ruddim_2019_IOP_Conf._Ser.__Earth_Environ._Sci._235_012079-1.pdf

by

Submission date: 04-Dec-2022 12:22PM (UTC+0700)
Submission ID: 1970571043
File name: ruddim_2019_IOP_Conf._Ser.__Earth_Environ._Sci._235_012079-1.pdf (427.54K)
Word count: 2799
Character count: 14777

ResearchGate

See discussions, stats, and author profiles for this publication at: https://www.researchgate.net/publication/331240320

Flood and landslide vulnerability as natural hazard in Parepare City

Article *in* IOP Conference Series Earth and Environmental Science · February 2019

DOI: 10.1088/1755-1315/235/1/012079

CITATIONS
3

READS
110

4 authors, including:

Safruddim Safruddim
Universitas Hasanuddin
4 PUBLICATIONS **4** CITATIONS
SEE PROFILE

A. M. Imran
Universitas Hasanuddin
63 PUBLICATIONS **111** CITATIONS
SEE PROFILE

Some of the authors of this publication are also working on these related projects:

Project Toll Highway Palarang Balik Papan - Mahkota II Samarinda, East Kalimantan, Indonesia View project

Project Flood and landslide vulnerability as natural hazard in Parepare City View project

All content following this page was uploaded by Safruddim Safruddim on 26 February 2019.

The user has requested enhancement of the downloaded file.

IOP Conference Series: Earth and Environmental Science

PAPER · **OPEN ACCESS**

Flood and landslide vulnerability as natural hazard in Parepare City

To cite this article: Safruddim *et al* 2019 *IOP Conf. Ser.: Earth Environ. Sci.* **235** 012079

View the article online for updates and enhancements.

This content was downloaded from IP address 115.178.234.244 on 25/02/2019 at 23:12

Flood and landslide vulnerability as natural hazard in Parepare City

Safruddim[1], A M Imran[1], Busthan[1], and Pachri[1]

[1]Geology Department, Hasanuddin University, Jalan Perintis Kemerdekaan KM 10, 90245 Makassar, Indonesia.

E-mail: *safruddimahmad@yahoo.co.id*

Abstract. Natural disaster risk is considered in regional planning to reduce risk potency. Parepare is one of the districts in South Sulawesi which has natural disaster potency such as flood, landslide and hurricane. Parepare lies in a very strategic area which is connecting the northern and southern parts of South Sulawesi. As a strategic area, Parepare grows rapidly and therefore the land conversion from forest and paddy field to settlement also increases. Impact of increasing settlement and other infrastructures are decreasing land capacity and tend to increase disaster potency. The natural disaster study indicates 3 major potencies arising: flooding which dominantly occurs in Karajae River, a landslide which commonly took place in hilly topography and hurricane everywhere in the city. To handle this condition at least 3 steps should be applied: a) prevention that includes all efforts of disappearing in reducing disaster; b) mitigation covered reducing disaster impact and c) preparedness activity for anticipating disaster.

1. Introduction

The town of Parepare located in a very strategic location as a connecting area between the northern and southern parts of South Sulawesi. Strategic geographic location makes Parepare City a bustling transit area. As a transit area, Parepare grows and develops in which also develops the service sector. The city of Parepare is experiencing rapid development in connection with the mobility of the people of South Sulawesi and even outside of South Sulawesi. It has dense traffic lanes not only for land but also sea traffic primarily with the island of Borneo. This development transformed Parepare City from an agrarian into a service city with high population growth. The population in 2010 was 129,262 thousand inhabitants to 138,699 thousand inhabitants by 2015. The population growth gives some impacts on the development of occupancy and other land needs such as road infrastructure and so on. Increased land use will also affect the exploration of natural resources, especially the food sector. Land conversion from forests / agricultural land to shelter and other infrastructure can no longer be retained and no longer restricted to just plains. Today, Utilization of Parepare City area is growing rapidly from mountainous areas to coastal areas. The Utilization brings a very big positive impact on the welfare of the people of Parepare City for sure, but the negative impact caused by the utilization of the region potential also cannot be avoided. Negative impacts that could arise from the utilization of areas that do not pay attention to natural conditions could cause disaster for the people around. The flood disaster that occurred in Parepare City on October 24, 2016, became the biggest disaster since 1967. Other disaster events, although the scale is not as big as 2016 ago, it has disturbed the social aspect. BPS (2016) notes that at least 4 types of natural disasters that recently occurred in the city of Parepare, there are floods, fires, hurricanes, and landslides. The data revealed that hurricanes (170 events) ranked the most in the last five years (2011 -2015), followed by fires (42 events), landslides (23 events) and floods (3 events). The amount of disaster

