Community Risk Assessment

Dhalghata Union, Maheshkhali, Cox's Bazar

November 2019

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Chapter 1. Introduction

A Community Risk Assessment is a participatory tool that has been developed to engage communities developmentally, using a highly participatory and a bottom-up approach. It provides an understanding of how risks are generated and how to reduce non-acceptable risks. A Community Risk Assessment can be adapted and applied in numerous contexts, for a wide range of risks. It is underpinned by a commitment to participator engagement with at-risk communities and relevant stakeholders.

Community Risk Assessment (CRA) is an approach that identifies risk and helps to reduce local risks through the application of participatory assessment and planning methods, aiming to strengthen people's capacities to manage specific disaster related hazards. The CRA approach allows a wide group of stakeholders, including residents, civil society organisations and local government actors to jointly understand the disaster risk profile in a particular area.

Dhalghata union was one of the most affected unions in the 1991 cyclone Gorky. After Gorky each and every cyclone that has hit the union has done so due to its geographical characteristics (Chowdhury, Bhuyia, Choudhury, & Sen, 1993; B. K. Paul, Rashid, Islam, & Hunt, 2010; S. K. Paul, 2011). Due to its location on the inner coastal area of the Bay of Bengal and elevation below the mean sea level, the exposure to different types of natural hazards is very high. This union experienced the historical devastating cyclone Gorky in 1991 and every year people have been affected by different types of natural disasters like cyclones, tidal floods, erosion, and waterlogging. This union was selected for Community Risk Assessment after it was identified by the District administration as a high-risk area facing multiple socio-economic problems. The objective was to determine the elements at risk to natural hazards and to develop a risk reduction strategy to minimize those risks.

Community risk assessment (CRA) is a methodology that has been specifically designed to engage communities in disaster risk reduction and adaptation. In this study, we have followed the Community Risk Assessment Guideline Developed by the Comprehensive Disaster Management Programme (CDMP). It provides insights into how local risks are generated and can be reduced. It is an approach that aims to empower the community concerned by involving them in defining problems, decision-

making, implementation of appropriate activities and evaluation of results and interventions. It acknowledges that risk reduction efforts will necessarily vary from one community to another because of unique geophysical, historical and socio-economic conditions. Risk assessment is a process that can be effectively employed to determine the nature and extent of risk by analysing potential hazards and evaluating existing conditions of vulnerability that could be a potential threat or cause harm to people, property, livelihoods and the natural environment on which they depend.

Community Risk Assessment generally comprises three key phases:

- Preparatory groundwork to determine the risk context and pre-CRA mapping
- A field-based CRA in collaboration with the community
- Collation of risk information into a report to inform appropriate solutions both for short term interventions as well as longer-term integrated disaster risk reduction planning

1.1. Short History of Dhalghata Union

Maheshkhali is the only hilly island in Bangladesh and one of the prominent developing zones located in the Cox's Bazar Zila. The Maheshkhali Channel separates the island from the mainland.

In 1982 Maheshkhali was upgraded to an Upazila admintrative level with one municipility and 12 Union (BBS, 2011). Nothing is known about the origin of the Upazila's name. However, it is said that the name of the Upazila originated from the name of an influential man named Mohesh who first began human habitation on the island. The Upazila occupies an area of 362.18 sq. km. including 57.47 sq. km. of forest area. It is located between 21°28' and 21'-'46' north latitudes and between 91'-'51' and 91'-59' east longitudes (BBS, 2011; UP, 2019).

As the only hilly island in Bangladesh, Maheshkhali has diversified geomorphological characteristics. The sea dominated coastal area and the hilly area makes this union a hub of natural resources and tourism. Dhalghata is one of the unions of this Upazila which has only one mainland connection with the Matarbari. The life and livelihoods of people of this union are mainly dominated by the sea and the climate.

