SITE SELECTION FOR REGIONAL SOLID WASTE FINAL DISPOSAL IN BANGKA ISLAND BASED ON GEOGRAPHY INFORMATION SYSTEM (GIS)

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ABSTRACT

The availability of an adequate final disposal a necessity for an area. Thewaste processing process consists of the stages of transportation, management, final disposal to waste utilization. Waste management in urban areas requires a final disposal that must meetenvironmental feasibility standards. Problems encountered in the current waste management at the capital city of Bangka Belitung Province, final disposal Parit 6 was already overloaded and still uses the Open Dumping method, and there are limitations in the availability of urban land. The purpose of this study was to selection for the regional solid waste final disposal (RSWFD) in accordance with the characteristics of the local location and the directions in the Spatial Plans of the Province of Bangka Belitung. The method used is a quantitative analysis method by calculating the need for the land area of the waste landfill based on population projections and waste generation. And the model used by the Geography Information System (GIS)in the form of ArcGIS 10.5 is overlaid using parameters based on (SNI 03- 3241-1994). The final result of the research is a recommendation for a RSWFD location for Bangka Island in accordance with the needs, feasibility and availability of existing land.

Keywords: solid waste, overlay, landfill.

INTRODUCTION

Urban population growth increasing along with waste production. Urban population growth was not only concentrated in one place but can be spread in various places population and diverse activities in big cities in Indonesia have resulted in the emergence of problems in urban infrastructure services, such as the waste problem (Damanhuri and Padmi, 2011).

The Ministry of Public Works defines that waste final disposal is a place to process and return waste to environment which are managed jointly by two or more regencies/cities in one province. The final disposal also needs to be placed specifically to reduce damage or negative impacts on the surrounding environment. Waste management from residential, commercial, industrial, and special areas, including public facilities, social facilities, and other facilities needs to be provided with waste sorting facilities (Management Government Regulation number 81 of 2012 concerning the Management of Household Waste and Similar Waste of Household Waste). Based on the law, it is stated that in 2013 all landfills in all districts/cities must have been operated with the sanitary landfill method.

The existing final disposal urban inBangka Belitung, namely waste final disposal Part 6, still uses the old method, which is an open dumping and this final disposal is experiencing overload, or inability to accommodate more waste. Efforts have been made by the local government by land acquisition around the final disposal to make it wider, but this effort was not successful because the location around the landfill site was already crowded with residential areas.

Regional Regulation of the Bangka Belitung Islands Province No. 2 of 2014 concerning the Regional Spatial Plan for the Bangka Belitung Islands 2014-2034

that the regional solid waste final disposal (RSWFD) is developed in Bangka Regency and Central Bangka Regency, but there is no definite location where this RSWFD will be built. Therefore, efforts are needed to overcome this issue, a study is needed to selection the location of a new RSWFD based on the selection of the RSWFD location in accordance with the provisions of the criteria applied in Bangka Island.

WASTE FINAL DISPOSAL

Waste final disposal is the most common way to dispose of waste, this method is considered the most economical and systematic way of managing waste, when compared to other methods such as recycling or reuse, burial and incineration of waste. Landfill is a place for waste to be at the last stage in the management process starting from the source of waste, collection, transfer, processing and processing. This is confirmed by the theory according to (Arianto in Dibyantoro 2011), landfill is the last place of a waste management, where the waste will be processed to reduce its bad impact. Final disposal has 3 methods, namely:

A. Open Dumping
B. Controlled Landfill
C. Sanitary Landfill

SOLID WASTE

Solid waste is anything that cannot be used, which is disposed and comes from human activities. Solid waste management issue is the biggest challenge to the authorities of both small and large cities in developing countries. This is mainly due to the increasing generation of such solid wasteland the burden posed on the municipal budget (Abdel-Shafy, 2018)

As for the generation of waste is influenced by factors that affect the final disposal of waste:
1. Population Growth Rate
2. Growth of Gross Regional Domestic Product (GRDP)

The population growth rate increase, concerns related to public health, and

insufficient landfill available land add more problems to the waste management problem (Kao & Lin on Sabreen et.al., 2021)

SITE SELECTION CRITERIA

The most sensitive and most important step in selecting landfill is location. In location theory, one of the topics discussed is the influence of distance on people mobility from one location to a different location. It is interrelated with the central point, the most selecting factor fora location that has a strong attraction to visit is the level of ease of getting to that location (accessibility).