Content from this work may be used under the terms of the Creative Commons Attribution 3.0 licence. Any further distribution of this work must maintain attribution to the author(s) and the title of the work, journal citation and DOI.
Published under licence by IOP Publishing Ltd

intensity, especially natural disasters which are occurring in an area indicates that nature is in an unstable condition.

This research specifically examines the potential floods and landslides that occur in Parepare. Both of these natural disasters are considered to be disasters which should be addressed immediately where Parepare area is traversed by Karajae watershed with other tributaries that are very potential to be the cause of flood in Parepare region. Also, Parepare topography whose territory is located in mountainous areas with steep slopes is also very vulnerable to the occurrence of landslides that would be very dangerous for the people around.

2. Research method

2.1 Location.

The location of flood study was conducted in the Karajae River Basin (DAS) located in Parepare. The research location is about 150 km from Makassar City. The area of the Karajae watershed is 142.45 km^2. To collect the flood data, we took it in some point which all entered into the territory of Parepare.

Figure 1. (a) Map of Karajae Watershed, (b) Map of location of the landslide

The landslide research site is located in Bacukiki and Ujung sub-district, Parepare City, South Sulawesi Province, and about 150 km from Makassar City. The research sites are located around the people settlements and also close to public facilities.

2.2 Data.

The study of potential flooding of Parepare city is done by using several parameters such as rainfall, river cross-section data, water flow rate, river water discharge, distribution of altitude, river distribution, flood occurrence, and river cross profile. Flood simulation using HEC-RAS software.

The study of the potential for landslide disaster in Parepare is done by using several approaches such as Geology approach covering lithology type, geophysical approach by using subsurface lithology interpretation, rock mechanical approach, and geometry approach of the slope.

3. Result

3.1 Flood.

Overall, the flooded area is 6.94 km2. The floodwaters covered some area include Lompoe Village, Bumi Harapan Village, and Watangbacukiki Village located in Bacukiki Subdistrict and Kampung Baru Village, Tiro Sompe Village, Cappagalung Village, Sumpang Minangae Village, and Lumpue Village located in Bacukiki Barat District. The flooded area is located about 100-250 meters from the Karajae River. The flooded areas are mostly rice fields, settlements, ponds, forests, and plantations. Based on the hydrology and hydraulics model, it can be seen that the locations affected by flood in Parepare area can be seen in the following figure 2:

