

# Community Preparedness Planning in Sub District of Meuraksa-Banda Aceh

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**ABSTRACT:** Community preparedness in disaster risk reduction planning is a condition of a community that is ready and able to face disaster in their area. Some goals of improving community in disaster preparedness is to increasing the capacity in early warning systems as well as getting the right and accurate information about the high risk zones which can be used as a reference to decision maker related to the preparation of spatial planning contingency based. **Materials and Methods:** The study was conducted in Districts Meuraksa-Banda Aceh from January 1-February 20, 2010. The method used is Participatory Action Research, consisting of several activities: Public Consultation Process, semi-structured interviews, field observations, and Global Positioning System (GPS) Survey. Data stored in a database system and analyzed with the Microsoft Excel and Geographical Information System (GIS) software: ArcGIS version 9.11. **Results:** The projections of population the population data for the year 2019 up to one hundred years showed the maximum population in Sub-district of Meuraksa is Punge Jurong 3466 people and minimum population is 229 people in Gampong Blang. The highest growth rates were found in three villages: Ulee Lheu (19%), Lampaseh Aceh (18%), and Punge Jurong (17%). The highest density is Punge Jurong while the smallest density is Village of Lambung. Currently, found three of the 28 buildings which recommended as evacuation building not exist in Sub-District of Meuraksa. Community regarded the evacuation building is only Nippon Koei which have capacity total is 1500 person. Difference average between the implementation and recommended evacuation route is 2.1 meter per track. Meuraksa Individual Evacuation Protocol of Sub-District of Meuraksa provide alternatives disaster risk reduction plan. **Conclusion:** Sub-District of Meuraksa require capacity building to increasing awareness as well as making regulations related to urbanization, several factors that augment vulnerability in Sub-District of Meuraksa as follow are: population, density, evacuation planning, evacuation facilities management, and poor of community participation, Meuraksa Individual Evacuation Protocol initiating the certain regulation to increasing the ability to enforce or encourage steps for mitigation and increasing defiance of safety precautions and regulations in Sub-district of Meuraksa.

**Keywords:** Community preparedness, Geographical Information System, Meuraksa Evacuation Protocol, Vulnerability, community participation

## I. INTRODUCTION

Disaster risk reduction (DRR) is aim to reduce the vulnerability and enhance the resilience of communities to the adverse effects of natural hazards [1]. At the provincial level in Aceh, the government has taken important initial steps to make fundamental reforms to

declare that disaster risk reduction is the province's development priorities. This declaration was further put into action in the formulation of the Mid Term Development Planning (RPJM) of Aceh Province for 2007-2012 that has been officially signed and endorsed by Governor's Decree No. 21/07. The RPJM mentioned that Disaster Risk Reduction is one of seven development strategies in Aceh Province [2].

Several international consultants such as Sea Defense Consultant has been working on formulating DRR in Meuraksa Sub District-Kota Banda Aceh [3,4]. Analysis studies ever undertaken for the Meuraksa still needs improvement to maintain sustainable awareness and preparedness to construct strong community to against disaster. The analysis which include population and density projections, evacuation facilities, and tsunami evacuation route were projected until this year and still need more support from the community participation [5]. According to National Disaster Management Law No. 24/2007, the key to emergency preparedness is the involvement and commitment of all relevant individuals and organizations at every level of community, provincial, national, and international [6]. Local communities are at the centre of immediate response and recovery activities. Empowering local authorities to reduce a community's vulnerability and increase preparedness makes the most effective use of its action. Every level of government and each organization should support communities in this work, through the multisectoral approach [7]. This multisectoral approach means that many organizations accept clearly-defined responsibilities and the need to coordinate their efforts. Based on analysis study on tsunami and earthquake in Nias 2007, without their involvement and commitment, emergency preparedness becomes fragmented, inefficient, and poorly coordinated [8]. It will also to help ensure at all levels of local government against potentially negative impacts from hazards and put in place a range of mutually reinforcing mechanisms and systems that will result in changes to the physical, social and economic development process [9,10].

