, which serves as a buffer for green areas balancing Jakarta's air pollution as well as water catchment. Maintaining the existence of the lake in the ISTN campus environment to remain an open space and water

catchment is a concrete form of ISTN participation in the adequacy of green open space This refers to the Law of the Republic of Indonesia number 26 of 2007 on Spatial Arrangement, stipulated that at least 30% of the city area is filled with open space. In addition, the existence of open space today is very necessary, especially for the denizen of Jakarta who continue to grow every year. The open space in Jakarta area is essentially an effort to control the increasingly critical urban physical environment by sources which caused environmental degradation such as increased air, water and soil pollution.

Another reference in the development of this lake is the results of previous research on people's perception of lake ISTN, where research results show that most academic community and communities want the existence of this lake physically and can use it as a public space. For that, it is necessary to arrange the lake to maintain the function of the lake and increase the utilization of the lake. As for the details, most of the academic community and the people expect the preservation of the lake accompanied by the desire to make lake ISTN as a space of interaction and recreation, in addition to the action to beautify the lake with the completeness of its facilities. As for the expectation of the design of lake academic community and the people expect lake ISTN facilities to have jogging tracks, park spaces that can accommodate gathering and relaxing activities, and have lake ISTN facilities for recreation and water sports.

Currently, the lake area on the ISTN campus has not been developed as one of the activity spots and recreation areas of the academic community, in addition to the arrangement of landscaping around the lake. The utilization of the lake is merely used for rowing activity, other activity units and other student and academic community activities have not optimally utilized the lake and its environment. In addition, it is hard to access the lake, and the lake tends to reduce the area due to weeds and sediments and the absence of plastering.

Going from the conditions mentioned above, how would the design of the lake be directed at the utilization of lake potential and lake conservation which aimed at seeking the utilization of the lake for the activities of the academic community and the people, and also the realization of the preservation of biological natural resources and the balance of their ecosystems.

The concept of Ecological Architecture, which is an ecological concept in environmental arrangement by utilizing the potential or natural resources and the use of technology based on environmentally friendly ethical management, is considered appropriate for the design of lake ISTN which seeks to utilize the potential of the lake while maintaining the sustainability of the lake. Based on the above condition, the design of lake ISTN will be directed at the utilization of the potential of the lake and the provision of facilities around the lake as well as the conservation of lake functions, by applying ecological architecture.

LITERATURE REVIEW

Ecological Architecture

Ecological Architecture is a concept that combines environmental science and architectural science. Ecological Architecture has a primary orientation on development model that focuses on the harmonious balance of the natural environment and artificial environment between environment, humans, and buildings (Yuliani, 2013).

Ecological design creates green buildings that, according to Brenda and Robert Vale (1996), will have the following principles;

- **Energy saving**
  Operationally running a building with minimal use of energy sources that are already very rare or take a long time to be produced again.
- **Utilizing conditions and natural energy sources**

Through the approach of*Green architecture*and*Bioclimatic design*, buildings adjust and adapt to the climate, environment, and surrounding circumstances whether it be when planning, building, or operating.

- **Respond to site conditions on building**
  Planning refers to the interaction between a building and a site. It is meant for the existence of buildings, both in terms of construction, shape and operation of buildings, does not damage the surrounding environment. So, if the building were not to be used, the original site is still there and has not changed much.
- **Pay attention to building users**
  In designing a building, we must pay attention to all building users and meet the needs, health, and comfort of building users.
- **Minimize new resources**
  A building should be designed by optimizing existing materials which are not harmful to the ecosystem by minimizing the use of new materials, where at the end of the building life, it can be reused to form another architectural order.
- **Holistic**
  A building must be thought of as the system of the universe, whether physical, chemical, biological, social, economic, mental-psychic and language and all its completeness should be viewed as whole and not a unity of separate parts.

Another ecological approach in architecture that is according to Frick (1998) is that eco-architecture includes harmony between humans and nature. Eco-architecture also contains dimensions of time, nature, socio-cultural, space, and building techniques. Eco-architecture is complex, containing parts of biological architecture (humanity and health), as well as development biology. Therefore eco-architecture is holistic and contains all fields. Elements of ecological architecture according to Heinz Frick and Suskiyatno (1998) are:

1. Air, which is essential for survival, has a close relationship with breathing in which oxygen is contained and needed by living things.
2. Water, which is one of the earth's forming elements, is needed for survival.
3. Soil/earth, which is also very vital for survival. In addition to footing, soil/earth also functions as a source of life by means of farming.
4. Fire, which is the energy used to burn.