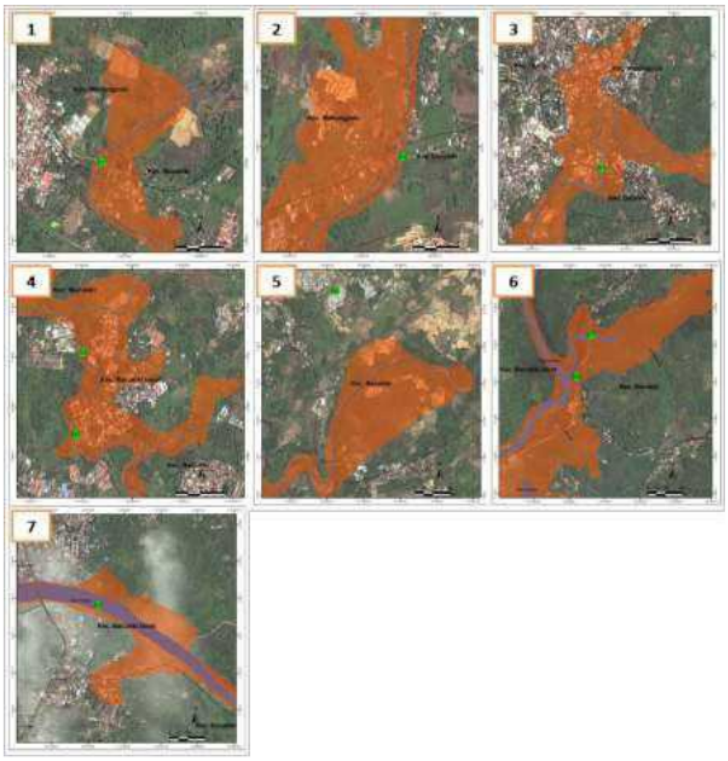

Figure 2. (1) Location map of B1 puddle station on Jawi - jawi river Lompoe village with 100 m^3/s discharge (2) B2 flooding station at Jawi - jawi river Lompoe village with 200 m^3/s discharge (3) B3 flooding Station station on Jawi - Jawi river Bumi Harapan Village discharge 350 m^3/s (4) B4 puddle station on Karajae River Cappagalung village with 350 m^3/s discharge and B5 station River Jawi - Jawi Cappagalung village discharge 350 m^3/s (5). B6 flooding station on Karajae River Bacukiki Subdistrict with 300 m^3/s discharge (6) B7 station on Karajae River Bacukiki Sub district with 300 m^3/s discharge and B8 flooding station on Karajae River Bacukiki Sub district with 300 m^3/s discharge (7) B9 flooding station on Karajae River West Bacukiki Sub district with 300 m^3/s discharge.

3.2 Landslide.

After collecting the data directly in the field and combined with some laboratory tests, the simulation about landslide prediction in the research area could be done. Several simulations of security factor could be done based on the data obtained. The landslide simulation is performed on two different types of conditions that are without groundwater and with groundwater. The simulation was done at 3 different points in Parepare City. Landslide simulation is done by using Geo Slope Software.

3.3 Effect of material properties on landslide material in research areas.

The physical and mechanical conditions of the soil will greatly affect the slope stability factor. Factors that cause the research location which vulnerable to landslide disaster could be described as follows:

- The value of water content in the research area that has a value of 62.23% is possible for the occurrence of ground motion because it will affect the physical and mechanical properties of soil. If these physical and mechanical properties are not able to form a sufficiently large shear

resistance value in the body slope, until the maximum limit value of certain water content, it will cause a volatile slope (landslide).

- The small shear angle values in the study area ranging from 20° to 27° then the movement of the soil may occur, as the larger of inner shear angle, the material will be more resilient to the external stress that imposed on it, besides the low cohesiveness value in the research area which ranges from 5 - 39,226 kN/m3, it is also possible for the soil movement because the pull force between particles in rock and soil is also low.
- The stability of the slope depends on the driving force and retaining force which acts on the slip plane. The retaining force is a force that prevents the avoidance of avalanches, while the driving force is the force which causes the avalanche. Comparison between force and cause force is called Security Factor (SF). The smaller the value of SF, the movement of the soil often occurs. On the hand, the greater the SF then the rare earth movement occurs.

3.4 Effect of land use on a landslide in research areas.

Land use is a manifestation of various human activities, such as settlements, plantations, farming, and paddy fields, which are a function of climate, soil type, and slopes. Human activities have a profound effect on the movement of the land, especially about construction, land cover conditions or land-use changes. In the research area is often found the existence of settlements on the slopes and cutting road cliffs which is the biggest factor in changes in of slope strength. Utilization of misuse land-use indirectly could cause a landslide.

