Land sustainability for public cemeteries in KHDTK Hambala: a preliminary study on the borrow-to-use forest area with a cooperation mechanism in Sumba, Indonesia

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Abstract. Deaths due to the COVID-19 pandemic in East Sumba raised the problem of limited burial grounds, so the government tried to provide a new location. The Hambala Special Purpose Forest Area (KHDTK) has a potential land to be used as a burial site by MoEF Regulation No.P.27/2018. The study analyzed the suitability of burial grounds using a GIS-based multi-criteria approach. Criteria and indicators cover the legality (license status of forests, policies), management (master plans, detailed plans), technical (human resources, infrastructure), socio-economic (pandemic, grave needs, economic impacts, culture, conflict), and ecological (topography, land cover, distance to water sources and settlements). A multi-criteria evaluation of the proposed use of KHDTK covering an area of 17 ha resulted in three scenarios of the burial land suitability map, namely the 'strict scenario' covering an area of 1.5 hectares; moderate scenario covering an area of 6.5 hectares, and 'scenario loosely' covering an area of 14.2 hectares. The third scenario as a reference for managers and stakeholders is lend-use of Forest Areas for burial grounds by government cooperation mechanism.

1. Introduction
The increasing population, both from births or migration, indirectly increases the death rate in Sumba Timur District. According to the Statistics Agency of Sumba Timur, in 2020, the total population in Sumba Timur was about 250 thousand people, with a growth rate of about 2% per year [1]. The average number of deaths is around 9 people per 1000 population, and there will be around 2000 deaths in 2020 [1]. Based on these facts, it is estimated that the population will increase by around 330 thousand with a death number of around 3000 people. Referring to the Ministry of Public Works and Housing regulation, if one person needs about 3 m2 for a cemetery, then the required cemeteries area for 2020 and 2035 are about 0.6 ha and 0.9 ha, respectively. Unfortunately, the death rate is not matched with the availability of a cemetery area, in which Sumba Timur District does not yet have a public cemetery area. This is also not following the regulation of National Standardization Agency (BSN) - SNI 03-1733-2004 of 2004 concerning Housing Planning in Urban Area, where each area with a population of 120 thousand people should have at least one public cemetery area (TPU) [2].

The state of the Covid-19 pandemic further complicates the condition of lack of TPU area in Sumba Timur. The Covid-19 pandemic brings multi-dimensional implications for the global society, especially social, economic, health, employment, and public services [3,4,5,6,7]. One of the urgent
public services is the management of Covid-19 death, including the availability of a proper cemetery place to anticipate human deaths in a short time.

In response to this problem, the Regional Government of Sumba Timur (Pemda Sumba Timur) has submitted a request on a Borrow-to-use Forest Area with a cooperation scheme in forest areas with a special purpose (KHDTK) Hambala for religious purposes (Public Cemetery Area-TPU/Tempat Pemakaman Umum). Following up on the request, the Environmental and Forestry Research and Development Center of Kupang (BPPLHK Kupang), as the manager of KHDTK Hambala, conducted regulatory and technical consultations with the relevant parties, i.e., Pemda Sumba Timur and Forest Area Designation Institute of Kupang (BPKH Kupang). Referring to the Regulation of the Ministry of Environment and Forestry number P.27/2018 concerning the Guidance of the borrow-to-use forest area, it is necessary to assess the request on the borrow-to-use forest area for TPU.

Assessment of a new TPU site requires a structured information system consisting of policy, economic, environmental, social, and cultural aspects. Placing the TPU area carelessly can lead to conflicts between cemetery grounds and other land-use types and violate the Regional Spatial Planning (RTRW). To overcome this problem, a GIS-based multi-criteria approach widely used by previous studies can be used to determine a suitable area for TPU [8, 9]. This study aims to analyze land suitability for new TPU in KHDTK Hambala using a GIS-based multi-criteria approach, specifically of legality, management, technical, socio-economic aspects, and potential conflicts in the proposed use of KHDTK for public funerals, especially for Covid-19 bodies, which are currently urgently needed.