Principles of Ecological Architecture of Heinz Frick has several principles of ecological buildings which include:

1. Adaptation to the local natural environment,
2. Save non-renewable natural energy sources and save energy use,
3. Protecting environmental resources (air, soil, water),
4. Maintain and improve natural circulation,
5. Reducing dependence on central energy systems (electricity, water) and waste (wastewater and garbage),
6. Possibility of residents to produce their own daily needs,
7. Utilizing natural resources around the planning area for building systems, both related to building materials and for building utilities (energy sources, water supply).

Conservation

Conservation is defined as an effort to manage natural resources wisely based on the principle of preservation. Natural resources are biological elements consisting of vegetal natural resources (plants) and animal natural resources with non-biological elements around them which as a whole form an ecosystem.

Meanwhile, according to the Kamus Besar Bahasa Indonesia, conservation of biological natural resources is the management of natural (biological) resources by using

them wisely and ensuring continuity of supplies while maintaining and improving the quality of their diversity values. This definition is also stated in the Law of the Republic of Indonesia concerning Conservation of Biological Natural Resources and Their Ecosystems Article 1 Number 5 of 1990.

The purpose of conservation is stated in the Law of the Republic of Indonesia Number 5 of 1990 concerning Conservation of Biological Natural Resources and Their Ecosystems, which aims to achieve the realization of the preservation of living natural resources and the balance of their ecosystems so that they can better support the efforts to improve community welfare and the quality of human life. Other than the purposes above, conservation measures contain other objectives such as:

1) Preservation which means protection of natural resources against commercial exploitation, to extend their use for study, recreation and water use purposes,
2) Recovery or restoration, namely the correction of past mistakes that have endangered the productivity of conserving natural resources,
3) The most efficient use possible. For example, food technology must make the best use of rambutan seeds, mango seeds, snake fruit seeds, and others which actually contain organic materials that can be processed into food ingredients,
4) Reusing (recycling) waste materials from factories, households, drinking water installations, and others, Modern waste management is still awaited,
5) Find substitutes for equivalent natural resources for resources that have diminished or completely depleted. Nuclear power replaces petroleum,
6) Deciding the most appropriate location. The best way in selecting natural resources to be used optimally,
7) Integration, which means that in the management of resources, various interests are combined so that there is no waste, or that one harms the other. For example, the use of springs for a city does not have to sacrifice the interests of irrigation for rice fields.

The conservation benefits are realized by:

1) The preservation of natural and environmental conditions, which means that conservation efforts are carried out by maintaining the conservation area.
2) Preventing disasters due to natural changes, which means disturbances to flora and fauna and their ecosystems in particular and natural resources in general, causing changes in the form of damage or decrease in the number and quality of these natural resources.
3) Preventing living things from extinction, means that if the disturbances that cause the decrease in the number and quality of living things continue to be left without any control, it will result in these living things leading to extinction.
4) Being able to realize the balance of the environment, both micro and macro, means that in an ecosystem there is a close relationship between living things and their environment.
5) Being able to contribute to science, means that conservation efforts as a means of preserving flora and fauna are supporting cultivation, a means to study extinct and non-extinct flora and fauna from their nature, potential, and use.
6) Being able to contribute to tourism, means that its characteristics and objects are ideal areas for recreation or nature tourism.

Ecosystem

In this life there is a reciprocal relationship between humans, plants, and the place where they grow. This relationship between living things and their environment forms an ecological system known as an ecosystem.

In the 1997 Environmental Law, the ecosystem as a unified arrangement is a very complete and comprehensive way between all elements of the environment to influence each other. These environmental elements can be called biotic elements, both in living things and inanimate objects in them. Everything is arranged into a single unit in an ecosystem, each of

which does not stand alone, but must interact with and influence each other so that they cannot be separated.

