

# Chapter 4

## Spatial Planning (Zoning Plan)

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4.1 Spatial Planning at Meso Level

4.2 Spatial Planning at Micro Level

This chapter explains the spatial planning in the meso and micro study areas for 2040. The concept of zoning development is based on the ICZM-Eco DRR concept while considering the current condition of the Semarang City spatial pattern. In explaining this concept, a big picture of the functions for each part of the region and each region within it can be seen by considering the existing conditions, potential, and problems related to ICZM-Eco Disaster Risk Reduction that may occur in the future.

Located in Beringin Watershed, the study area follows the planning concept of the spatial plan to describe the spatial use distribution in the meso and micro areas by considering the elements of the ICZM-Eco DRR concept. Some of the primary considerations in the preparation of spatial planning in the meso area include 1) regulating the balance between the upstream area (Mijen District), midstream area (Ngaliyan District), and downstream area (Tugu District), 2) space allocation for various community's socio-economic activities and environmental preservation activities.

In general, spatial planning in study areas is distinguished according to geographical and topographical conditions, namely upstream, midstream, and downstream. Watershed preserves the balance and the dynamic of water, and is essential for both the environment and the community. Therefore it is necessary to establish a well-integrated program between the upstream and downstream area to preserve and improve its condition

Based on the illustration (see **Figure 4.1**), the upstream area is directed as a protected and water catchment area. In this case, vegetation in the Mijen area will be maintained following the pillar ecosystem restoration. Besides being protected areas, the upstream area also serves as a limited cultivation development area with low density. Meanwhile, the midstream area in Ngaliyan District is directed as a high-density area. Lastly, the downstream area (Tugu District) is directed as a protected coastal area and a medium-density area. The downstream area becomes the focus of the micro area in this study. It focuses on creating spaces that can support local communities' activities, so that with proper spatial planning, it can improve the community's welfare and create a resilient community. A more detailed explanation of meso spatial planning and micro spatial planning explained in the following sections.

**The upstream is allocated as the protected zone for water catchment area. The midstream is the most likely to be directed as the dense settlement zone (Ngaliyan District). Meanwhile, the downstream is the protected coastal area with low-medium density (Tugu District).**



**FIGURE 4. 1 ILLUSTRATION OF UPSTREAM TO DOWNSTREAM**

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## 4.1 SPATIAL PLANNING AT MESO LEVEL

The meso spatial planning includes spatial use plan for conservation and cultivation zones that is divided into three parts (upstream, midstream, and downstream). Selection of the spatial pattern is done by referring to the conservation and cultivation zones established by local government and considering the analysis results.

The pattern of spatial use in the meso study area is a spatial use direction based on the principle of using natural resources based on environmental sustainability towards sustainable development. This direction can affect the growth and development of the meso study area without disturbing its environmental sustainability.

Selection of conservation and cultivation zones in the meso study area considers the limits and the environment carrying capacity in this area. In accordance with the Semarang City Spatial Plan (RTRW) for achieving sustainable development in the future, especially in areas with potential pressure and environmental disturbance, the selection of spatial use for the cultivation zone is based on the nature of the accommodated activities, the potential for development, land suitability, and morphological conditions.

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### 4.1.1. Conservation Zone

A conservation zone is an established area whose primary function is to protect environmental sustainability. It includes natural resources, artificial resources, also historical and cultural values for the benefit of sustainable development. The conservation zone also functions to maintain humans' safety and other living things from being vulnerable to the physical conditions of the environment. Following its function, the goal of the conservation zone is to improve the protection of the soil, water, and climate (hydrological), also maintain the diversity of flora, fauna, and ecosystems. It will be an essential aspect to increase the carrying capacity of the local environment while undertaking regional development efforts. The planned utilization of conservation areas in the meso study area includes the form of local conservation zones, forest conservation zones, and mangrove conservation zones. These zones then divided and spread in the upstream, midstream, and downstream. **Table 4.1** gives detail about the spatial allotment of meso planning area.

#### A. Local Conservation Zone

The local conservation zone in the meso study area consists of several sub-zones: River Border Sub-zone, High Voltage Air Channel (SUTT) and Extra High Voltage Air Channel (SUTET) Border Sub-zone, Railroad Border Sub-zone, and Toll Road Border Sub-zone.

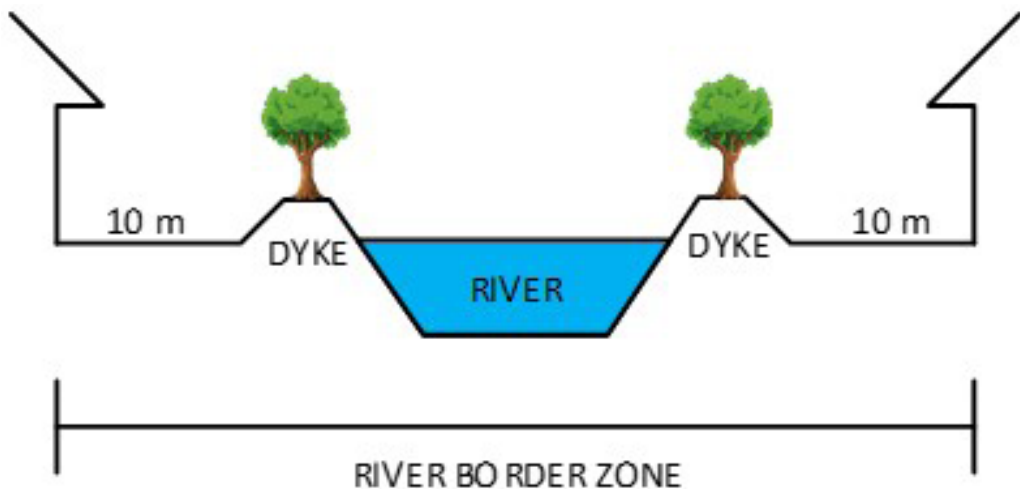
##### 1. River Border Sub-zone

River borderlines are areas along the either sides of the riverbank, including artificial rivers/canals/primary irrigation canals, which have significant benefits for maintaining the river sustainability functions. According to the ICZM-Eco DRR concept, it focuses on the ecosystem restoration along the riverbank. Therefore, the river border protection is carried out to secure the river flow and protect the river's function from aquaculture activities that can disrupt and damage river conditions.

