

MULTIDISCIPLINARY INSIGHTS: GEOHERMAL WELLS, PRESERVATION, ENGINEERING, AND CHEMICAL PROCESSES

EDITOR
Assoc. Prof. Merivan Şaşmaz



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PREFACE

Within this compilation, esteemed experts have contributed their insights and expertise across nine comprehensive chapters that span various disciplines. Each chapter offers valuable perspectives and thoughtful analysis, representing the diligent work of the authors. The ten chapters in this compendium cover various disciplines and are authored by experts in their respective fields.

In the first chapter, we explore the properties of high-quality geothermal resources. We examine specific examples and potential risks associated with them. The chapter is titled "Investigation of the Risk of Brine Intrusion into Geothermal Boreholes Planned in Didim Plateau (Aydin/Turkiye)."

Moving on to the second chapter, we discuss a case study on the conservation and revitalization of the Ciliwung Riverbank in Manggarai, Jakarta. We explore ways to protect abused natural resources. This chapter is titled "The Conservation and Revitalization of The Ciliwung Riverbank in Manggarai, Jakarta."

In chapter three, we focus on finding efficient and cost-effective simulator options for robot design. We examine their applications and usefulness in this field. The chapter is titled "Simulators In Robot Design and Applications."

Chapters four and five provide an overview of engineering applications and introduce best practices. The topics covered include improving exhaust after-treatment thermal management to reduce emission rates in diesel-driven vehicles and reviewing the abrasive waterjet cutting of polymeric materials.

In chapters six and seven, we delve into research on high-performing materials. We explore the effects of surface treatment and fabric design on the mechanical properties of polymer matrix composites. Additionally, we analyze the setup and analysis of thermophotovoltaic systems using gallium antimonide (Gasb) cells in high temperatures.

Chapters eight and nine discuss chemical processes related to wastewater cleaning and food processing, respectively. We explore the fundamentals and applications of photocatalytic oxidation processes, as well as the use of ultrasound extraction in the food industry.

In chapter ten, prepare to embark on an enlightening journey into the realm of the Fuzzy HD Method, a revolutionary blend of high definition and fuzzy logic that challenges conventional approaches to data analysis, offering new insights into the complex interplay of precision and uncertainty.

The content presented in the aforementioned chapters is the responsibility of the respective authors and does not necessarily reflect the views or opinions of the ISPEC publishing house and its editor. The information provided is based on the expertise and research of the authors up to the time of publication. Readers are encouraged to critically evaluate the material and consult additional sources for a comprehensive understanding of the subjects discussed.

Lastly, I would like to express my sincere gratitude to all the authors and the IKSAD publishing house for their invaluable contributions in compiling this insightful compendium. Their diligent work and expertise have brought together a diverse range of disciplines, providing readers with a wealth of knowledge and perspectives. I also extend my appreciation to the readers for their engagement and interest in this book. May this compilation serve as a catalyst for further exploration and scholarly discourse in the respective fields covered. Thank you for your time and dedication to expanding our understanding of these important subjects.

Assoc. Prof. Merivan ŞAŞMAZ

Editor, June 2023

CHAPTER 2

THE CONSERVATION AND REVITALIZATION OF THE CILIWUNG RIVERBANK IN MANGGARAI, JAKARTA¹

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INTRODUCTION

Jakarta city is the center of the economy, from regional to international, because 65% of national money circulates in the capital region, so that nearly 80% of economic activity in Indonesia is centered in the city of Jakarta. Centers for science and technology, as well as socio-cultural activities are also based in Jakarta. This is the main attraction, making the growth and development of the population in Jakarta more rapid (Rahmatulloh, 2017). However, this also results in an unequal ratio between the population and the availability of land (especially the need for agriculture and settlements), so that many residents turn the riparian area into a residential and agricultural area (Diva, 2019). Based on the Government Regulation of the Republic of Indonesia Number 38 of 2011 concerning Rivers, trends that have a negative impact on rivers need to be controlled so that a harmonious and sustainable state can be achieved between river functions and human life, for the benefit of the future. If this trend is not addressed immediately, then in the future, it is likely that rivers will become increasingly polluted, floods will become uncontrollable, and the life of the people living along the river will become increasingly uncontrollable with a low quality of life. Even these things have started to happen now.