3.5 Effect of rainfall on a landslide in research areas.

Climate is an important factor which causes land surface changes. Climatic factors that greatly affect the mass movement are rain and temperature. Rain as the cause of erosion, increasing the weight of rocks that have been weathered, and reduce the tensile force between rocks that have weathered with fresh rocks under it with the formation of the field of slip. Temperature is closely related to the intensity of solar radiation that affects the occurrence of expansion and shrinkage of rocks that encourage rocks to tend to undergo the weathering process rapidly, so it can be concluded that rainfall and temperature greatly affect the occurrence of groundmass movement because after a heavy rainfall, rainwater infiltration process into the slope causing the rise of ground water in the slope and the reduction of strong shear/ rock/slope soil, rainwater into the soil will also increase the load of the slope, causing the slope to become heavier. The inability of the slope to withstand the load will gradually lead to the process of soil mass movement in the slope. Rainfall as one of climate component will affect water content and water saturation. Rainfall as one component of climate will affect water content and water saturation. Rain can increase the water content in the soil and will cause the physical condition of the slope body to change. The increasing of water content will weaken the mechanical physical properties of soil as well as the decreasing of soil cohesion values so that the shear strength of the soil decreases, while the weight of the soil mass increases. As the weight of the soil mass increases, the soil shear will decrease, and it will increase the risk of soil movement.

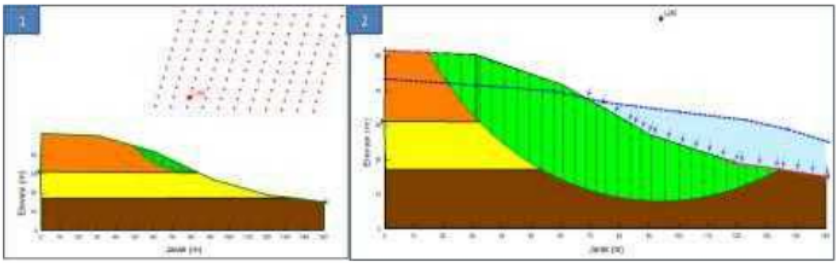

Figure 3. (1). Analysis of safety factor at Landslide Point 1 with no water table
(1) with water table (2) using Geo Studio 2007 software.

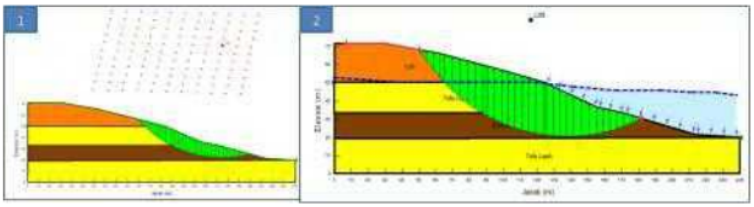

Figure 4. (1). Analysis of safety factor at Landslide Point 2 with no water table (1) with water table (2) using Geo Studio 2007 software.

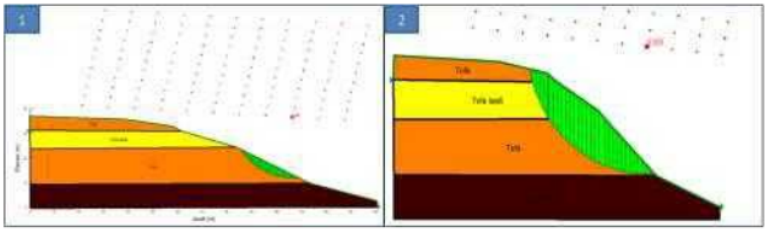

Figure 5. (1) Analysis of safety factor at Landslide Point 3 without geometric change of slope (1) without geometric change of slope (2) using Geo Studio 2007

4. Discussion

4.1 *Flood.*

- Factors that affect the occurrence of floods in the area of Parepare is rainfall, river height, river gradient, and land use.
- Based on the flood model that has been produced, floods can occur in January - March, and October - December.
- The match of flood model and flood history data in the research area is 60-70%. Factors that affect it is the lack of rainfall stations in the study area, the distance between the river cross-section data collection is too wide and does not include the possibility of the influence of man-made buildings in making flood models.
- Based on Data Elevation Model (DEM) -SRTM with 30 meters resolution, it can be seen that the flooded area lies in the elevation less than 50 meters above sea level.

