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ANALYSIS OF EXISTING AND INDICATIONS AREA OF THE PANEMBONG LAKE, SERANG REGENCY, BANTEN PROVINCE

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ABSTRACT

Indonesia is estimated to have more than 1,575 lakes, consisting of 840 large lakes and 735 small lakes (situ). As a source of raw water and flood control, lakes and reservoirs play a crucial role in maintaining the balance of land use and natural resources. This study will analyze the existing conditions and area indications of Situ Panembong by doing a Mapping/Topographic Surveying This study is expected to provide important contributions to the mapping and discourse on lakes in Indonesia, as well as information for maintaining Situ Panembong in Banten Province as a protected area. A key benefit of mapping the survey data in this study is that it can also summarize information from the field, allowing it to be used in planning. The method used in this research employs qualitative analysis. The technical measurement methods used in this activity include measuring land areas, topography, situation, longitudinal and transverse profiles, and aerial photography. The reasult is that Conditions in the Panembong Lake demonstrate a strong relationship between hydrology, land use, and socio-economic and industrial activities. Aerial mapping using digital photogrammetry technology produced several key products—orthophotos, DSMs, DTMs/topography, and 3D models. These results collectively provide an accurate spatial representation of the morphological conditions and physical characteristics of Panembong kae. The Digital Surface Model (DSM) shows elevation variations that encompass all surface features, including vegetation and anthropogenic structures. The extracted Digital Terrain Model (DTM) and topographic maps show a relatively gentle contour across the lake body, with a gradual increase in elevation toward the perimeter. These topographic characteristics confirm that the lake is located in a natural basin with a flow pattern that vegetates toward the center of the reservoir.

Keywords : Existing Condition, Indications Area, Panembong, Lake, Serang, Banten

1. INTRODUCTION

As an archipelagic nation, Indonesia has vast waters covering more than two-thirds of its territory. Therefore, matters related to these waters and the water resources within them must receive special attention in terms of their utilization and efforts to maintain their sustainability (Taryoto, 2013).

As a source of raw water and flood control, lakes and reservoirs play a crucial role in maintaining the balance of land use and natural resources, both naturally and artificially formed (Saputra et al., 2023). With its status as a natural water reservoir, the lake has several functions, including being part of the ecological system and water management system for the surrounding area, being a water catchment area for the surrounding area, being a water catchment area and a temporary container for water before it flows into the river, if the discharge allows, it can be a power plant, a water recharger for groundwater basins and a barrier to salt water intrusion, and can be a location for fisheries cultivation, tourism and agricultural irrigation sources. Lakes as part of the watershed (DAS) system, serve important functions, including water retention for flood control, water resource conservation (groundwater supply), local economic development, and recreation. In flood mitigation, lakes play a crucial role as water retention basins, reducing runoff and retaining water (Mohamad et al., 2021). Urban lakes are crucial ecological and recreational assets within urban areas, significantly enhancing urban resilience (Wang & Cheng, 2024). Based on the Republic of Indonesia Law Number 26 of 2007 concerning Spatial Planning, Article 5 paragraph 2 b, local protection areas include, among others, coastal boundaries, river boundaries, areas around lakes/reservoirs, and areas around springs;

Based on data released by the Indonesian Institute of Sciences (LIPI) in 2020, Indonesia is estimated to have more than 1,575 lakes, consisting of 840 large lakes and 735 small lakes (situ) (Dianto et al., 2020). As part of the hydrological cycle, lakes—whether naturally formed or artificial—are protected areas that collect water from surface or ground sources. To maintain their sustainability, an area surrounding the lake body called the lake boundary or shoreline serves as a buffer zone to protect the lake's ecosystem (Wolok et al., 2024).

Mapping/Topographic Surveying is a branch of geodesy that specifically studies small portions of the Earth's surface by taking measurements to create maps. Measurements taken of detailed natural and man-made points include horizontal (X, Y) and vertical (Z) positions relative to the average sea level. In making maps, which is known as mapping, this can be achieved by conducting a measurement survey on the surface of the earth which has an irregular shape. Mapping surveys are very necessary and important along with the development of the times, this is related to the increasing human population so that the need for a plot of land continues to increase.

According to data from the Banten Province Regional Development Planning Agency (BPKAD), 137 lakes are officially registered on the Property Inventory Card (KIB). The majority of these lakes are assets transferred from West Java Province and other agencies shortly after Banten officially became a province. The boundaries of an area play an important role in determining the administrative authority of a local government (Muharrom, 2025).