In planning the river border, there are several standard or regulations that considers the land suitability and carrying capacity aspects. River border criteria (based on Central Java Provincial Regulation No. 9 of 2013 concerning Amendments to Central Java Provincial Regulation No. 11 of 2004 concerning Borderline) are as follows:

- The river boundary line with an embankment in the urban area is determined to be at least 3 (three) meters from the outer edge of the embankment along the river channel.
- The river boundary line with an embankment outside the urban area is determined to be at least 5 (five) meters from the outer edge of the embankment along the river channel.
- River border lines without an embankment in urban areas are determined:
  - At least 10 (ten) meters from the left and right edges of the riverbed along the river channel, in terms of river depth is less than or equal to 3 (three) meters;
  - At least 15 (fifteen) meters from the left and right edges of the riverbed along the river channel, in terms of river depth is more than 3 (three) meters to 20 (twenty) meters; and
  - At least 30 (thirty) meters from the left and right edges of the riverbed along the river channel, in terms of river depth is more than 20 (twenty) meters.
- Rivers without an embankment outside the urban areas consist of:
  - A large river with a watershed area greater than 500 (five hundred) square kilometers; and
  - A small river with a watershed area less than or equal to 500 (five hundred) square kilometers.
- The large river boundary line without an embankment outside the urban area determined to be at least 100 (one hundred) meters away from the left and right edges of the riverbed along the river channel.
- The small river boundary line without an embankment outside the urban areas determined to be at least 50 (fifty) meters from the left and right edges of the riverbed along the river channel.

As for the river border plan in the meso study area, which for river flows that cross the Beringin River, and all of its tributaries, the determined borderline is 10 (ten) meters from the left and right edges of the riverbed along the river channel. Basically, in the meso planning area, the Beringin Riverbank need to be supported by a green area, which functioned to encourage environmental sustainability. **Figure 4.2** illustrates the river section in meso area.



**FIGURE 4. 2 ILLUSTRATION OF RIVER SECTION**

## 2. High and Extra High Voltage Air Channel (SUTT/SUTET) Border Sub-zone

Based on the Minister of Energy and Mineral Resources Regulation No. 18 of 2015 (ESDM Ministerial Regulation 18/2015) concerning Free Space and Minimum Clearances in High Voltage Airways, Extra High Voltage Airways, and High Voltage Direct Current Air Channels for Electric Power Distribution, free space is a space bounded by vertical and horizontal field around and along the SUTT, SUTET, or SUTTAS conductors where humans and objects are not permitted for the safety of humans, living things, and other objects, also the safety of the power lines operation. This free space includes the distance from the vertical axis of the tower/pole to the conductor, the horizontal distance due to the swing of the conductor, and the distance of the impulse switch.

Human activities and the presence of other objects only permitted in a safe space. So to build, it must considering the location and the height of the building from the high voltage airways (SUTT) and extra-high voltage airways (SUTET). The location of the building on SUTT/ SUTET is as follows:

- At SUTT 66 KV (tower not elevated) the building location must more than 5.5 m from the high voltage line axis and must less than 450 lines from the flat line of the tower.
- At SUTT 150 KV (tower not elevated) the building location must more than 8.5 m from the high voltage line axis and must less than 450 lines from the flat line of the tower.
- At SUTET 500 KV double circuit (the tower is not elevated) the building location must more than 13 m from the high voltage line axis and must less than 450 lines from the flat line of the tower.
- At SUTET 500 KV single circuit (tower not elevated) the building location must more than 17 m from the high voltage line axis and must less than 450 lines from the flat line of the tower.

As for the SUTT/SUTET border plan in the meso study area, the determined border line is 6 meters from the left and right SUTT/SUTET line axis along the SUTT/SUTET channel. Therefore, this SUTT/SUTET border sub-zone planned in the entire meso area, including the upstream, midstream, and downstream area. **Figure 4.3** illustrates the SUTT/SUTET border zone.

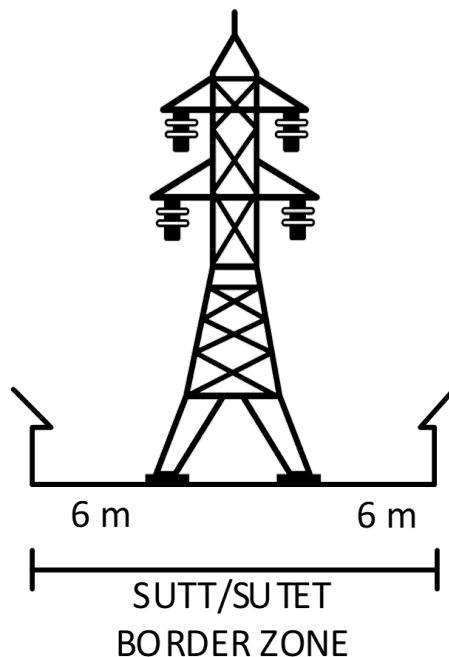


FIGURE 4. 3 ILLUSTRATION OF SUTT/SUTET BORDER ZONE

### 3. Toll Road Border Sub-zone

According to Law No. 38 of 2004 concerning Roads, a toll road is a public road for continuous traffic with full control over the access road, without an intersection and equipped with road space fences. The road borderline is the road plan line specified in the city plan. The development of the toll road border is directed as an ecological green open space, which responsive to flood conditions by developing the toll road borderline as a rainwater catchment area.

As for the toll road border plan in the meso study area, the determined borderline is 10 meters from the left and right toll road axis along the road line. The toll road border plan especially plan for the Ngaliyan District, which is passed by the Semarang-Batang toll road.

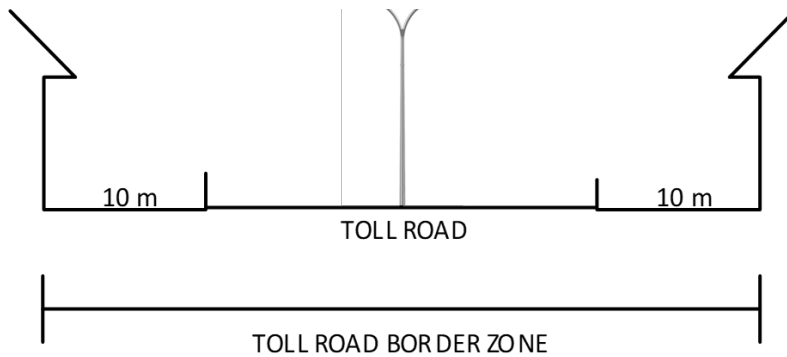


FIGURE 4. 4 ILLUSTRATION OF TOLL ROAD BORDER SUB-ZONE

To sum up, the local conservation zones are spread in almost every sub-district of meso area. The total area of local conservation zone planning in the meso area is 682.20 hectares, which is calculated from river border sub-zone, SUTT/SUTET sub-zone, and toll-road sub-zones.

### B. Forest Conservation Zone

As stated in previous chapter, that the upstream as part of the meso area will be planned as a forest conservation zone. In line with the ICZM-Eco DRR concept, the conservation area is crucial to keep the natural environment. According to the Minister of Public Works Regulation No. 05/PRTM/2008 concerning Guidelines for Provision and Utilization of Green Open Space in Urban Areas, it states that urban forests can be used as conservation areas and support the city environment (conservation, protection, utilization of germplasm, and biodiversity). Moreover, urban forests can also be used for a various social activities (limited, including passive activities such as sitting, resting, or reading and active activities such as jogging, gymnastics or other light sports), nature tourism, recreation, producing forest products, oxygen, economy (fruits, leaves, vegetables), also as an education and research facility.

