THE EFFECT OF SEA EMBANKMENT CONSTRUCTION IN REDUCING THE ECOLOGICAL IMPACT OF TIDAL INUNDATION ON THE COAST OF SEMARANG CITY

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ABSTRACT

One of the environmental problems faced by Semarang City is the threat of flooding and robbing. The Semarang City Government since 2016-2019 has implemented the Flood and Rob Control Project program in various forms of infrastructure, including the manufacture of polders, sea embankments. The purpose of this study is to examine the effectiveness of the construction of sea embankments on the coast of Semarang city in reducing ecological impacts. The methods used include literature review, field review, and interview. The results of the study show that the construction of the sea embankment succeeded in making the area on the south side of the embankment free from rob, but on the south side of the sea embankment during the rainy season period becomes a flood control embankment so that the community becomes threatened with flooding.

Keywords: Semarang City, sea embankment, ecological impact

INTRODUCTION

Floods and tidal floods are disasters that routinely hit the northern coastal area of the city of Semarang. If serious handling efforts are not made, the disaster will become an obstacle to various economic and social activities for the community in the location as well as increase economic costs for trade and service activities. Efforts to overcome the flood disaster are contained in the Semarang City Drainage Masterplan in 2007 which subsequently became Semarang City Regional Regulation Number 7 of 2014 concerning the Semarang City Drainage System Master Plan for 2011-2031. Furthermore, in the drainage master plan, the programs for handling the flood disaster are described which include the following activities: 1. Construction of the Jatibarang reservoir; 2. Making and maximizing drainage systems; 3. Manufacture of pumping stations; 4. Construction of sea embankments; 5. Road

elevation; 6. Embankment construction; 7. Manufacture of parapets (water barrier walls); 8. Manufacture of pump housing and retention pond; 9. Cleaning of drainage channels.

In addition to the activities carried out by the government in the 9 programs, efforts made by the community include by carrying out the following activities: 1. Elevation of house buildings; 2. Cleaning of drainage channels in residential channels; 3. Construction of emergency embankments on a small scale; 4. Establishment of disaster awareness groups. According to BNPB (2012) when a flood disaster occurs, community adaptation includes: moving goods to a safer place and changing professions to become pond farmers. At the adaptation stage, people move permanently or temporarily (evacuate).

Since the construction of a number of flood and rob control infrastructure carried out by the Ministry of PUPR in collaboration with the Provincial Government of Central Java and Semarang City, the flood has begun to be resolved. To contain the runoff of the storm, a tidal embankment was built that stretches along 2.17 km from the Sultan Agung Islamic University Campus (Unissula), encircling the Terboyo industrial area to the Sringin River. Flood and rob control is made into one package considering that the infrastructure built is in the context of controlling both. The form of flood and tidal control efforts includes the construction of Semarang tidal flood control divided into 2 work packages, namely the Sringin Polder System and the Tenggang. In package 1, the construction of a Banjardowo retention pond with a capacity of 30,000 m3 as a water parking lot in the rainy season, normalization and repair of the Sringin River parapet, the construction of estuary gates and Sringin River Polders and the construction of a 2.17 km tidal embankment from the Unissula Campus encircling the Terboyo industrial area to the Sringin River. The number of pumps in the Sringin River Pump House is 5 pumps with a capacity of 2 m3/second to drain water discharge from the Sringin River to the sea in the rainy season.

Package 2 is in the form of the creation of a retention pond for Rusunawa Kaligawe with a capacity of 66,000 m3, the construction of estuary gates and Polders at the mouth of the Tenggang River, with a retaining embankment in the Terboyo terminal and industrial area and the normalization and repair of the Tenggang River parapet. The number of pumps in the Tenggang River Pump House is 6 units with a discharge capacity of 2 m3/second.

RESEARCH OBJECTIVES

Examining the effectiveness of seawall construction on the coast of Semarang city in reducing ecological impacts.

RESEARCH LOCATION

The research location is in Semarang City, Central Java Province, Indonesia with geographical coordinates of 6°50' - 7°10' South Latitude and a line of 109°35 - 110°50' East Longitude.

METHOD

The research methods used include:

a. Field survey, which is direct observation in the field including documenting the impact of floods and robs
b. Literature review, namely searching for relevant literature about floods and robs in Semarang City
c. Interviews, namely asking residents in locations that are affected by floods and robs.