This study will analyze the existing conditions and area indications of Situ Panembong by doing a Mapping/Topographic Surveying. Based on various previous studies that are relevant to this research, there has been no research that discusses about Analysis of Existing and Indications of the Area of the Panembong Lake, Serang Regency, Banten Province. The main studies on lakes in Indonesia so far have focused their discussion on two main aspects, namely air quality analysis and evaluation of tourism conditions, such as reaserch about Analysis of the Development of Lake Tourism Towards Ecotourism in Lake Sidomukti, Sukmajaya District, Depok City (Wijayanti et al., 2022), Revitalization of Situ Tipar as a New Tourist Attraction in Depok City (Mohamad et al., 2021), Analysis of the Physical Potential of Situ Gunung Natural Tourism as a Tourist Destination in Kadudampit District, Sukabumi (Nurjannah, 2020), research about Water Quality Study of Gintung Lake, East Ciputat District, South Tangerang City (Widyana & Widiyastuti, 2013), and Water Quality Analysis for the Development of Recreational Facilities and Fisheries Cultivation in Situ Cicadas (Saputra et al., 2023). There's also previous research about Overview of Sustainable Urban Lakes/ "Situ" Management (Pambudi, 2021).

This study is expected to provide important contributions to the mapping and discourse on lakes in Indonesia, as well as information for maintaining Situ Panembong in Banten Province as a protected area. A key benefit of mapping the survey data in this study is that it can also summarize information from the field, allowing it to be used in planning.

2. DATA AND METHODS

The method used in this research employed qualitative analysis. During the data collection phase, the research team explored the study area through field observations to gain a sense of the conditions within the site area.

2.1 Primary Data Collection

This was a data collection technique conducted directly in the field through observation, visualization or photography, mapping, and gathering verbal information. Techniques used in primary data collection included: 1) Measurement Surveys; The measurement survey was the main stage in this activity. Measurements included field measurements, GNSS measurements, 2) Land Ownership Boundary Survey/Land Ownership Inventory (land use and status); 3) Identification of Lake Characteristics and Conditions; and 4) Documentation.

2.2 Secondary Data Collection

Secondary data collection was a data collection technique that involved collecting data from relevant agencies, both government and private, as well as from relevant literature. This method involved collecting, identifying, and processing written data and working methods that were used as input for the discussion of the material. Data collection was done through written or electronic documents from relevant agencies/institutions. This method was used for secondary data.

2.3 Technical Measurement Methods

The technical measurement methods used in this activity included measuring land areas, topography, situation, longitudinal and transverse profiles, and aerial photography.

2.3.1 Geodetic Measurements Using the Real-Time Kinematic (RTK) Method

In determining the coordinates, the points used were benchmarks based on the results of the land ownership inventory in the area. Prior to boundary measurements, geodetic GNSS measurements were conducted at the BM and CP. Next, the points or benchmarks that constituted the boundaries of the land parcel and the area were measured using a validated Global Positioning System (GPS) Real-Time Kinematic (RTK) GPS.

Situation measurements were made using Real-Time Kinematic (RTK) GPS. To obtain an approximation to the Google Earth mapping system (Datum WGS 84), BM points were measured using dual-frequency geodetic GPS for 1 hour. These measurements involved processing aerial photography results in the form of a DTM with terrestrial data from the RTK GPS.

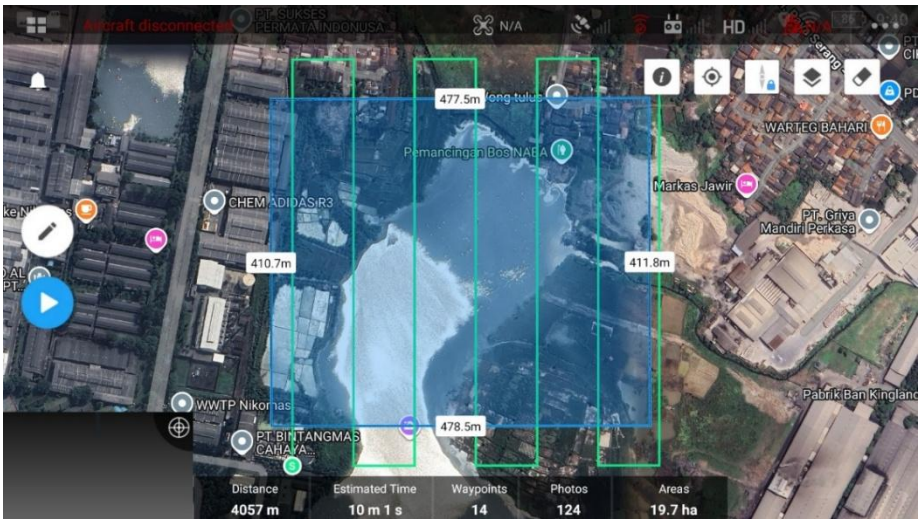

Figure 1. One of the Rawa/Situ Panembong Flyway Designs

2.3.2 Aerial Photography

The aerial photography process involved several key stages. The team first performed preparations, which included the creation of a flight plan along the mapped route and the distribution of Ground Control Points (GCPs). This was followed by the creation and installation of premarks in the field and the execution of aerial photography. Furthermore, the team carried out horizontal and vertical control measurements to serve as anchor points and conducted premark point measurements. Finally, the photogrammetry processing was completed, which included sub-processes such as aerial triangulation, photo compilation, observation of anchor points, orthophoto processing, 2-dimensional digitization of significant objects, and the creation of mosaics.