Mijen District, located in the upstream area is prioritized as a green area with vegetation that holds a role to reduce the criticality of land in Mijen District, also can maintain the runoff of the Beringin River generally, so it can minimize flooding in Semarang City. The most important, the meso planning area should allocate a huge area in the conservation zone so that limits the development of residential areas to balances the city condition. Viewed from an environmental point of view, the massive development of residential area is detrimental because it decreases green areas/ forest areas, which also results in the reduction of water catchment areas. Therefore, the upstream area should be maintained as a conservation area, which functioned as the water catchment system to production forests and protection forests. Thus, the forest conservation area in the meso study area is directed around 548.68 hectares, which contributes almost 10% of the total meso area.

## C. Mangrove Conservation Zone

Mangrove ecosystem conservation zones can be located and concentrated in mangrove areas with the best conditions or in several locations with smaller areas. However, it is better if there is one location of protection, because it has a smaller edge effect so that maximizing the protection function of the zone. The direction of the mangrove forest management plan is as follows.

- In coastal waters that still have mangroves made coastal protection areas.
- Turbid waters are recommended for buffer areas because turbid waters will quickly produce an arising land, with silt deposits. Puddles in this area must be maintained so that mangroves can grow.

Mangrove ecosystems are very complicated because many factors affect the mangroves' growth and development. It is necessary to arrange the type of mangrove management because each type of mangrove has advantages and disadvantages. Mangrove conservation zones in the meso study area only exist in Tugu District. The total area of mangrove conservation zone planned in the meso study area is 425.08 hectares.

## 4.1.2. Cultivation Zone

Cultivation zones are areas designated to be cultivated based on the conditions and potential of natural resources, human resources, and artificial resources. The determination of the cultivation area focuses on facilitating and monitoring the management activities. The activities include the provision of infrastructures and facilities, also the handling of environmental impacts due to aquaculture activities.

The cultivation area development in the study area must be effective, efficient, and synergistic so that the utilization of space and resources can be more optimal. In this regard, the emphasis of the strategy for developing aquaculture areas is to optimize the use of resources while maintaining environmental sustainability in the region. The development of growth center in the cultivation area aims to form a settlement system, which integrates other regions. Therefore, the development will systematically encourage mutual growth in a more balanced region.

## A. Residential Zone

Residential zones are allotment of spaces consisting of groups of houses that facilitate the people life and livelihood, equipped with amenities. The purpose of the housing zones establishment is to provide land for the development of houses with various densities, accommodate various types of houses to encourage the provision of shelter for all levels of society, and reflect the patterns of development desired by the community in existing residential environments. In the future, according to their needs, residential zones could provide a residential space such as shelter, social housing, healthy simple housing, and village environment or traditional housing.

There are several general criteria in designing the residential zone in the meso study area, as follows:

1. Areas that technically available for settlements are area that safe from natural disasters, healthy, and have access to business opportunities;
2. The slope is 0% - 15% with the provisions of building arrangements;
3. Availability of facilities and infrastructures of the residential environment;
4. Location availability for existing and planned residential areas;
5. Not located in areas with technical irrigated agricultural functions or have the potential to be developed as technical irrigation fields;
6. The guarantee of water availability;

7. The erodibility is good and free from flooding or puddles;
8. The utilization of space for residential allotment areas must appropriate to the carrying capacity of the land and must consider the provision of a healthy and safe environment from natural disasters and an appropriate environment for community development, while regarding the preservation of environmental functions;
9. Allotment areas must have road infrastructure and accessible by public transportation facilities;
10. The utilization and management of residential designation areas must support the availability of physical facilities or public utilities (markets, trade and service centers, offices, clean water facilities, waste management, and drainage) and social facilities (health, education, religion);
11. Does not interfere with the existing protection function;
12. Does not interfere with efforts to preserve the ability of natural resources.

The pattern of the planned residential area will follow the structure of the developed area. There will be public facilities, education, health, economy, open space, and other primary facilities. There are three categories of residential zone plans in the study area, namely medium, low, and high-density residential sub-zone. In Mijen District, a low-density residential zone covers an area of 587.88 hectares; in Ngaliyan District, a high-density residential zone covers an area of 794.23 hectares, and in Tugu District as a medium-density residential zone covers an area of 310.28 hectares. Based on these provisions, the planned designation of residential zones in the meso study area is 1,692.39 hectares or approximately need 23% of the total meso planning area.

- Directives for the development of high-density residential sub-zones, such as in Ngaliyan District as the midstream area, including:
  - a. The control of development that exceeds the supporting data and the capacity of the region;
  - b. Provision the development of public green open spaces and private green open space in the yard or with the roof garden;
  - c. Planting trees that can absorb high CO<sub>2</sub>;
  - d. Vertical residential development following the provisions of the intensity on each spatial use;
  - e. Improving the quality of public infrastructures and facilities, also directing the offsite system sanitation.
- Directives for the development of medium-density residential sub-zones, such as in Tugu District as the downstream area, including:
  - a. The control of development that exceeds the supporting data and the capacity of the region;
  - b. Development of a medium-density residential zone with a building density of 40-100 houses/hectare;
  - c. Provision of green open space (RTH) and non-green open space (RTNH) to support public facilities in a residential zone;
  - d. Planting trees that can absorb high CO<sub>2</sub>;
  - e. Development of road networks in new settlements; and
  - f. Providing public infrastructures and facilities in the proportion of 40% (forty per cent) of the total area of residential zone.
- Directives for the development of low-density residential sub-zones, such as in Mijen District as the upstream area, including:
  - a. Control of development that exceeds the supporting data and the capacity of the region;
  - b. Development of a low-density residential zone with building densities between 10-40 houses/hectare;
  - c. Regional arrangement;
  - d. Planting trees that can absorb high CO<sub>2</sub>;
  - e. Limited green open space.



## B. Trade and Service Zone

The trade and service zone is part of the cultivation zone to develop commercial business activities, workplaces, businesses, entertainment and recreation venues, and to support public/social facilities. Trading activities developed in the trade center are generally retail and wholesale trade activities with the scope or scale of city and regional services. Shops and shopping centers that provide secondary goods (such as electronics and household appliances) and tertiary goods (staple food) are public facilities to support trading activities.

The determination of trade and service zones is aims to:

- Providing land to accommodate workers in the form of offices, shops, services, recreation and community services;
- Providing sufficient space to place basic physical equipment in the form of supporting facilities that can function properly; and
- Providing sufficient space for public facilities, especially to serve production and distribution activities that are expected to increase the regional economic

The planning development of trade and service zones in the meso study area will cover approximately 283.13 hectares. The trade and service zone allocate near the main road of the meso area, such as along the Ngaliyan-Mijen street as one of the busiest streets in Mijen and Ngaliyan Districts, also along the Walisongo street which located in Tugu District. Accordingly, the trade and service zone is spread evenly from upstream to downstream parts of the study area.

