

Impacts of Marine Sand Mining Activities to the Community of Lontar Village, Serang - Banten

Pengaruh Aktifitas Penambangan Pasir Laut Terhadap Komunitas Perkampungan Lontar, Serang, Banten

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ABSTRACT : Marine sand mining activities in Lontar Village have been started legally since 2003 and temporarily halted in 2013. The locals blamed the activities for severe environmental destruction in almost every corner of the village such as low productivity of aquaculture, coastal erosion, and habitat loss. This paper has an objective to provide preliminary data and analyses for environmental impact assessment of marine sand mining in Serang (Lontar Village). Field investigations were carried out in June 2014 to collect primary data such as bathymetrical data and water quality parameters in the region to understand the environmental conditions after 10 years of marine sand mining activities as well as the characteristics of local oceanography. Extensive interview with the locals were also conducted to collect information about the socio-economic conditions of the village. Field findings showed that Lontar Village have experienced critical environmental problems such as coastal erosion, high turbidity and loss of marine lives. Moreover, we also found that the abandoned aquaculture fields have also been converted as sand mining quarries. Recommendations to reduce further environmental damage in Lontar Village are proposed considering both socio-economy and physical aspects.

Keywords: sand mining, Lontar village, environmental damage, erosion

ABSTRAK : Aktifitas penambangan pasir laut di Kampung Lontar telah dimulai secara legal sejak 2003 dan telah berhenti untuk sementara tahun 2013. Keberatan penduduk setempat terhadap aktifitas penambangan tersebut adalah disebabkan oleh adanya gangguan lingkungan di hampir setiap sudut perkampungan seperti rendahnya produktifitas budidaya perikanan, erosi pantai dan hilangnya berbagai aneka ragam habitat. Tujuan penelitian ini adalah untuk mendapatkan data awal dan analisis terhadap pengaruh lingkungan akibat aktifitas penambangan pasir laut. Penyelidikan lapangan telah dilaksanakan pada bulan Juni 2014 yaitu untuk mengumpulkan data sekunder seperti batimetri dan parameter kualitas air di kawasan tersebut. Penelitian ini adalah untuk mengetahui kondisi lingkungan setelah 10 tahun aktifitas penambangan pasir laut, begitu juga karakteristik oseanografi daerah tersebut. Wawancara intensif dengan penduduk lokal telah dilakukan juga untuk mengumpulkan informasi tentang kondisi sosial ekonomi perkampungan tersebut. Temuan lapangan menunjukkan bahwa perkampungan Lontar mengalami masalah lingkungan yang kritis seperti proses erosi pantai, kekeruhan yang tinggi, dan hilangnya kehidupan laut. Lebih lanjut lagi penelitian ini telah menemukan bahwa sekumpulan ladang budidaya perairan telah beralih menjadi tambang pasir. Saran untuk memperkecil kerusakan lingkungan lebih jauh di Perkampungan Lontar, diusulkan pertimbangan aspek sosial ekonomi dan aspek fisik.

Kata kunci : tambang pasir, Perkampungan Lontar, kerusakan lingkungan, erosi.

INTRODUCTION

Rapid infrastructure development in large cities like Jakarta requires more spaces and large amount of construction materials. This condition has forced authorities to find alternatives for spaces by reclaiming coastal areas. Sands, one of important construction materials for the reclamation of coastal area have long been transported to Northern Jakarta from neighbouring regions like Serang in Banten Province. Marine sand mining in Java Sea of Serang has been started since 2003. In 2003 – 2008, the activities intensified due high demand from the reclamation project of Pantai Indah Kapuk (PIK) in North Jakarta. Legal tools have also been provided by the local government by releasing local government regulation (or Perda) about marine sand mining No.540/Kep.68/Huk/2003 and working permits for several dredging companies. Since sands from the Northern Sea of Serang have high economic values and the distance from the quarries to the reclamation site (North Jakarta) is about 60 km, the marine sand mining will continue in years to come as stated in the latest Local Regulation, Perda No. No. 2/2013 about zonation of coastal area and the sea of Serang Regency. Though marine sand mining activities in Serang have been temporarily halted in 2013 through local government regulation No. 540/02-Huk.BPTM/2013 and because of the pressure from the coastal village communities, the continuation of future mining is still wide open, particularly for the construction of the Jakarta Giant Seawall Project. Moreover, the Agency for Environment (BLH) of Serang in 2013 have also released a list of eight companies eligible to mine the sands from the sea in the North of Serang.

The impact of marine sand mining has been discussed in many publications. Coastal erosion

(Thornton, 2007, Kusumawati, 2008), marine pollution (Nasution et al., 2004), social conflicts (Kusumawati, 2008), hydrodynamics changes (Pranowo and Husrin, 2005) and severe environmental degradation (Young and Griffith, 2009) are some of them. For the case of Lontar Village, marine sand mining has also triggered the locals (fishermen and farmers communities) to mine sands in the beach or in fish ponds due to higher economic values than fishing or farming. This condition has led to more damaging to the environment. This paper describes the latest conditions of coastal area in Lontar Village (physical processes and social aspects) and the effects to the communities after 10 years of marine sand mining operation (2003 - 2013). The objective of this research is to provide preliminary data and analyses (bathymetry, water quality and existing environmental conditions) for environmental impact assessment of marine sand mining in Serang (Lontar Village) based on the latest observation and the collected primary data in the field.