RESULT

Manufacture of polders and sea embankments

According to Bayu Kencana (2019), the Ministry of PUPR through Balai Besar Wilayah Sungai (BBWS) Pemali Juana in collaboration with the Semarang City Government since December 2016 has started the construction of the Semarang rob flood control which is divided into two work packages, namely the Sringin and Tenggang Polder Systems. Package I work includes the construction of a Banjardowo retention pond with a capacity of 30 thousand m3, normalization and repair of the Sringin River parapet, construction of estuary gates and Sringin River Polders with embankments from the Tenggang River to Sringin. The Sringin polder is equipped with a pump with a capacity of 5 x 2 m3 per second which can function to pump rob water back to the sea.

Package II is in the form of the construction of a retention pond for Rusunawa Kaligawe with a capacity of 66 thousand m3, the construction of estuary gates and

Polders at the mouth of the Tenggang River with a retaining embankment in the Terboyo terminal and industrial area and the normalization and repair of the Tenggang River parapet. The Tenggang Polder is equipped with a pump with a capacity of 6 x 2 m3 per second. In 2016, Polder Banger was completed, so that floods and robs in Semarang Port to Central Semarang could be relatively handled. As for the other 2 Polders, namely the Tawang Polder and the Semarang River Polder, it has been operating since 2014. According to Bayu Kencana (2019), the tidal flood control project on the coast of Semarang was completed in June 2019. One form of flood control is the Ministry of Public Works and Housing building a tidal runoff barrier, building a tidal embankment that stretches along 2.17 km from the Sultan Agung Islamic University Campus (Unissula), encircling the Terboyo industrial area to the Sringin River (Figure 1).

This means that people affected by floods and robs since 2019 hope to be free from floods and robs. The results of a survey of the social conditions of people affected by floods and robs in the Terboyo Kulon Village, Terboyo Wetan, Trimulyo area show that the community hopes that there will be a solution by the government so that they are free from floods and robs. Since the completion of the construction of the embankment line to the north of the Terboyo industrial area and two pump houses, namely Tenggang and Sringin, completed in 2019, the area within the boundary of the line is relatively free from rob. This was acknowledged by people living in the area based on interviews in 2019.

On June 7, 2020, there was a robbery on the Semarang-Demak road section in Sayung. Based on field observations, the occurrence of the storm was caused by seawater flowing inland through small rivers so that the puddle of storm water reached the road. In the part between the end of the mouth of the Babon River to the east into the Demak Regency area until 2020, flood and tidal control has not been carried out. In fact, if traced, there are areas of Semarang City that have not been handled, namely included in Trimulyo Village.

Data for Semarang City with a total area of 373.78 km^2 with a population of 1,659,975 people in 2023 was obtained with a population density figure of 4441.05 people/km^2 (BPS Semarang City, 2023). Based on the criteria of Perka BNPB No. 02 of 2012, all coastal sub-districts in the city of Semarang with a population density of

more than 1000 people/km^2 have a population index exposed to floods and robs, including high classes. The high-class criteria can be interpreted that flood and tidal disasters have a major impact on the large number of people exposed (Heryoso Setiyono, et al., 2024).

The results of interviews with respondents who survived the flood and rob disaster in 2019 are shown in Table 8.10. The interview locations are spread across several villages in Genuk District and some in villages in North Semarang District (Heryoso Setiyono, 2023). Based on Table 8.10, it shows that almost all respondents (20 respondents) at the research location where the houses they live in have experienced floods and robberies. All respondents knew the difference between inundation caused by flooding due to rain and tidal waves coming from the sea.

Regarding the answers of respondents who experienced flood and rob events for the same location, that before the 2017-2019 Flood and Rob Management Project, in addition to experiencing flood events due to rain factors, locations also experienced flood events due to marine factors. After 2019, one location only experienced flooding, and another location only experienced flooding.

Regarding the question of future hopes, all respondents stated that they would continue to stay in the locations affected by floods and storms because they had settled for a long time. All respondents hope (believe) that in the future the problem of floods and robs can be overcome.

- Do you know the difference between flood and rob.
  Answer: know
- Has your location ever been hit by floods.
  Answer: yes
- Has your location ever been hit by rob.
  Answer: yes
- Is your location hit by floods and robs
  Answer: yes
- What will be done because the location is hit by floods and robs.
  Answer: stay tuned

- Is there hope in the future if the problem of flooding and rob can be overcome?
  Answer: yes

Based on some of these basic questions, people who live in areas prone to floods and robs almost all experience floods at the same time. The community has the expectation that one day the problem of floods and robs can be overcome through the role of the government. Therefore, almost all respondents who were asked had a decision to stay at the location even though every rainy season must be ready to face floods and before the turn of the rainy season to the dry season prepare to face the impact of the storm.

