BOOK I : APPLIED TECHNOLOGY

PROCEEDING

International Seminar on

Regional Economic Development through Science, Technology, and ARt
REDSTAR - 2012

Published by :
Medan Institute of Technology
Jalan Gedung Arca 52 Medan
North Sumatra
Indonesia
23 June 2012

International Seminar on

Regional Economic Development through Science, Technology, and ARt REDSTAR - 2012

Danau Toba International Hotel
Jalan Imam Bonjol 17, Medan
23 June 2012

PROCEEDING

Published by:
Medan Institute of Technology
Jalan Gedung Arca 52
Medan, North Sumatra, Indonesia
www.itm.ac.id

Published by:
Medan Institute of Technology

ISBN 978-602-18277-0-6

THE COMMITTEE

STEERING COMMITTEE
Prof. Ilmi Abdullah (Rector of ITM)
Dr. Ir. Hj. Hidayati, M.Si. (Environmental Protection Agency of North Sumatra)

ORGANIZING COMMITTEE
Chairman: Ir. Sumargo, Ph.D. (Politeknik Negeri Bandung)
Vice Chairman: Ir. Suhelmi, MM. (Institut TeknologiMedan)

DRAFT PAPERS
Raja Nasrul Fuad, S.Kom., M.Kom.
Tri Hadi Jatmiko, ST, MT.
Surta Ria N. Panjaitan, ST. MT.
Aazokhi Waruwu, ST., MT.

PUBLICATION
Perdamean Sinurat, ST, MT

DOCUMENTATION
M. Vivahmi, SH., M.Si.

ACCOMOTATION AND FOOD & BEVERAGES
Ir. Riana Puspita, MT.

REVIEWERS
Prof. Ilmi Abdullah (ITM)
Prof. Dr. Ismail bin Daut (UniMAP)
Dr. Mohd. Fareq bin Abd. Malek (UniMAP-Malaysia)
Dr. Pornchai Phukpattaranont (PSU-Thailand)
Hudson Siriwuwapong (PSU-Thailand)
Prof. Ir. Ade Syafruddin, Ph.D. (ITB)
Prof. Zaidir (UNAND)
Ir. Refdinal Nazir, Ph.D. (UNAND)
Ir. Sumargo, Ph.D. (POLBAN)

Dr. Zeffitni, MT. (UNTAD)
Ir. Rahmad Imbang, Ph.D. (POLBAN)
Ir. Hertog Nugroho, Ph.D. (POLBAN)
Dr. Vera Pujani M.M.Tech. (UNAND)
Dr. Eng. Hendra, MT. (UNIB)

Message from the Rector of Medan Institute of Technology

Assalamu 'alaikum warahmatullahi wabarakatuh

First of all, I would like to thank to the Directorate General of Higher Education for "detasering" program so that many capacity building programs at the Medan Institute of Technology (ITM) can be improved. Next year, I expect that ITM can still get detaser for other field, and look forward to subsequent years would be able to send detaser and become university sources instead of university target. Thus showing the success of the "detasering" program at DIKTI.

Appreciations are also due to the Government of North Sumatra through Regional Planning Agency and Environmental Protection Agency for the support to this seminar.

Master Plan Economic Development Acceleration and Expansion of Indonesia (MP3EI) worth a total of Rp 469 billion will be implemented in six regions of Indonesia, including North Sumatra. In North Sumatra, there will be 41 megaprojects with a total value of construction MP3EI amounting to Rp 43 trillion. Medan Institute of Technology as nation's agent of change should take part in this government program. To achieve this goal, through collaboration Resource and Target University, we held an international seminar Redstar - Regional Economic Development through Science, Technology, and Art. The seminar is expected to continue to be held on an ongoing basis each year. It is expected that this efforts could provide a real contribution in developing human resources capacity and also to explore good practices in economic development both from within and outside the country.

Finally, have a pleasant seminar and I hope you enjoy your staying in Medan.

Wassalamu 'alaikum warahmatullahi wabarakatuh.

Rector of Medan Institute of Technology

Prof. Ir. Ilmi Abdullah, M.Sc.

Remarks from the Chairman of the Committee

Assalamu 'alaikum warahmatullahi wabarakatuh

Gratitude we pray to Almighty God for the gifts that this REDSTAR international seminar can be implemented for the first time with the target of the seminar to be held on an ongoing basis.