The Ciliwung River is one of the historic rivers in the city of Jakarta, which stretches from Bogor (upstream), covers the areas of Mount Pangrango, Mount Gede and Cisarua, then flows downstream on the north coast of Jakarta. The length of this river reaches 120 kilometers and the area of the watershed (DAS) is 387 square kilometers. The Ciliwung River is divided into 3 (three) sub-watersheds, namely; The upstream Ciliwung with an area of 15,251 hectares (located in the Regency and City of Bogor area), the middle Ciliwung with an area of 16,706 hectares (in the Depok, Bekasi, Regency and Bogor City areas), and the downstream Ciliwung with an area of 6,295 hectares (in the DKI Jakarta area). At the end of 2020, it is estimated that only 9.7 percent/3,693 hectares of forest area will remain, which is the natural regulator of water management, remaining in the Ciliwung Watershed. While the ideal area of green open space is around 30 percent of the area of the river (Rahmad, 2020). Based on the results of research conducted by LIPI, it revealed that there was another problem that occurred, namely the threat of extinction of fish in the Ciliwung river, around 92.5 percent of fish species in the Ciliwung river had become extinct, caused by continued pollution (Hadiaty, 2017).

One of the first steps to be able to control this tendency is to provide

socialization to the community, especially those living in the river border areas, so that awareness and concern for the current condition of the river arises. But to restore the function of the river and preserve it for future generations, it is not enough just to socialize, a long-term solution is needed in the form of area planning along the river border. One of them is by establishing clear and firm river demarcation lines and watersheds (watersheds), as well as creating green lanes and green open spaces (RTH) along rivers. This will reduce runoff by 30 percent, by making the river 50-70 meters wide, 2-3 meters deep, 2 meters wide bank, 2-3 meters wide embankment, one meters high embankment with bare stone material, filled with grass plants, which are able to control flooding in the rainy season, when the river water level is still -0.5 to -1 below the embankment (Purwono & Mustika, 2018).

Another thing that can be done is to conserve and revitalize the Ciliwung river area. River conservation is an effort to use, protect, restore river functions, and maintain rivers for now and in the future (Setyowati et al., 2018). Meanwhile, revitalization of rivers will increase the quality and value of the area, by improving and creating spaces that are beneficial for social, cultural and economic activities (Purwantiasning, 2015). The purpose of this study is to provide a systematic description or description of the facts in the field, based on the results of an analysis of the case study of the Ciliwung, Manggarai, Tebet, South Jakarta riverbank areas, and describe the design efforts that have been carried out in the framework of conservation and revitalization.

THE RESEARCH METHODS

The planned research location is located on the banks of the Ciliwung River, Manggarai Village, Tebet District, South Jakarta. The location map can be seen in Figure 1. This research was carried out for approximately 5 (five) months and started in November 2021 until March 2022. Based on the results of a survey from the sub-district regarding future plans to become the location of the manggarai station as a city station, so we decided to widen the site from the research area so that there is continuity and alignment of environmental functions around the central station area in Jakarta. Designation: city forest, city park, billboards, strategic mining (conditional). Data was collected through photos and videos observing the location of the Ciliwung Riverbanks.



Figure 1. The Research Location

THE HISTORY OF CILIWUNG RIVER

The Ciliwung River was originally the place where the Dutch first built a castle on the east bank of the estuary. Meanwhile, there is the Culemborg Building and Jalan Pakin Customs office on the west bank of the estuary. Kali Besar is a straight stream of the Ciliwung River to the south, Weltevreden to the west, Sunda Kalapa Harbor at the mouth of the river, and there is a private house that was once the office of Sultan Hamengkubuwono IX of Yogyakarta to the east, Prapatan area. Small boats sailed along the Ciliwung river to transport goods from warehouses near the Kali Besar to ships that anchored at sea in the early Batavia period. The boat entrance from the canal to Waterpoort is via a branch of the Ciliwung River which empties into the ocean (See Figure 2).



Figure 2. a) Raft with cargo on the Ciliwung river in Batavia;
b) Crossing on the Ciliwung River in Batavia
(Source: konservasidasciliwung.wordpress.com)

In addition, Ciliwung river water was originally used as a source of drinking water for local residents, but this river water has been considered unhealthy since 1740, because of the discharge of hospital waste water and all the garbage that flows directly into the river. This caused many patients to

suffer from dysentery and cholera, and even caused a very high death rate among residents of Batavia/Jakarta (Hasits, 2021), because there were shops, hotels, and luxury villas which were the residences of VOC officials along the canals built by the VOC (Arby, 2020) (See Figure 3).



