# Identification of the Actual Shoreline Impact on Pond with ArcGIS Basemap Images in Muncar Sub-District, Banyuwangi Regency

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## Abstract

The regulatory law no. 32 of article 14 of 1990 is regulated at least 100 meters calculated from the highest tidal point towards the continent. Pond use must consider the distance from the shoreline to avoid losses. This research aims to discover the coastline influence on the sustainability of the ponds in the Muncar Sub-district. The methodology used in this study was digitized on the screen using the ArcGIS base map. The existence of a coastline in digitization for determining an area occurs abrasion or accretion. Then the pond is digitized to discover its existence, then computes the length of the shoreline. The results obtained the existence of the coastline that there are ponds along 15,907.87 m and no pond shoreline 8,173.02 m. In comparison, the number of working ponds can reach 247 plots. Among the five villages that have ponds, three have complied with the regulations. The Kumendung Village is 1432 meters, Sumbersewu Village is 336 meters, Kedungwringin Village is 857 meters eligible, and the other two villages are ineligible Tembokrejo Village along 5 meters and Wringinputih Village 7.3 meters. Ponds that do not comply with regulations are exposed to an abrasion hazard. Therefore, there need to be countermeasures such as backfilling or mangrove planting. Based on these findings, observations should be made to discover the truth of the shoreline existence against ponds that are at risk of abrasion.

## 1. Introduction

The beach is dynamic, as the area is a meeting place between the influence of the land and the ocean [1]. This coastal region has much potential for the surrounding community to exploit. One of the usages of coastal areas is pond farming [2]. Pond development usually involves the coastal border area. The area overlaps with the waves of the sea. Based on Act no 32 Article 14 of 1990 was explained on the coastal boundary. Furthermore, the regulation is also contained in the Minister of Marine Affairs and Fisheries Number 21/PERMEN-KP/2018 on the procedure for calculating coastal border boundaries and regional regulations of Banyuwangi Regency Number 08 of 2012 on The Spatial Plan of Banyuwangi Regency 2012-2032. It is known that the coastal border is a land area that is a propositional range of at least 100 meters along the coastal landmass calculated from the highest tide point towards the mainland [3]. This beach border must be protected because it has a function to maintain the sustainability of coastal areas.

Usually, this coastal area or coastal border is used as a mangrove forest area that aims to protect coastal areas from the impact of waves that can cause abrasion. This coastal border area is also used as a residence for marine life [4].

Coastal borders are greatly influenced by the movement of coastlines that are easily subjected to continuous changes both naturally occurring and manufactured. Examples of that affect coastal boundary changes such as ocean wave activity, sediment movement and land use in coastal areas. This change in coastline can trigger abrasion and accretion that can cause damage and can cause sedimentation in coastal areas [5][6].

Changes in the coastline that affect the condition of the coastal border can endanger the sustainability of pond cultivation [2][7]. The development of ponds that are too near to the coastal border area or can be said not under the rules of cultivation will significantly endanger the sustainability of the pond itself. Therefore, this research aims to find out the existence of the coastline against the existence of ponds by using The World Imagery Basemap ArcGIS in Muncar Subdistrict, one of the sub-district Banyuwangi that seeks brackish fishery cultivation using ponds.

## 2. Methodology

### 2.1 Study Area

Muncar District is one of the districts located in Banyuwangi Regency. The astronomical location of the Muncar Subdistrict is at a southern latitude of 8º 26' 6.36" and east longitude 114º 19' 2.28". This district has an area of 146.70 Km2 with 10 villages which include Sumberberas Village, Wringin Putih, Kedungwirngin, Tambakrejo, Tapanrejo, Blambangan, Kedungrejo, Tembokrejo, Sumbersewu and Kumendung. Muncar District on the north is directly adjacent to Blimbingsari Subdistrict, the east borders the Bali Strait, the south with Tegaldlimo Subdistrict and Cluring District and Srono Subdistrict border the west. Muncar subdistrict is a subdistrict that makes the pond a place of cultivation. Based on data from the Fisheries and Marine Service of Banyuwangi Regency in 2014, the total area of ponds located in this sub-district is 554.4 Ha [3].