REDSTAR aims to raise innovation in science, technology and art so as to support government programs MP3EI. With the focus of discussion as many as 13 fields will be linked either directly or indirectly with the preparation of mega-projects in North Sumatra. We also invite scientists and practitioners from both inside and outside the country to participate in this seminar. Papers that pass the selection after the exposure will be published in the International Journal of Engineering Research and Education (JERE) at UniMAP, while other papers will be published in the proceedings of this seminar.

I would like to extend very high appreciation to many parties who have been contributing to this seminar, from North Sumatra government, environmental centers, private companies and state enterprises including local and international universities.

Finally, I would like to welcome to the city of Medan to all participants of the seminar. We apologize for any shortcomings in the implementation of this seminar and we will continue to improve for the implementation of the following year.

Wassalamu 'alaikum warahmatullahi wabarakatuh.

Chairman of the Committee REDSTAR 2012

Ir. Sumargo, Ph.D.

AGENDA OF SEMINAR

DELI ROOM	
07:30 – 08:30	Registration
08:30 – 08:35	Welcome words from MC
08:35 – 08:40	Remarks from the Chairman of REDSTAR Seminar
08:45 – 08:50	Message from the Rector of Medan Institute of Technology
08:50 – 09:00	Keynote Speech from the Rector of Universiti of Malaysia Perlis
09:00 – 09:20	Keynote Speech from the Governor of North Sumatra
09:20 – 09:45	Coffee Break

DELI ROOM	APPLIED TECHNOLOGY
09:45 – 12:00	Paper presentation
12:00 – 13:00	Break and Lunch
13:00 – 15:30	Paper presentation
15:30 – 15:45	Coffee Break
15:45 – 16:45	Paper presentation
DELI ROOM	
16:45 – 17:00	Announcement for Best Paper by Category

TOBA ROOM	STUDY ON SCIENCE & ART
09:45 – 12:00	Paper presentation
12:00 – 13:00	Break and Lunch
13:00 – 15:30	Paper presentation
15:30 – 15:45	Coffee Break
15:45 – 16:45	Paper presentation
DELI ROOM	
16:45 – 17:00	Announcement for Best Paper by Category

Table of Content

DETERMINING TSUNAMI VULNEBERABILITY AREA IN BENGKULU CITY WITH SPATIAL ANALYST BASED ON GEOGRAPHICAL INFORMATION SYSTEM

Boko Susilo * and Wilda Novratilesi

Department of Informatics Engineering

Faculty of Engineering, University of Bengkulu

*Corresponding author. Tel: +62736-7310093

Email address: bksusilo@gmail.com

Key words: Tsunami, Geographic Information Systems (GIS), Spatial Analysis, ArcView.

Abstract

The geographical position places the city of Bengkulu as an area of tsunami vulnerability or area of tsunami prone, but not all areas of Bengkulu is a tsunami prone area, so it needs to be held researching to determine the tsunami prone areas. The purpose of this study was to determine the category of tsunami prone areas in the city of Bengkulu. The Research method is by processing spatial data of the Bengkulu city through Geographic Information System with ArcView program. There are four parameters which are used to determine of tsunami vulnerability areas in a thematic map. The parameters are distance of beach, topography, vegetation, and shape of shore. The results of the research are three categories of area of tsunami vulnerability that are the heavy area of tsunami vulnerability, medium, and safety area. The result of analyze can be displayed by Script avenue programming. The tool of analyze used ArcView 3.3, AV spatial analyst 2.0a, and AV model builder.

INTRODUCTION

Originally the term comes from the Japanese Tsunami. If taken literally means "big waves in the harbor". Tsunami is a natural phenomenon, a massive wave that occurs after an earthquake. On December 26, 2004, Tsunami in Aceh, had occurred tectonic earthquake 8.9 on the Richter scale and resulted in a huge ocean waves, reaching a height of 34.5 meters. This huge wave hit the city like in Lhoknga, Aceh Besar district and ruins everything passed. These

waves reach inland as far as several miles from shore. The beach is hit by the tsunami reached more than 500 km and the total area affected reached 668, 470 hectares, covering 13 districts/ municipalities in Aceh, including the residential area of 178, 820 hectares, as well as ponds, fields, and forests [4].

To avoid panic when the earthquake and tsunami occurred, it is necessary to know the areas in Bengkulu, which is prone to Tsunami. Awareness of the need for tsunami disaster reduction efforts have been made by local governments, it is pointed out the determination of the signs point to the gathering of community safety to avoid the danger of tsunami.