Ecosystem is an ecological system formed by the inseparable interrelationships between living things and their environment. In an ecosystem, organisms in the community will develop together with the physical environment as a system. Thus, these organisms will adapt and influence the physical environment for survival.

There are several opinions regarding ecosystems according to experts, according to Mulyadi (2010, p.1) said, "The term ecosystem was first introduced by Tansley (1935). He argued that the reciprocal relationship between biotic components (plants, animals, humans, microbes) and abiotic components (light, air, water, soil, etc.) in nature is actually a relationship between components that make up a system". According to Tansley (1935), in Mulyadi (2010 p. 1) : "Ecosystem is a reciprocal relationship between biotic components (plants, animals, humans, microbes) with abiotic components (light, air, water, soil) in nature, actually a relationship between components that make up a system. This means that both in structure and function, these components are an inseparable whole. As a consequence, if one component is disturbed, the other components will sooner or later be affected. Tansley mentions this natural system as an ecological system or ecosystem"

Meanwhile, according to Soemarwoto (1983), ecosystem is an ecological system formed by the reciprocal relationship between living things and their environment. This organizational level can be regarded as a system because it has components with different functions.

Regarding the architectural design of an ecosystem, according to Heinz Frick (2007), the principles of ecological architecture are responding to the local climate, minimizing energy use, utilizing local materials, providing energy sources, water, waste disposal, and using effective and appropriate humane technology.

METHODS

Design and conservation of lake ISTN Jakarta by applying the principles of Ecological Architecture using qualitative descriptive methods starting from literature studies related to data and theories regarding the principles of Ecological Architecture through books, articles, journals, and data obtained from the internet. The discussion in the research focuses on the design and conservation of lake ISTN in Jakarta with the concept of Ecological Architecture. Meanwhile, related to the principles of Ecological Architecture, it is guided by the principle of being able to respond to the local climate, the principle of using materials to minimize energy, the principle of using an effective and appropriate humane technology, the principle of preserving environmental resources, and the principle of forming a complete circulation in the supply and disposal of water (Frick & Suskiyanto, 2007) and the principle of responsiveness to site conditions (Brenda & Vale, 1991). The five principles used are then used as guidelines in the process of analyzing the shape and mass structure of the lake environment, selecting materials, and treating regional water.

RESULTS AND DISCUSSIONS

Existing condition

Lake ISTN has an area of 3.5 ha with a depth of 5-8 m In the rainy season while in the dry season the lake area is 3 hectare with a depth of 3-5 m. The current function of the lake is as an open space and is used for water sports and the distribution of fish seeds is often carried out, but there is no cultivation for
fish yet.

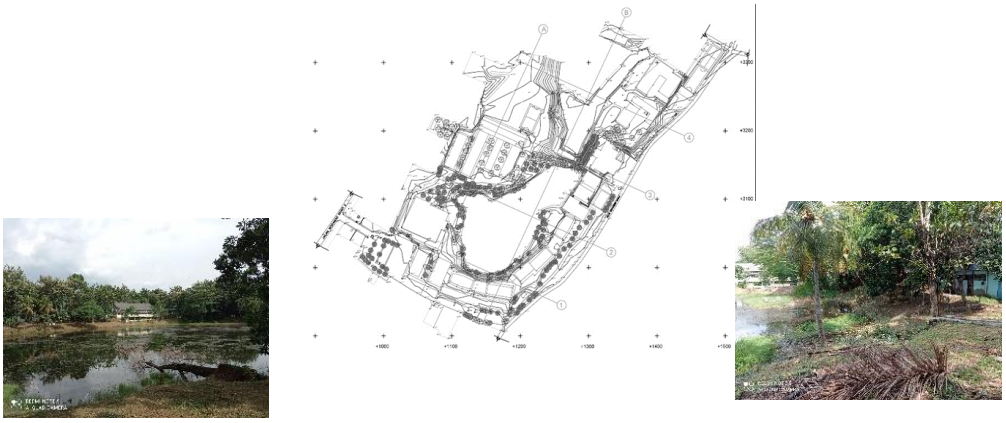


Figure 1. Condition of the lake and the surrounding area of lake ISTN

Problems in lake revitalization and optimization

1. The occurrence of lake sedimentation and weed growth
2. The potential of the lake has not been utilized for supporting activities
3. Poor maintenance of conditions around the lake from garbage and dirt
4. There is no access around the lake in order to have easy maintenance
5. The plastering has not been done
6. Water sources from springs need maintenance and sustainability