### 2.2 ArcGIS Basemap Images

ArcGIS base map image is a built-in map that we can get from the ArcGIS application. ArcGIS is a geographic information system (GIS) application developed by ESRI (Environmental Science & Research Institution) [8][9][10]. In this research, ArcGIS 10.6 application is used. To use this ArcGIS world image basemap, the thing we need to do is open the add data section and then select imagery. Then the appearance of the earth's surface will be displayed as it appears on google maps. After the basemap imagery is displayed, the coastline and ponds are digitized according to the tidal features seen. As for the digitization of ponds, it is very easy to identify because of the consistent rectangular shape and the difference in the surface being smoother than the surrounding soil. After the coastline and ponds are digitized, it is followed by direct observation and measurement to the mapped area. The results of digitization and observations are the sources of data in this study.
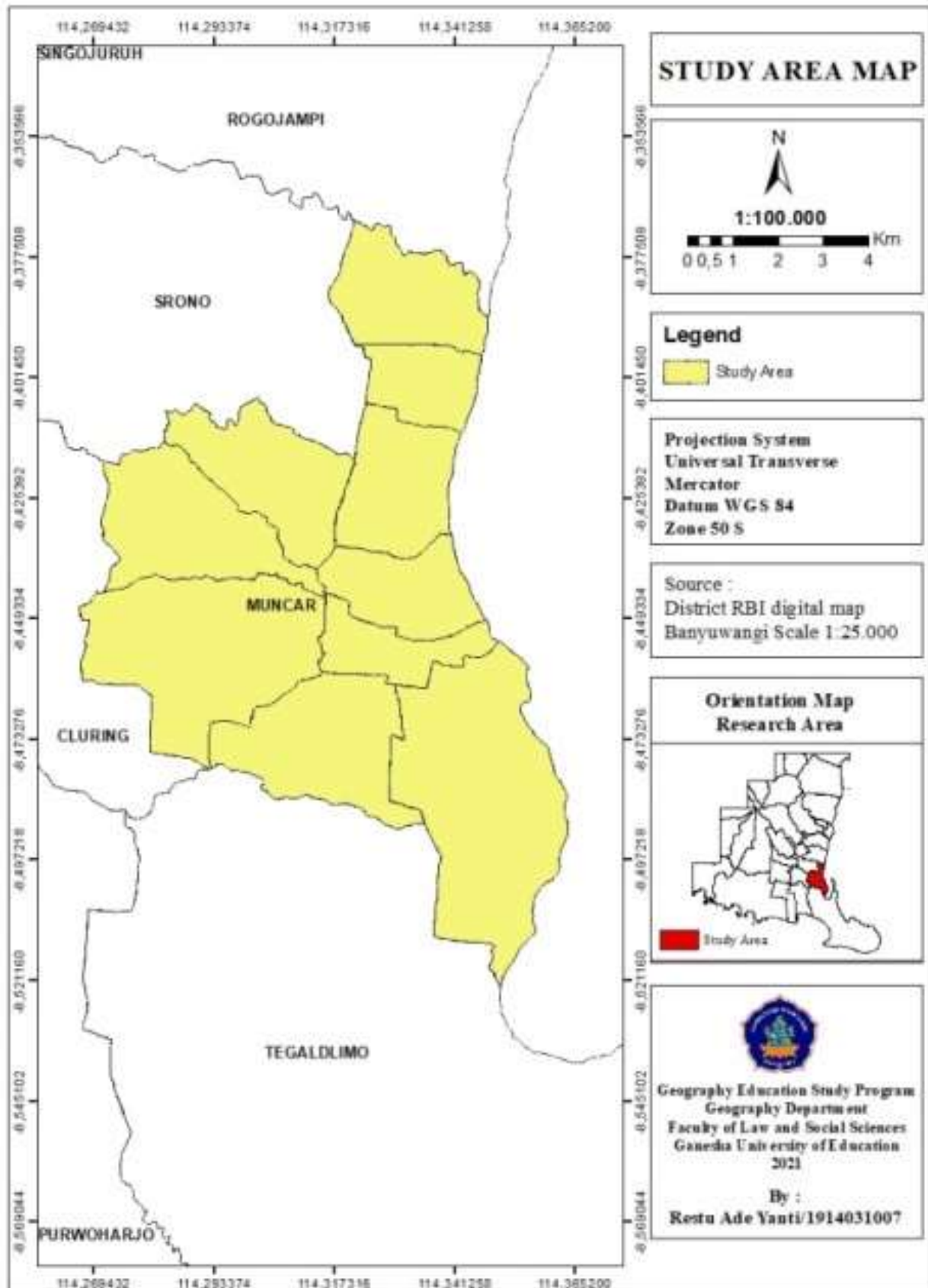
**Fig 1.** Study Area Map