Locations or points safe for the public gathering when the Tsunami happened is (i) interchange (junction) SLB (Special School) with a height of 23.109 m (meter), (ii) Simpang Sekip (the intersection of Sekip) with an altitude of 20.513 meters(m), (ii) The hospital of M. Junus with a height of 20.398m, (iv) Simpang Pagar Dewa (KM 8) with a height of 20.098 m, and (v) Simpang Department of Education with a height of 19.388 m.

Handling of the tsunami is not enough just to specify points or safe locations for the gathering of the community but need socialization areas prone to tsunami disaster. For this case needs the calculation to the location of the position of the estimated areas prone to tsunami hazard.

Constraints faced by the current government are an effective and efficient in delivering the location of points or locations prone to tsunami complete and informative to the public.

To help provide a clear and accurate picture of the location, distance and accessibility of safe areas to areas prone to tsunamis can be used in

spatial representation. Spatial presentation can be simply defined as data that has a spatial reference (geographic). Each piece of data in addition to providing an overview of a phenomenon can always provide information about the location and spread of the phenomenon in a space (region).

METHOD OF RESEARCH

Software that is used as a tool in the study was application program ArcView 3.3 with Spatial Analyst extension, a model builder, and scripts Avenue. The data in this study is the distance to the location of the beach, the city of Bengkulu topographic maps, vegetation maps, and map form the coast of Bengkulu city.

Research Procedure

Geographic Information System (GIS) is a system based on computer which used to save and manipulate the information of geography. GIS was designed to collect, save; analyze objects, and phenomena from geographic location as important characteristics to be analyzed [3].

Spatial analysis of activities carried out by defining the concept of spatial analysis phase. Identification of spatial analysis performed to determine the outcome of the determination of tsunami-prone areas in the city of Bengkulu with the help of Script Avenue and ArcView display.

There are four basic maps as the parameter determining the tsunami-prone areas in spatial analysis, namely:

1. Map input.

It is a map parameters used in the process of determining the tsunami-prone areas, thematic maps is a map of each parameter. All thematic maps to be used must have similarities projection, the similarity coordinates and attribute data are complete, to support the subsequent analysis.

The maps of these parameters as follows[1]:

a. Distance Map of Coastal Areas.

   The first parameter is the distance from one the location to the beach, maps is derived from classifying areas based on urban neighborhoods in the city of Bengkulu. Classification of these villages has made into 3 classes, namely areas including near, intermediate, and far from the beach. The base map can be seen in Figure 1 below:

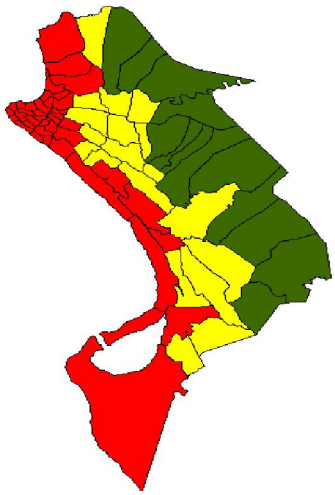

Figure 1: Distance Map of Coastal Areas

b. Topographic map of the city of Bengkulu.

   The second parameter is a topographic map of Bengkulu City area. This map is derived from the slope maps (contours)

contained on the base map Bengkulu City. Topographic map shown in Figure 2 below:

Figure 2: Topographic map of the city of Bengkulu

c. Vegetation map of the city of Bengkulu.

The third parameter is maps land vegetation (land cover) Bengkulu City. The vegetation mentioned is an annual plant that has the potential to reduce the pounding waves during a tsunami. Vegetation maps of land cover in the city of Bengkulu are re-digitized by ignoring the land used for settlements. Vegetation maps can be seen in Figure 3 below:

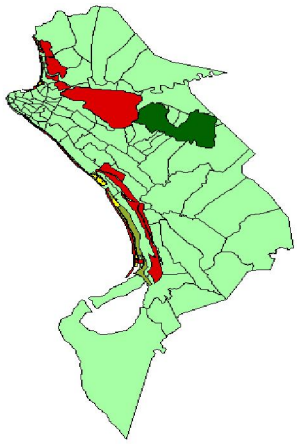

Figure 3: Vegetation map of the city of Bengkulu.

d. Forms of Bengkulu City Beach Map.