In order for a disaster response plan to be effective, it must be sensitive to the manner in which the public is likely to behave. Plans also must be flexible enough to change in reaction to the numbers of laws, organizations, populations, technology, hazards, resources, and personnel involved in response, because the level of preparedness of community be able to decrease any time as long as possible with the occurrence of changes in socio-cultural,

political and economics [2,11]. There several factors that augment vulnerability are: physical, political, social, cultural, economic, and technological [10]. Community preparedness efforts and prevention and mitigation policies can increase resiliency and decrease vulnerability to future events [12]. Preparedness is part of the concept of community-based disaster management. That very important to be ensured the participation is should allow using of local knowledge and expertise, providing opportunities in decisions that concern the community, ensure policies, and practices that allow for self-determination in response and recovery planning [7].

Developing continuous risk communication among various elements is an important action to maintain sustainable awareness and preparedness. In this regard, map shall be considered as one of effective media for communicating tsunami risk [13]. Developed a series of maps include human populations, critical facilities and differences in vulnerability are considered as relevant with regard to reducing the number of disaster victims, to improving prevention efforts on disaster risk, to plan the evacuation route, and to maintenance the evacuation facilities [14]. According to this, it is necessary to synergy between the current situation, evacuation plan, and existing spatial planning which can be use to reduce the vulnerability of physical, economic and social disaster in Sub-district of Meuraksa. This may also provide an alternative consideration for the policy and decision makers to increasing the disaster risk reduction plan especially to Sub-District of Meuraksa and generally to the people in Aceh.

The purpose of this research is to increase the capacity of preparedness in disaster early warning systems and to make alternative considerations in decision making related to spatial planning policy based disaster mitigation.

## II. MATERIAL AND METHODE

The study was conducted in 16 Village in Meuraksa Sub-district in Banda Aceh from 1 January to 20 February 2010. The samples were purposive sampling relating to the village and tsunami planning. The several activities as follow are: Public Consultation Process (PKM) by the implemented of Participatory Action Research, conducting semi-structured interviews, and observation and GPS Survey to assessment of the evacuation facilities and disaster plan. Data are stored in a database system and analyzed with the Microsoft Excel and ArcGIS v 9.11.

## III. RESULTS

### Population Projection up to year 2109

From the results of data analysis in the Sub-district of Meuraksa, showed the maximum and minimum population village in Sub-district of Meuraksa is Punge Jurong 3466 people while Village of Gampong Blang is 229 people. Population projections explained that the highest growth rate was found in three villages in Sub-District of Meuraksa as follow: Ulee Lheu (19%),

Lampaseh Aceh (18%), and Punge Jurong (17%). The results showed in Table 1 below. The density of Punge Jurong respectively following years 2019, 2039, 2059, and 2109 as follow are: 45.7, 53.9, 62.1, and 82.5 inhabitants per km<sup>2</sup>. The smallest density is Village of Lambung following years 2019, 2039, 2059, and 2109 are: 2.5, 3.5, 4.4, and 6.8 inhabitants per km<sup>2</sup>. Analysis of density data from 2019 to 2109 showed in Table 2 below.

Table 1. Projection of Population Meuraksa

Village	2019	2039	2059	2109	R (%)
SURIEN	597	608	618	645	0.525
ASOENANGGRO	225	251	277	342	1.300
GAMPONG BLANG	207	212	217	229	0.250
LAMJABAT	264	289	313	375	1.225
GAMPONG BARO	455	510	564	701	2.725
PUNGE JURONG	1920	2263	2607	3466	17.175
LAMPASEH ACEH	651	1017	1383	2298	18.300
PUNGE UJONG	691	907	1123	1663	10.800
COT LANGKUWEUH	346	349	351	358	0.125
KAMPONG PIE	223	244	264	316	1.025
ULEE LHEUE	537	932	1326	2313	19.725
DEAH GLUMPANG	353	364	376	405	0.575
LAMBUNG	206	282	358	548	3.800
BLANG OI	829	1064	1299	1886	11.750
ALUE DEAH TENGOH	444	471	499	568	1.375
DEAH BARO	332	340	348	368	0.400