### 3. Result and Discussion

Muncar District consists of 10 villages, 6 of which are directly in contact with the ocean. The 6 villages include Kumendung Village, Sumbersewu Village, Tembokrejo Village, Kedungrejo Village, Kedungwringin Village and Wringinputih Village. The length of the coastline of Muncar District, which is 22,940.82 meters, is obtained from the measurement results using ArcGIS. In previous studies, there has been research on the effect of coastlines on ponds, which were identified using Google Earth Engine (GEE), or the results of image analysis [11] [12] [13] [7]. The image seen on the ArcGIS world image basemap is almost the same as that seen in GEE. With the use of world images in ArcGIS, it will be easier to identify coastlines and ponds without having to use images that are downloaded and stored on a PC. Based on the results of identification using World Imagery from ArcGIS Basemap, it can be seen that only 5 villages have ponds, namely Kumendung Village, Sumbersewu Village, Tembokrejo Village, Kedungwringin Village and Wringinputih Village. With a total area of ponds in this sub-district, which is approximately 554.4 Ha [3].

Each village in Muncar District has a length of coastline that has different ponds. Likewise, each village also has a different number of pond plots. The existence of the coastline that has ponds and non-ponds of each village in Muncar Subdistrict based on the measurement of digitization results is illustrated in Table 1.

**Tabel 1**
Shoreline Existence In Muncar Sub-district

| Village | The Existence of Coastlines | |
| --- | --- | --- |
| | Pond (Meter) | Non Pond (Meter) |
| 1. Kumendung | 456,0463 | 404,5127 |
| 2. Sumbersewu | 1765,334 | 40,28725 |
| 3. Tembokrejo | 1289,299 | 1087,998 |
| 4. Kedungrejo | - | 3786,193 |
| 5. Kedungwringin | 322,3469 | 1714,077 |
| 6. Wringinputih | 12074,84 | 1139,952 |
| **Count** | **15.907,8662** | **8.173,02** |

*Source : Processing Data (2021)*

Based on the results of digitization equipped with observations, it can be known that there are ponds that are still actively cultivating and some are no longer used. Some of the ponds that are not used are caused because the pond is still under repair or has not entered the seed sowing period, and some are abandoned because the quality of the pond is not qualified, so that it causes the pond to be empty or abandoned. The data of the pond plot contained in this sub-district is as Table 2.

**Tabel 2**
Pond Plots In Muncar Sub-district

| Village | Number of Pond Plot |
|---|:---:|
| 1. Kumendung | 46 |
| 2. Sumbersewu | 30 |
| 3. Tambakrejo | 42 |
| 4. Kedungwringin | 8 |
| 5. Wringinputih | 121 |
| **Count** | **247** |

*Source : Processing Data (2021)*

Based on the results of observations using the World Imagery Basemap ArcGIS and the results of direct measurements of the pond area, it can be seen that some ponds in Muncar District have met the regulations for the use of coastal borders and some have not. To find out these requirements, digital measurements were carried out through the World Imagery Basemap ArcGIS and also direct measurements from the outermost part of the pond facing the sea to the highest tide line. The digitization results along with the measurement of the distance from the pond to the shoreline are then made a map. The results of direct measurements from maps of several sample locations are as follows Table 3.

**Tabel 3**
Length Of the Distance From the Pond To the Shoreline

| Village | Long Distance Pond to Coastline (Meter) |
|---|:---:|
| 1. Kumendung | 1.432 |
| 2. Sumbersewu | 336 |
| 3. Tambakrejo | 5 |
| 4. Kedungwringin | 857 |
| 5. Wringinputih | 7,3 |

*Source : Processing Data (2021)*

Based on the results of the analysis above, it can be seen that the accuracy of the map of the distance between the pond to the shoreline is appropriate. This is evidenced by the fact that in some sample locations, there are ponds that have met the regulatory criteria, which are more than 100 meters from the highest tide line, such as Kumendung, Sumbersewu and Kedungwringin villages according to the results of the analysis. However, there are also ponds that are less than 100 meters away, such as in Tembokrejo Village. One of the ponds there is even one behind the wall which is directly open to the sea. Likewise, the ponds in Wringinputih Village. However, the ponds in Wringinputih Village do not use permanent buildings, but use

embankments. Here is an overview of the existence of the coastline against ponds in the Muncar Subdistrict.