The fourth parameter is a map form the beach. Map of the coast form obtained from the office of Energy and Mineral Resources. The map is the result of the research office of Energy and Mineral Resources by dividing the beach form the basis of three (3) zone. These zones are Zone 1 with a high risk of tsunami, Zone 2 is the area devastated by the tsunami with little risk, and Zone 3 is the area that is almost no risk of tsunami. Map of vegetation can be seen in Figure 3 below:

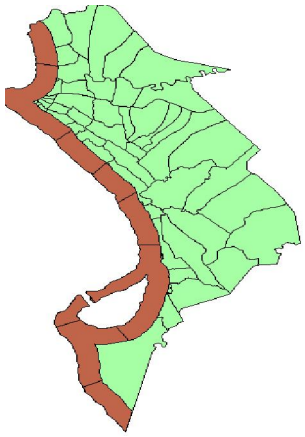

Figure 3: Forms of Bengkulu City Beach Map.

2. Change the type of maps.

After all maps parameters required for the analysis is complete and if the base map which is owned as a parameter determining the tsunami-prone areas are still in vector format, it must be converted into a grid format. It is intended that maps can be further processed to obtain the results of the tsunami-prone areas of Bengkulu city. But if the maps have a grid format, a map does not need to be changed again, and can be directly used for further processing.

3. The process of the model builder is preparing maps that have been processed previously. Thematic maps are compiled to form the intersection of them, which will determine the intersection of regional vulnerability to tsunami. Through a process of spatial analysis performed on the model builder in order to know the areas Bengkulu is prone to tsunamis, these areas can be seen on maps of the analysis, the maps indicated by a red color degradation, the more obvious red color found on the maps, the more vulnerable area of the tsunami, and vice versa
4. Map is a maps the results generated through spatial analysis, this map will be visible from areas prone to tsunamis Bengkulu. These areas have been obtained based on the parameters detailed previously.
5. Display Avenue which maps the results of the analysis with the help of Script Avenue programming language, it aims to create the look of maps areas prone to tsunami resulting from the analysis.

Geographic information system has three main elements, namely: (1) System is a collection of elements that interact in a dynamic environment to achieve certain goals. (2) Information derived from the processing of data. Each set of data objects has its own geography because it is not entirely the existing data can be represented in the map. (3) Geographic is part of the spatial or spacing. It leads to the specification of objects location in a space. Objects can be physical, cultural or economic nature. Sightings are shown on a map to give a representative picture of an object in accordance with the spatial reality of the earth in the GIS[2].

The procedures of research conducted in this study are presented in Figure 4 below:

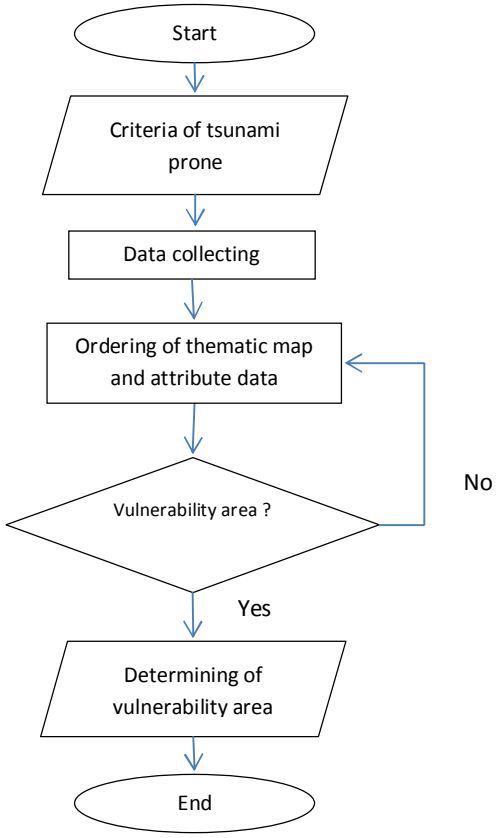

Figure 4: Procedure of research

RESULTS AND DISCUSSION

Locations or points safe for the public gathering when the Tsunami happened is (i) interchange (junction) SLB (Special School) with a height of 23.109 m (meter), (ii) Simpang Sekip (the intersection of Sekip) with an altitude of 20.513 m, (ii) The hospital of M. Junus with a height of 20.398 m, (iv) Simpang Pagar Dewa (KM 8) with a height of 20.098 m, and (v) Simpang Department of Education with a height of 19.388 m.

Handling of the tsunami is not enough just to specify points or safe locations for the gathering of the community but need socialization areas prone to tsunami disaster. For this case needs the calculation to the location of the position of the estimated areas prone to tsunami hazard.