Development Potential on Lake ISTN Masterplan

In the Design and Conservation of Lake ISTN, Jakarta uses the theme of Ecological Architecture design, which is implemented both on a macro and micro level. The potential development of facilities and infrastructure is in accordance with Table 1: Potential Development of Facilities and Infrastructure around the lake

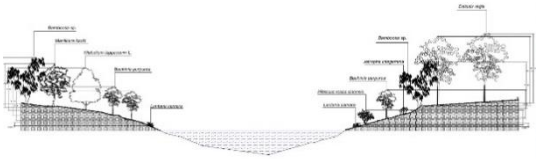
ACTIVITY GROUPING	FACILITIES REQUIRED	DESIRED OBJECTIVES
Recreational	• Playground • Jogging Track • Fishing	Providing recreational facilities for the academic community and the people
Sport	• Rowboat dock • Provision of an area for land sports, in the lakeside • Provision building for rowing sports equipment	Provide a water sports arena (rowing) and its facilities and other sports on the lakeside
Support Activities	• Entrance area arrangement for events • Lakeside Amphitheater Construction • Lakeside canteen	Assist with regional facilities and infrastructure.
Education	• Access from the classroom to the lakeside • Lakeside gazebos for student discussions with wifi facilities	Optimizing the function of the lake for improving the teaching and learning process
Technology Application	• Exposure to electricity from solar panels and hydropower • Waste treatment technology	Application of efficient technology, to open the insight of academic

		community
Lake area service	• Water control tub • Waterflow between lakes • Waste Management • Mini arboretum	Organizing the regional water system so that it is organized and sustainable
Protecting the Ecosystem	• Distribution of fish seeds • Planting bird-attracting tree • Ecotech garden • Cleanup • Cleaning weeds • Plastering • Protect the spring and its flow	The ecosystem is maintained and there is no reduction in the area of the lake

Table 1: Potential Development of Facilities and Infrastructure around the lake

Application of Macro and Micro Ecological Architecture

The planning and development of lake ISTN which is directed at the conservation of the function of the lake as well as the application of macro and micro ecological architecture will respond to natural conditions and the surrounding natural environment. The application of Ecological Architecture has been implemented in the design as shown in Table 2: Application of Ecological Architecture at Macro level and Table 3: Application of Ecological Architecture at Micro level.

MACRO APPLICATION OF ECOLOGICAL ARCHITECTURE	
Principles of Preserving Environmental Resources And Responding To Site Conditions Adding greenery, so that it will enrich the local ecosystem and keep the lake natural with the application of an Ecotech garden or an environmentally friendly park and the technology to maintain water conditions. The types of plants on the shores of the lake are the type which spread branches, as well as types that can attract birds and other insects, and efforts are made to avoid using plants that easily drop their leaves, such as *acacia spp* (acacia plants).	 

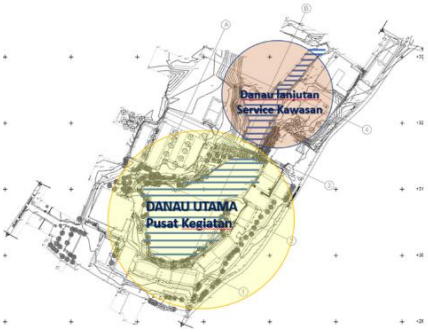
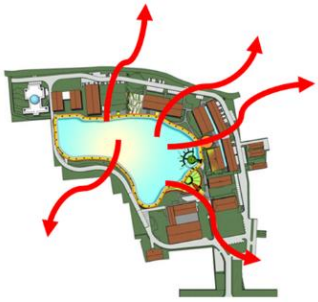
Principles of Humane and Efficient Use of Technology Utilizing the potential of the lake environment, in the form of a main lake for academic community activities and an advanced lake for regional services in the form of waste processing, *nursery*, plus *arboretum* or *mini botanical garden*	
Principle of Responsiveness to Site and Material Use by Minimizing Energy Utilizing and responding to the lake environment by managing the regional environment in order to save energy, where the surrounding buildings are optimal in terms of thermal comfort and lighting	
Principles of Humane and Efficient Use of Technology Application of energy from the solar system around the lake, energy from water, processing waste into compost, nursery plants to meet environmental needs located in the service zone area as a real educational object for the academic community and the people.	   
Responding to Local Climate, Principles of Using Materials to Minimize Energy and Preserving Environmental Resources Maintaining environmental resources (air, soil, water) and utilizing natural resources around the planning area for building systems, both related to building materials and for building utilities (energy sources, water supply). Air flow to the building that will help the thermal condition, utilization of water and solar heat for energy sources	