2. Method
2.1. Research site
The study was conducted at KHDTK Hambala, located at 124° 31’ 27,034” – 124° 32’ 03,312” South Latitude and 9° 30’ 22,043” – 9° 30’ 38,822” East Longitude (Figure 1). Based on regional administration, Hambala KHDTK is located in Temu Village (Kanatang sub-district) and Kambajawa Village (Waingapu City subdistrict), East Sumba District. The physical condition of the soil is generally the Mediterranean, with rock formations and soil solum less than 20 cm at an altitude of ±150 masl. Climatic conditions are indicated by the number of rainy days reaching 90 days/year and low rainfall reaching 866.26 mm/year. This situation affects variations in air temperature ranging from 22.73°C–28.44°C, and relative humidity reaching 77.17%, including land cover dominated by savanna ecosystems (Figure 1). Several types of vegetation develop naturally or by planting [13], including Timu (Timonius timu), kesambi (Scleicera oleosa), kom (Zizipus jujube), kedondong hutan (Spondias sp.), injuatu (Pleiozymum timoriense), angasana (Pterocarpus indicus), asam (Tamarindus indica), gamal (Gliricidia sepium), dan fikus (Ficus spp.), cemara udang (Casuarina equisetifolia), kayu putih (Eucalyptus camaldulensis), jati (Tectona grandis), jati putih/gmelina (Gmelina arborea), akasia (Acacia spp.), kayu putih (Eucalyptus alba) and kayu putih (Melaleuca leucadendron). The potential richness of flora has implications for its carrying capacity for fauna diversity in the KHDTK area, including 36 species of birds from 24 families [13].
Figure 1. The Location of KHDTK Hambala, Sumba Timur District, East Nusa Tenggara Province, (presented on SPOT 5 imagery in 2016).

2.2. Data collection
The collection of data and information is carried out using normative references in determining aspects and indicators. The main reference is the Regulation of the Minister of Environment and Forestry [14,15]. There are 5 variables (indicators) that are the object of the study, including (1) aspects of forest area legality, (2) management, (3) technical, (4) social-economic and (5) ecology-environment. Data were collected from the local government and field observations in the KHDTK Hambala area. After that, weights and scores were given to each variable and indicator referring to literature studies, field observations, and interviews with the local government and the community. The weights and scores are based on the degree of importance of variables and indicators on the feasibility of TPU proposals in forest areas. Therefore, the weighting of 5 variables and 15 indicators in this study, the highest weight on the pandemic indicator, followed by the grave needs and potential conflict indicators, while other indicators have the same weight in determining the feasibility of the proposed TPU location. The range of scores for each indicator represents the feasibility of TPU candidate locations from low (score 1) to high (score 5). Determining the feasibility of the location accumulates the results of the multiplication between the weights and scores on each indicator (as follows). The feasibility value is in 5 (five) categories, namely high, rather high, medium, rather low, and low.

\[ K = \sum_{i=1}^{n} (w_i \times x_i) \]

\( K = \text{candidate eligibility TPU;} \)
\( w_i = \text{indicator weight for-I} \)
\( x_i = \text{indicator score for-i} \)

3. Results and discussion
Key findings on research variables indicate that in the legal aspect, there are regulations from the national [14,15,16,17], regional [18], and site [19] levels that underlie the proposed use of the KHDTK area for religious purposes through the TPU. The management aspect indicates that the applicant has not prepared a detailed area management plan for the KHDTK manager. On the technical aspect, supporting infrastructure in roads and buildings is already available, but the quality needs to be
improved to make it more adequate. Especially for the social aspect, extraordinary events in the form of the COVID-19 pandemic, the need for a proper burial ground is the justification for allocating the KHDTK area as a TPU location. On the ecological and environmental aspects, the requested location is too close to residential areas, so that the applicant's proposal needs to be revised to mitigate its potential impact on the residential environment. In general, the results of the initial study of variables and indicators have a feasibility value for the proposed use of the KHDTK Hambala area as a TPU, as the results of the calculation of the degree of importance (weight) and values for each indicator are in Table 1.