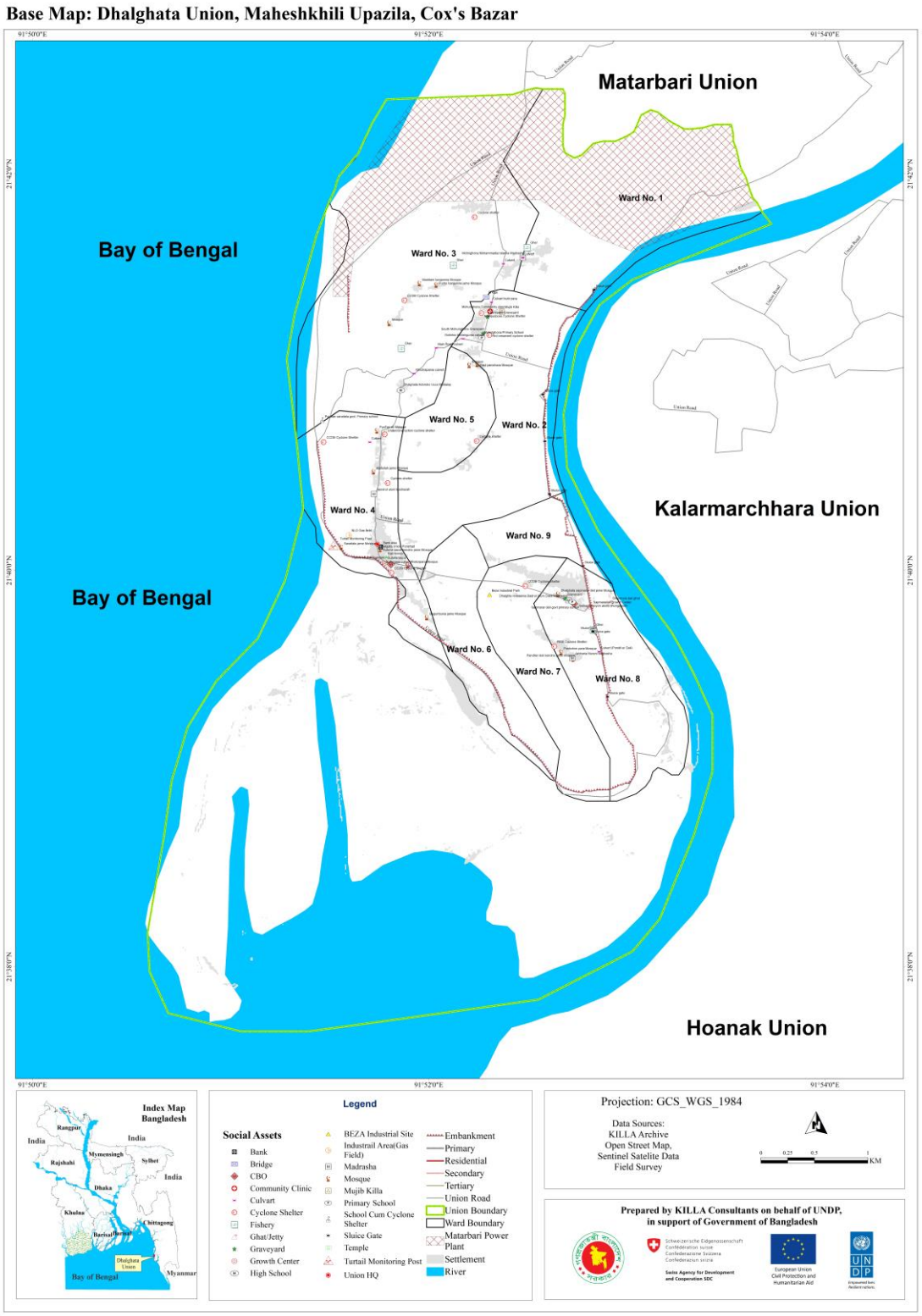

Figure 1: Base Map, Dhalghata Union

In the year 1659, the island of Dhalghata, highly regarded for its beauty and a union of Cox's Bazar, was established as a tourist city (UP, 2019). Located on the banks of the southern reaches of the Bay of Bengal, the coastal estuary houses an ancient town.

Due to the changes in the natural environment over time, the land area of Dhalgata Union gradually increased. With the development of human occupation, the name of the region changed along with local traditions..

Dhalghata Union is geographically located in the Cox's Bazar District and Maheshkhali Upazila This union is 23 km far from Upazila Sadar and its area is 21.67 square km. its population is 20000 made up of 11564 males and 9436 females. Here the yearly population growth rate is 1.30% (BBS, 2011).

The geographical location of Dhalghata Union makes it is more vulnerable to climate change and natural disaster. Most of the people live below the poverty line so that local resources and public infrastructure do not have the capacity to face natural disasters and normal tidal phenomenon.

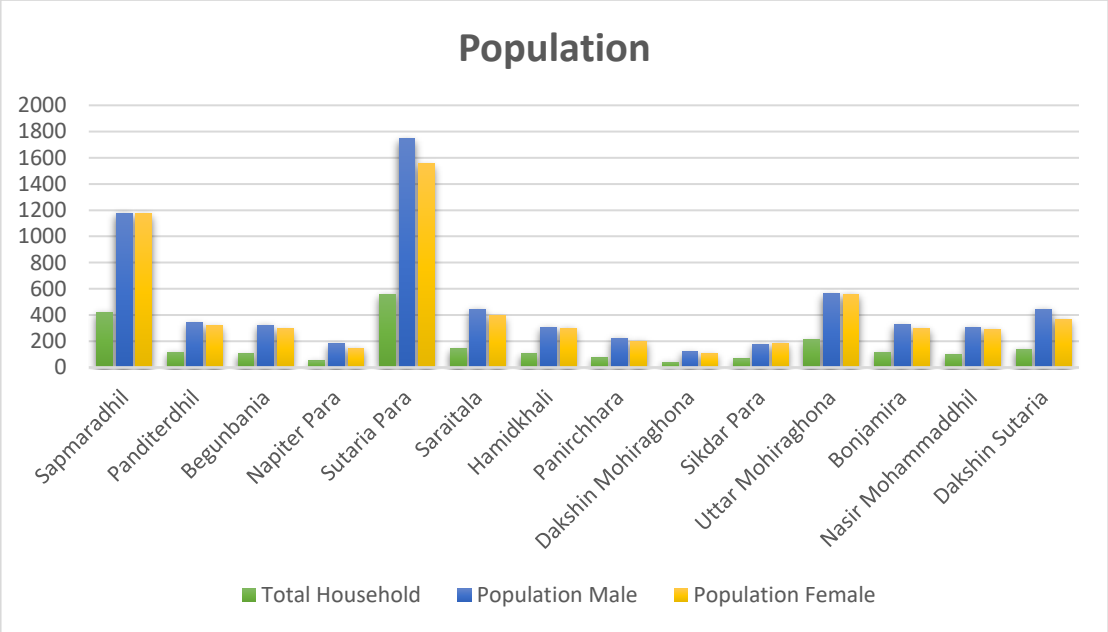

Figure 2: Population size of different villages (BBS, 2011)

Dhalghata union consists of 14 villages, 1 Mouza, 46 mosques, 1 temple, 3 markets and 1 post office. Every year two resources are able to be harvested in rotation; prawns and salt. Because of the salty land other crops cannot be cultivated here. In Dhalghata Union the health care system is very poor. There is one union community clinic, one doctor and one nurse. However, doctors are not available every day. The transportation system of the Dhalghata union is also very poor. There is only 17km of paved road,

8km of semi-paved road, and 14km of non-paved road. This union is also called the union of the culvert. A total of 46 culverts are located here (BBS, 2011).