Table 2. Density of Meuraksa

Village	Cove rage Area (Ha)	Density			
		2019	2039	2059	2109
SURIEN	39	15.3	15.6	15.9	16.5
ASOENANGGRO	17	13.2	14.8	16.3	20.1
GAMPONG BLANG	72	2.9	2.9	3.0	3.2
LAMJABAT	28	9.4	10.3	11.2	13.4
GAMPONG BARO	59	7.7	8.6	9.6	11.9
PUNGE JURONG	42	45.7	53.9	62.1	82.5
LAMPASEH ACEH	59	11.0	17.2	23.4	38.9
PUNGE UJONG	21	32.9	43.2	53.5	79.2
COT LANGKUWEUH	35	9.9	10.0	10.0	10.2
KAMPONG PIE	32	7.0	7.6	8.3	9.9
ULEE LHEUE	68	7.9	13.7	19.5	34.0
DEAH GLUMPANG	53	6.7	6.9	7.1	7.6
LAMBUNG	81	2.5	3.5	4.4	6.8
BLANG OI	85	9.7	12.5	15.3	22.2
ALUE DEAH TENGOH	40	11.1	11.8	12.5	14.2
DEAH BARO	45	7.4	7.6	7.7	8.2

### Evacuation Facilities and Evacuation Route

Observation and collection on 28 buildings which proposed by the SDC as an evacuation building conducted with Global Positioning System (GPS). Currently, from

the 28 buildings found that 3 of the 28 buildings do not exist in Sub-District of Meuraksa. The building which do not exist follow are: a new building which located in Deah Baro, building located in Gampong Pie, and building located in Blang Oi. Interview and PRA data informed that all evacuation building which has been built never disseminated to the community. Community really does not understand that building designed and functioned for the evacuation for the reduction risk of tsunami. Community argue that other buildings which proposed by SDC are not an evacuation building. Community does not know several buildings such as schools; mosques and Recreation Park proposed by SDC as well as the evacuation building or evacuation facilities. They only know, the building such as school is for education process, mosque for religion activities, and Recreation Park is for holiday or tourism activities. Moreover, community does not how much the capacity per building, the certification of strenght, and who is the person in charge to manage the evacuation buildings.

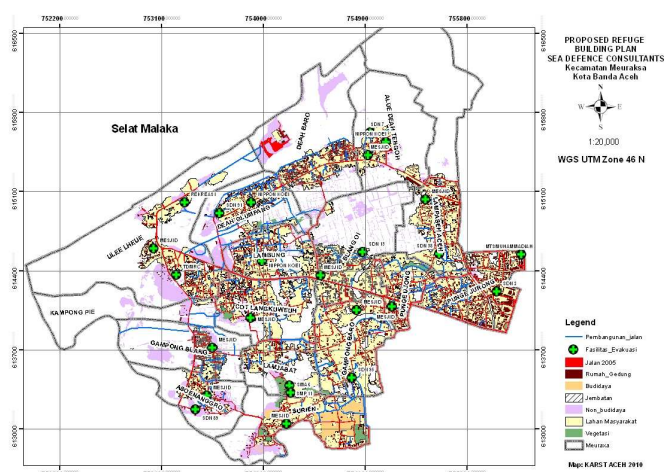


Fig 1. The distribution of the Evacuation Building proposed by SDC

The total capacity evacuation proposed by the SDC is 9150 people. Comparison of the projected population up to one hundred year showed Sub-District of Meuraksa need more evacuation building than 28 building which proposed by SDC. Moreover, the community ensures that as building evacuations are only three Nippon KOEI buildings which spread across on three villages with a total maximum capacity are 1500 people. Comparison of population projections Meuraksa with capacity building evacuation showed on Table 3.