METHODS

Literature study was first conducted to obtain information about the area, marine sand mining related issues, coastal resources of the area, social and economic conditions, and hydro-oceanographic characteristics. We found many critical issues from the media (online newspapers) involving coastal communities, NGOs, private companies, governments, and politicians. This indicates that marine sand mining has drawn public attentions and be part of national issues. However, there were few scientific publications related to this issues especially in the research location of Serang Banten. Based on the literature studies, field investigations in Lontar Village were carried out to

collect data on water quality parameters, bathymetry and environmental conditions of the village. Water quality parameters consists of DO, pH, Turbidity, Salinity, Temperature, and Chlorophyll. The parameters were measured in situ using Multi-parameters checker from TOA-DKK. The bathymetry of Lontar Waters were measured using a single-beam echosounder (Echotrak CVM Teledyne Odom Hydrographic) with Real Time Kinematic (RTK) GPS from Trimble for positioning system.

The impacts of marine sand mining to the communities in the



Figure 1. The location of marine sand mining in Serang and its distance from Jakarta (Google Earth Image)

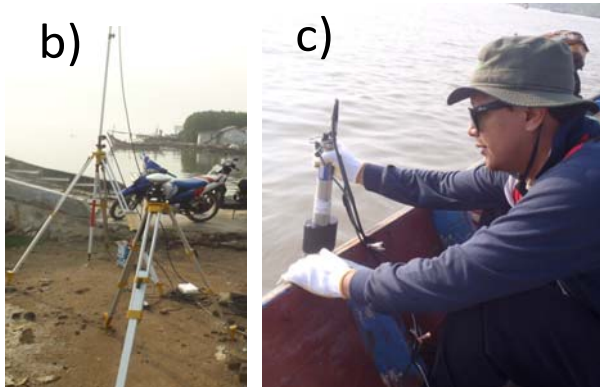
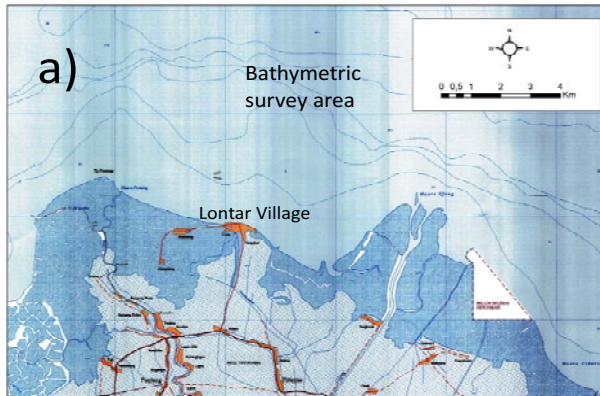


Figure 2. a) Survey location in Lontar Village, b) RTK GPS Based and c) Water quality parameters measurements (Map source: BIG)

village were carried out via random interviews with local leaders, fishermen and farmers (aquacultures). Environmental conditions of the village were identified through direct observations as well as interviews with the locals. Photographs of environmental conditions were taken for documentations.

To address important issues such as coastal erosion and environmental degradation, the hydrodynamics in the North of Serang was analysed by means of a numerical simulation using a hydrodynamic model of MIKE21. Bathymetrical changes and water quality parameters were analysed to find out the true impacts of marine sand mining to the ongoing coastal erosion and environmental degradation. GIS analyses was also conducted to confirm the changes of coastline and land-use in the area over times. Maps from the Indonesian Navy (Dishidros) and other authorities (BIG, Ministry of Public works) and satellite data (Landsat) were used for the GIS analyses.

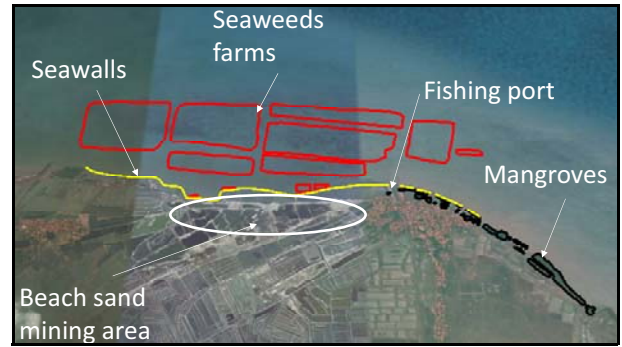


Figure 3. Existing environmental conditions of Lontar Village (Google Earth Image)

RESULTS

Existing environmental conditions

The Village of Lontar is located in the Northernmost of Tirtayasa sub-district. It has 600 ha of area, with 6 km of coastline stretching from MuaraKangkung (Tj. Pontang) in the West to MuaraBrunuk in the East. Most of the villagers work as traditional fishermen where they catch fish in the neighbouring waters (~4 miles). A small fish harbour and its infrastructures (TPI Lontar) is located strategically in the middle of residential area. The jetty of the harbour has long been unused because the elevation is too high and the woods made up the jetty are broken/decomposed. The second largest occupation of villagers are fish pond farmers of shrimps, *Bandeng* (Milkfish) and *Mujair* (Tilapia). More than 50% of land cover is used for fish ponds (Kusumawati, 2008). Lately, many villagers also works as sand miners in the beach and in their own fish ponds.