Table 1. The results of the technical study of the feasibility of TPU candidates based on several aspects at KHDTK Hambala.

| Variable/Aspect          | Indicator                              | Weight | Value | Weight x Value |
|-------------------------|----------------------------------------|--------|-------|----------------|
| Legality                | Area/Permit status                     | 5%     | 5     | 0.25           |
|                         | Compliance between regulations         | 5%     | 5     | 0.25           |
| Management              | Area planning plan                     | 5%     | 4     | 0.2            |
|                         | Management plan                        | 5%     | 3     | 0.15           |
| Technics                | Human resources administrator           | 5%     | 3     | 0.15           |
|                         | Supporting facilities & infrastructure  | 5%     | 3     | 0.15           |
| Social-economy          | Extraordinary event (pandemic)         | 20%    | 5     | 1              |
|                         | Population & TPU needs                 | 10%    | 3     | 0.3            |
|                         | Estimated economic impact              | 5%     | 2     | 0.1            |
|                         | Cultural compatibility                 | 5%     | 2     | 0.1            |
|                         | Conflict of interest                   | 10%    | 3     | 0.3            |
| Ecology-environment     | Land topography                        | 5%     | 4     | 0.2            |
|                         | Land cover                             | 5%     | 4     | 0.2            |
|                         | Hydrology-distance from the river      | 5%     | 3     | 0.15           |
|                         | Distance from settlement               | 5%     | 2     | 0.1            |
| Total Eligibility Score |                                        |        |       | 3.6            |

Notes: (a) Weight is the degree of importance of each indicator for TPU candidates, with the total weight of all indicators being 100% (weighting scale 1-100); (b) Values are the numbers for each TPU candidate indicator on low priority (score 1) to high (score 5); and (c) The total score corresponding to each indicator, representing the right location for TPU candidates from low (score 1) to high (score 5).

3.1. Legality aspects
The legality of the request conforms with the regulations governing the use of forest areas at the national, regional, and site levels in the management of KHDTK. The management of public burial places (TPU) in Indonesia is regulated in Government Regulation No. 9 of 1987 concerning Provision and Use of Land for a Cemetery. This regulation provides certainty of government support in services in the form of state land for burial, with the condition that it is not located in a densely populated area. Article 8 (16) mandates that the government designate certain forest areas for special purposes for the public interest, such as research and development, education and training, and religion and culture. At the operational level, it is in line with [14] articles 2, 3, 4, and 6 which stipulate that forest areas (production and protection) can be used for development outside of forestry activities through a cooperation mechanism, one of which is for burial.

The management of KHDTK Hambala refers to [20] covering an area of ±509.42 ha as research and development KHDTK, so that it has legal legality under the control of the Ministry of Environment and Forestry (MoEF). On the other hand, referring to [18], the KHDTK Hambala is
included in the Green Open Space (RTH) area that can be used for public purposes, one of which is cemeteries. Proposed utilization through the application for TPU candidate locations in the Detailed Spatial Planning (RDTR) and Waingapu Urban Zoning Regulations 2015-2035, KHDTK Hambala is a subzone of RTH Public Cemetery with code Subzone RTH-4. Considering the suitability of laws and regulations, the application for the use of the area for TPU meets the criteria and deserves to be continued.

3.2. Management aspect
The proposed area structuring plan consists of 7 blocks, consisting of 5 blocks according to religion/belief, 1 block for extraordinary events/epidemic/pandemic, and 1 building block for cemetery support facilities and infrastructure. Even though the block management and arrangement plan already exists, it has not been adjusted to the proportion of the population based on religion/belief. Referring to BPS data [20], with a population of 250 thousand people, it can be seen that the proportion of population-based on belief to the total population is: Protestant (78%), Catholic (9%), Marapu (7%), Muslim (6%) and Hindu-Buddhist (<1%) [1]. On the other hand, the proposed TPU land area of 17 ha has an unbalanced proportion in each block based on the proportion of population and religion to the total area of land requested. The size of the candidate block indicates this for TPU for each religion/belief, namely Protestant (31%), Catholic (15%), Marapu/Local belief (19%), Islam (12%), Hindu-Buddhist (14%) and special TPU for pandemics (6%) and TPU social facilities (3%). This situation needs to be adjusted to the realities and projections of population growth through proportional adjustments with its mortality rate.