Figure 3. Aerial photo of Batavia with the Ciliwung River
(Source: konservasidasciliwung.wordpress.com)

The Ciliwung River Basin in Indonesia has a very strategic value. This is evident in terms of topography, the Ciliwung watershed is divided into 3 (three) parts, namely the upstream, middle and downstream. Changes in the upstream part of the watershed will affect all other parts as a watershed ecosystem. The city of Jakarta has a strategic value in its development and management because it is located in the downstream part of the Ciliwung watershed (Ruspendi et al., 2013). However, there is an increase in the need for space such as settlements, public facilities, and other built-up land due to the rapid development activities in the Ciliwung watershed area. An increase in population also causes dynamics/changes in space requirements from time to time (Saridewi et al., 2014).

Another thing that happens in the Ciliwung watershed is disturbance to the surface of the water bodies around and within it, as a result of land change and reclamation, as well as the pollution that occurs. Based on the results of research conducted by Arifin et al. (2014), regarding Blue Open Space, distance from the main road, slope, city, population density, and soil type are factors that influence changes in Blue Open Space in the Ciliwung Watershed. 11 (eleven) strategic alternatives based on Strengths Weaknesses Opportunities Threats (SWOT) analysis were obtained, and five of them were: 1) Required to provide Blue Open Space as environmental service providers, when creating residential areas, and making special rules for (private)

property developers, 2) Provide socialization to the community about the important role of Blue Open Space, 3) Complete the Blue Open Space infrastructure to protect against siltation, 4) The regional government makes a Blue Open Space management plan by providing a reward and punishment mechanism for the community, and 5) Develop local community-based tourism areas in Blue Open Space that are considered potential.

THE RIVERBANK AREA DESIGN

In designing riverbank areas, guidelines are needed to serve as a basis or benchmark, so that they can be carried out systematically. Republic of Indonesia Government Regulation Number 38 of 2011 concerning rivers and river management is the guideline used in this research.

In Article 5 regulations, riverbeds and riverbanks are part of a river. The function of the riverbed is as a space for flowing water and as a place for river ecosystem life to take place. While the function of the river border is as a buffer space between the land and the river ecosystem, so that the function of the river and human activities are not mutually disturbed. River border lines are very important in river design, in article 8 it is explained that river border lines are determined at: a) rivers without embankments within urban areas; b) rivers without embankments outside urban areas; c) river embankments within urban areas; d) embankment rivers outside urban areas; e) rivers affected by tides; f) flood exposure lakes; and g) water springs.

The Ciliwung River as the object of this research is included in the non-banked river in urban areas. So, the boundary line is determined by: a) the depth of the river is less than or equal to 3 m (three meters), and has a minimum distance of 10 m (ten meters) from the right and left banks of the riverbed along the river channel; b) the depth of the river is more than 3 m (three meters) up to 20 m (twenty meters), and has a minimum distance of 15 m (fifteen meters) from the right and left banks of the riverbed along the river channel; c) the depth of the river is more than 20 m (twenty meters), and has a minimum distance of 30 m (thirty meters) from the right and left banks of the riverbed along the river channel. River conservation, river development, and controlling the destructive power of river water are part of river management. River management is usually carried out by involving technical agencies and related community elements, which is carried out based on standards, guidelines, norms and criteria set by the Minister.

River protection (flood lakes and floodplains, riverbeds, riverbanks,

stream maintenance of rivers, and river restoration sections), and prevention of river water pollution are activities that are usually carried out in the context of river conservation.

THE RIVERBANK AREA COMPARATIVE STUDY

This comparative study will explain the results of several studies on riverbank housing. What are the factors that trigger the emergence of housing in riverbank areas, and what solutions are provided by researchers for any problems that arise due to the development of housing in riverbank areas. See Table 1.