Figure 4. a) A seawall protecting the coastline of Lontar from erosion, b) sand mining activity in the beach (dead fish ponds), c) Seaweed farms near the unused jetty, d) Mangrove forests behind the seawall.

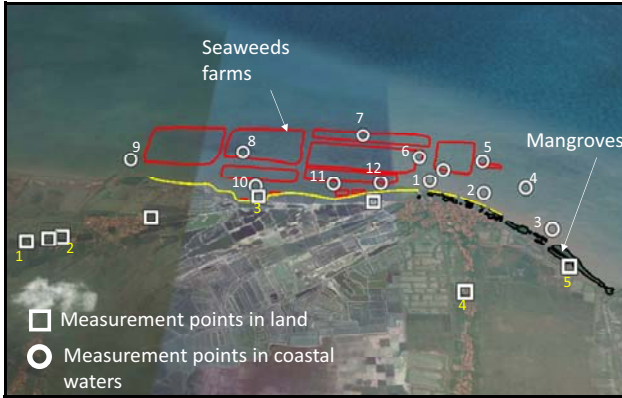


Figure 5. Measurements points of water quality parameters in land and offshore area (Google Earth Image).

The main access to the main roads as long as 7 km in the south of the village experiences severe damage. Poor maintenance and high traffic of trucks carrying sands are the main causes of the damage access road. The dust from the damaged road disturbs the locals every day. Since 2007, due to poor quality of the water and severe coastal erosion, many fish ponds near the coastline have been converted as sand mining quarries. Due to high erosion rate, the coastline of Lontar Village is protected by a 7-km long of seawalls made of masonry rocks. In front of this seawall, seaweed farming are observed covering an area of about 1.5 km². In the western part of the village, the coastline is naturally protected by young mangrove forests. This mangrove forests were planted in 2005.

Table 1. Water quality parameters measurements in land (see Figure 5)

| No | Water quality parameters | | | | | |
|--------|--------------------------|-----------|-------------|-------------|-------------|------------|
| | pH | DO [mg/L] | Cond. [S/m] | Turb. [NTU] | Temp. [° C] | Sal. [psu] |
| 1 | 8.76 | 6.35 | 4.39 | 26.7 | 31 | 29.6 |
| 2 | 8.23 | 5.55 | 4.23 | 1.7 | 30.6 | 28 |
| 3 | 8.38 | 6.33 | 4.42 | 25.2 | 30.5 | 29.4 |
| 4 | 8.72 | 6.27 | 3.51 | 31.1 | 31.6 | 22.8 |
| 5 | 7.88 | 5.61 | 8 | 63.6 | 31.5 | 32.4 |
| Ref.*) | 7 - 8.5 | > 5 | - | < 5 | 28 - 32 | s/d 34 |

Table 2: Water quality parameters measurements in coastal waters of Lontar (see Figure 5)

| No | Water quality parameters | | | | | |
|--------|--------------------------|-----------|-------------|-------------|-------------|------------|
| | pH | DO [mg/L] | Cond. [S/m] | Turb. [NTU] | Temp. [° C] | Sal. [psu] |
| 1 | 7.75 | 3.84 | 3.71 | 30.8 | 27.9 | 23.9 |
| 2 | 7.74 | 3.97 | 4.03 | 32.9 | 27.9 | 26.3 |
| 3 | 7.65 | 3.62 | 3.92 | 28.1 | 27.4 | 25.4 |
| 4 | 7.66 | 3.86 | 3.7 | 28.9 | 27.4 | 23.8 |
| 5 | 7.59 | 3.22 | 3.96 | 48.7 | 27.6 | 25.8 |
| 6 | 7.61 | 2.75 | 4.04 | 52.4 | 27.6 | 26.3 |
| 7 | 7.63 | 4.11 | 3.87 | 53 | 28.9 | 25.2 |
| 8 | 7.65 | 4.11 | 3.87 | 58.8 | 28.9 | 25.2 |
| 9 | 7.68 | 3.93 | 3.77 | 67.6 | 29.2 | 24.5 |
| 10 | 7.71 | 3.93 | 3.77 | 66.4 | 29.3 | 25.6 |
| 11 | 7.57 | 3.87 | 3.96 | 61 | 29.1 | 25.9 |
| 12 | 7.58 | 3.87 | 3.96 | 60.7 | 29.1 | 26.6 |
| 13 | 7.88 | 4.83 | 3.71 | 15.1 | 28.3 | 23.9 |
| 14 | 7.89 | 4.44 | 3.7 | 15.9 | 28.3 | 23.9 |
| 15 | 7.86 | 5.07 | 4.01 | 7.7 | 28.5 | 26.2 |
| 16 | 7.87 | 4.59 | 4.06 | 6.4 | 28.5 | 26.5 |
| 17 | 7.83 | 4.4 | 4.12 | 9.8 | 28.5 | 27 |
| 18 | 7.84 | 3.71 | 4.18 | 8.7 | 28.4 | 27.4 |
| 19 | 7.93 | 5.41 | 2.75 | 35.5 | 29.1 | 27.3 |
| 20 | 8.02 | 4.9 | 3.76 | 24.4 | 29.3 | 24.4 |
| 21 | 7.94 | 5.41 | 3.29 | 10.1 | 28.9 | 21.1 |
| 22 | 7.98 | 4.8 | 4.01 | 10 | 28.9 | 26.3 |
| Ref.*) | 7 - 8.5 | > 5 | - | < 5 | 28 - 32 | s/d 34 |