The request from the Regent of East Sumba has attached a master plan/site plan from the location of the TPU candidate (in the form of a map), but the detailed written management plan document including the plan/mechanism of cooperation between the applicant and the KHDTK manager in the management of the TPU candidate is not yet available. The master plan/site plan is one of the main instruments that need to be prepared because it relates to site arrangement, which has implications for the landscape and function of the forest area. Through the site plan, efforts can be made to optimize utilization while still taking into account the function of the area as a forest area so that site management interventions will be different from the general state of the TPU location.

3.3. Technical aspects

Human resource management is one of the important indicators considered in management. Because the management of the prospective TPU location is through a cooperation mechanism, the applicant acts as the main manager and the KHDTK manager and the surrounding community. In terms of quantity, the availability of human resources from the applicant's side is adequate and requires capacity and quality improvement to ensure that management is carried out sustainably.

Supporting facilities and infrastructure are available in the form of an entrance from the highway to the location requested for TPU with a distance of about 1850 m. In addition, the road inside the blocks for TPU is about 1500 m long. The type of road currently available is the macadam road (stone and dirt) with a width of ±3 meters. Therefore, not all types of vehicles can be used to reach this location. In addition, there are already two buildings at the requested location, namely: a cemetery house and a building for religious ceremonies, but their condition is not well maintained. Based on the supporting facilities and infrastructure indicators, the application for the use of the KHDTK area is feasible to continue and requires improvement in the quality and quantity of supporting facilities and infrastructure.

3.4. Socio-economic aspects
3.4.1. The extraordinary events of the COVID-19 pandemic. The occurrence of an extraordinary event in the form of the COVID-19 pandemic (Figure 2) became the basis for the Regional Government to apply for TPU at KHDTK. So far, as many as 90 bodies of COVID-19 victims have been buried at the location of the TPU candidate. The increasing incidence of COVID-19 is the basis of justifying the
need for land and the construction of TPU so that the application for the use of the area is feasible to continue.

Figure 2. COVID-19 Cases in East Sumba District March 2020-July 2021. (Source: http://www.covid19.nttprov.go.id/home/data, 10-08-2021)

3.4.2. Ratio of population to TPU needs. The applicant (local government) plans to use the TPU land to benefit the Covid-19 corpses in the community in Waingapu City and its surrounding areas. The biggest potential beneficiaries are the people of Temu urban village (Kanatang sub-district) and Kambajawa urban village (Waingapu City, District capital). The population in the two kelurahan reaches 17 thousand people [1, 21], and in the sub-district, it reaches 50 thousand people [22], and the district reaches 250 thousand people [21]. Based on the regulations (SNI 03-1733-2004 concerning Procedures for Planning for Urban Housing Environments [23] and [2] concerning Guidelines for Provision and Utilization of Green Open Space in Urban Areas) every urban area with a population of 120 thousand people must have a TPU location. Referring to these provisions, the population in Waingapu still has not reached the standard number for the provision of TPU, but referring to the population at the district level, there must be at least 2 TPUs in East Sumba District. In reality, there are no built TPU that is adequate to serve the needs of the community. The existing TPUs are generally family-owned in a very limited area and have experienced a decrease in their capacity.