One of the considerations in developing the study area is the emergence of the informal sector around the trade, industrial, and service center. The informal sector is temporary, such as street vendors that appear in the morning and evening. These informal sector activities need to be organized and regulated so as not to cause problems that interfere with the surrounding activities. The followings are some arrangements plan for informal trade and services that appears as a supporting activity:

- Relocating informal sector trade location from inappropriate places such as sidewalks or the roadside to safer places and not disrupting the function of the area. There will be a particular location provided for the informal sector with high trade accessibility and often passed by pedestrians or become a transit point for the community.
- It hopes that the informal sector trading activities will not disturb the surrounding activities.
- The use of materials that give the shabby appearance, such as tarpaulins or plastic, is not allowed. The informal sector building must be temporary so that it can dismantle easily. It needs uniformity in the shape and size of buildings according to the type of merchandise so that it looks more organized.

Direction for management and use of space in trade and service zones: permit the trade and service activities in the form of shop/stall activities in all trade and service zones; direct the shopping center/modern shop activities at the main street; develop regional sales centers in the main road; develop traditional market activities through regional restructuring and market revitalization, and; develop road networks equipped with pedestrian pathways to improve the accessibility of economic support.

## C. Public Service Zone

The zone of public service facilities is a space designated to accommodate the functions of activities, such as education, transportation, health, worship, social culture, sports, and recreation, with facilities developed in the form of single/tenuous, series/meeting with the scale of service of each region. The purpose of establishing this zone includes:

- Providing space for the development of educational, health, worship, socio-cultural, sports, and recreation activities, with its facilities to meet the community needs according to the population served and the developed of service facilities scale;
- Determining environmental service centers by the scale of services as stated in the City Spatial Plan (RTRW); and
- Arranging the hierarchy of service centers according to the RTRW.

The public service zones development in the meso study area covers approximately 214.35 hectares, which spread evenly in the study area. The directions of educational facilities development in the study area are designed as follows:

- Development of existing public education service facilities through programs that aim to improve quality, maintenance systems and existing public service facilities;
- Determination of the location for educational facilities far from the center of the crowd and arterial roads, while considering the accessibility;
- Development of secondary and tertiary education facilities in the downtown directed to locations or areas or roads that are adequate and not cause disturbance to the environment;
- Development of educational facilities on the edge of the main road by considering the smooth movement of the road;
- Provision of education, as an effort to meet the population educational needs, specifically the need for educational facilities;
- Provision of education, as an effort to increase human resources in order to improve the standard of living and welfare independently; and
- Improvement in the provision of educational facilities to realize a broader range of services for educational facilities.

Directions for developing health facilities, in general, are carried out by improving the quality of population health in the planning area. There are some purposes, as follows:

- Development of existing public health service facilities through programs that aim to improve the quality, care system and existing public health service facilities.
- Provision of health facilities by referring to the availability of facilities and the range of existing services, also by considering planned development needs during the planning period.
- Determination of health facilities location is cultivated near the center of settlements, making it easier to reach the distance to health services.
- Health facilities also can be placed close to the central government.

## D. Industrial Zone

The industrial zone is a zone where economic activities occur, which processes raw materials, semi-finished goods, and or finished goods into higher-value goods, including industrial design and engineering. The establishment of the industrial zone aims to:

- Provides space for producing goods activities including design and engineering activities related to other economic works; and
- Facilitate the growth of new industries by controlling the use of other spaces, to maintain environmental harmony so that guarantee the mobility between spaces and the quality of the environment is controlled.

The industrial estate in the meso study area is planned to consist of several types of industry:

- Food Industry;
- Pharmaceutical, Cosmetic and Medical Devices Industries;
- Textile, Leather, Footwear and Miscellaneous Industries;
- Transportation Equipment Industry;
- Electronics and Telematics Industry;
- Capital Goods Industry, Components, Auxiliary Materials, and Industrial Services;
- Agro-Industry;
- Basic Chemical Industry;
- Warehouse;
- Bonded Zone; and
- Other Types of Industry.

The industrial zones development in the meso study area covering approximately 1,121.98 hectares, mainly focuses on the development of Wijayakusuma Industrial Estate (KIW), Bukit Semarang Baru (BSB), Candi Industrial Estate (KIC), also small and medium industrial centers (SIKM). These industrial zones are spread evenly in the upstream, midstream, and downstream areas. Wijayakusuma Industrial Estate (KIW) which located in Tugu District (downstream) has the largest allotment of industrial zone. Meanwhile, the Bukit Semarang Baru Industrial Area has the smallest allotment area since it locates in the upstream area, which plans to be the forest conservation. Accordingly, this meso spatial plan tries to manage the industrial zone development through some directions in certain ways, as explained below:

- Provision of green open space for balancing environmental functions
- Integrate the development of Industrial Estates with the surrounding environment by considering the radius/distance and the level of produced pollution to prevent and reduce pollution.
- Equip the development of industrial estate/warehouse with the provision of environmental infrastructures, public utilities, housing for workers, and social facilities with a proportion of 40% (forty percent) of the total land area, which then submitted to the regional government.
- Industrial zone development must considering to its land requirements, types of space, availability of public service facilities (parking lots, green open spaces, street vendors, fire prevention and mitigation), ease of access, and traffic flow.
- Development and implementation of industrial activities must be accompanied by integrated efforts to prevent and overcome the environmental pollution starts from arranging the AMDAL, efforts to manage and monitor the environment (UKL and UPL), provision of wastewater treatment plants (IPAL), also followed by intensive and comprehensive supervision from the regional government.
- Individual industrial units that are still located outside the industrial area and have the potential to cause environmental pollutions will gradually relocate to areas planned as industrial zones. Meanwhile, small and household industry can be located in a residential area as long as it does not interfere with the housing environment's function.

## E. Aquaculture Zone

Aquaculture zone is a designation area for humans to manage and utilize aquatic biological resources. In the micro area, aquaculture zone is a zone to raise, breed fish, and harvest the results in a controlled environment. The allocation of fisheries area is integrated with the mangrove area. The development of fishery activities is planned in an area that covers 532.47 hectares, which almost all located in the downstream (Tugu District).

## F. Agriculture Zone

The development of agricultural zones is based on the analysis of the land's ability and suitability for agricultural cultivation activities. It focused on dryland agriculture, which means that an area whose topography and soil conditions are appropriate for dryland agriculture activities. Aside from dryland farming, this area is also permissible to cultivate perennials. The area's development aims to utilize potential land suitable for agriculture to produce food while still concerning environmental sustainability. Agriculture zone in the meso area is planned to cover 985.22 hectares, which mostly located in midstream and upstream areas with the following development directions, as follows:

- Wetland agriculture can be developed on dry land agriculture as long as there is sufficient water availability.
- For certain considerations, agricultural areas at certain locations can be designated as sustainable food agriculture land (LP2B) areas to ensure that agricultural areas do not change functions.
- Agricultural areas can be mixed with other uses as long as the function of agricultural areas can still be maintained.
- For certain interests that are considered strategic at the national or regional level, agricultural areas can be converted into non-agricultural areas.