Preparation, including the creation of a flight plan along the mapped route and the distribution of GCPs, followed by the creation and installation of premarks in the field, aerial photography, horizontal and vertical control measurements as anchor points, premark point measurements, and photogrammetry processing, which includes aerial triangulation sub-processes, including photo compilation and observation of anchor points, orthophoto processing, 2-dimensional digitization of important objects, and mosaic creation.

The initial step in aerial photography is to identify the study/AOI (Area of Interest) and then design a flight path for each location where aerial photography will be conducted shown in **Error! Reference source not found.**. The following is a flight path design for each location. Flight Height: 100 meters, Flight Speed: 7 m/s, Sidelap/Overlap: 75/75, and Total Flights: 6 times.

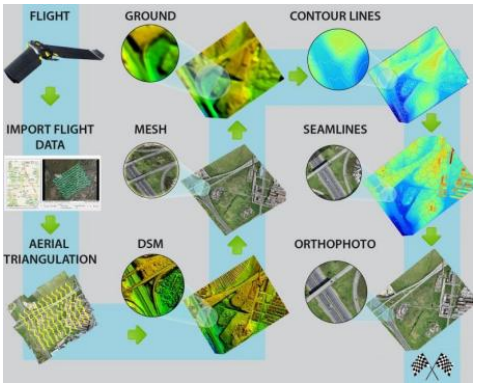

Figure 2. Stages of Aerial Mapping Data Processing

2.4 Analysis Method

The analysis was conducted using Existing Condition Analysis, Spatial Planning Analysis, and Topographic and Boundary Modeling Analysis.

3. RESULTS AND DISCUSSION

3.1 Benchmark Point Search

A reference point/benchmark (BM) is a point of reference or benchmark used for measurements, with known elevation and fixed coordinates. A benchmark (BM) is a pillar created as a fixed point indicating position (X, Y) and elevation (Z). BM benchmarks serve a crucial role in surveying and mapping activities, serving as anchor points or control points that reference the position of an object within a global coordinate system.

The reference system used in these activities is the Indonesian Geospatial Reference System (SIRS) of the Geospatial Information Agency (GIIA). According to Regulation of the Head of the Geospatial Information Agency Number 13 of 2021 concerning the Indonesian Geospatial Reference System, a Geodetic Control Network is defined as a distribution of geodetic control points integrated

within a single reference framework. A Geodetic Control Point (GCP) is a position on the earth's surface characterized by a specific physical form that serves as a reference framework for geospatial information, including horizontal, vertical, and gravity values. Based on the results of the reference point/benchmark (BM) search, the closest locations for horizontal and vertical fastening were identified, as follows:

a. Reference Point for Fastening
b. Point Name: CGON
c. Location: Pillar location above the concrete roof of the Cilegon STO Office, Jl. Perdamaian block D No. 14
d. Station Name: Cilegon
e. Village: Jombang
f. District: Jombang
g. Latitude: -6.0207731333333
h. Longitude: 106.05224755556
i. Elevation Height: 41.211 meters

3.2 Location Orientation

Serang Regency has a diverse landscape, ranging from plains to steep hills. In terms of land morphology, Serang Regency lies at an elevation of 0-1,778 meters above sea level (masl) and is generally classified as a plain and undulating topography. Generally (>97.5%) of Serang Regency's area has an average elevation of 25.66 meters above sea level. The 0-meter-above-sea-level elevation stretches from Tirtayasa District to Cinangka District on the west coast of the Sunda Strait, and the 1,778-meter-above-sea-level elevation is found at the foot of Mount Karang, which borders Pandeglang Regency to the south. Rawa Panembong is located between the administrative areas of Cijeruk Village, Tambak Village, and Nambo Ilir Village, Kibin District, Serang Regency.

Geographically, the location of Rawa/Situ Panembong is at coordinates 6°10'23.41"S South Latitude and 106°19'19.35"E East Longitude and administratively it is located between 3 (three) areas, namely Cijeruk Village, Tambak Village and Nambo Ilir Village, Kibin District. Based on the Goods Inventory Card (KIB) data, Rawa/Situ Panembong is listed as a regional asset with the Goods Code Number/Goods ID/Initial ID 01.01.07.01.001/198/198, year of acquisition 1945, area 400,000 m2 or 40 ha.

a. North: Irrigated Rice Fields, Vacant Land (Tambak Village)
b. South: Irrigated Rice Fields, Vacant Land (Cijeruk Village, Warakas Village)
c. East: Irrigated Rice Fields (Nambo Ilir Village)
d. West: PT Nikomas Gemilang (Cijeruk Village)

Given these conditions, Rawa/Situ Panembong occupies an area surrounded by agricultural land and an industrial area. This location demonstrates the interaction between the ecological function of the lake and the surrounding agricultural and modern economic activities, thus requiring balanced management to maintain environmental sustainability while supporting regional development needs.

Field observations indicate that the road network leading to Rawa/Situ Panembong is connected to a provincial road network approximately 14 meters wide and in good condition. This facilitates regional accessibility living near Rawa/Situ Panembong, as well as those from outside the area.