Table 3. Population Projections and Capacity of evacuation Building

Evacuation Building	Capacity	Population Projection				
		2010	2019	2039	2059	2109
All SDC's Proposed	9150	8280	10101	11923	16477	
NIPPON KOEI	1500	8280	10101	11923	16477	
Survey Result	7950	8280	10101	11923	16477	

This study also confirmed two of three Nippon Koei access between basement to up level was locked and

difficult to reach the safe point in that buildings. Access to another floor was lock with a iron chain, vessel rope around, and broken doors which placed in order to not be accessible. Some people claim it should be done to protect the facilities from the some non legal couples which inappropriate with Syariah Law. Nippon Koei evacuation building identified has no lighting/ electrical, electrical wire which store in that facility were stolen, and toilets known not have water. Evacuation maps and evacuation routes were found in bad conditions. Evacuation maps are found sticking a poster campaign by political parties that participated in the legislative campaign, as a media for graffiti, and broken.

### Implementation of the Evacuation Planning

SDC also proposed evacuation route planning to reduce disaster risk in Sub-District of Meuraksa. In document report, some roads proposed to enhance the community preparedness. Several roads such as: new road of Ulee Lheu, road of Lhoknga to Gampong Pie, and new road of Deah Baro proposed 10 meter width and 15 other roads proposed 6 meter width. Overall, the width of evacuation routes which proposed by SDC are 6 meter. The measurements of road width conducted per 25 meter in each tracks by GPS. The survey results of 18 roads found that difference between proposed and implementation. Analysed data showed from 10 of 18 roads not have same width to SDC proposed while 8 roads have increased width. Mean difference in the average per track are 1.2 m. The comparison between escape route plan which proposed by SDC and the results showed on Table 4.

Table 4. Escape Route Plan proposed by SDC and Survey Result

Road Name	SDC (meter)	Now (meter)	Difference (meter)
Jln Pendidikan	6	7.47	+1.47
Jln Lamjabat Raya	6	5.96	-0.04
Jln Asoe Nanggroe Raya	6	5.59	-0.41
Jln Surien Raya	6	4.86	-1.14
Jln Gampong Baro Raya	6	5.85	-0.15
Jln Cot Lamkueweuh Raya	6	4.64	-1.36
Terusan K Sarong	6	4.18	-1.82
Jln Keuchik Yaya	6	5.00	-1.00
Jln. Baru Ulee Lheu	10	19.22	+9.22
Jln Bungong Nusa Indah Raya	6	10.70	+4.70
Jln Bungong Nusa Indah Raya	6	11.00	+5.00
Jln Abdul Salam Meuraksa	6	9.33	+3.33
Jln Baru-Deah Baro	10	11.05	+1.05
Jln Abdul Salam Meuraksa	6	9.39	+3.39
Jln Lhoknga	10	8.22	-1.79
Jln ADT-1	6	10.69	+4.69
Jln. K Sarong	6	3.63	-2.37
Jln Keuchik Yaya	6	4.78	-1.22
Mean (metre)	6.67	7.86	+ 1.2

### Evacuation Safe Zone

SDC recommended the evacuation time to reach the evacuation building is less than 15 minutes. According to the results of previous research, it was found that the average running speeds as follow are: adults: 2.86 m/sec<sup>2</sup>, youth: 3.33 m/sec<sup>2</sup>, children: 2 m/sec<sup>2</sup>, and elderly: 1.67 m/sec<sup>2</sup>. These data obtained the approximate distance for the people save to reach the building evacuation. The equation used is:

$$V = S / t (1)$$

V = velocity (m /sec<sup>2</sup>),  
 S = Distance (m),  
 t = time (seconds).