## G. Tourism Zone

The tourism zone is the designation space for natural, artificial, and cultural tourism activities. It provides space for the development of various types of tourism accommodation with various densities throughout the region, which encourages the provision of tourists accommodation. The tourism zone in the meso study area is directed as coastal tourism in the form of mangrove walks, boat rides, and fishery product shopping tours, especially in the downstream area (Tugu District). In line with the ICZM-Eco DRR concepts, one of the tourism zone concepts is to consider the disaster mitigation in planning the zone. The development of tourism activities is planned to be 109.54 hectares, which located in the coastal of the meso area. Plans for developing tourism and recreation activities in the study area have some purposes as follows:

- Increased accessibility;
- Provision of supporting facilities;
- Improvement of environmental conditions;
- Support for economic development;
- Improvements in the marketing process through promotion
- Local Community Support; and
- Improved Human Resource Management.

Furthermore, the directions for developing the tourism sector in the study area are considering some consideration as explained below:

- Control the city's development through environmental restoration, rejuvenation and improvement, and new environmentally friendly development;
- Control the development of space by considering the protected area of its subordinate area, economic development, the intensity of space utilization and infrastructure capacity;
- Provide parking space in the tourism zone;
- Provide various types of tourist facilities, such as homestays and others which encourage tourists' accommodation;
- Provide tourism supporting infrastructure and facilities, such as good access to roads, electricity, telecommunications, clean water, and waste management;

**TABLE 4. 1 EMBODIMENT OF THE SPATIAL PATTERN PLAN IN MESO STUDY AREA**

No	Zone	Area	Total Area (Ha)
<b>CONSERVATION ZONE</b>			<b>1,894.86</b>
1	Local Conservation Zone	Upstream, Midstream, Downstream	677.85
2	Forest Conservation Zone	Upstream	791.93
3	Mangrove Conservation Zone	Downstream	425.08
<b>CULTIVATION ZONE</b>			<b>4,910.53</b>
	Residential Zone		
1	- Low Density Residential Zone	Upstream	458.59
	- Medium Density Residential Zone	Downstream	310.28
	- High Density Residential Zone	Midstream	794.23
2	Trade and Service Zone	Upstream, Midstream, Downstream	511.86
3	Public Service Zone	Upstream, Midstream, Downstream	214.35
4	Industrial Zone	Upstream, Midstream, Downstream	993.99
5	Aquaculture Zone	Downstream	532.47
6	Agriculture Zone	Upstream, Downstream	985.22
7	Tourism Zone	Downstream	109.54

Source: Analysis, 2020

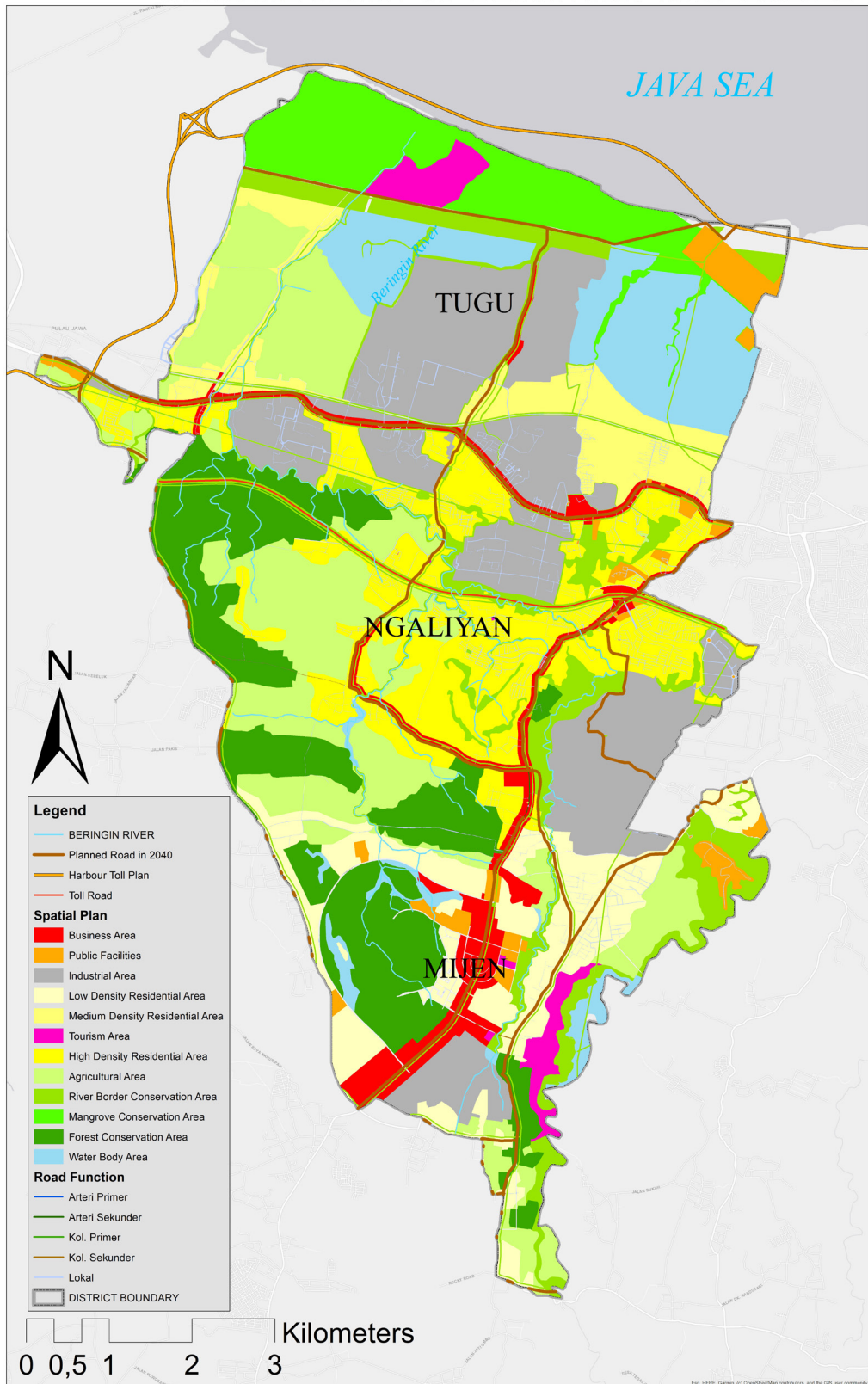


FIGURE 4. 5 SPATIAL PLANNING AT MESO LEVEL MAP

## 4.2 SPATIAL PLANNING AT MICRO LEVEL

The micro spatial plan is a spatial allotment plan within the micro area. It includes an allotment for conservation and cultivation zones that covers 5 RWs in Mangunharjo and Mangkang Wetan Sub-Districts. The determination of the spatial pattern refers to the conservation and cultivation zones that have been established by the government, which considering the implementation of ICZM Eco Disaster Risk Reduction concepts.