Table 2. Application of Architecture at Macro level

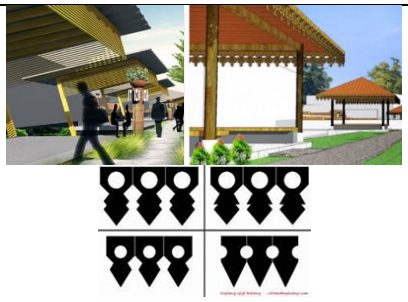
MICRO APPLICATION OF ECOLOGICAL ARCHITECTURE	
Principles of Preserving Environmental Resources, and Principles of Establishing Complete Circulation in Water Supply and Disposal Repair and nourish all ecological components so that they are able to function to accommodate water which can be used for clean water purposes, absorb rainwater for groundwater replenishment, and able to develop into living and sustainable ecosystem areas for all lakes around.	
Principles of Using Materials with Minimum Energy The use of building materials that are easy to be renewed, and environmentally friendly. Providing gazebos for discussions such as: wood, bamboo, and so on. Also accompanied by Betawi cultural ornaments in order to participate in preserving local culture.	
Principle of Response to Site Conditions Utilization and arrangement of lakesides by providing parks for recreation and sports using materials that do not damage the environment	
Pr Utilization of potential for water sports by providing a dock and an amphitheater	
Principles of Being Able to Respond to Local Climate	

Table 3: MICRO APPLICATION OF ECOLOGICAL ARCHITECTURE Arrangement of inter-building plazas on the shores of the lake as a gathering point and a flow of air to the surrounding buildings 	 
Principles of Using Materials with Minimum Energy The use of building materials that are easy to be renewed, and environmentally friendly. On the jogging track / pedestrian facilities.	 

CONCLUSION

Lake ISTN in Jakarta with the concept of Ecological Architecture is a campus facility as well as an area facility as an open space and water catchment area that is maintained because it is related to the preservation of other lakes, such as Setu Babakan and Setu Mangga Bolong. The concept of Ecological Architecture in the lake environment is found in the processing of the lakeside area that applies the orientation of the building towards the lake with an intermediate space in order to support efforts to maintain existing contours and vegetation and to support the distribution of natural ventilation and natural lighting to the maximum in the environment. The selection of local building materials along with incorporating elements of local culture, and paying attention to changes in materials after use so that they can be returned to nature are some ways to encourage the concept of Ecological Architecture. In addition, the concept of Ecological Architecture can also be applied to regional water treatment through the application of an ecotech garden, also maintaining springs and channels between lakes and reducing the sedimentation process. The concept of Ecological Architecture as a method of completing the design as well as conserving the function of the lake has the advantage of producing a design object that is in harmony and able to preserve the surrounding nature. The area that is maintained as an open space and water catchment area in South Jakarta needs to be preserved for its ecosystem in order to avoid natural damage. The concept of Ecological Architecture at a macro level pays attention to acclimatization conditions, maintains lake ecosystems, protects springs and is protected from waste, has area service areas and exploits natural potential. The micro application is carried out on the gazebo design with easily renewable materials, the application of appropriate technology for energy sources and technology exposure for educational purposes such as solar power, water and waste management as well as the arboretum, as well as the utilization of water for activities both in water and on land while protecting the environment. The concept of Ecological Architecture in the design as well as

conservation of the function of the lake must really pay attention to the existing conditions of the surrounding environment, so as to be able to produce a design that is right on target, namely increasing the function of the lake as an open space and water catchment area as well as a container for activities, avoiding overexploitation, providing a positive impact on the environment and able to preserve sustainable nature.

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