Rob is no longer happening, but the flood is getting bigger

In the rainy season at the beginning of 2019, it was recorded on January 21, 2019 that heavy rain caused the East Canal Flood River to overflow. The areas affected by the incident are Kemijen, Tegalrejo and Cilosari, East Semarang District. Based on the BMKG report (2019), the accumulated rainfall around the Java Sea for January 2019 ranged from 400-600 mm. The flood on February 6-8, 2021 in Semarang City occurred widely due to high-intensity rainfall, causing the coastal area of Semarang City to be flooded. According to BMKG (2021), the rainy period of February 5-6, 2021 in North Semarang and Genuk and other sub-districts is included in the category of very heavy rain between 100-150 mm/day. The highest rainfall was recorded in Ngaliyan at 183 mm, including the extreme category. One part of the area in Genuk experienced a major flood. Genuk is known as a part of the area that is surrounded or protected by sea embankments from the threat of rob. On the other hand, the sea wall is suspected to be one of the causes of the increasingly high and prolonged floods in the February 2021 period.

The sea embankment functions as a buffer for the arrival of the storm from the sea to the mainland. On the other hand, in the rainy season, the sea embankment changes its function to a flood embankment that holds water that will go to the sea.

This condition is the cause of the flood getting higher and longer to stagnate, so that during the rainy season the community becomes a victim of the protection system created.

Integrated toll road construction with sea embankment

As an effort to completely solve the Central Government's efforts to overcome flood and tidal disasters, the construction of a trans-Java toll road was designed, especially one that connects Semarang City with coastal cities in the eastern part of Semarang, namely an integrated toll road with a sea embankment as an effort to prevent tidal floods. The toll road connects Semarang with Demak, Kudus, Rembang, Tuban, and Surabaya, which is also known as the northern coast of Java.

The handling of floods and tidal waves for the 2017-2019 period is considered incomplete, because there are several parts that still need to be continued, such as the sea embankment that has not been connected from BKT to the Babon River. Furthermore, there is a plan to build a Semarang-Demak toll road that will pass through the northern part of Genuk District which also functions as a sea embankment. Meanwhile, in the coastal part of the Demak Regency area in Sayung District, it is also part of the handling of floods and robs.

The Semarang-Demak flood and rob management activity plan is shown in Figure 2. According to Rizaldi (2021) the flood and rob management plan is a continuation of the flood and rob management of Semarang City, the difference is that the next plan is expanded towards the Demak Regency area in Sayung District. The priority of activities is centered in the Sayung District as Package I, while in the Semarang City area is to continue the flood and rob control project that has not been completed as Package II, including:

a. The extension of the tidal embankment, in the western part from behind Unisula to BKT and in the eastern part from the Kali Sringin pump station to the north around the Terboyo Industrial Estate

b. Creation of a new channel connecting the Sringin River polder to the east in the direction of the Babon River. The purpose of making the channel is to discharge water with a pump of 2 x 0.5 m^3/second into the Babon River.

c. Improvement of drainage system in Terboyo Industrial Estate

d. Manufacture of Genuk-Baboon channel equipped with 2 x 0.25 m^3/second pumps, and

e. Creation of channels and pumps from the Banjardowo retention pond towards the Babon River with a pump of 3 x 1 m^3/second.

Based on the form of activities that will be carried out in flood control and the Semarang-Demak tidal cycle, the activities are directed at flood control, while for tidal control, it is enough to make a tidal embankment that will hold the movement of seawater towards the mainland.

The work that has been carried out since 2020 is the Semarang-Demak toll road construction project (Figure 2). The construction of the toll road is a continuation of the Banyumanik-Kaligawe toll road to the north around the north side of Genuk District and continues towards Sayung District. The toll road section in the city of Semarang is at Sta 0+000 to Sta 10+690. According to Rizaldi (2021), the construction of the road also forms a retention pond called the East Semarang Retention Pond with an area of 225 ha.

Originally, the retention pond was planned to have an area of 253 ha, but later developments reduced the area of the retention pond to 225 ha. Based on map analysis, the reduction is due to a plan to add a new reclaimed land area to the north of Unisula covering an area of 18 ha. The expansion of reclaimed land is in the Genuk District area.

The impact of making a toll road that is integrated with the sea embankment until this article is made (in 2024) is still in the construction stage, so the impact is not yet known.

CONCLUSION

a. The construction of a sea embankment and connected to an arterial road (Yos Sudarso road) functions to contain the tidal waves coming from the sea to the mainland. The area on the north side of the embankment itself has not been free from the threat of rob.

b. In the rainy season period, the function of the sea embankment changes to a flood embankment which has the effect of holding floods on the south side of the embankment. The consequence is that the flood is getting higher, more widespread, and longer.