Water Quality Parameters

Water quality parameters (DO, pH, Turbidity, Salinity, and Temperature) were measured in fish ponds and coastal waters of Lontar. There are 5 points of measurement for fish ponds and sand ponds and 12 points of measurement in the coastal waters (Figure 5). The results of water quality measurements in land (fish ponds and sand ponds) are tabulated in Table 1. Table 2 shows the measurement results of water quality parameters in coastal waters. Figure 5 shows the measurement points in Lontar Village. Reference values for the standard of water quality parameters are based on the national regulation released by the Ministry of Environment No. 51/2004 (KepMen LH No. 51/2004).

Bathymetry measurement

The measurement of bathymetry was carried out to investigate the concession area of marine sand mining offshore the Lontar Village. Figure 6 shows the bathymetry of Lontar Village as well as the area permitted for marine sand mining offshore the village. It shows that the bathymetry of the area is generally flat up to 2 km offshore. The Western part is steeper than the Eastern part where River Cijung is located. The marine sand mining area started from the water depth of 6 m.

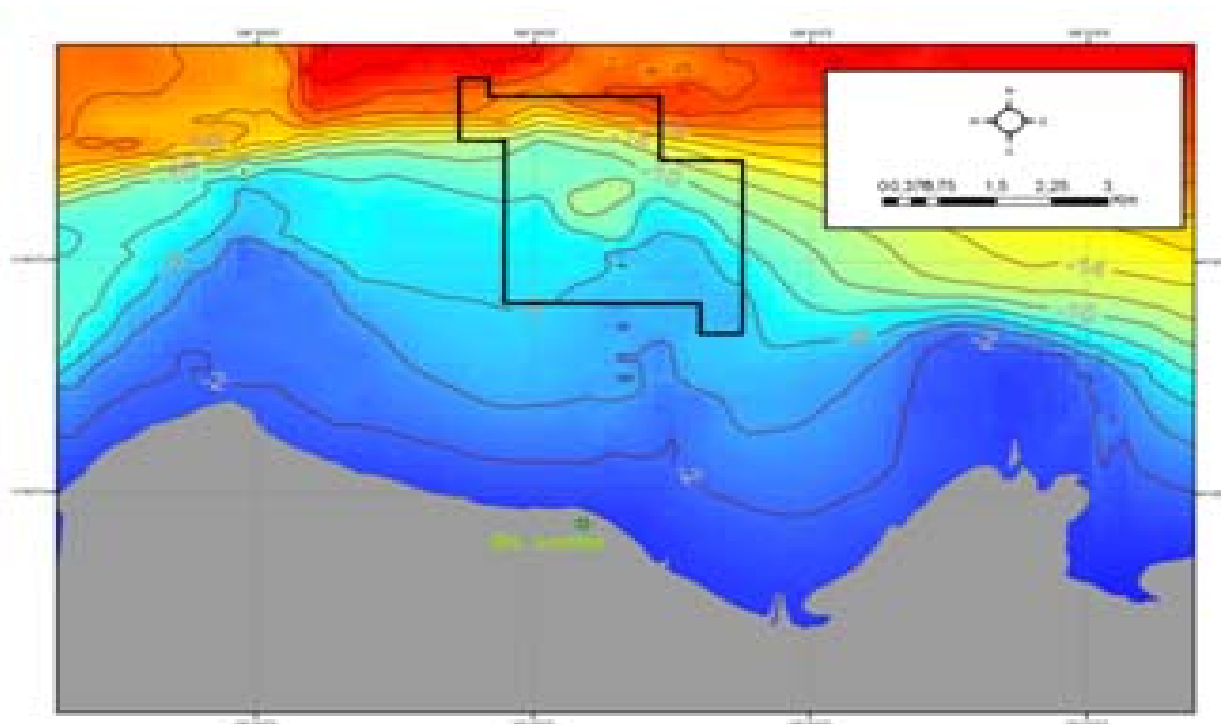


Figure 6. The bathymetry of Lontar Village and the area of marine sand mining (boxed area).