Table 1. Comparative Study Results

Aspect	Surabaya River	Riverbanks Kahayan in Palangkaraya	Kalimas River (Dinoyo Tenun area)	Riverbanks Martapura Banjarmasin
Areas	Close to the Joyoboyo bus terminal (north side), market and train station Wonokromo (South side).	The river functions as a water transportation route (main function), a source of drinking water, and for daily needs.	Many stalls have sprung up selling daily necessities.	The riverbanks functioned as open public spaces (siring) and became water transportation routes for the people of South Kalimantan to go inland.
Residents/users	Work in terminal, market and station areas.	<ol style="list-style-type: none"> 1. The majority are of productive age, 2. The majority work as shrimp and fish fishermen. 	<ol style="list-style-type: none"> 1. Low-income groups, and immigrants from outside the city of Surabaya 2. Only a small proportion of the population has a permanent job, 3. Most of the population has elementary school education, 4. Public awareness to protect the environment is quite good, as evidenced by visitors from around the location and from afar. 	Visitors from around the site and from afar.
Problems	<ol style="list-style-type: none"> 1. Network infrastructure 2. Water pollution 	<ol style="list-style-type: none"> 1. Water pollution 2. Sanitation 3. Danger of wild animals 4. Building strengt 	The use of rivers to support daily activities is still high (for defecating and for making a living with activities 'mining' or catching	

			fish).	
Solution	Local people expect compensation in the form of funds, land for relocation or both	<ol style="list-style-type: none"> 1. Create new settlements for relocation that are still close to rivers, 2. Counseling and training from the local government. <ol style="list-style-type: none"> 1. The government and the private sector must also build hospitals, health centers, schools, mosques and other facilities 	<ol style="list-style-type: none"> 1. Create a center of economic activity, 2. Create city recreation. 	<ol style="list-style-type: none"> 1. Front edge approach, to add more value to the riverside area, 2. Techno-economic approach, 3. The affordability of the location in the development of an open space. 4. Interesting design or shape.

THE CITY PLANNING INFORMATION DATA

The planned research location is located on the banks of the Ciliwung River, Manggarai Village, Tebet District, South Jakarta. Location map can be seen in the following figure Designation: City Forest, city park, billboards, strategic mining (conditional) (See Figure 4).



Figure 4. The City Plan Information

At the front of the settlement, the pedestrian area has not been fully constructed, where the pedestrian area that is made stops until opposite Manggarai Station. While other parts have not been made pedestrian areas so that the settlement is directly adjacent to the main road which has relatively fast traffic (See Figure 5).



Figure 5. The Pedestrian Area

From direct observation, the condition of the Ciliwung River and the housing on its banks are not well organized and rundown. Housing along the Ciliwung River does not have easy access to clean water. There is no domestic waste disposal system, so some people dispose of household waste directly into the river without being treated first. The provision of electricity for housing along the Ciliwung River is also not well organized (See Figure 6).



Figure 6. a) Ciliwung River; and b) Housing Highway of Ciliwung Riverbank

Due to the absence of a playground or RPTRA, many children living along the Ciliwung River do activities and play on the side of the main road which has relatively fast traffic. Data on the number of residents of each RW, residents' occupation, residents' education, and religion can be found from population data collected by the Manggarai ward every year. The research scope data consists of three RWs located on the banks of the Ciliwung River, namely RW 01, RW 04 and RW 010. The total population consisting of RW

01, RW 04, and RW 010 is 9,177 people, while the number of residents who are right on the banks of the Ciliwung River is approximately 2,500 after deducting the residents of RW 01 and 010 who are not on the banks of the Ciliwung River and residents who live in TNI housing that cannot be moved.

According to the land analysis, the land is located along the banks of the Ciliwung River in the Manggarai sub-district area, it is included in the RW 1 – 4 – 10 area. In fact, the land is an area along the banks of dense and slum residential areas. The area on the land is divided into 4 areas, namely the commercial flat area, the commercial and lodging area, TNI housing, and the park area (See Figure 7). Manggarai Station will become Jakarta's central station, and the park area will be used to accommodate social and children's needs to play and interact, which so far have not been accommodated in that area, causing children to often play on the main road which is of course very dangerous. Based on Schematic Drawing of Area Division, it is found that the size of the existing area is divided into 4 types, namely commercial flats, commercial lodging, TNI housing, and park areas, the following is the calculation of the area per area: a) Commercial Flat Area: 8915m²; b) Lodging Commercial Area: 8,708m²; c) TNI Residential Area: 7308m²; d) Park Area: 13.420m²; e) Total: 38,351m²; and Total area designed: 31.043m². The area that is designed includes the area of commercial flats, commercial and lodging, and the garden area, in the TNI housing area, is not an area that is included in the area designed in the research project.