People of Dhalghata claim to experience high levels of unemployment because government projects like the coal power plant, and the Chinese-funded infrastructure projects have arranged workers from other areas.

The graph represents the number of males and females living in different locations of the Dhalghata union. Sapmarardail and Sutariapara is the highest population in comparison to other areas of this union. Through a closer look at the graph we can conclude that male-female balance is quite stable in all areas. More than 1000 households in the of Sutaria Para and Sapmarardail and more than 1000 people live in these two villages in ward no 6, 8 (BBS, 2011).

In Dhalghata there is a large number of people in the labor market according to BBS survey 2011. 33% of the population are aged between 15-29(year) and 27% population in the age group 30-59(year) **Figure - 2**. These demographics provide labor in different industries such as salt cultivation and prawn farming with a smaller portion working to construct the power plant. These sources of income are not stable due to extreme climate events and a lack of diverse skills in the labor force precluding other forms of employment.

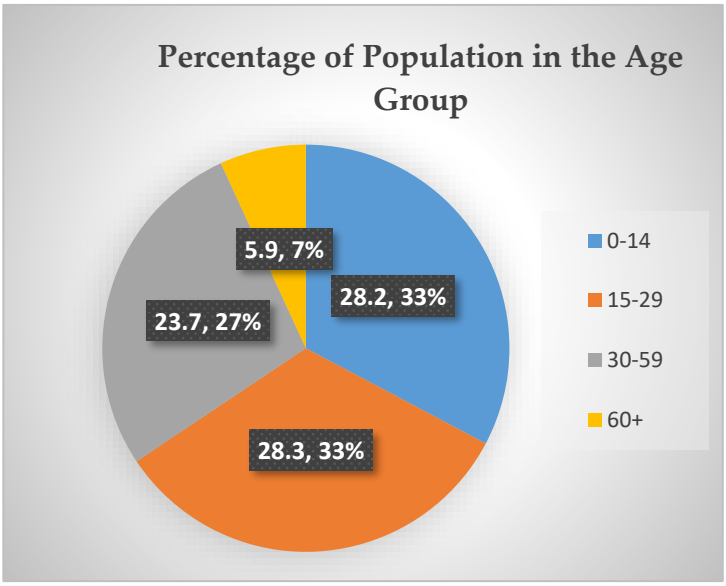

Figure 4: Percentage of population in different age group (BBS, 2011)

1.3. Socio-Economic Condition of Union

Dhalgata is as island off of Maheshkhali island with frequent natural disaster and exposure to climate change. The recent mega development project work is an external factor which is creating new livelihood options but is damaging existing sustainable

livelihoods. Based on economic status, 65% are extremely poor, 20% are poor, 10% are marginal poor and the other 5% are non-poor in this Union.

The cause of the significant poverty in Dhalgata may be the frequent hazards caused by climate. Frequent cyclones and tidal floods cause severe damage to agriculture. As the main occupation of the people in this union is prawn and salt cultivation, and fishing, damage to these sectors causes a severe impact on the individual households and the regional economy. For example: during periods of calm the average wage of a male day laborer is 600 taka, but during periods of disruption due to tides and weather events the wage gets down to 300 taka. Thus, frequent hazards effect the economy of this union severely (BBS, 2011).

Along with these hazards, land appropriation by the government is another matter of concern for local people because they don't get compensation for their land. Additionally, the government projects in this Union do not provide employment opportunities for locals. Due to land appropriations by several projects, the salt farming industry has an uncertain future in the Union. As salt production is a major economic activity for the people of this Union, people are getting worried about their futures and are specifically concerned about the availability of land for salt production.

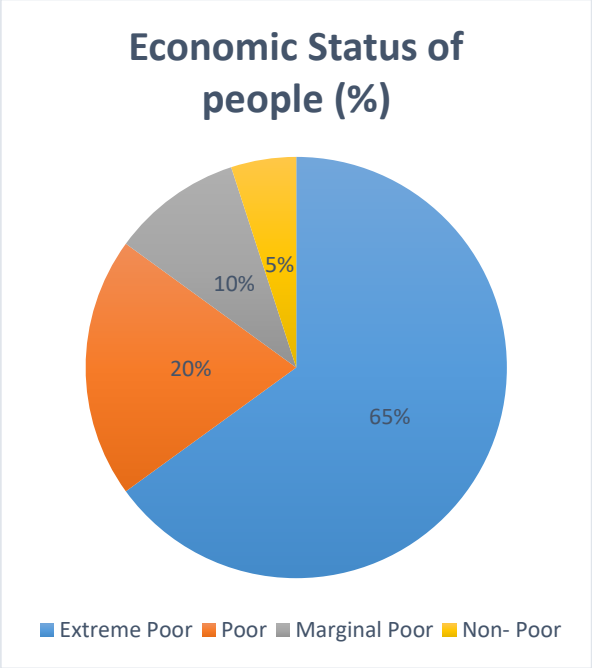

Figure 6: Figure 7: Economic Status of people (BBS, 2011)

Dhalghata is highly exposed to the Bay of Bengal and the locals' lives and livelihoods are dependant on its climate. This dependency has a significant impact on the literacy rate of the region. Female literacy is higher than male literacy. In **Figure 3** we have seen the female literacy rate around 33.8% and the male literacy rate at 29.8%. These

statistics indicate that females are more willing to get an education than males in this union.