Population density is one of the indicators used in assessing the suitability of the TPU location. The location of the TPU candidate in Temu sub-district is considered suitable because it has a low population density (105 people/km²), far below the allowed population density limit to build a TPU, which is 200 people/ha [8]. The need for TPU land is very urgent, and the ratio of population and population density around the TPU location is adequate, but it is necessary to rationalize the land area allocated to the projected land area for grave needs. Based on the results of an analysis of the current population (in 2020) and predictions of population growth for the next 15 years (2035), the average population mortality rate and land requirement for graves at the district level is around 12.45 ha (Table 2). Based on indicators of population, mortality rate and grave needs (at the district level), the application for the use of the KHDTK area for TPU is feasible to continue with a note that it is necessary to rationalize the area of TPU candidates to be adjusted to the needs of the grave.
Table 2. The number of populations, deaths and the need for graves at the village, sub-district and district levels in East Sumba 2020-2035.

| Years | Population (people) | Death (people) | Grave Needs (ha) |
|-------|---------------------|----------------|------------------|
|       | Village | Sub District | Village | Sub District | Village | Sub District | Village | Sub District |
| 2020  | 17.943   | 50.685        | 244.280 | 161         | 456      | 2.204        | 0.05    | 0.14         | 0.66 |
| 2021  | 18.302   | 51.699        | 249.166 | 165         | 465      | 2.342        | 0.05    | 0.14         | 0.70 |
| 2022  | 18.668   | 52.733        | 254.149 | 168         | 475      | 2.387        | 0.05    | 0.14         | 0.72 |
| 2023  | 19.041   | 53.787        | 259.232 | 171         | 484      | 2.433        | 0.05    | 0.15         | 0.73 |
| 2024  | 19.422   | 54.863        | 264.417 | 175         | 494      | 2.480        | 0.05    | 0.15         | 0.74 |
| 2025  | 19.811   | 55.960        | 269.705 | 178         | 504      | 2.527        | 0.05    | 0.15         | 0.76 |
| 2026  | 20.207   | 57.080        | 275.099 | 182         | 514      | 2.476        | 0.05    | 0.15         | 0.74 |
| 2027  | 20.611   | 58.221        | 280.601 | 185         | 524      | 2.525        | 0.06    | 0.16         | 0.76 |
| 2028  | 21.023   | 59.386        | 286.213 | 189         | 534      | 2.576        | 0.06    | 0.16         | 0.77 |
| 2029  | 21.444   | 60.573        | 291.937 | 193         | 545      | 2.627        | 0.06    | 0.16         | 0.79 |
| 2030  | 21.872   | 61.785        | 297.776 | 197         | 556      | 2.680        | 0.06    | 0.17         | 0.80 |
| 2031  | 22.310   | 63.020        | 303.731 | 201         | 567      | 2.734        | 0.06    | 0.17         | 0.82 |
| 2032  | 22.756   | 64.281        | 309.806 | 205         | 579      | 2.788        | 0.06    | 0.17         | 0.84 |
| 2033  | 23.211   | 65.566        | 316.002 | 209         | 590      | 2.844        | 0.06    | 0.18         | 0.85 |
| 2034  | 23.675   | 66.878        | 322.322 | 213         | 602      | 2.901        | 0.06    | 0.18         | 0.87 |
| 2035  | 24.149   | 68.215        | 328.769 | 217         | 614      | 2.959        | 0.07    | 0.18         | 0.89 |
| Total | 3.010    | 8.503         | 41.484  | 0.90        | 2.55     | 12.45        |

Remarks:
- The year of analysis is adjusted for the end of the East Sumba District RDTR in 2035
- The population in 2020 based on the results of the 2020 Population Census, the population for 2021-2035 is calculated by referring to a population growth rate of 2% per year [21]
- The number of deaths refers to the Crude Death Rate from the BPS, about 9 people per 1000 inhabitants [26]. At the district level during 2021 – 2025, the death rate is added to the estimated death due to COVID-19, which is assumed to be 100 people/year. For the next period (2026 – 2035), it is assumed that the COVID-19 pandemic has ended, and there are no additional deaths from COVID-19 cases
- The need for graves refers to the Minister of Public Works Regulation No. 5/ PRT/M/2008.