Analyzed data use (1) equation showed the distance (S) with 15 minutes (t = 900 seconds) confirm the ability and safe to reach the evacuation building for the adult category is 2.6 km, youth: 3 km, children 1.8 km, and elderly can reached only 1.5 km.

Table 5. Evacuation Safe Zone

Category	v (m/det)	t (det)	s (m)
Adult	2.86	900	2574
Youth	3.33	900	2997
Child	2	900	1800
Elderly	1.67	900	1503

GIS analysis showed that all evacuation buildings were building to coverage all areas in Sub-district of Meuraksa. Analysis also showed all evacuation buildings can be used by neighborhood sub-districts. Polygon area which yellow colour as confirm in Fig.2 is a buffering zone for the elderly and the gray thick line is the border of Sub-District of Meuraksa. These maps showed that all elderly inside and around Sub-District of Meuraksa can reach all existing buildings including Nippon Koei building. Buffering on GIS analysis of three existing Nippon Koei buildings showed these buildings can save all people in the region of Meuraksa.

Based on map of potential tsunami which produced by the Ministry of Energy and Mineral Resources (ESDM), Sub-District of Meuraksa is in the area of potential tsunami. Results analysis on the safe zone distance of several categories as confirm on Table 5 provide the other important information for safe zone which divided into four category. The following categories are: children safe zone, elderly safe zone, adult safe zone, and youth safe zone. Overlapping analysis by Arc GIS 9.11 between geodatabase of safe zone and four category safe zones provide the Meuraksa Individual Evacuation Protocol which showed on Fig.3.

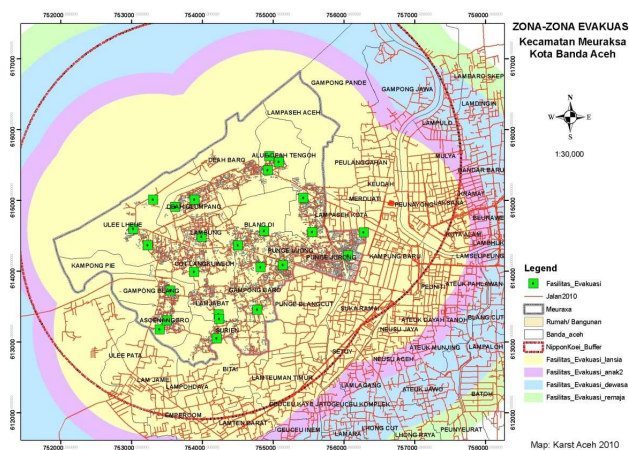


Fig.2. Evacuation Buildings Coverage in Sub-District of Meuraksa

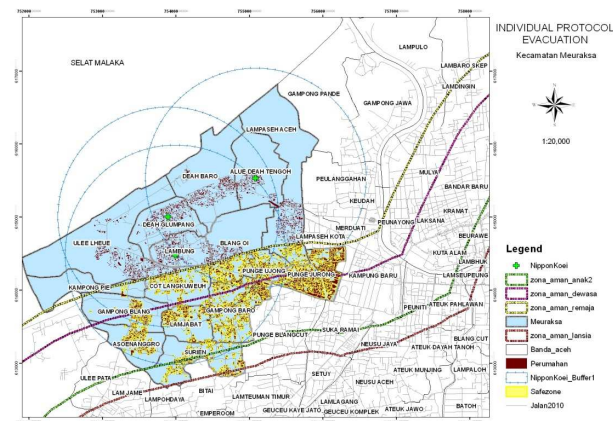


Fig.3. Meuraksa Individual Evacuation Protocol

Average individual per household is 6 peoples. GIS analysis by intersecting attribute data between categorical safe zone and home/ building (digitizing from Google earth) and geodatabase related to Meuraksa (source: Japan International Cooperation Agency (JICA)) confirmed, the estimation of the number of survivors for youth category (Fig.4) is 24180, adult category (Fig.5) is 13740, child category (Fig.6) is 1314, and elderly is 150 (Fig.7) known as the minimal survivor estimate number. The results each safe zone and the estimated survivor showed on Table 6. Overlapping this spatial data with three Nippon KOEI evacuation building provide alternatives safe zones for people who are stay and live on the safe zone when the tsunami arise not to run to Nippon Koei building. Every body that is stay and lives on the safe zone, recommended directly run and try to reach safe zone as represent on the Meuraksa Individual Evacuation Protocol.