It needs the pattern of spatial use, built on the principle of utilizing natural resources based on environmental sustainability towards sustainable development as a direction for spatial use in the micro area. Hopefully, the direction can spur the growth and development of the micro area without disturbing its environmental sustainability.

The determination of conservation and cultivation zones in the micro area considers the limits and carrying capacity of the environment. The determination of conservation zones established in the micro area, according to the Semarang Spatial Planning, is for sustainable development in the future, especially in subject areas that have potential to environmental pressures and disturbances. Meanwhile, the determination of spatial use for the cultivation zone is based on the nature activities, the potential for development, land suitability, morphological conditions, and the product of the planned area.

The activities and functions of the micro area should be determined first before developing the spatial zones. The micro area will be divided into five main functions, as follows:

1. Fisheries and Non-Fisheries Living;
2. Fisheries and Maritime Economy;
3. Conservation;
4. Tourism; and
5. Training and Educational.

For each function, it needs some activities to accommodate the spatial zones development. Activities analysis in the micro area then becomes the basics in designing the spatial allocation to calculate the space needs in the micro area. Spatial allocation analysis is a calculation of the amount of space needed for each activity to be accommodated in the designed site planning by considering the number of users and the standard use of activities. There are some supporting resources for determining each activity's land requirement, such as ministry regulation, city regulation, best practice, and other literature. **Table 4.2** explains the analysis results of space allocation in the micro area. According to the table, the total area to develop in the micro area is about 636 hectares.

**TABLE 4. 2 EMBODIMENT OF THE SPATIAL PATTERN PLAN IN MICRO STUDY AREA**

Function	Activities	Facilities	Number	Unit	Land Demand (Ha)	Note
<b>MAIN FUNCTIONS</b>						
Fisheries and Non-Fisheries Living Activities	Living	Landed Housing	934	Housing	1713	A
	Drying fish and Smoke Fish Processing	Drying fish and Smoke Fish Processing	1	Unit	0.1	B
		Fishponds			Ponds	
	Area	SME Center	1	Unit	0.38	B

Function	Activities	Facilities	Number	Unit	Land Demand (Ha)	Note
Fishery and Maritime Economy	Selling Fish	Fish Auction (TPI)	1	Unit	5	C
	Harvest shellfish	Fishponds		Ponds	98	D
		Ship moorings/sandar kapal	1	Unit	1	E
	Mangrove Cultivation	Mangrove processing area	1	Unit	0.3	F
		Integrated Waste Treatment Plant	1	Unit	0.1	G
Conservation Activities	Conservation	Water retention basin/pool	1	Unit	2	F
		Riverbank restoration			5	D
		Mangrove restoration			150	D
		Early warning system spot	1	Unit	0.5	F
<b>SUPPORTING FUNCTIONS</b>						
Tourism Activities	Relax and recreation culinary	Souvenir center and culinary stand		Unit	3	G
		Mangrove tourism			26	
Training and Educational Activities	Training and education	Vocational school	1	Unit	0.42	H
	Educational tour	Training centre	1	Unit	0.58	F
<b>CIRCULATION/PSU (40%)</b>					<b>11.42</b>	I
<b>PADDY FIELD (LP2B)</b>					<b>133</b>	J
<b>PUBLIC OPEN SPACE (20%)</b>					<b>121.4</b>	J
<b>PRIVATE OPEN SPACE (10%)</b>					<b>60.7</b>	J
<b>TOTAL LAND REQUIREMENT</b>					<b>636.03</b>	

Source: Analysis, 2020

\*Note:

A: Minister of Public Housing Regulation No. 7/2013 concerning Implementation of Housing and Settlements with Balanced Occupancy

B: Architect's Data, 1 & 2, Ernst Neufert, John Wiley and Sons, New York, 1980

C / E: Regulation of the Minister of Maritime Affairs and Fisheries PER.08 / MEN / 2012

D: Analysis

F: Best Practice

G: Ministry of Agrarian Affairs and Spatial Planning (Central Land Agency)

H: Minister of National Education Regulation No. 24 of 2007 concerning Infrastructure Standards

I: Minister of Public Housing Regulation No. 7/2013 concerning Implementation of Housing and Settlements with Balanced Occupancy

J: Semarang City Regional Regulation No. 14 of 2011 concerning Semarang City Area Spatial Planning 2011-2031

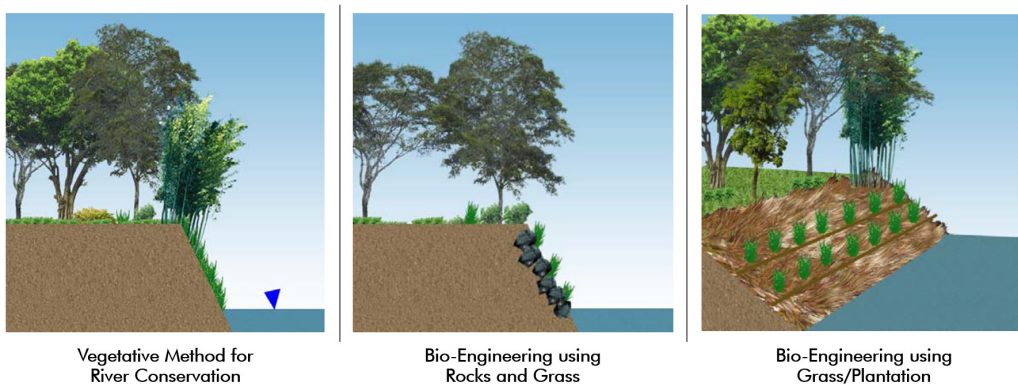


## 4.2.1. Conservation Zone

In micro area, conservation zone is including the river border conservation and mangrove conservation zone as follows.

### A. River Border Zone

One of the pillars in ICZM-Eco DRR concepts is ecosystem restoration, such as implemented in the Beringin River border conservation. Generally, the guideline for conserving the Beringin River border zone is similar to the meso area. It focuses on improving natural conservation in the river zone from the upstream to downstream. In detail, the plan of river border conservation in the micro area considers which areas along the left and right sides of the river that have significant benefits for maintaining the river function, securing the river flow, and developing the river as a green area. Besides that, in line with the ICZM-Eco DRR concepts, vegetative and bio-engineering concepts will be developed in the river border of the micro area, especially in the river border segment that is surrounded by natural environments such as paddy fields, fishponds, and mangroves. The bio-engineering method is in the form of growing particular vegetation that is suitable for river borders, which have a high chance of physical danger combined with abiotic components (rocks). The large of the river border zone in the micro area is approximately 5 hectares. **Figure 4.6** illustrates the river border vegetation.