The location of waste disposal should meet several site criteria as follows (SNI- 03-3241-1994 concerning Procedures for Selecting the Location of Final Waste Disposal):

1. Not in a protected area.
2. Land slope <20%.
3. Not located in a disaster area(level of flood hazard).
4. The distance from the airport ismore than 3,000 meters.
5. Has a low-density demographic.
6. Within administrative limits.
7. The area has not yet been developed.
8. Buffer of body water (river) >100 meters.
9. Buffer from residential >300 meters.
10. Not on agricultural land.
11. Closest distant to the source ofthe waste.
12. Have a good condition of road network.

METHODS

In this study, to achieve the results, some technical analysis is needed. The technical analysis is carried out using the following methods:

1. Land Capacity Analysis
   The need for land area from the landfill in the form of cover and buffer zone needs refer to the

technical manual No CT/S/Re-CT/004/98. The calculation of land capacity with the equation that has been formulated by (Murtudo in Audina, 2018) is as follows:

$$L = \frac{V''S\$}{H''(Sh()*+age\ 0\ 1ea(\ 0\ 2(e3)45)}$$

• Calculating the volume of waste V = waste generation for a certain number of people in x years
• Support area = 25% x L; Where:
L= Landfill area (m^2)
Buffering = Area of Buffer Zone and landfill supporting facilities (m^2)
V = Volume of compacted waste (m3/day)
SC = Soil cover (m^3) = 15% of volume rubbish
H = Height of landfill and overburden (m) (in-Indonesia between 10-15 m) (Manurung, 2019)

2. Location Analysis

The location of the analysis is carried out by giving a radius from the center point of each region by referring to the location of the landfill in several regions in Indonesia, it can be seen in Table 1. After carrying out the radius of each region, the intersection point is obtained, then the location is considered to be able to cover the area. services for some areas.

Table 1. Regional Site Disposal Facilities in Indonesia

Landfill Name	Province	Area (Ha)	Distance (km)
Blang Bintang	Banda Aceh, Aceh	206	23
Payakumbuh	Regency. Agam, West Sumatra	14	125
Bantar Gebang	West Java, Bekasi	104	41
Sarimukti	West Java, Cimahi	25	48
Piyungan	Sleman, Yogyakarta	12	13

3. Site Analysis

To selection the service area for several regions, a central point buffer from each region was carried out and to see the suitability of the land and which locations are suitable of being a regional waste final disposal by overlaying oroverlapping in the Arcgis 10.5 application through parametersshown as below:

Table 2. Parameters of Site Criteria

No.	Parameter	Score
1.	**Flood Free 25 Years**	
	No flood	1
	Possible flood > 25 years	0
2.	**Distance from housing to landfill**	
	<300 meter	0
	>300 meter	1
3.	**distance to body of water**	
	<100 meters	0
	>100 meters	1
4.	**population density**	
	high density	0
	low density	1
5.	**Slope**	
	>20%	0
	<20%	1
6.	**Protected Area**	
	Not in the area protected/nature reserve	1
	Located in the region protected/nature reserve	0
7.	**Limit Administration**	
	Within limits administration	1
	Not within administrative boundaries, but in one management system integrated garbage	0
8.	**Agriculture**	
	not on agricultural land	1
	Located on unproductive land	0
9.	**Land**	
	undeveloped area	1
	awakened	0
10.	**closest distance to the source of the waste**	
	From 30-60 minutes from the centroid rubbish	1
	More than 60 minutes from centroid rubbish	0
11.	**Distance from Airport**	
	Maximum 3000 m	1
	Less than <3000	0
12.	**Road Network**	
	have good condition and flat	1
	have bad condition	0