The higher female literacy rate does not represent the effect of womens empowerment or a more liberal society, rather in this union there are no female workers. About 100% of day laborers are male and in the fishing community boys work with their family member in the fishing boat.

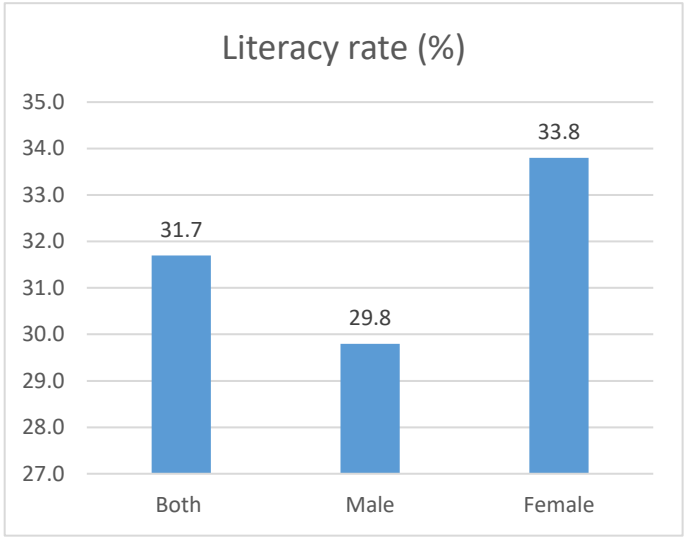

Figure 8: Literacy rate (%) (BBS, 2011)

The exposure of the people of Dhalghata to disasters and climate change creates financial vulnerability and accounts for the higher poverty rate. Another example of this poverty is that people do not set up sanitary latrines, with 75% of people using non-sanitary toilet facilities, and the other 25% using sanitary toilet facilities (Figure 4). In most cases people are not aware of sanitary systems and are also regularly exposed to disasters so that they are not interested in investing in sanitary systems which are likely to be damaged or destroyed.

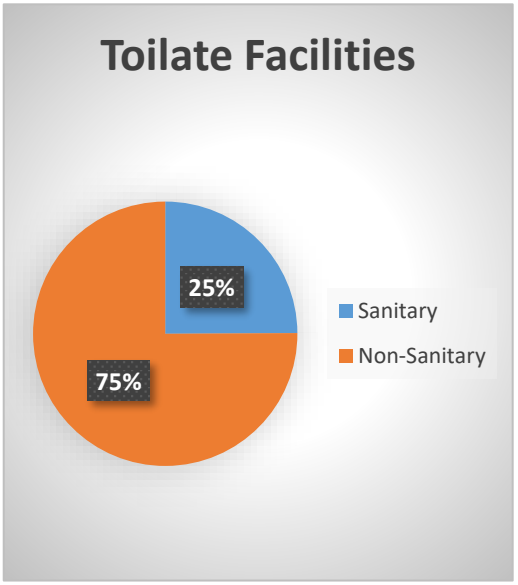

Figure 9: Toilet facilities (%) (BBS, 2011)

Natural disasters and extreme climate events leave their footprints everywhere. The household structure is one of the significant indicators of household type. According to the BBS-2011 survey, only 1% of houses in this union are pucca/semi-pucca with another 99% of houses being

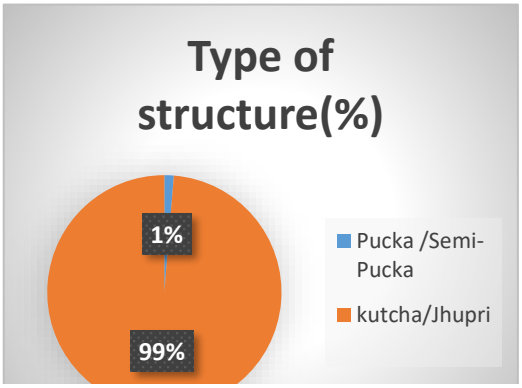

Figure 10: Type of structure (%) (BBS, 2011)

katcha. In terms of economic status, 90% of people in this union are poor or extremely poor. Due to the poverty found in the union and it's high exposure to natural disasters, the community is significantly affected

Figure 5 represents the structure type of housing. About 99% of houses of this union are katcha and 1% are pucca or semi-pucca.

The sources of drinking water; 95% of people in the union use shallow tube wells as their main source of drinking water, with 5% collecting their drinking water from other sources like ponds and streams

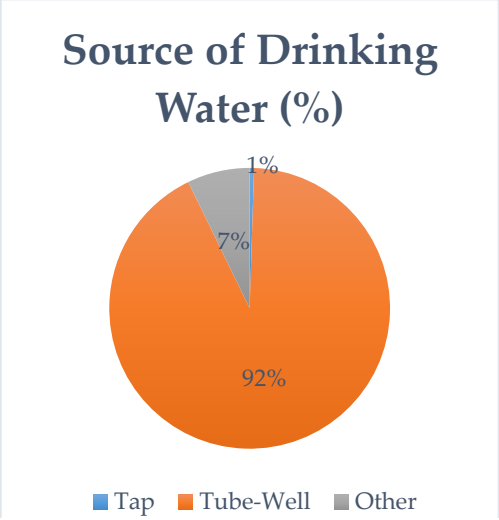

Figure 11: Source of Drinking Water (%) (BBS, 2011)

The source of livelihoods is shrinking day by day due to uncertainty caused by climate change, natural disaster and the maladaptive human activities by the government and the local people. The reason behind the great portion of poverty may be the frequent enviroenmental hazards in this union. Regular cyclones and tidal floods cause severe damage to local agriculture. As the main industries of the local population are shrimp culture and salt cultivation, damage to these sectors causes a significant negative impact on the household economy and to the regional economy.