3.3. Field Measurement

The implementation of field measurements using the GPS RTK method includes: 1) Initial setup of the rover (by setting up the measurements using the network RTK method); 2) Once the rover is ready for use, move to the first point on the land parcel boundary for which coordinate data will be collected; 4) Record and save the recorded coordinates according to the specified coding; 5) Then, move to the next point and repeat the process until coordinate data has been obtained at all points marked with land parcel boundaries.

Figure 3. Measurement of Land Areas Around Rawa/Situ Panembong

Figure 3 illustrates the field implementation of the land boundary survey around Situ Panembong. The results of the identification and measurements conducted revealed that in the area surrounding Rawa/Situ Panembong, there are a total of eight plots of land, consisting of two community-owned plots and six company-owned plots. This identification serves as an important basis for determining boundary points that can be measured without creating conflicts over land use or overlapping land ownership claims. For more details, see the following table:

Table 1. Ownership of Land Plots around Situ Panembong

No	Field Owner	Land Status	Surface area (m^2)
1.	Tawi B Seripah	SPPT	760
2.	Kanim B Armin	SPPT	1.841

For the field measurements, the method used was Real-Time Kinematic (RTK) GPS, which boasts a high level of accuracy with horizontal positioning accuracy in the range of 1–5 cm. This method was deemed appropriate given the relatively open topography of the Lake, allowing for signal fixation with accurate resolution of phase ambiguities. All field boundary coordinates were recorded using established mapping technical standards, ensuring high reliability of the measurement results.

The results of existing field measurements in the Panembong Lake/Situ indicate that the total area is 468,000 m², equivalent to 46.80 hectares. This area is divided into two bodies of water:

a. Small Panembong Lake/Situ (north)
   Around 133,100 m², or approximately 13.31 hectares.
b. Large Panembong Lake/Situ (south)
   Around 334,900 m², or approximately 33.49 hectares.

From these measurements, it can be seen that the existing area differs by 68,000 m², or 6.80 hectares, compared to the area listed on the Goods Inventory Card (KIB), which states 400,000 m².

3.4 Land Use and Hydrological Conditions

Based on field observations, aerial image analysis, and interviews with village officials around the Rawa/Situ Panembong area, it was discovered that land use patterns in this area are highly diverse and demonstrate a close relationship between agricultural, residential, and industrial activities. This diversity reflects the dynamics of regional development that have driven gradual changes in spatial function, particularly in areas surrounding the lake's boundaries. The spatial distribution of these land use types and the extent of the Situ Panembong area are shown in **Figure 4**.