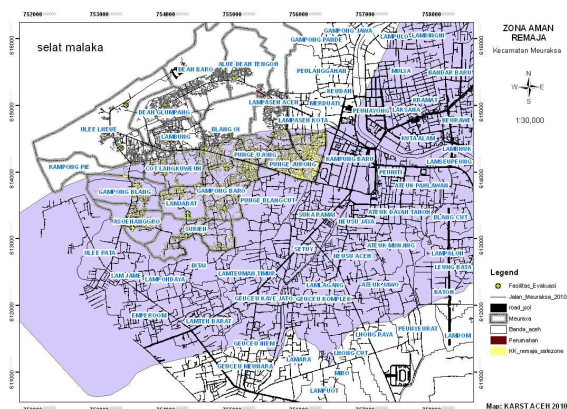


Fig.4. Map of Estimation Number of Survivors for Youth Category

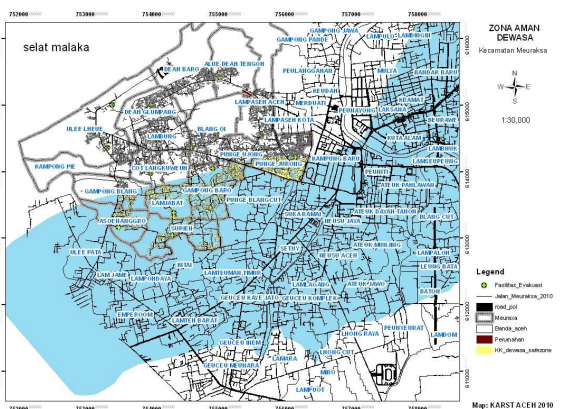


Fig.5. Map of Estimation Number of Survivors for Adult Category

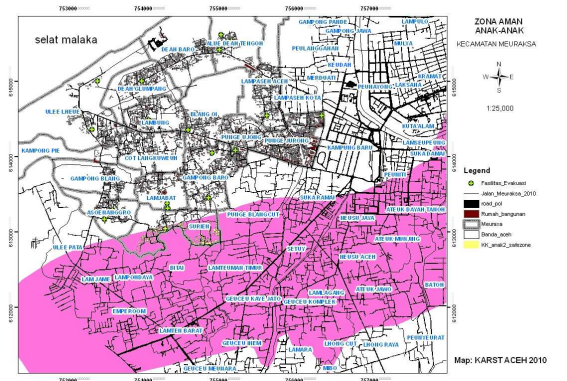


Fig.6. Map of Estimation Number of Survivors for Child Category

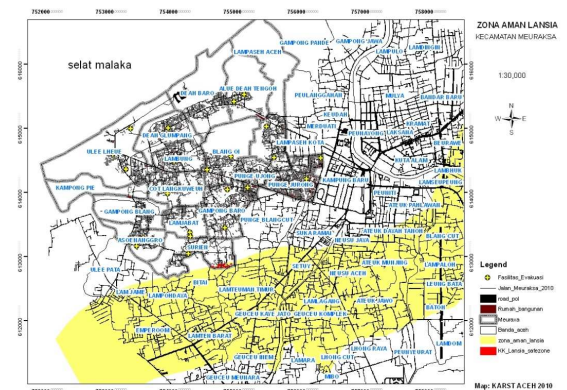


Fig.7. Map of Estimation Number of Survivors for Elderly Category

Table 6. Category of Safe Zone and Estimate Survivor

Category of Safe Zone	v (m/s <sup>2</sup> )	t (sec)	s (m)	Total House/ Building* (unit)	Estimate Survivor (people)
Adult	2.86	900	2574	2290	13740
Youth	3.33	900	2997	4030	24180
Child	2	900	1800	219	1314
Elderly	1.67	900	1503	25	150
Total					39384