At present the densely populated Dhalghata Island on the southeast coast of Bangladesh, just north of Cox's Bazar, was selected as the site for two major projects; one consisting of two 600MW coal-fired power plants, the other being two-700MW power plants. With construction of these power plants, there are multiple jobs being created in the Maheshkhali.

Bangladesh Economic Zone Authority (BEZA) has proposed the acquisition of 19 thousand acres of land for the development project. Within this area, half of the land is being retained by BEZA and another half of the land is being distributed to the other four government organizations for the construction of the coal power plant and LNG terminal. However, local people say that BEZA has already acquisition more than 27

thousand acres of land. Due to some geogrpahical features, the development projects have been shifted to the Maheshkhali. Among these features, the new location allows for the draft of large ships moving near the Maheshkhali. This is the reason the Prime Minister's Office is overseeing large-scale developments in Dhalghata and Maheshkhali and positioning these places as hubs of power generation and economic development.

1.4. Local Resources

Dhalghata union has a lot of features exposed to different types of environmental hazards throughout the year. These featurescan be classified into broader classes i.e. Physical features, natural features and Institutional features. Among the physical elements, there are Primary Schools, Health Centers, Mosques, Cemeteries, Community Clinics, Banks, Organizations, Offices, Orphanages, Jetties, Madrassas, and Cyclone Centres. Additionally there is transport infurstructure like roads (paved roads, unpaved roads) (Field Survey, 2019). These elements are highly exposed to cyclones, storm surges, tidal floods, coastal erosion and waterlogging.

Dhalghata is an island off of the Island of the Maheshkhali. High salinity intrusion and coastal erosion dominate livelihoods and make the people and resources vulnerable. Among the physical features, the schools, madrasas, and cyclone shelters are highly exposed to the sea and cyclone tidal surges. Additionally, as most of the houses are Jupri they do not have any capacity to face the ocean waves and surges. Therefore, these houses are at the frontline of natural disasters. The roads are exposed to water logging, storm surge and tidal floods. The soil quality is so low that in the road, guidewalls are needed for slope protection. Due to the high salinity concentration in the soil, local building materials are easily damaged by storms. The ongoing mega development projects make another scenario with exposure of anthropogenic hazards (Field Survey, 2019).

Chapter 2. Local Hazards and Vulnerabilities

2.1. Historical Analysis of Hazards

The geographical location of Bangladesh and its geomorphic conditions have made the country easily vulnerable to natural disasters such as tropical cyclones and accompanying storm surges, floods, tornadoes, droughts, and riverbank and coastal erosion. The havoc caused by the disastrous cyclones of 1970 and 1991, when about 500,000 and 138,000 people, respectively, perished, is still vivid in the memory of the people. There were also disastrous floods in 1984, 1987, and 1988(Chowdhury, Bhuyia, Choudhury, & Sen, 1993; B. K. Paul, Rashid, Islam, & Hunt, 2010). Among these disasters the cyclone Gorky 1991 was one of the most devastating to the Cox's Bazar region. The category 4 cyclone with 193 km/h wind speed hit the coastal area especially Chittagong, Cox's Bazar, Barisal, Noakhali, Patuakhali, Barguna and Kutubdia (Chowdhury, Bhuyia, Choudhury, & Sen, 1993; B. K. Paul, Rashid, Islam, & Hunt, 2010; S. K. Paul, 2011)..

Dhalghata union is very much vulnerable to cyclones and storm surges due to its close proximity to the Bay of Bengal. This union faces challenges every year due to its exposure to the Bay of Bengal. Every person of this union has a their own story aboutthe damages done by previous cyclones and storm surges.

The main environmental hazards in Dhalghata union area are cyclones, storm surges, water logging and tidal flooding. The 9 wards of Dhalghata union were affected by the cyclones of 1991, 1997, 2016. Coastal floods in 1997 and 1998 hit this union causing huge property loss and damage(Chowdhury et al., 1993; B. K. Paul et al., 2010; S. K. Paul, 2011). Another coastal flood in 2016 caused damage to infrastructure. An embankment failure in 2015 due to coastal surge brought suffering to the people of the union. Water logging is an all year long hazard for this union. Surge water sometimes results in water logging. Due to water logging the infrastructure of this union is being sodden by stagnant water.