DISCUSSION

Based on the results of the analysis of the calculation of land area requirements and suitability of parameters, there are three alternative locations for final disposal sites, including Jeruk Village, Kayu Besi Village and Bukit Kijang Village. of the three alternative locations are in the same district and have conformity values to several parameters. These parameters

can be seen in table 3 below

Table 3. Suitability of Site Parameters

Site Criteria*	Bukit Kijang (Alternative 1)	Kayu Besi (Alternative 2)	Jeruk (Alternative 3)
Land area (16 ha)	√	√	√
Land Use (Land has not been developed)	√	√	√
RTRW Spatial Pattern (Cultivation Area)	√	√	√
Slope (>20%)	√	√	×
Residential Distance (300 meters)	√	√	×
Airport Distance (3000 meters)	√	√	√
Water Body Distance (100 meters)	√	√	×
Density Level (Low)	√	x	x
Flood Hazard Level (Free flood)	√	x	x
Not in agricultural area	√	√	√
The closest distance from the garbage source	√	√	√
Road Network (have a good condition)	√	√	√

Based on the parameters described above, the prospective location for this Regional solid waste disposal has met the site criteria, namely land area, administrative boundaries, land use, spatial pattern, not in agricultural land, slope, distance from settlements, distance from water bodies, distance from airports, density level, disaster-prone level, and road network.

The distance from the waste service to the RSWFD location is 20-40 kilometers, that means the travel time to the Bangka Belitung Province landfill candidate location takes between 31 minutes - 60 minutes from the waste centroid, with a speed of approximately 60km/hour. In terms of land area parameters, it is necessary to plan a buffer area such as perennials or limited production forest and besides that it also meets the location criteria, namely the distance from the TPA to its service area.

Therefore, Bukit Kijang Village can be considered as one of the references in selecting the location of a new Regional TPA to overcome the existing waste problems on Bangka Island, especially Pangkalpinang City.
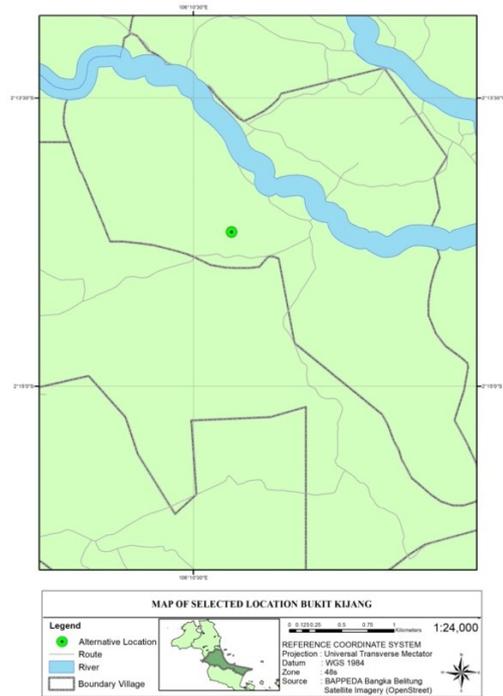

Figure 1. Selected Location

CONCLUSION

1. Based on the calculation of the need for the Bangka Island regional solid waste final disposal (RSWFD) until 2034, it is 16 Ha consisting of 13 Ha for waste final disposal with a buffer area of 3 Ha. The selected site can serve the population for 14 years.

2. Calculations based on the criteria of SNI 03-3241-1994, resulted in three alternative locations for the Bangka Island landfill, namely Bukit Kijang Village, Kayu Besi Village and Jeruk Village.

3. By using site criteria/parameters concerning spatial patterns (regulation), land use, slope levels, buffer of airports, land use, density, flood hazard, distance from settlements and distance from water bodies, agricultural area, road network, administrative area, the most suitable location for RSWFD was chosen, namely Bukit Kijang Village, Namang District, Middle Bangka Regency.

RECOMMENDATION

Based on the research that has been done, there are suggestions for further research, namely adding community in parameter assessment. In this study only sourced from the government and has not involved the community in the weighting of the assessment criteria.

Suggestions for practitioners are addressed to the Provincial Government of the Bangka Belitung Islands and the respective Regency/City Governments to pay attention to the sustainability of the old waste final disposal with the new waste final disposal. As well as suggestions for regulatory policy makers, namely the Central Government to review/reassess land use standards and parameters in spatial planning patterns can be explained further about the definition of cultivation areas.

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