4.2 *Landslide.*

- Slope conditions at point 1 are included in the landslide-prone zone. This condition will be more severe if the intensity of rainfall is higher, it will affect the mechanic value of rock which makes slope conditions unstable and susceptible to slump. The occurrence of landslides also evidences this at this point of observation.
- Slope conditions at point 2 are included in the safe zone of the landslide. This condition remains stable despite the considerable intensity of rainfall. The affecting factor is the sloping slopes.
- Slope conditions at point 3 are included in landslide-prone zones. This is due to the geometry changes of the slopes in the form of dredging activities. Also, if the intensity of rainfall is higher, it will affect the rock mechanics value that makes slope conditions unstable and susceptible to slump.

Acknowledgments
We want to thank the head of Sedimentology Laboratory and the Head of Geotek Laboratory, with all the team, Geological Engineering, Hasanuddin University for all the facilities provided, for our togetherness, their support and assistance during our research. Our special thank goes to the Head of BPBD and Government of Parepare City, who has provided research fund and given support so that we can finish our research and prepared the manuscript.

References

[1] Akbar M 2016 Analisis profile muka air banjir sungai molompar kabupaten Minahasa Tenggara *J. Sipil Statik* **4** 49-64.
[2] Aquaveo 2016 *Analysis Tuflow Hydrodynamic*, Version 12.1.2 for Surface Water System Modeling System Prepared for US Army Corps of Engineers (Washington: Aquaveo).
[3] Arsyad A, Hamid W, Yusmin A and Ibrahim F 2014 *Analisa Kegagalan Lereng Batuan Vulkanik Pada Jalan Malino-Sinjai Dengan Menggunakan Pemodelan Elemen Hingga* (Makassar: Universitas Hasanuddin).
[4] Harijadi 2015 Analisis banjir way besai dengan model matematis unsteady flow menggunakan softwere HEC – RAS *J. Rekayasa* **19** 13-28.
[5] Kamiana I M 2011 T*eknik Perhitungan Debit Rencana Bangun Air* (Yogyakarta: Graha Ilmu).
[6] Budiman M 2011 *Geologi dan Studi Kestabilan Lereng Daerah Dlingo dan Sekitarnya Kecamatan Dlingo Kabupaten Bantul Daerah Istimewa Yogyakarta* (Yogyakarta: Universitas Pembangunan Nasional Veteran).
[7] Pane E S 2010 *Pengembangan Simulasi Aliran Air ada Saluran Drainase Kota Menggunakan Pemodelan Network Flow* (Surabaya: Institut Sepuluh November Surabaya).
[8] Peraturan Menteri Dalam Negeri 2006 *Pedoman Umum Mitigasi Bencana No. 33 tahun 2006* (Jakarta: PERMENDAGRI).
[9] Sosrodarsono S 1999 *Hidrologi untuk Pengairan* (Jakarta: PT Pradnya Paramita).

View publication stats

ruddim_2019_IOP_Conf._Ser.__Earth_Environ._Sci._235_0120...1.pdf

ORIGINALITY REPORT

3%	%	3%	%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	Muhammad Irfan, Faizah Shahudin, VINCENT HOOPER, Waqar Akram, Rosmaiza Ghani. "The psychological impact of coronavirus on university students and its socio-economic determinants in Malaysia", Cold Spring Harbor Laboratory, 2020 Publication	1%
2	Kenneth N. Brooks, Peter F. Ffolliott, Joseph A. Magner. "Hydrology and the Management of Watersheds", Wiley, 2012 Publication	1%
3	Ramy Mohamed Ghazy, Abdallah Elmaghraby, Ramy Shaaban, Ahmed Kamal et al. "Effectiveness and Safety of Chloroquine or Hydroxychloroquine as a mono-therapy or in combination with Azithromycin in the treatment of COVID-19 patients: Systematic Review and Meta-Analysis", Cold Spring Harbor Laboratory, 2020 Publication	1%

4 Progress in Sustainable Energy Technologies Generating Renewable Energy, 2014. <1%

Publication

Exclude quotes	On	Exclude matches	< 4 words
Exclude bibliography	On		