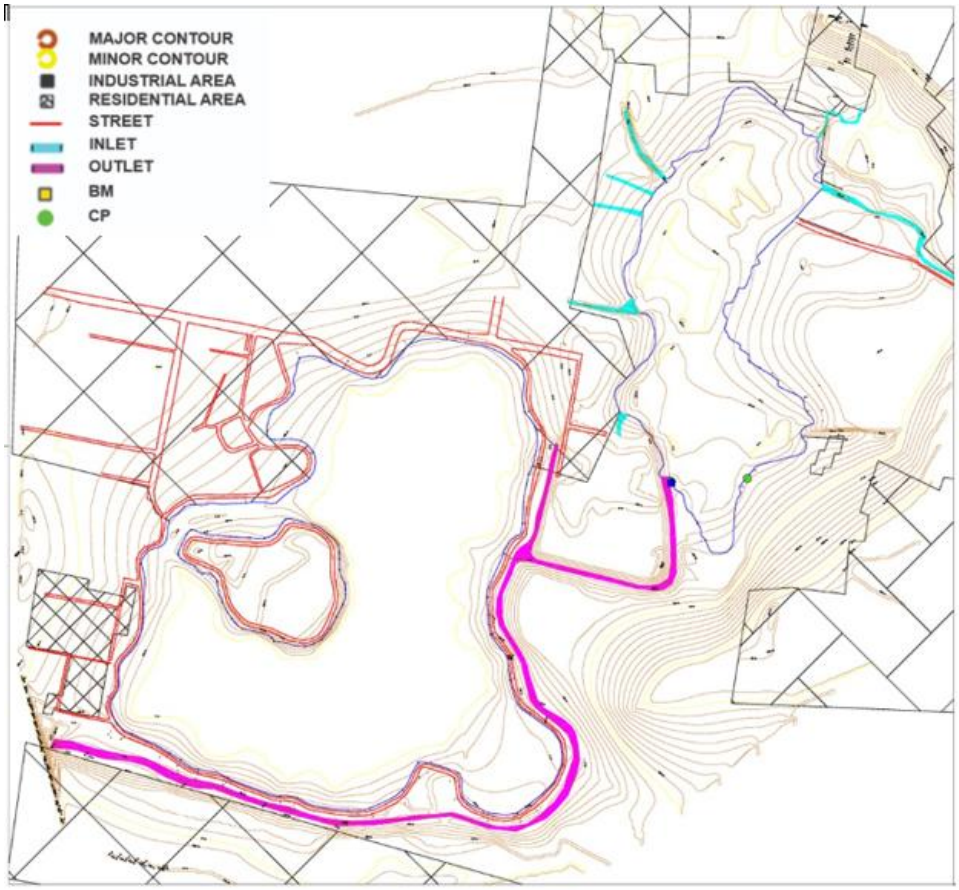

Figure 4. Map of Situ Panembong Area

In the western area of Rawa/Situ Panembong, land use is dominated by large-scale industrial buildings. This occurs because the western boundary of the lake directly intersects the industrial area owned by PT. Nikomas and several other factories located within the industrial area corridor. The presence of these large-scale industries has a significant impact on the spatial planning and water management around the lake, including the potential for physical changes to the lake and surface runoff due to the increase in impervious surfaces such as factory buildings, access roads, and other supporting facilities.

Meanwhile, in the southern and eastern parts of the lake, land use remains dominated by agricultural areas, consisting of rain-fed and irrigated rice fields that utilize the lake's water supply. The cropping pattern in this area still follows traditional planting seasons, allowing the lake to serve as a water buffer, crucial for meeting the water needs of farmers. The extensive agricultural land demonstrates that the lake's ecological function as a source of irrigation water is still well-maintained.

On the northern side of Rawa/Situ Panembong, land use patterns tend to be more diverse. In addition to rice fields, this area is also beginning to develop into residential areas, both sporadic and established as permanent clusters. In some locations, residential and agricultural land directly adjoin industrial buildings, creating a complex spatial pattern.

The diversity of land uses around Rawa/Situ Panembong demonstrates that this lake serves multiple functions for both the community and industry, serving as a water source, natural green space, and as an ecological boundary between agricultural and industrial activities. However, the continued growth of industry and settlements can potentially create environmental pressures, such as physical changes to the lake, including shrinking lake area and decreasing lake function, declining water quality, and disrupting the hydrological balance if not managed properly.

From a hydrological perspective, Rawa/Situ Panembong is part of the Ciujung River Basin (DAS). This position makes the lake a crucial part of the regional water system, serving to accommodate runoff during the rainy season, regulate river flow, and maintain the balance of groundwater availability in the surrounding area. The presence of a single main outlet that flows into the Ciujung Watershed network allows the lake to function as a natural regulator, helping prevent local flooding and excessive inundation following heavy rainfall. Overall, the land use and hydrological characteristics of Rawa/Situ Panembong indicate that this area holds strategic ecological, social, and economic value. Therefore, integrated management is crucial to maintaining the sustainability of the lake's function amidst the rapid development of industrial and residential areas.

3.5 Condition and Utilization of Lakes

Based on field observations, Rawa/Situ Panembong is a natural lake ecosystem formed through long-term geological and hydrological processes. The lake's primary water sources are rainwater, surface runoff, and contributions from several surrounding springs. Inlets supplying water are located in the west, east, and south. Meanwhile, the outlet of Rawa/Situ Panembong leads to the Cikambuy River, which then connects to the surrounding hydrological network.

Hydrologically, Rawa/Situ Panembong is located within the Cijujung Watershed (DAS). This location makes the lake play a crucial role as a water regulator, both in retaining runoff during the rainy season and maintaining water reserves during the dry season. This hydrological function helps reduce the risk of flooding, maintain soil moisture, and support stable river flows during dry periods.

In terms of utilization, Rawa/Situ Panembong plays a strategic role for the surrounding community, particularly as a source of agricultural irrigation. Lake water is used to irrigate rice fields, thus supporting agricultural productivity and year-round water availability. Overall, Rawa/Situ Panembong holds significant ecological and socio-economic value for the surrounding community. The combination of hydrological, ecological, and agricultural functions makes this lake a vital component of environmental sustainability and the livelihoods of local comunities

3.6 Existing Conditions

The Panembong Lake/Situ is administratively located on the border of three villages: Cijeruk, Tambak, and Nambo Ilir, all within the Kibin District. The lake's location between several villages makes it a crucial area for both hydrology and the socio-economic well-being of the surrounding community. Based on outreach programs, field observations, and interviews with village officials and the community, preliminary information regarding the existing condition of the Panembong Lake/Situ was obtained, which can be explained as follows:

a. The primary water source of the Panembong Lake/Situ comes from rainwater naturally collected in the lake basin. In addition, several inlets enter the lake through the west, north, and south. The presence of these inlets contributes to the dynamic characteristics of the lake's water flow, particularly during the rainy season when water discharge increases significantly. This diverse water supply system enables the Panembong Lake/Situ to function as a natural water reservoir, capable of retaining surface runoff from the surrounding area.
b. The Panembong Lake/Situ Panembong has one main outlet that drains water into the Cikambuy River. This outlet plays a crucial role in maintaining the balance of water volume within the lake, particularly in preventing excessive flooding during the rainy season. The relatively stable outlet allows for regular outflow, allowing the water level in the lake to return to normal after periods of intense rainfall.