DISCUSSION

Marine sand mining in Serang has been started since 2003 following the legal permits from the Regent of Serang No.540/Kep.68/Huk/2003. The area of marine sand mining initially covers ~ 5000 ha with minimum distance from the shoreline is 2 Miles at 10 m of water depth. It was also mentioned in the regulation that Environmental Impact Assessment (EIA) should be first carried out prior the mining project. Due to high economic values of marine sands, the regulation has been updated in 2008 through the Regent Regulation No. 8/2008 about coastal area zonation for marine sand mining. In 2013, this regulation once again has been updated by The Regency Regulation No. 2/2013 about zonation of coastal area and the sea of Serang Regency. In the latest regulation, the area for marine sand mining covers 31.508,7 ha with 2-m thickness of sands are allowed to be mined. Figure 7 shows that the area of marine

sand mining covers almost the entire deeperwaters of the sea in the North of Serang.

The impact of marine sand mining in Lontar has been extensively discussed in Kusumawati (2008). The mining industry definitely increased the local government income or PAD. Meanwhile, direct impact to the environment such as coastal erosion, bathymetrical/hydrodynamic changes and

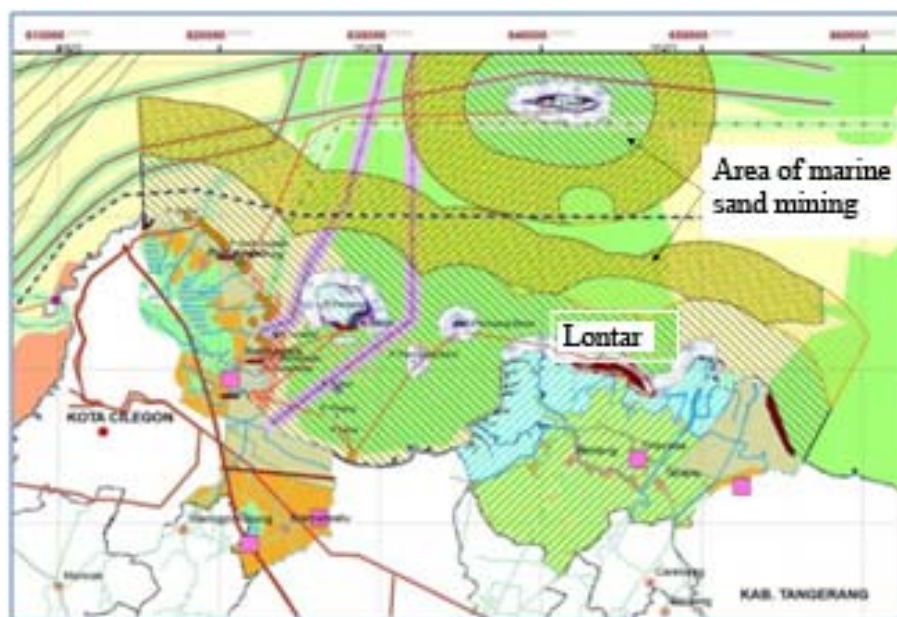


Figure 7. Zonation of coastal and offshore areas in Serang showing the area for marine sand mining.