Constraints faced by the current government are an effective and efficient in delivering the location of points or locations prone to tsunami completely and informatively to the public. To help provide a clear and accurate picture of the location, distance and accessibility of safe areas to areas prone to tsunamis can be used in spatial representation. Spatial presentation can be simply defined as data that has a spatial reference (geographic). Each piece of data in addition to providing an overview of a phenomenon can always provide information about the location and spread of the phenomenon in a space (region).

The analysis of the Tsunami Prone to be 3 (three) classes

1. Tsunami Prone level

Table 1: Area of heavy Category to Tsunami Vulnerability

Criteria	Areas that include for Vulnerability Category
Heavy	Beringin Jaya, Rawa Makmur Permai, Rawa Makmur, Pasar Bengkulu, Kampung Kelawi, Bajak, Suka Merindu, Kampung Bali, Tengah Padang, Kebun Keling, Pondok Besi, Kampung Cina, Malebero, Belakang Pondok, Teratai, Kebun Ros, Jitra, Pengantungan, Kebun Dahri, Sumur Meleleh, Pasar Melintang, Pintu Batu, Kebun Geran, Padang Jati, Anggut Dalam, Pasar Baru, Berkas, Anggut Atas, Kebun Kenanga, Anggut Bawah, Penurunan, Kebun Beler, Kandang, Muara Dua, Sumber Jaya.

Categories are the distance parameter-prone areas of the coast < 300 meters, the topography of the area classified as 0-3%, 3-8%, 8-15%, vegetation distance between trees 10 meters, the slope of the beach and the bay.

2. Moderate levels against the Tsunami.

Table 2: Areas of Medium Criteria

Criteria	Areas that include for moderate Category
Moderate (medium)	Tanjung Jaya, Tanjung Agung, Sawah Lebar Baru, Kebun Tebeng, Padang Nangka, Panorama, Sawah Lebar, Tanah Patah, Nusa Indah, Padang Harapan, Jalan Gedang, Lingkar Timur, Lingkar Barat, Bumi Ayu, Kandang Mas, Sumber Jaya, Jembatan Kecil.

Category parameter prone areas with the moderate criteria are the distance to the beach is about 1.5 - 4 km, the topography: 0-3%, 3-8%, 8-15%, vegetation, tree spacing: 10 meter, 5 meter, and 1 meter, while the criteria form the beach is flat and elongated.

3. Safe Levels Of Tsunami

Table 3 Category Secure Against Tsunami

Criteria	Areas that include for Secure Category
Secure	Dusun Besar, Timur Indah, Sidomulyo, Sumur Dewa, Suka Rami, Pagar Dewa, Pekan Sabtu, Padang Serai, Betungan.

Category of safe area parameter: the distance to the beach > 4 Kilometers (km), topography of the area: 0-3%, 3-8%, 8-15%, vegetation distance between trees 10 meters and 1 meter, while the form of the coast is rugged and steep.

To get an idea of the tsunami-prone areas in the city of Bengkulu, first performed data analysis using scoring methods are presented in Table 4.

Table 4: Criteria Based on Parameter Prone Areas

No	Criteria	Weight Factor (%)	Level of Tsunami Vulnerability Area					
			Class R	Score	Class S	Score	Class A	Score
1	2	3	4	5	6	7	8	9
1	Distance of Beach	40						
1	2	3	4	5	6	7	8	9

	Near		< 300 m	5				
	Medium				1.5 - 4 km	3		
	Far						> 4 km	1
2	Topography	35						
	Low		0 – 3 %	5				
	Medium				3 – 8 %	3		
	Height						8-15 %	1
3	Vegetation	15						
	Rare		10 m	5				
	Medium				5	3		
	Tight						1 m	1
4	Shape of Beach	10						
	Zone 1		flat and bay	5				
	Zone 2				flat and elongated	3		
	Zone 3						rugged and steep	1

Note: km = kilometers, m = meters

The analysis stage of determining tsunami-prone areas using a scoring method that gives the score and set of qualitative values for each parameter, according to the discrete constraints on tsunami-prone criteria. Scoring by giving the weight of each of vulnerability former based on 4 (four) parameters has been determined. Weighted score is obtained by calculating the multiplication of the scores of the critical level (vulnerability) with a weighting factor. Score weighting = score x weight.