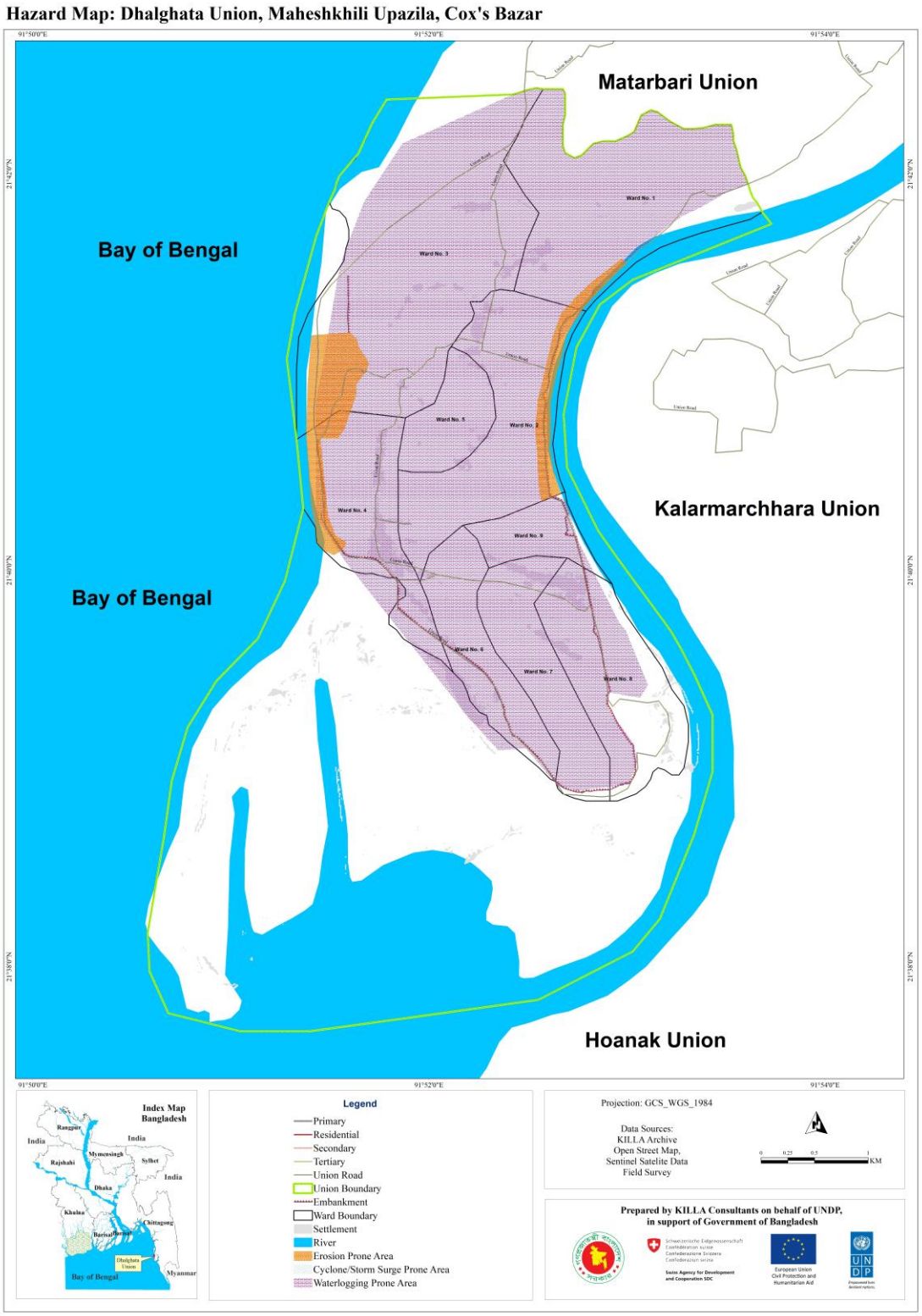

Figure 12: Hazard Map Dhalghata Union

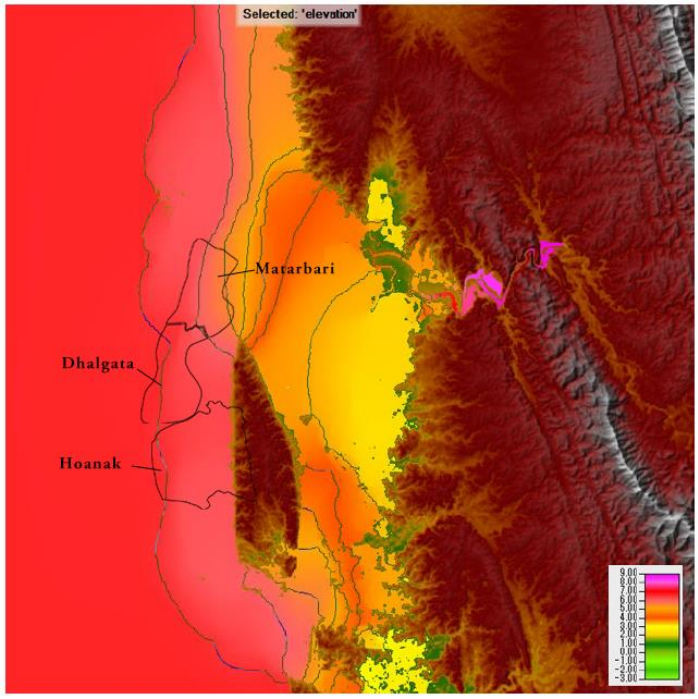

Figure 13: Maximum Water Surface Elevation Distribution (50-year Storm Surge + 20-year Flood) (Japan International Cooperation Agency(JICA), 2018)