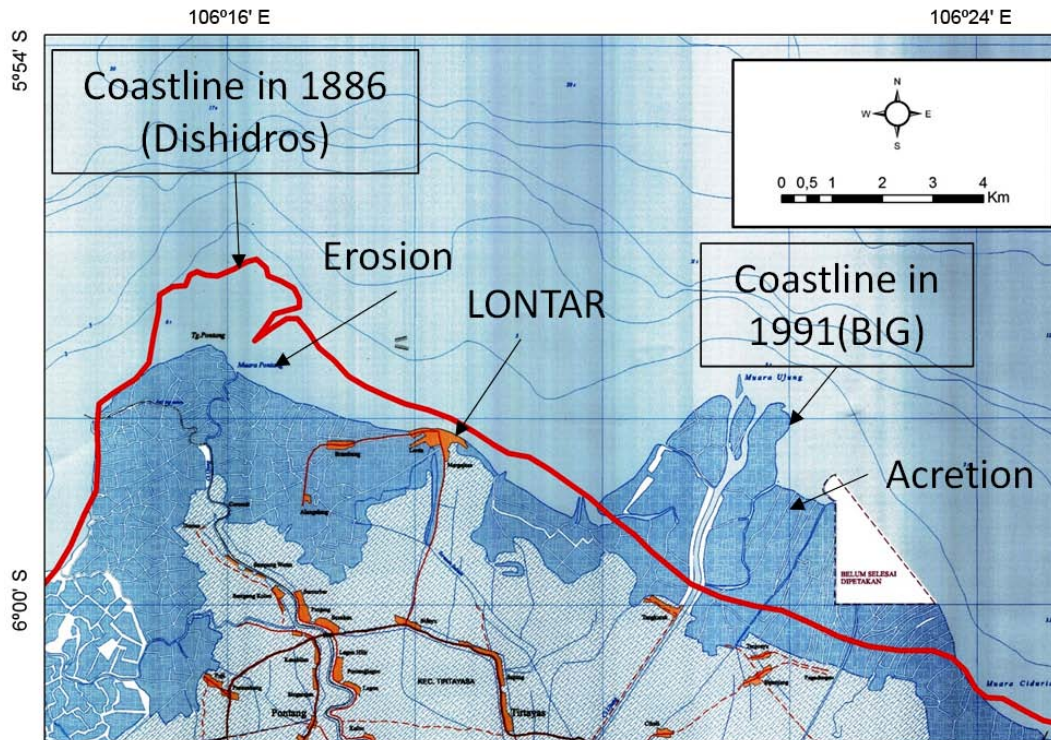


Figure 8. Coastal erosion in the old and accretion in the new Ciujung Delta (Maps from Dishidros and BIG)

environmental damage (lost of marine lives, high turbidity) directly felt by fishermen communities. Decrease of caught fish and operational disturbance of traditional fishermen have resulted in social conflicts in many levels among fishermen, local government and private companies. Poor law enforcement, unbalanced CSR funds distribution and minimum supervision to the mining activities have worsen the situation in Lontar Village during the mining project. Due to low production of fish ponds (tambak), the locals started to mine sands in their own ponds in 2007. The activities has grown rapidly and now they are equipped with hundreds of trucks (capacity 1.25 m³) to carry sands from dead fish ponds. This situation worsen environmental conditions in the village.

GIS analyses showed that coastal erosion have run 3 times faster during the marine sand mining activities (2003 - 2007) than before the activities (1991-2002) (Kusumawati, 2008). However, this finding have not supported by both hydrodynamics and sediment transport data. TanjungPontang has been naturally eroded since 19 century due to diversion of the old Ciujung River in the West to the new one in the East of the village (Ongkosongo and Wijonarko, 2004). This situation have resulted in the decrease of sediment supplies in the area and reworking of the coastline by marine processes have started (erosion).

Studies in 1995 -2001 showed that the erosion rate of TanjungPontang have removed 3 km of wide beach and caused high turbidity in TelukBanten (Hoekstra, et al., 2003). This occurs because dominant westward tidal currents and wave-driven currents transported materials from the eroded TanjungPontang to the bay (TelukBanten). The report concluded that sediment materials from TanjungPontang is apparently the main source of sedimentation in TelukBanten. Reworking of physical processes occurring along the coastline from the old delta of River Ciujung to the new one is clearly observed from the GIS analysis using the old official map of the navy (Dishidros) and the new marine map from the BIG (The Agency for Information of Geospatial). Fig 8 shows that the eroded area of old Ciujung Delta (where Lontar Village is located) has been balanced by the deposition (accretion) in the New delta of Ciujung river. This findings make the analyses of coastal erosion due to marine sand mining is rather difficult to conclude.

The flow of sediment materials from TanjungPontang to TelukBanten was qualitatively investigated by means of hydrodynamics simulation of tidal currents around the area. Figure 9 shows tidal current circulation patterns during spring tide around TanjungPontang using Hydrodynamic Model MIKE21. The bathymetry of the model was taken from the Navy (Dishidros). The boundary conditions of the models