Figure 7. Schematic Drawing of Area Division

THE REVITALIZATION OF THE CILIWUNG RIVERBANK

Here is the overall concept that we can suggest for the benefit of revitalizing the Ciliwung riverbank area so that it can function properly:

1. Site Plan

The site design concept is taken from the elements and principles of landscape design, the pattern can be adapted and applied to the site as an allotment of spatial patterns that take the form of curved lines and round pattern shapes which in their application are combined with straight lines as a form reference, in the park area there is a green field area to accommodate the main needs, namely an outdoor children's play area as well as a place to exercise because a jogging track is provided that surrounds the green field area, and there is also a water pool area for ventilation functions in this hot area so that in addition to being a tourist spot and social interaction it can also answer needs environment and increase the temperature around the area, there is also a parking area that is provided to avoid illegal parking around the riverbank area, and there is also a trader's area for selling so that economic functions can still be carried out around the area (See Figure 8).

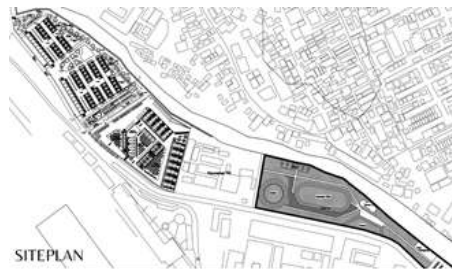


Figure 8. Site Plan

The site plan area is divided into 4 areas, namely the Commercial Flats area, Commercial and Lodging Area, TNI Housing, and the Park area, each area is designed to meet the needs of the environment so that there is a reversal of the function from what was previously only a slum housing which polluted the environment, to areas that can be utilized can even produce good economic value and social interaction.

2. The Commercial Flats Area

There are 12 flats with a capacity of around 115 heads of households, to accommodate residents who previously lived in slum settlements and owned businesses so that they could still get decent housing with good sanitation while still being able to open businesses. On the part directly adjacent to the road, commercial flats are made where the first floor is a shop

area and the second floor is a residential area. While on the inside is a flat area where the first floor and second floor are residential areas. In addition to the low tide unit, there is an outdoor space provided for social interaction so that the impression of a residential house is not lost and also so that social interaction can continue to occur thereby increasing the economic value around the commercial flat area (See Figure 9).



Figure 9. The Commercial Flats Area

3. The Commercial and Lodging Areas

The commercial area is designed for commercial and lodging needs, because to accommodate the mobility of the Central Jakarta Station at Manggarai Station later, therefore the commercial area will later become a culinary tourism spot with existing tenants as well as a place for capsule lodging, so as to be able to accommodate the large number of people who will come and stay, because of its strategic location, namely on the opposite side of the direct station, the commercial area connects the commercial area with the station area with a special JPO designed for pedestrian transportation from the commercial area to the station area (See Figure 10).



Figure 10. The Commercial and Lodging Area

4. Environmental Park Area



Figure 11. The Environmental Park Area

The Environmental Park Area is designed not with tall buildings and prioritizes outdoor spatial planning which will later be used for activities such as playing sports, and carrying out social interactions, the greenery pattern around the park area is regulated so as to protect and separate the main road from the park area (See Figure 11).

CONCLUSION

In a research project around the Ciliwung riverbank area in the Manggarai sub-district, South Jakarta, we found that the Manggarai station was planned by the government to change its function to become the largest central station in Jakarta, the unavailability of adequate infrastructure to accommodate the Manggarai central station is one of the focuses of the research. this, still needs a lot of improvement and also government policies to fix around the banks which have now become slums that pollute the river, of course this is a bad thing if it is maintained for a prolonged period, it will cause environmental damage, the population density will continue to soar, and the squalid areas around the riverbanks so that the water in the Ciliwung river is polluted and brings disease to both humans - river biota - and the surrounding environment, therefore some of what we can conclude, among others, is the need for system improvements em population, changes in the layout and function of the land for flat areas, commercial areas and lodging as well as a playground area for children, so that the circulation and needs of local residents can be met.

The result of the research is planning suggestions as well as design outputs for the design of areas around the riverbank area by looking at the

changes in function in the area to become the central station area in Jakarta, and also to meet the standards of human needs for activities, land use, and the surrounding environment when viewed from the field of architectural science.

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