Source: Modified from Nehren et al., 2014 (p. 41)

**FIGURE 4. 6 ILLUSTRATION OF RIVER BORDER VEGETATION**

### B. Mangrove Conservation Zone

Beach border is a plain along the coast with a width that is proportional to the shape and physical condition of the beach, at least 100 meters from the highest tide point towards the land. The protection of coastal borders aims to protect the function of the coast from aquaculture activities that can disturb or damage the coastal environment condition.

The micro-planning area needs mangroves to protect coastal border functions. Each type of mangrove has its advantages and disadvantages. Mangrove becomes the most important thing in the micro area because mangrove management can improve the coastal community's livelihood. In this concept, mangrove has two main functions: mangrove as natural preservation and mangrove for economic purposes. Considering that, a tourism area will be developed near and integrated with the mangrove conservation zone. However, there is a risk of community activities that may bring negative impacts to the mangrove. Therefore, a strict regulation in mangrove management is essential for managing people to not only use mangrove to increase their economics but also to conserve it properly.

Mangrove conservation zone will be developed along the coastline for about 150 hectares. Mangrove area will be one of the central zones in the micro area since it locates in the coastal area. In planning of mangrove area, it will also merge with the tourism area so that mangrove is not only used as a conservation area but also can increase the tourism in Tugu District. Some directions in conserving mangrove are as explained in the meso spatial planning.

## 4.2.2. Cultivation Zone

The cultivation area is a cultivated area based on natural conditions and potentials, also human and artificial resources. The cultivation area aims to facilitate the management and monitoring of activities, including the provision of infrastructures and facilities, also the handling of environmental impacts due to aquaculture activities. Based on the spatial allotment, the cultivation zone contributes almost 70% of the micro area. For the cultivation area, there are seven zones planning in the micro area, as follows:

### A. Residential Zone

The residential zone will be equipped with public and social facilities following the structure of the developed area, such as community centre, schools, hospital, public convenience, etc. . It will accommodate the needs of both existing and additional residential areas and provides housing, especially for the local community in the micro area.

The residential zone in the micro study area is categorized as a medium-density residential zone covering an area of 17.13 hectares. Based on the projection analysis, the residential zone can accommodate up to 950 households with landed houses. The residential zone is located near the coastal area as it follows the community's activity which depends on coastal and river activities. Furthermore, the residential area will be equipped with an education and training center located close to the community, which occupies one-hectare of total micro area. In accordance to the concept of ICZM-Eco DRR, the establishment of education and training center aims to improve the local community's knowledge, skills, and livelihoods. In line with two main pillars in the concept, for achieving sustainable livelihoods and improving community's capacity, a vocational school which focuses on fishery and marine-based knowledge should provide the required education and training. In addition, activities such as training and workshop can directly support these pillars.

### B. Trade and Service Zone

The basic idea of planning the trade and service zone in the micro area is to provide more economic opportunities for the communities. The trade and service zone in the micro area is described as business areas for small-medium enterprises (SMEs) and fish auction located in the north part of the micro area, near the tourism area. Approximately, it covers 0.38 hectares of the total area. This zone tries to integrate all facilities such as SMEs centre and open space with the surrounding like the mangrove area and fishponds. This area will be one of the major areas in the new development of Mangkang Wetan and Mangunharjo that will also be equipped with new road access to make it more accessible for communities or visitors/tourists. Hopefully, the development of trade and service zone can encourage local people to develop their economy by producing and selling some local products.

## C. Aquaculture Zone

The aquaculture zone is used for human activities related to the management and utilization of aquatic biological resources. The planned development of fishery activities covers 98 hectares for fishponds. Moreover, the aquaculture zone with approximately 6 hectares of the total micro area is equipped with supporting facilities such as fish auction, dried fish and smoked fish processing facilities, waste treatment, and ship moorings. The integration between fish auctions, fish drying and processing, and ship mooring activities in this zone is significant in developing selling value of the area.

## D. Tourism Zone

Considering the potential which the study area possesses, tourism development is one of the most viable options to improve the local communities' livelihood. The development of the tourism zone in the micro area is planned to be 29 hectares, consists of souvenir center, culinary stands, and mangrove tourism. The tourism zone in the micro area has economic and environmental purposes. Therefore, it is located close to the aquaculture zone, trade and service zone, mangrove and open space area. Some supporting facilities in the tourism zone, such as parking area facilities and mangrove walks, aim to integrate tourism activities in one zone. Moreover, visitors can enjoy the supporting facilities such as a restaurant that provides a comfortable feeling and sceneries of parks, or open space and mangrove area. Besides, the Beringin River that passes along this micro area can also add to the attractive element for tourism. Through the development of tourism, it also provides the packages of disaster risk reduction efforts for mitigation and locality-based education as the tourism attraction.

## E. Open Space

Physically, green open space can be categorized into natural open green space in the form of natural wild habitats, protected areas and national parks, and non-natural or built green space such as parks, sports fields, and green lane trails. Functionally, green space serves as ecological, social, cultural, aesthetic, and economic purposes.

Green roads can provide green space by placing plants between 20-30% of the road space according to the road class. In the micro area, green space will be planned around 30% of open space from the total area. The open space is divided into two categories, namely public open space and private open space, in which they need ±120 ha and ±60 ha of the total micro area. The open space also can be used for community market at the weekend, as well as for other various events.

## F. Agriculture Zone

The southern part of the micro area will be designed as an agriculture zone. Its location gives advantages to the paddy field area. The development of this area is to utilize potential land suitable for agriculture and food production while still considering environmental sustainability. In this area, aside from dry-land farming, the land conditions are also suitable to cultivate perennials. Agriculture development in micro-area is also in line with the Semarang Spatial Planning document which states that agriculture zone should be provided and maintained in Tugu Sub-district. Besides that, maintaining the agriculture area is also part of the Sustainable Food Agriculture Land Program (LP2B). The total area for the agriculture area is approximately 133 hectares located in the south part of micro-area.

## G. Others

Non-Green Open Space Zone serves as an open space in urban areas that are not included in the green space category, in the form of hardened land or water bodies. Non-open spaces zone located in micro-area includes a retention pool that serves as one of the solutions to deal with lumps that often occur in the micro-area. The total area for the retention pool is approximately 2 hectares, located in the southeast part of the micro area surrounded by the agriculture area.