Note: 1 unit of HH/ building average 6 people

#### IV. DISCUSSION

Information from detailed vulnerability is used in the field of risk, hazard, and disaster management as well as in the areas of global change and environment. There are three distinct themes in vulnerability studies [13]. One of three distinct themes in vulnerability studies is the vulnerability of places. The Organization of American States developed a series of evaluation that incorporate vulnerability assessment into their pre-impact planning and mitigation efforts [14]. These evaluations include human populations. Analysis result relating to population explained that Punge Jurong is the heavily population than 15 villages and there are three other villages including Punge Jurong that has high growth rate per year. This increase occurred more due to the unplanned migration or urbanization to this area. Based on this situation, in order to maintain sustainable awareness to construct strong community to against disaster it is important to promote disaster risk reduction both by increasing awareness of disaster as well as making regulations related to urbanization, especially for the villages which designated that augment vulnerability such as Punge Jurong, Ulee Lheu, and Lampaseh Aceh.

Research result explained that found several factor that augment vulnerability in Sub-District of Meuraksa. There are several factors that augment vulnerability related to evacuation facilities and evacuation route: over-centralization of decision making, inability to enforce or encourage steps for mitigation, and dependency and an absence of personal responsibility. This condition is increasingly with the perception of the community that only Nippon Koei building as evacuation building and inadequate foresight of community relating to the evacuation infrastructure. Vulnerability is the dependent component of a disaster that is determined by the degree of risk, susceptibility, resistance and resilience [9]. Moreover, vulnerability is a combination of characteristics of a person or group in terms of their capacity to anticipate, cope with, resist, and recover from hazard impacts [10]. Community preparedness efforts can increase resiliency and decrease vulnerability to future events. Community preparedness which implemented by participation approach will be more effective in the planning of a sensible and practical system and more

suitable for the needs of the community. Moreover, community participation will covers contingency planning, community preparedness, task forces and response mechanisms. That very important to be ensured the community participation on identification, planning, implementation, and monitoring evaluation in related to disaster plan [12,15]. Various element (stakeholder) especially decision and policy maker in related disaster risk reduction plan in this area is should allow using of local knowledge and expertise, providing opportunities in decisions that concern in the community, ensure policies, and practices that allow for self-determination in response and recovery planning [7].

Compilation between projection of population in the future with evacuation building, that capacity of all evacuation building is unable to accommodate people in Sub-district of Meuraksa even more in 30, 50, and 100 years. GPS also collected there are new facilities built in Sub-District of Meuraksa such as waterboom and ferry harbor. Current situation explained the evacuation building in community perception only three Nippon Koei buildings, the limited capacity of Nippon Koei buildings which should accommodate all people in Sub-District of Meuraksa, several people in neighborhood sub-districts, water boom visitor, or ferry passenger showed this condition augment vulnerability in Sub-District of Meuraksa. According to Patton [10] the political factor can augment vulnerability. The political factors that augment vulnerability in Sub-District of Meuraksa are inability to enforce or encourage steps for mitigation and defiance of safety precautions and regulations. Meuraksa Individual Evacuation Protocol designated to decreasing that augment vulnerability on Sub-District of Meuraksa. This protocol will increase the ability to enforce or encourage steps for mitigation and defiance of safety precautions and regulations. However, this protocol still requires advanced research and a lot of simulations to improvement disaster risk reduction in Sub-district of Meuraksa, but decision and policy makers especially policy relating to spatial planning should be consider this map to make certain rules or regulations for disaster preparedness efforts in this area.