From the analysis carried out the analysis of the obtained maps of determining tsunami-prone areas. To be more precise, it can be seen in the following figure:

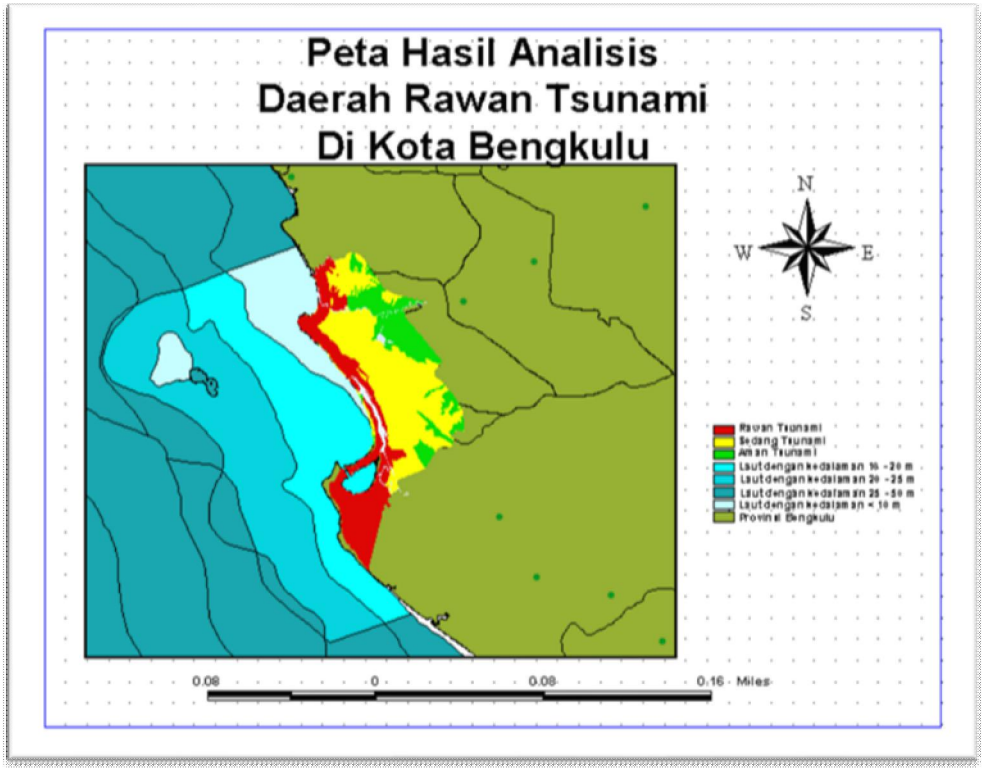

Figure 2: Map of analysis of tsunami-prone areas in the city of Bengkulu.

: Vulnerability area of tsunami (red color); : moderate (medium) caused tsunami hazard (yellow color); : safe or secure area caused tsunami hazard (green color).

CONCLUSIONS AND RECOMMENDATIONS

Conclusion

Based on spatial analysis can be concluded that the areas prone to tsunami in the city of Bengkulu are

1. An area with a distance of less than < 300 meters from the beach,
2. The height is less than 2 meters above sea level,
3. Vegetation distance between trees is less than 10 feet and beach-shaped ramps, and low relief. Note that the waves occurs no more than a height of 10 meters.

Suggestion

Determination of critical areas or potential tsunami hazards are not only determined by 4 (four) parameters. Because of that, the next research can be added to the determination of tsunami prone areas based on the spatial 3-dimensional, and so forth. Thus, this information can be analyzed more accurately and produce knowledge about tsunami-prone regions are more easily understood by users, both as a community and the city of Bengkulu, Bengkulu City Local Government

ACKNOWLEDGEMENT

The authors are grateful to Research Institution of University of Bengkulu for the financial support.

REFERENCES

1. Fauzi, Julian, et al, 2008. Utilization of Spatial Data (GIS) in Coastal Management Basic Map Bengkulu City. Bengkulu.
2. Harsanugraha, interview. , 2008. Analysis Modeling Tsunami Vulnerability Map of the Creation and the Gaza evacuation of derivatives SRTM90 (Case Study: City of Padang). PIT MAPIN XVII: New York.
3. Prahasta, Eddy. 2001, Geographic Information Systems: ArcView Tutorial, Information Technology: New York
4. Panglaot, 2007. Lessons from the Tsunami Disaster. [Online] available: http://panglaot.multiply.com/reviews/ accessed on 28 November 2008.