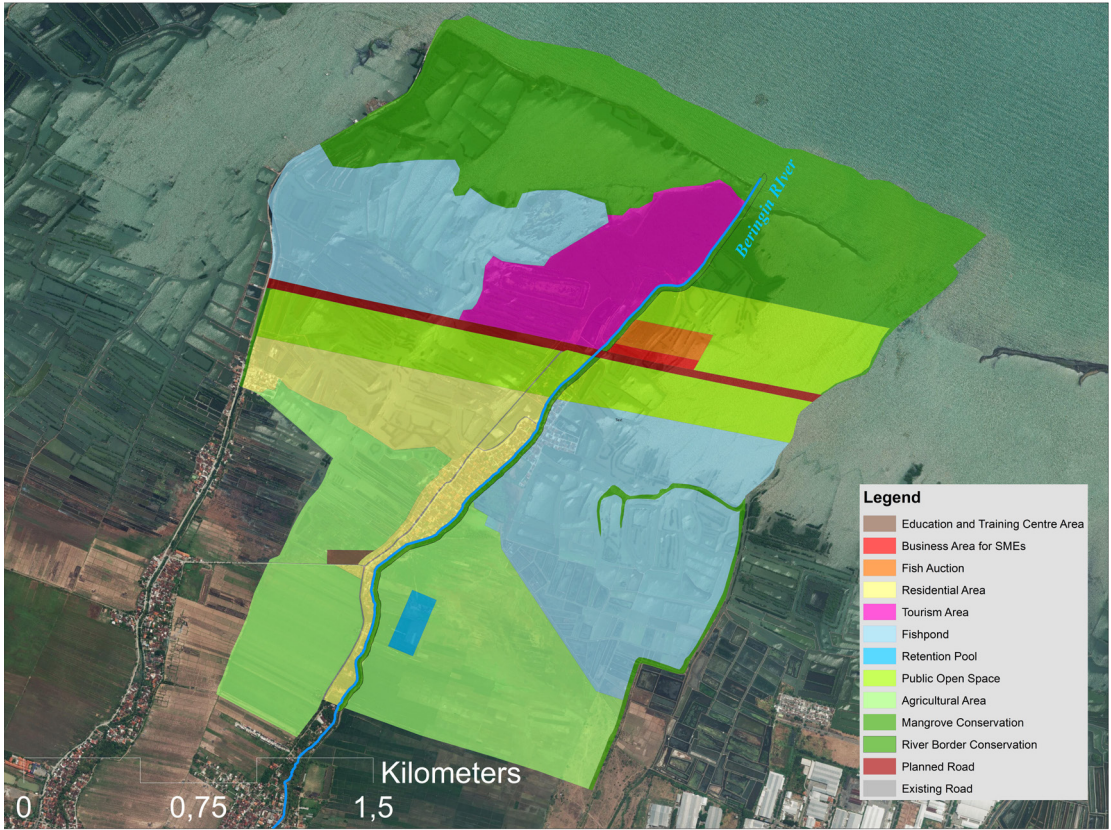


FIGURE 4. 7 SPATIAL PLANNING AT MICRO LEVEL MAP



FIGURE 4. 8 3D ILLUSTRATION OF MICRO AREA PLANNING

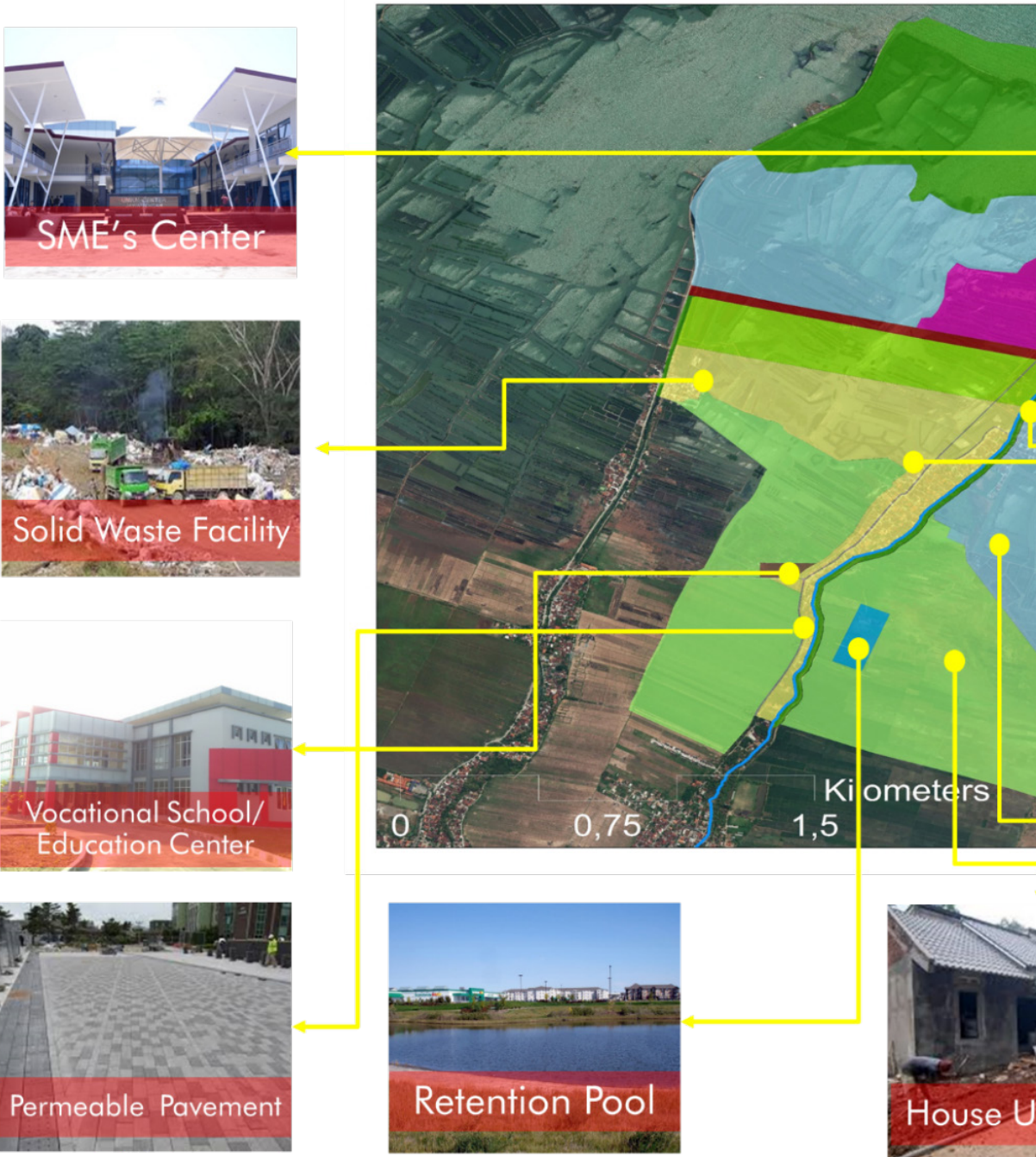


FIGURE 4. 9 ILLUSTRATION OF MICRO AREA PLANNING