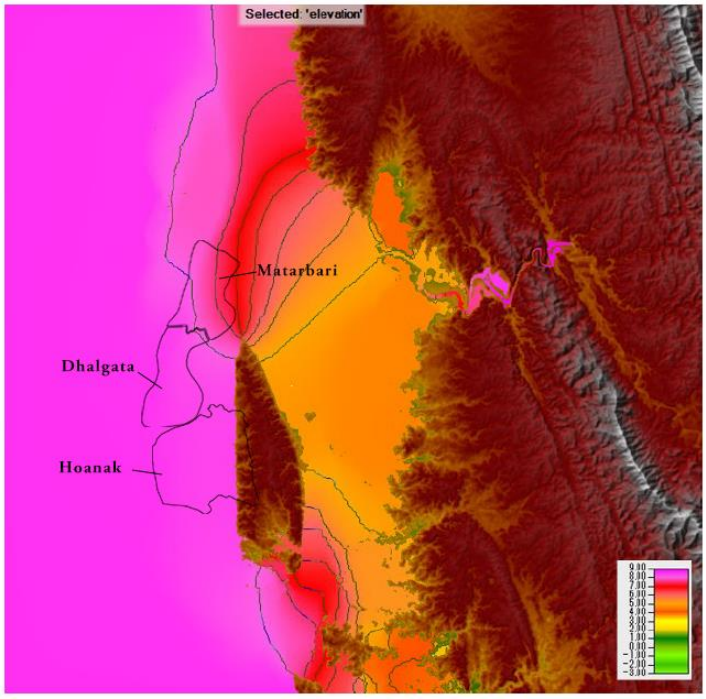

Figure 14: Maximum Water Surface Elevation Distribution (100-year Storm Surge + 20-year Flood)(Japan International Cooperation Agency(JICA), 2018)

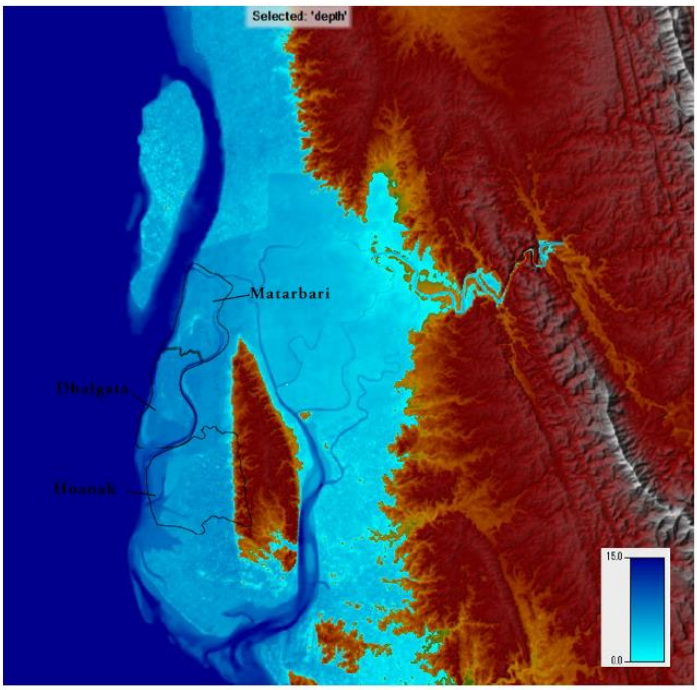

Figure 15: Distribution of Maximum Inundation Height (100-year Storm Surge + 20-year Flood)(Japan International Cooperation Agency(JICA), 2018)

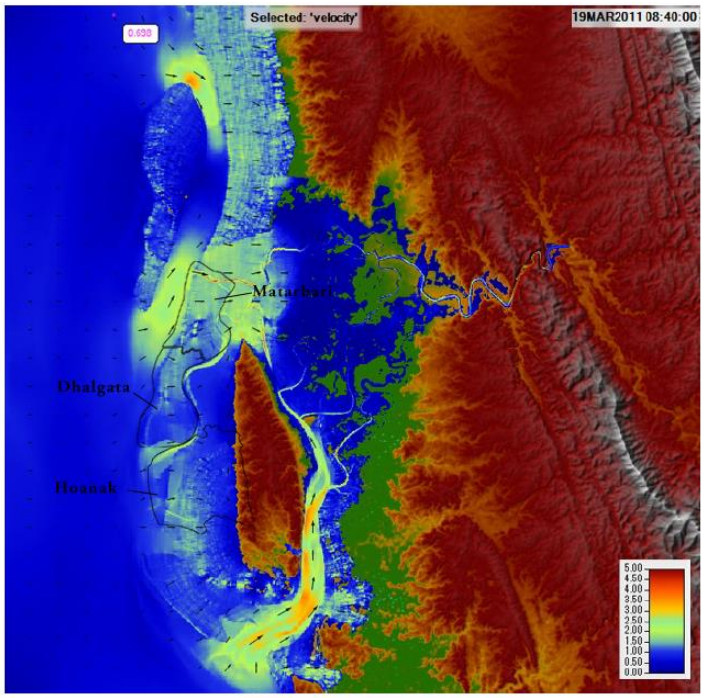

Figure 16:Flow Velocity / Velocity-Vector Distribution (100-year Storm Surge + 20-year Flood)(Japan International Cooperation Agency(JICA), 2018)

The salinity concentration is so high that there is no crop production except that of salt and shrimp. The households look like an island in the rainy season. The land in this union is low-lying with elevation not straying much above the mean sea-level. Due to the lower surface elevation and the surface roughness the inundation modelsa show

higher levels of inundation for different frequency periods. Figure-10 to Figure 13 show the frequency analysis of different return periods and different parameter. Figure 10 shows the maximum water surface elevation distribution for 50-year storm surge and 20-year flood, according to the frequency modeled the water height of about 6 meters in the Dhalghata Union for the 50-year period for storm surges and 20-year period for floods. For the 100-year period for storm surges and 50-year period for flood events, the water height was increased to 7 -9m (Figure-11). On the other hand, the inundation height for the 100-year period for storm surges and 20-year period for floods is about 5-6 meters in different places of the Dhalghata union (**Figure-12**). Though most of the area of Dhalghata union the elevation is below the Mean Sea Level (MSL) and the surface roughness is very low, in some of cases the inundation height is much higher than the model represents. Due to low elevation and low surface roughness, the water will be over the land for a once in 100-year storm surge and a once in a 20-year flood (Japan International Cooperation Agency (JICA), 2018).