## V. CONCLUSION

In order to maintain sustainable awareness to construct strong community to against disaster require the program to promote disaster risk reduction both by increasing awareness of disaster as well as making regulations related to urbanization in Sub-District of Meuraksa. There several factors that augment vulnerability in Sub-District of Meuraksa: population, density, evacuation planning, evacuation facilities management, and poor of community participation. Meuraksa Individual Evacuation Protocol initiating the certain regulation to increasing the ability to enforce or encourage steps for mitigation and increasing defiance of safety precautions and regulations in Sub-district of Meuraksa.

## REFERENCE

- [1]. AusAID, 2009. Investing in a Safer Future A Disaster Risk Reduction policy for the Australian aid program, Published by the Australian Agency for International Development (AusAID), Canberra, June 2009.
- [2]. Provincial Government of NAD Agency for Rehabilitation and Reconstruction of NAD-Nias United Nations Development Programme 16 April 2008. Making Aceh Safer Through Disaster Risk Reduction In Development (DRR-A). DRR-A PAD 2008
- [3]. Sea Defence Consultant, 2007. Concept Tsunami Escape Plan Banda Aceh. SDC-R-70079. [www.seadefenseconsultants.com](http://www.seadefenseconsultants.com).
- [4]. Sea Defence Consultant, 2007. Pedoman Perencanaan Pengungsian Tsunami. SDC-R-70022. [www.seadefenseconsultants.com](http://www.seadefenseconsultants.com).
- [5]. Sea Defence Consultant, 2007. Tsunami Escape Plan for Meuraksa. SDC-R-70029. [www.seadefenseconsultants.com](http://www.seadefenseconsultants.com).
- [6]. National Disaster Management Law No. 24/2007. Undang-Undang Republik Indonesia Nomor 24 Tahun 2007 Tentang Penanggulangan Bencana.
- [7]. World Health Organization, 1999 Community emergency preparedness: a manual for managers and policy-makers, WHO Library Cataloguing-in-Publication Data World Health Organization, Geneva, Switzerland.
- [8]. Cahyo N, 2007. Study of Community Preparedness on Earthquake and Tsunami Disaster in Nias Selatan. (Kajian Kesiapsiagaan Masyarakat Dalam Mengantisipasi Bencana Gempa Bumi dan Tsunami di Nias Selatan), Report, MPBI-UNESCO, 2007
- [9]. McEntire, D.A. Triggering agents, vulnerabilities and disaster reduction: towards a holistic paradigm. *Disaster Prevention and Management* 2001;10:189-196.
- [10]. Paton, D. and Johnston, D. Disasters and communities: vulnerability, resilience and preparedness. *Disaster Prevention and Management* 2001;10:270-277
- [11]. Landesman, L.Y., J. Malilay, R.A. Bissell, S.M. Becker, L. Roberts, and M.S. Ascher. 2001. Roles and responsibilities of public health in disaster preparedness and response. *Public Health Issues in Disaster Preparedness*. Aspen Publishers, Inc. 1-56.
- [12]. Fouad B, 2004. The 21 May 2003 Boumerdes Earthquake-Lessons Learned and Recommendations. 13th World Conference on Earthquake Engineering Vancouver, B.C., Canada August 1-6, 2004
- [13]. Tanaka S, Dinar I, Daisuke K, 2008. Sustainable tsunami risk reduction and utilization of tsunami hazard map (THM) AIWEST-DR2008.
- [14]. Weichhselgartner, J. Disaster mitigation: the concept of vulnerability revisited. *Disaster Prevention and Management* 2001;10:85-94.
- [15]. Jeyanth K. Newport, Godfrey G.P. Jawahar, (2003). Community participation and public awareness in disaster mitigation, *Disaster Prevention and Management*, Vol. 12 Iss: 1, pp.33 – 36.