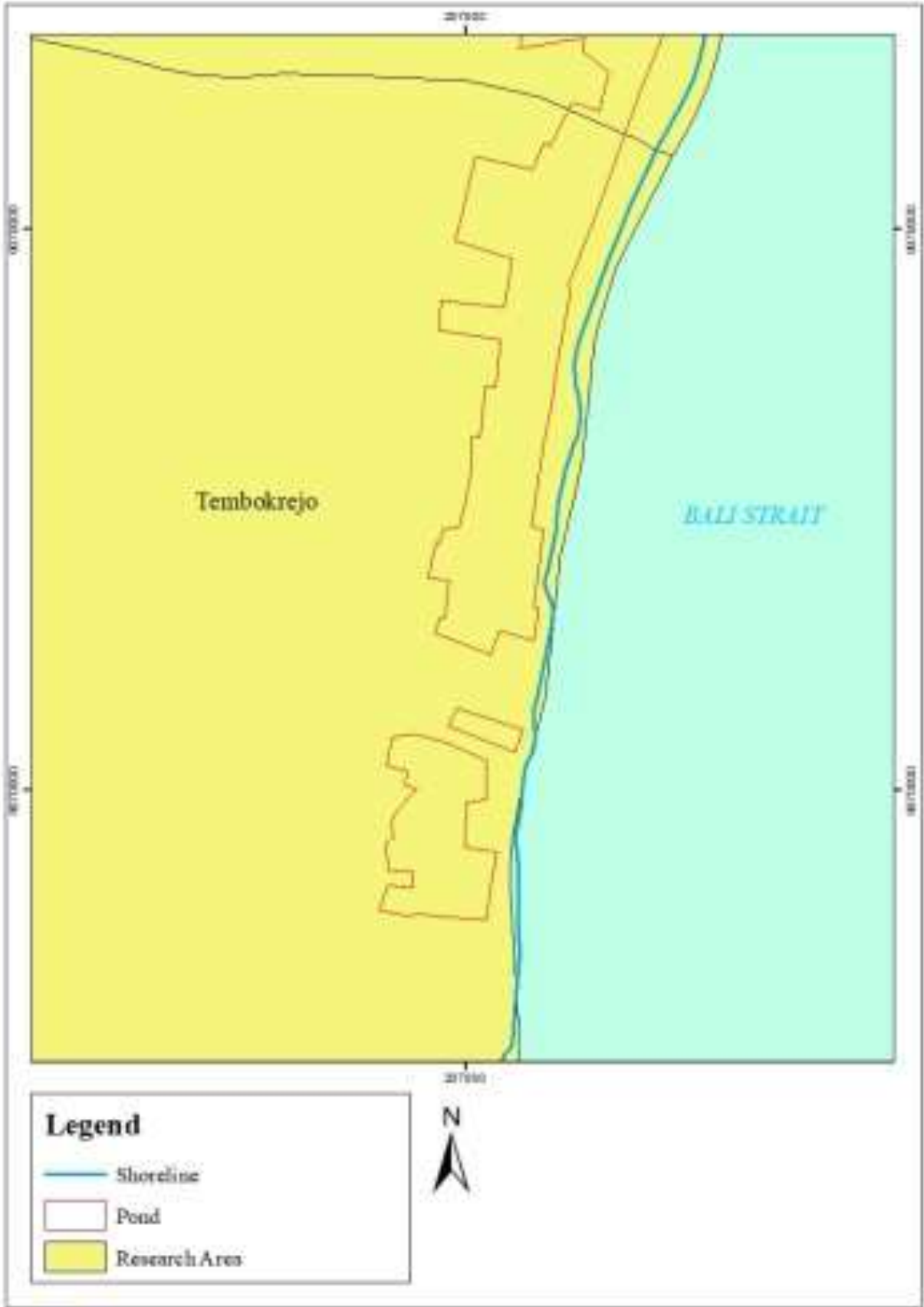**Fig 2.** The Distance From The Pond To The Shoreline More Than 100 Meters
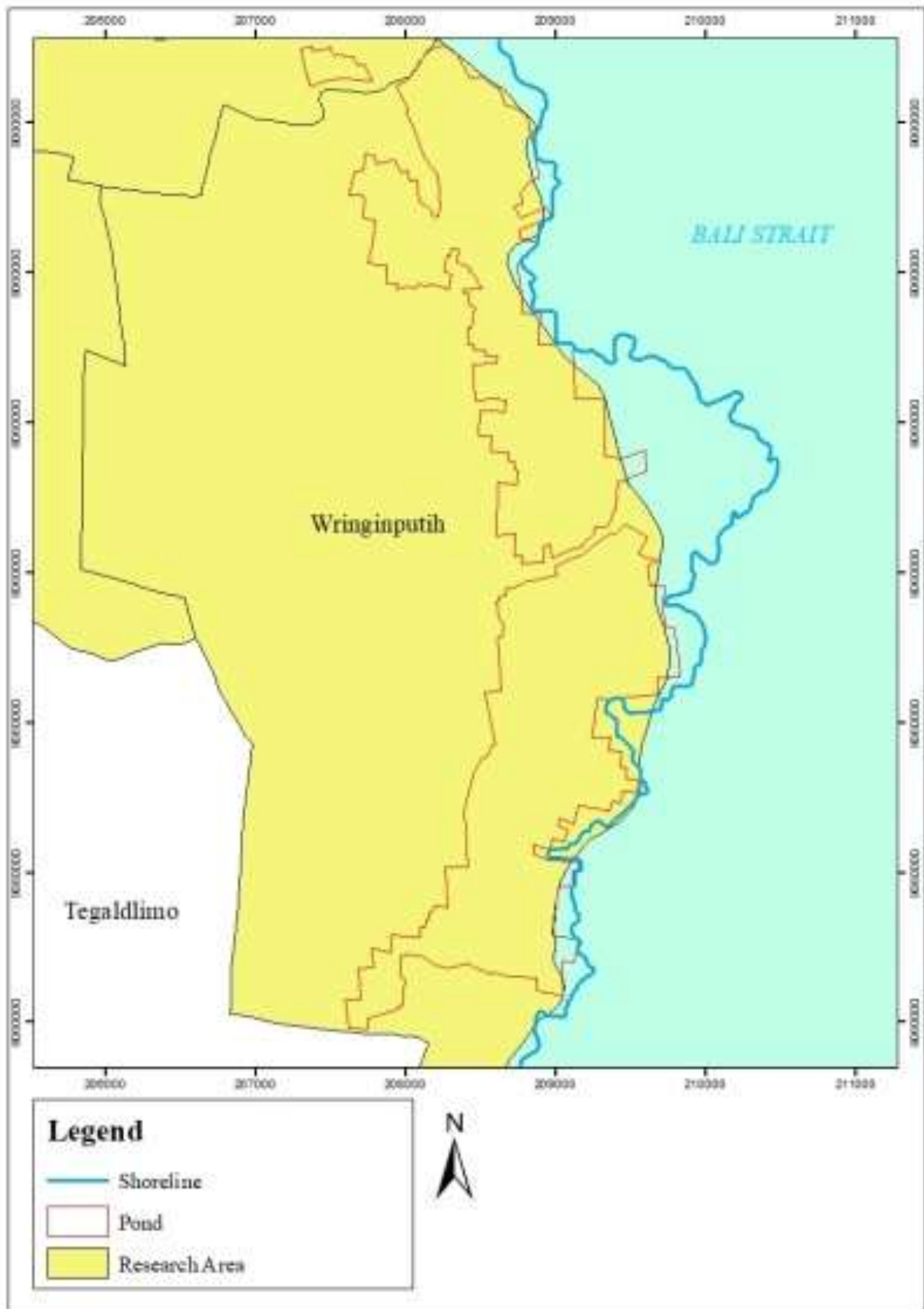
**Fig 3.** Tembokrejo Village Pond Distance