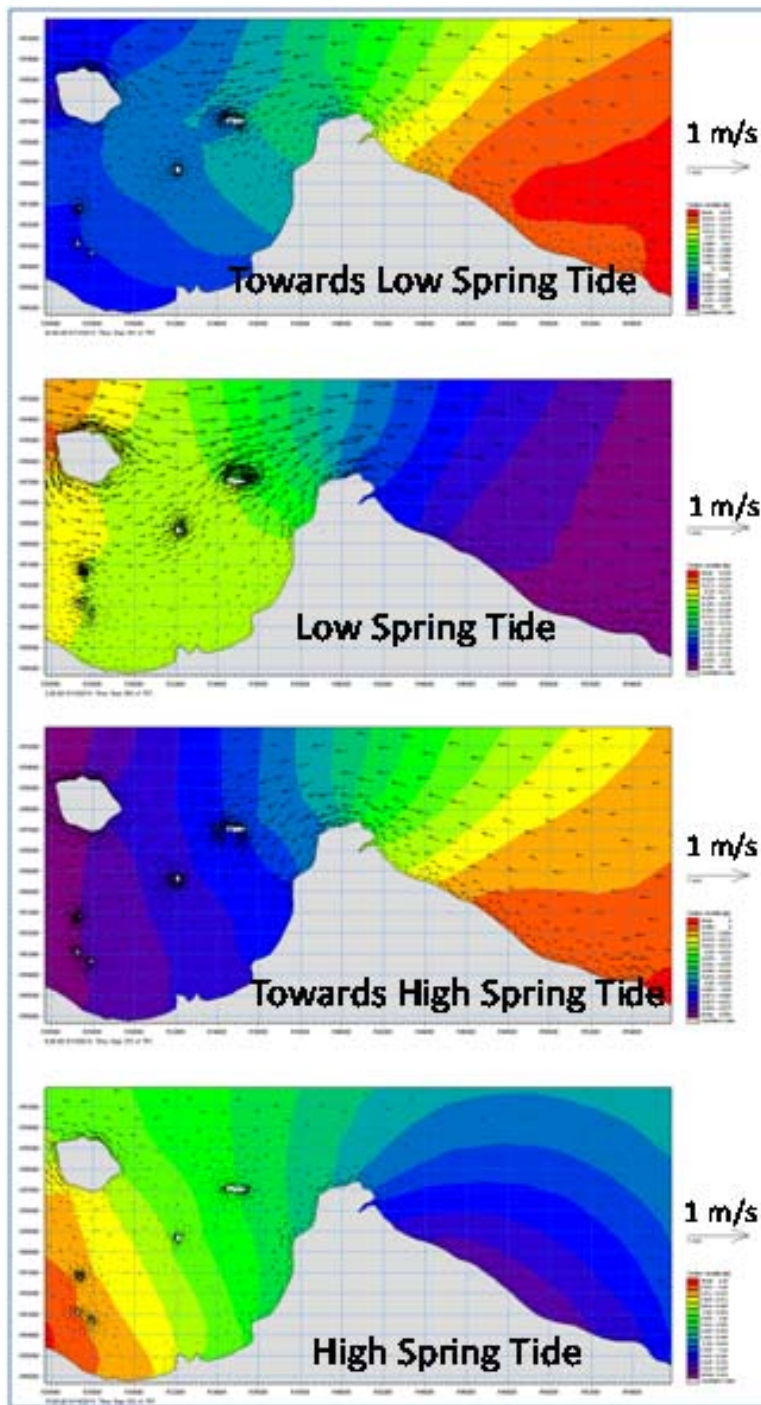


Figure 9. Tidal current patterns during spring tide in Serang

were generated from a MATLAB package called Tidal Model Driver (TMD) from the Earth and Space Research (www.esr.org). The current movement shows that stronger currents to the west occur twice in one tidal cycle. This confirms previous studies that more sediments materials transported towards TelukBanten in the West of TanjungPontang. Erosion in the area is likely to occur due to stronger currents on the tip of

TanjungPontang. The current movement characteristics during neap tide provide similar patterns.

A year after marine sand mining was temporary stopped, few marine sand mining activities were still observed by fishermen. Direct damage of the activities is difficult to assess. However, bathymetry measurement in the area shows significant changes of sea bed as the results of sand mining in the previous years (Figure 10). The sand mining area is located in shallow water with the distance less than 2 miles from the coastline. This might be the source of main conflicts because in this area there are many traditional fishermen activities such as traditional fishing, trawling, and bait-fishing platform (*bagan*). marine sand mining activities in the area had disturbed the operational activities of fishermen communities of Lontar Village.

Direct impact of marine sand mining during the field survey was not observed. Ironically, indirect impacts namely beach sand mining was observed (Galian C). The locals who previously opposed the marine sand mining for the cause of the environment are now gradually damaging their own environment by doing sand mining in the beach. Water quality measurements as shown in Table 1 and 2 provide us high turbidity values (> 5 NTU) around the area of beach sand mining. Field observations showed that in averaged there are 20 trucks in an hour or 160 trucks a day carrying sands from the dead fish ponds. Each truck has a capacity of $1,25 \text{ m}^3$. This means in one day around 200 m^3 of sands are removed from the beach. In 2014, there are hundreds of trucks in operation in the village to mine beach sands from the dead ponds. Conflicts among the locals on the sand mining in the beach have emerged lately.

The locals who are not miners opposed the mining activities in their village because of environmental concerns (damage roads, poor air quality and water pollution). The local who work for the mines urged that they just took sands from non-productive ponds and the ponds are belong to them. The miners said that mining the sands from their own ponds are their rights and