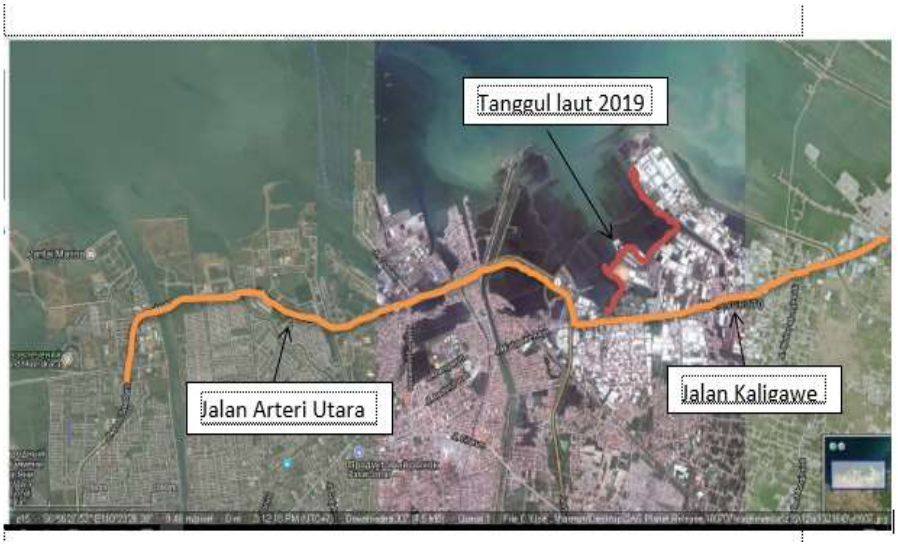

Figure 1. The sea embankment completed in 2019 and the North Arterial Road also function as a tidal barrier (Heryoso Setiyono, 2023)

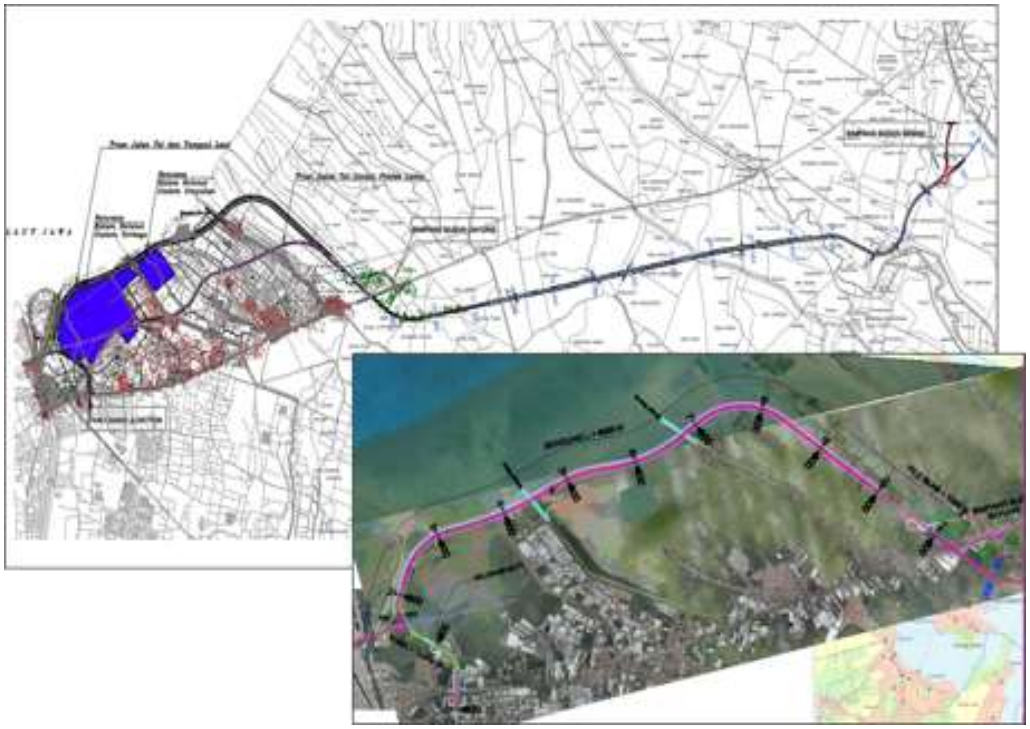

Figure 2. The plan to build the Semarang-Demak toll road is integrated with the sea embankment (Rizaldi, 2021)

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