3.4.3. *Estimated economic impact of the existence of TPU.* The surrounding community is the group that is considered the most affected, especially the people of Kambajawa Village and Temu Village. The population of Kambajawa village reaches 11 thousand people. As many as 3,085 people are dryland farmers of horticultural crops, 136 are breeders, 29 are fishermen, and 1,241 are engaged in trading. In addition, there are 11 people engaged in the craft industry, 1512 people are civil servants/police/TNI and others, and as many as 5324 are engaged in other businesses [21]. The population of Temu Village is 5 thousand people. As many as 20% are farmers, while other residents have jobs as traders, breeders and fishers. Referring to BPS data [22], obtained information on the income/capita of the community as much as Rp. 5 million/year (±Rp. 400 thousand/month), lower than the per capita income at the district level of East Sumba and NTT Province of around Rp. 8 million/year (±Rp. 650 thousand/month) [20]. Although it is not expected to have a significant impact on economic indicators, a well-managed TPU is expected to be a lever for opening up job opportunities and increasing the income of the surrounding community.

3.4.4. *Compatibility with community cemetery culture.* Generally, the people of Sumba carry out cemeteries around their houses or at family graves on private land. In the Marapu community, which is identified as around 16,000 people [1], death and burial ceremonies are important because the deceased’s soul is released to the ancestral land [24]. There is a stone grave tradition, namely the burial tradition of using large stones as a support for the tomb accompanied by the slaughter of several...
animals for offerings to their ancestors, which is still carried out by Marapu adherents. Along with the entry of Christian teachings, the tradition underwent a transformation, cemetery ceremonies on family land had been adjusted to religious rules. The government urges the public not to carry out cemeteries around their yards, but they are still faced with 2 main obstacles: community traditions/culture and the unavailability of a representative TPU. Therefore, the construction of the TPU is expected to provide an alternative for the community to change the cemetery tradition around the yard.

3.4.5. Estimated conflicts of interest between institutions/actors. Based on the observations and previous studies, it was found that there are three main actors with interest in the utilization/management of the KHDTK Hambala, namely: BPPLHK Kupang (as the manager), the East Sumba Regional Government and the community [25]. The potential for conflict between managers and the local government has started since the city’s expansion in 2000, and the KHDTK area is a target for the construction of public facilities such as garbage dumps and TPU. Some of the locations requested for TPU, especially in the east and south, are bordered by agricultural land/community settlements. The potential for conflict is indicated by the encroachment of agricultural land and the community’s lifting of the KHDTK boundary.

The request to use the TPU area with a cooperation mechanism is expected to be a means of conflict resolution from the three main actors who use land in KHDTK. Local governments can gain access to use land in the construction of the TPU, the surrounding community can be involved in the management of the TPU, and the KHDTK (BPPLHK Kupang) get support in its management. Through the utilization cooperation mechanism, it is hoped that it can reduce potential conflicts of interest so that the application for the use of the KHDTK area for TPU is worth continuing.

3.5. Ecology-environment aspect
3.5.1. Topography/slope. The slope of the land in the requested area is dominated by flat slopes (70%) of the total area of TPU candidates) with an average slope of 13%, smaller than the average slope of the entire KHDTK area of 16% (Figure 3a). Some parts of the land are steep, characterized by rather dense contour lines, while others have sparse contour lines (Figure 3a). Referring to [17], the flat-sloping slope at the location of this TPU candidate (maximum slope is 15%) has a low potential for erosion and landslides, thus fulfilling the requirements for the construction of the TPU.

3.5.2. Landcover. Land cover in the KHDTK Hambala is dominated by grasslands/savanna [13]. Based on field observations, at the location requested for TPU, almost the entire area is savanna, so that the use for TPU has a smaller environmental impact compared to cover in the form of shrubs or secondary forest.