**Fig 4**. Distance to Wringinputih Village Pond

Ponds less than 100 meters away from the highest tide line, such as those found in Tembokrejo Village and Wringinputih Village, can be at risk of abrasion hazards because the outermost boundary of the pond that is there directly faces the ocean and will be inundated with excessive seawater. In addition, the waves can also damage the outermost part of the pond. The way that can be done to minimize or overcome the risk of abrasion to preserve the sustainability of ponds is by making breakwater embankments or taluds and planting or preserving mangrove plants to strengthen the coastal land. Based on the results of observations, ponds located in the two villages have implemented the anticipation. Tambakrejo Village applies embankments/talud, and Wringinputih Village preserves mangroves/mangroves to minimize losses due to the risk of abrasion.



**Fig 5.** Abrasion Prevention

## 4. Conclusion

Based on the results of digitization using World Imagery Basemap, ArcGIS ponds and coastlines can be easily detected and digitized. Based on the results of observations, the existence of the beach line stranded ponds is 15.907.8662 meters long and non-ponds along 8,173.02 meters. The number of active ponds in the Muncar Subdistrict amounted to 247 plots. Of the five villages that have ponds, 3 of them have met the regulation of at least 100 meters from the highest tide of seawater. Kumendung village long existence of the coastline against the pond is 1432 meters long, Sumbersewu Village 336 Meters, Kedungwringin Village 857 Meters. At the same time, the other two villages are not following existing regulations. Tembokrejo Village is 5 Meters long, and Wringinputih Village is 7.3 Meters. Ponds located in Tembokrejo Village and Wringinputih Village have the risk of being submerged in seawater if sea levels rise because the outermost boundary of the pond directly faces the sea. The way to minimize the risk of abrasion is by making dikes or planting mangroves.

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