c. In terms of land use, the area around the lake is dominated by agricultural land, particularly rice fields, which utilize the available lake water for irrigation. Furthermore, several areas on the sides of the lake have also developed into industrial and residential areas. The presence of industrial buildings in the northern and eastern parts of the lake influences land use patterns and the potential for changes in the area's water system. However, the majority of the community still relies on the lake as a water source for agricultural and plantation activities.
d. The use of lake water extends beyond rice field irrigation to include raw water for industrial needs at several business facilities in the surrounding area. This demonstrates the lake's strategic value as a water resource that supports sustainable economic activity

Overall, the existing condition of Rawa/Situ Panembong demonstrates a strong relationship between hydrology, land use, and socioeconomic and industrial activities. The presence of natural inlets and outlets, along with the diverse land uses surrounding the lake, demonstrates its role as a vital and complex ecological system.

3.7 Situational Measurement

Situational measurement is a crucial step in the process of collecting land surface data, aimed at comprehensively describing the existing conditions of an area. This measurement encompasses not only natural elements found in the field but also man-made elements that influence the spatial characteristics and land use of the surrounding area. In the Rawa/Situ Panembong area, field survey results indicate that the situation is composed of a combination of natural and man-made elements that interact to form the environmental pattern of the lake area.

a. Natural Elements

The natural elements in the Rawa/Situ Panembong area are dominated by agricultural landscapes in the form of rice fields scattered throughout several sides of the lake, particularly in the Northeast, East, Southeast, and West.

In addition, there are areas of bare land and shrubs scattered along the North and South sides of the lake. In the central part of the land area separating Rawa/Situ Panembong Besar from Rawa/Situ Panembong Kecil, there are also stretches of bare land and wild vegetation that serve as natural boundaries between water bodies.

b. Artificial Elements

In addition to natural elements, several man-made elements have also been identified and have a significant influence on the condition of the Rawa/Situ Panembong area. These artificial elements include:

1) Two outlets or drainage channels function to control the lake's water level. They are located to the south of Rawa/Situ Panembong Kecil and to the north of Panembong Besar. These two outlets are located in the central area of land separating the two lakes and play a vital role in the area's hydrological system, particularly in maintaining water flow balance and preventing excessive flooding.
2) Seven inlets scattered throughout the Rawa/Situ Panembong Kecil area serve as inflow routes for water from the surrounding environment. The distribution of these inlets reflects the presence of several surface water catchment points originating from rainfall runoff and small streams from surrounding agricultural areas.
3) Residential buildings are scattered throughout the north and east of the lake.
4) A number of significant industrial buildings are located on the south and west sides of the lake. The presence of these industrial facilities indicates that the Rawa/Situ Panembong area is in an area experiencing economic development and infrastructure development.

Overall, the combination of natural and man-made elements found in the Rawa/Situ Panembong area provides a comprehensive overview of the area's physical characteristics.

3.8 Aerial Mapping Results

The aerial mapping results obtained through a series of photogrammetric processing steps, including data acquisition, geometric correction, surface model generation, and final visualization, are presented in **Figure 5** and **Figure 6**. The image displays a detailed representation of the land surface shape, environmental features, and spatial elements that play a key role in topographic analysis of the area.