3.5.3. Hydrology – proximity to water sources. The proposed TPU location is in a transitional area between upstream and midstream in the watershed landscape. This situation requires careful consideration because it is related to the eco-hydrological function as a water catchment area. The prospective TPU is close to the river (estimated distance of 50–350 m), flows throughout the year and is used by the community for daily needs, including irrigation (Figure 3b). On the other hand, there are springs in the vicinity as the main water source for water agency management (PDAM) Kota Waingapu, including a bottled water treatment plant. Although the previous study stated that a distance of more than 150 m from the TPU was considered safe against the possible impacts [8], the case of the TPU candidate at KHDTK Hambala had special characteristics because water sources/springs were very limited. It is necessary to add further studies that need to be carried out to deepen this study.

3.5.4. Environmental impact – distance to settlement. Considering the regulations and the results of previous studies, the location of the TPU is at least 500 m from the settlement [8] to minimize the environmental impact of the existence of the TPU. This requirement was adopted as one of the protocols/operational standards adhered to for Covid-19 burial places. Field facts show that the location of the TPU candidate has a distance variation of 200-700 m from the settlement (Figure 3c).
Considering that at the location of the TPU candidate, there are already around 52 COVID-19 corpse graves, it would be wiser to review the proposed TPU candidate to meet the minimum distance requirement from settlements.

Figure 3. Tree indicators of Ecology–Environment Aspects for the feasibility study of TPU candidate: (a) slope; (b) distance to water resources; (c) distance to settlement.

Based on the results of a technical study of the variables and indicators in the proposed TPU candidates, several scenario options for management are as follows:

a. Strict scenario. This scenario complies with the technical requirements for indicators used in flat-sloping topography (0-15%), the distance from the river must be above 150 meters, and the distance from residential areas is more than 500 meters. Consideration of this scenario because it technically meets the requirements as a TPU location, and the minimum distance from the settlement is met. The obstacle is that the possible land area is relatively small, covering 1.54 ha (Figure 4 – an area with crosshatch), with the capacity for grave needs only for 2 surrounding villages until 2035, and not meeting the needs at the sub-district and district levels.

b. Moderate scenario. This scenario assumes that the potential TPU locations meet several technical requirements. For the moderate scenario, indicators are used: (1) flat-sloping topography (0-15%), (2) the distance from the river is greater than 150 meters, (3) the distance from residential
areas is more than 250 meters. The consideration is that it has an area of 6.55 ha (Figure 4 – an area with crosshatch and simple hatch) and can accommodate the needs of tombs in 2 sub-districts until 2035 has not been able to meet the needs of tombs on a district scale. The weakness is that the distance from the settlement is ±250 m, which is below the minimum required distance of 500 m.

c. Loose scenario. This scenario assumes that the potential TPU locations meet several technical requirements. For the loose scenario, indicators are used: (1) flat-sloping-slightly sloping topography (2) the distance from the river is greater than 100 meters (3) the distance from settlements is more than 150 meters. The consideration is to have a wider land size of 14.16 ha (Figure 4 – an area with light grey color) to accommodate the needs of tombs at the district level as much as 12.45 ha until 2035. In addition, the area obtained in this scenario is slightly lower with the requested location of 17 ha to minimize the potential for conflicts that arise due to the gap between the requested and the approved ones. We suggest that this scenario is the best one. However, further study on ecological impact should be conducted to obtain a comprehensive dataset.

Figure 4. Suitability map for Public Cemetery/ TPU area with three different scenarios.

4. Conclusion
The proposal for cooperation in using the KHDTK Hambala for the construction of TPU can be continued with a choice of tight, moderate, and loose scenarios. Each scenario has advantages and disadvantages so that the choice of policy needs to be supported by a strong academic study of the variables and indicators used to mitigate the potential environmental risks that will be generated. Cooperation in the use of the KHDTK Hambala is one of the opportunities for mitigating conflicts of interest between the management, the East Sumba Regional Government, and the surrounding community. However, this collaboration proposal has not considered the exit strategy to be taken,
including asset management developed in the KHDTK Hambala area and the sustainability of the cemetery landscape management after the cooperation period ends.

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Authors contributions
The authors have equal contribution to this work.

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