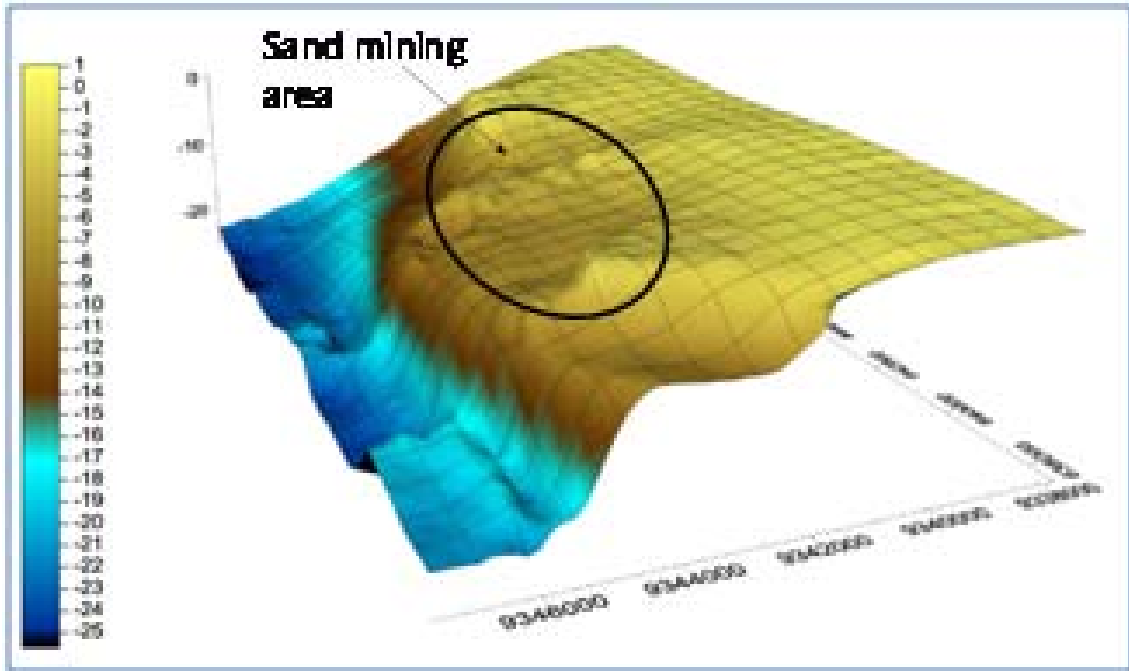


Figure 10. The 3D Lontar bathymetry showing basins as the results of sand mining in the previous years (see also Figure 6).

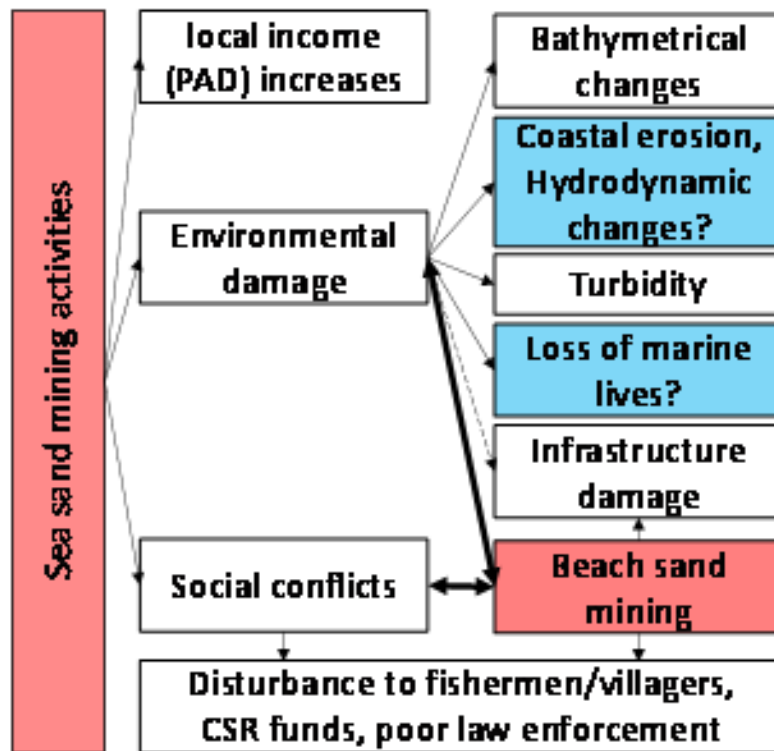


Figure 11. The flowchart impacts of marine sand mining in the Village of Lontar, Serang

cannot be stopped. The village of Lontar is now definitely facing two similar problems in different scale, sand mining activities in both land and in the sea.

In 2010, some fishermen started to farm seaweeds in Lontar Waters (Figures 3 and 5). High quality seaweeds from Lontar have been marketed to Jakarta and Surabaya. As shown in Table 1 and table 2, aside from turbidity other water quality parameters are within the standard. High production of seaweeds may be related to the circulations of waters in Lontar where the currents transported materials along the pathways. This assumption is supported by the facts that seaweeds production peaks during windy seasons of both West season (December - February) and East season (April - October). During the transitions, the production of seaweeds is much smaller.

CONLUSSIONS

From the discussion above, the impact of marine sand mining activities in the Village of Lontar are summarised in Figure 11.

Marine sand mining provide more income to the local government through taxation (PAD). However, environmental damage felt by the local communities, especially in the village of Lontar such as bathymetrical changes and high turbidity of the waters, coastal erosion, and hydrodynamics characteristics .

Land use changes in Ciujung River also play important role in the dynamics of the coastal processes. Growing seaweed farms and wider mangrove forests proved that water quality in Lontar is in good condition.

Sands in Lontar have high economic values. Many fish ponds have been converted into „sand ponds%and environmental damage is unavoidable. Social conflicts among communities commonly occurred. If marine sand mining will continue in the future, law enforcement and tight supervision on the activities to meet the new regulation (Perda No. 2/2013) are urgently needed.

The local coastal community should also receive education and proper information about their own environment. Comprehensive investigations on oceanography characteristics of the region including sediment transport analyses are required in order to better understand the true impacts of marine sand mining to the environment in the past and in the future.

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