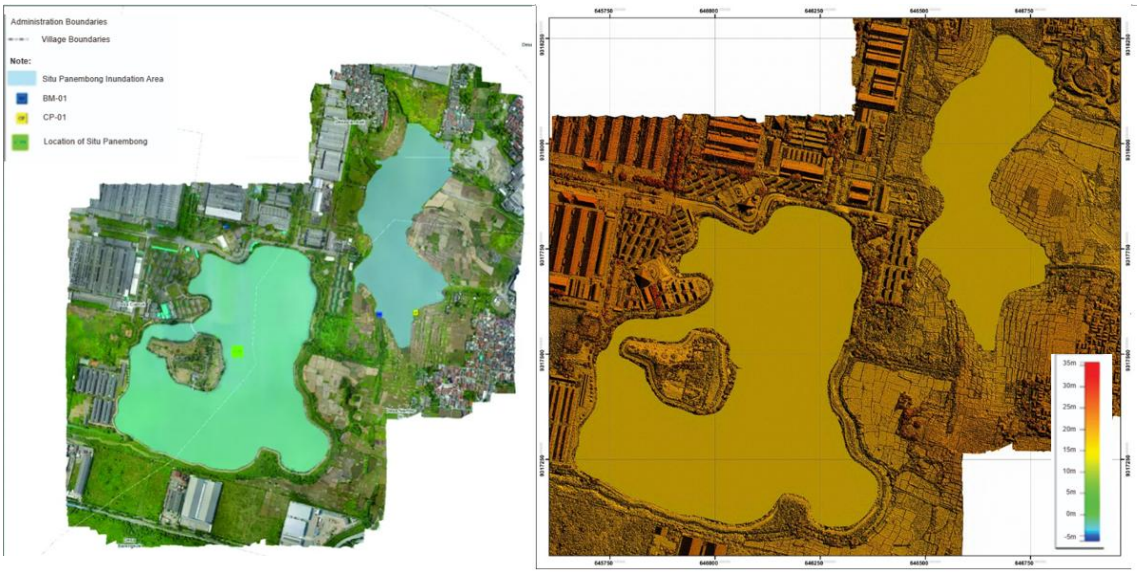

Figure 5. Orthophoto Map of Rawa/Situ Panembong

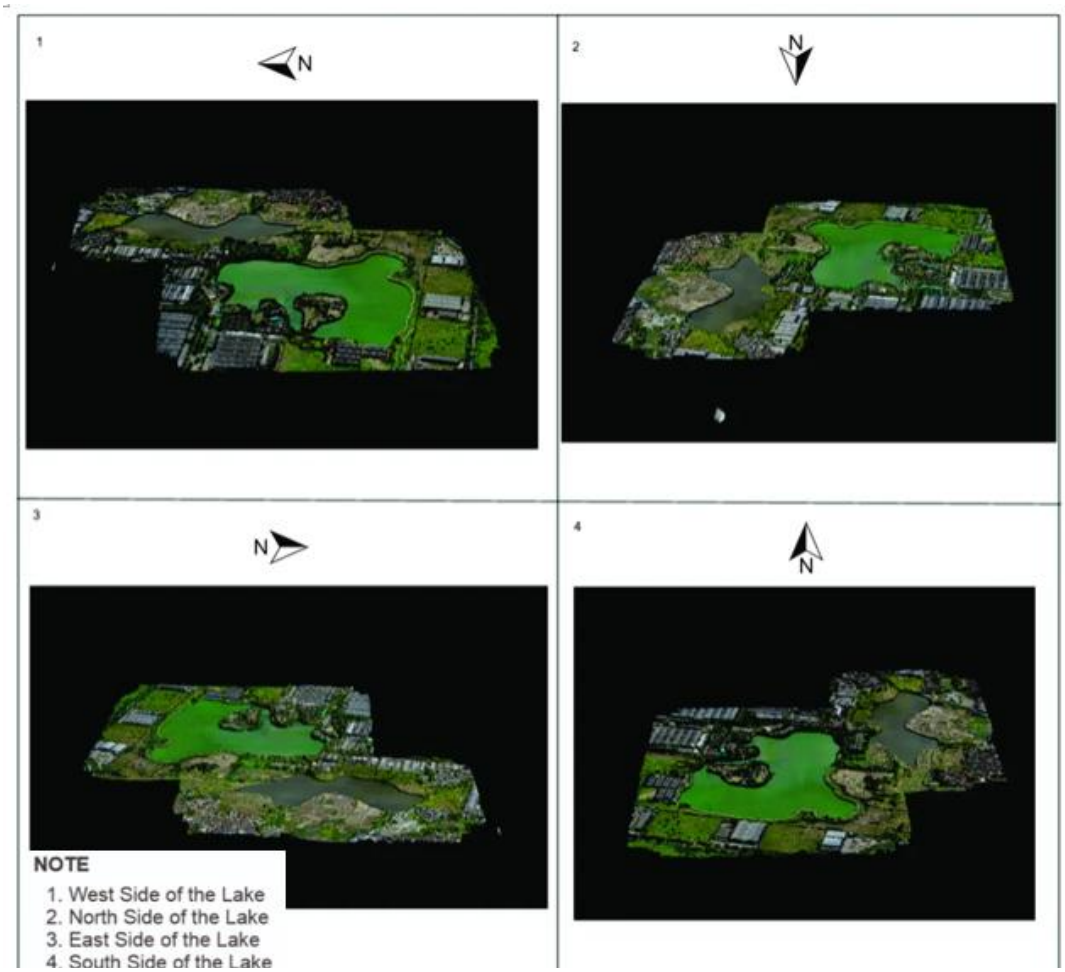

Figure 6. 3D Model of Panembong Lake

3.9. Analysis of The Indication of The Area Of The Panembong Lake

The results of the analysis in 2025 showed that the area of the Panembong Lake/Situ inundation experienced a significant decrease compared to 2004. Based on the results of the digitization of water bodies in 2025, the total area of the remaining water body was only around 46.91 hectares which was originally 51.57 hectares in 2004. The most significant physical change in the Lake/Situ occurred in the upper (small) Panembong Lake/Situ inundation from 18.50 hectares in 2004 to 13.36 hectares in 2025. A visual comparison of the 2004 and 2025 images shows that the area that was previously a permanent inundation has now turned into dry land with low vegetation or bare land.

These changes indicate a significant decline in Situ Panembong's water holding capacity. The reduction in water holding volume is likely influenced by natural sedimentation processes that have been ongoing for decades, as well as human activities around the water catchment area, such as land clearing and residential development. This reduction in watershed area has the potential to disrupt the hydrological functions of the Lake/lake, including flood control, groundwater conservation, and habitat for local flora and fauna.

Overall, the identification results indicate that the physical changes in Situ Panembong from 2004 to 2025 are progressive and lead to a shrinking water body. These findings provide an important basis for management recommendations, such as the need for water catchment area rehabilitation, sedimentation control, and the development of long-term conservation strategies to maintain the sustainability of the Lake/lake's function in supporting environmental balance in the surrounding area.

The results of this study are in line with research on the Identification of Existing Conditions of Situ Cidanti to Meet Water Needs for the Community in Gunung Sari Village, which explains that Situ is one of the water sources in the Village and is used to meet the needs of raw water, fisheries, and irrigation (Sari et al., 2024). This research also complements the research discourse on lakes in Indonesia, such as research on the Identification of Incompatibility of Land Use in Lake Boundary Areas with Spatial Planning (Choiriyyah et al., 2023).

Table 2. Summary of Measurement Results and Analysis of Indications of the Area of Panembong lake

Description	Area (Ha)	Inventory Card/KIB* Area (Ha)	Difference (Ha)
Panembong Lake			
Measurement Results	**46.91**	40	6.91
Google Earth Satellite Imagery	51.57		11.57

**KIB: Kartu Identitas Barang*

4. CONCLUSIONS AND SUGGESTIONS

The existing condition of Rawa/Situ Panembong is administratively located on the border of three villages: Cijeruk, Tambak, and Nambo Ilir, all within the Kibin District. The Lake's location between several villages makes it a crucial area for both hydrology and socioeconomic development for the surrounding community. The existing condition of Rawa/Situ Panembong demonstrates a strong relationship between hydrology, land use, and socio-economic and industrial activities. The presence of natural inlets and outlets, along with the diverse land uses surrounding it, demonstrates that this Lake serves as a vital and complex ecological system.

The aerial mapping conducted using digital photogrammetry technology yields several key products—orthophotos, DSMs, DTM/topography, and 3D models—which collectively provide an accurate spatial representation of the morphological conditions and physical characteristics of the Panembong Lake/Situ Panembong.

4.1. The resulting orthophotos provide a precise representation of the surface of the site, allowing for the identification of inundation boundaries, vegetation conditions, open land distribution, and man-made elements with a high degree of horizontal accuracy. These orthophotos also provide a clear picture of the heterogeneity of land cover around the site, which could potentially influence runoff patterns.

4.2. The Digital Surface Model (DSM) shows elevation variations encompassing all surface features, including vegetation and anthropogenic structures. The DSM analysis indicates that the core area of the site has a relatively low and homogeneous elevation, while the edges exhibit greater elevation fluctuations due to the presence of tall vegetation, embankments, and other structural elements. This information is crucial for understanding water storage dynamics, potential sediment thickening, and identifying zones of surface subsidence or elevation.

4.3. The results of the Digital Terrain Model (DTM) extraction and topographic maps show a relatively

gentle contour in the body of the lake, with a gradual increase in elevation towards the perimeter. This topographic characteristic confirms that the lake is located in a natural basin with a flow pattern that orients toward the center of the reservoir. This information is important for hydrological analysis, including estimating reservoir capacity, identifying water inflow and outflow routes, and the potential for overflow at specific points in the lower-elevation edge areas.

of the land geometry and reinforces findings from the elevation data. This model confirms the existence of morphological variations not optimally captured in two-dimensional orthophotos, particularly related to basin depth, vegetation height, and differences in micro-topography around the lake's edge. This visualization also allows for a more comprehensive spatial interpretation of the physical conditions and geomorphic processes occurring.

Overall, the aerial mapping results indicate that the Panembong Lake/Situ Panembong is located in a low-elevation basin topographic configuration dominated by relatively flat surfaces, with increasing elevation variations towards the edge areas. This condition indicates the function of the lake as a natural reservoir for surface water that is sensitive to changes in land use around it

An analysis of the indicated lake area was conducted to obtain a more comprehensive picture of the actual extent of the Panembong Lake area. The area calculation was not based on a single source of data, but rather utilized various complementary approaches to ensure technically sound results. In some locations, information from field observations and interviews was also supplemented to verify changes in conditions over time.

By integrating all these approaches, an indication of the lake area was obtained that more closely reflects both existing and historical conditions. The results of this analysis also serve as a basis for understanding the factors causing the discrepancy between the administrative data of the KIB and actual conditions on the ground, while also supporting the process of securing regional asset administration in Serang Regency.

This research is similar to and complements various previous studies related to Lakeland assessment, including one that evaluated land suitability for housing development in the Gondang area of Tulungagung Regency (Putri et al., 2020). Furthermore, a study examining Lakeland and its water quality in Marabahan, Barito Kuala Regency, showed that Lakeland area in Barito Kuala Regency is decreasing (Sakdiah et al., 2020). However, unlike this study, that study did not address water quality in the Panembong Lake in Banten Province. Recommendations for future research include exploring more complex variables and using other methods related to Lakeland conditions in Indonesia, as well as providing additional insights related to geodesy and geomatics engineering in Indonesia.

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