2.2. Hazard Venn and Hazard Seasonality

Dhalghata union experiences cyclones and coastal floods on a regular basis due to its close proximity to the coast and geographical location in the Bay of Bengal. Cyclones occur mainly from Baishak (Mid-April) to Srabon (Mid-July), Coastal flooding is another cause of difficulty in this union and occurs mainly from Ashar (Mid-June) to Vadra (Mid-August). Water logging is present all-year long, but mainly prevalent during Ashar (Mid-June) to Ashwin (Mid-September). Storm surge occur during the monsoon season from Ashar (Mid June) to Ashwin (Mid-September). Coastal erosion is also an all-year long hazard due to the union's close proximity to the Bay of Bengal. Erosion is prominent during Baishak (Mid April) to Vadra (Mid August).

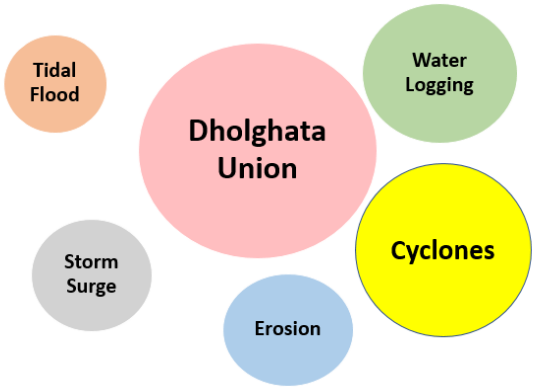

Figure 17: Hazard Venn (Field Survey, 2019)

Table 1: Hazard Calendar

Hazard	Baishak		Jaishtha		Ashar		Srabon		Vadra		Ashin		Kartrik		Agrahayon		Poush		Magh		Falgun		Chaitra	
	Mid-April	Mid-May	Mid-May	Mid-June	Mid-June	Mid-July	Mid-July	Mid-August	Mid-August	Mid-September	Mid-September	Mid-October	Mid-October	Mid-November	Mid-November	Mid-December	Mid-December	Mid-January	Mid-January	Mid-February	Mid-February	Mid-March	Mid-March	Mid-April
Cyclone																								
Storm Surge																								
Coastal Flood																								
Water-logging																								
Erosion																								

2.3. Crop Seasonality and Exposure to Hazards

Crop seasonality is broadly classified in three classes depending on cropping patterns i.e. Rabi Crop (October – March), Kharip -1 (March – July), Kharip -2 (July – October).

There is no agricultural production in this union. There is only shrimp cultivation and salt farming. Salt farmers are worried about their futures as they do not get equitable wages. The price of salt is also declining day by day. Due to industrial development in this region farmers are anxious about their employment as they lack the skills needed for a job in the industrial sector.

Table 2: Crop Calendar

Crop Season	Rabi (October – March)	Kharip -1 (March – July)	Kharip -2 (July – October)
Crop Name	Salt	Shrimp	Shrimp
		-	-

2.4. Land Use Pattern

In the Dhalghata union most of the land is used for salt farming in the dry period and in the monsoon these salt fields are used for the shrimp cultivation. Due to the high salinity concentration in the soil, there is no agricultural production in the union. About 50% of the land is used for the salt cultivate and shrimp farming and 35% of the land is taken for development projects like Matarbari Coal Power plant and the BEZA Economic Zone.

Due to recent industrial expansion in this union, farmers are worried about their land. The older land use map we have seen shows that only settlements and salt field were found. In the 2019 map, we have seen that the northern side displays a development project which is mainly the Matarbari power plant area. On the southern side of the union there is a coastal forest area reserve. According to the time-series map, the expansion of the union has progressed towards the south and has an active deltaic system.

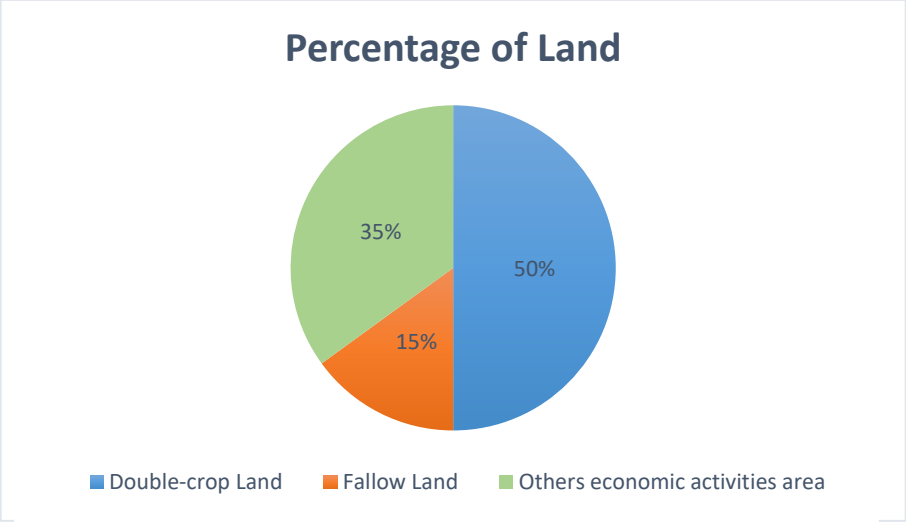

Figure 19: Land Use Pattern (Source-Field Survey)

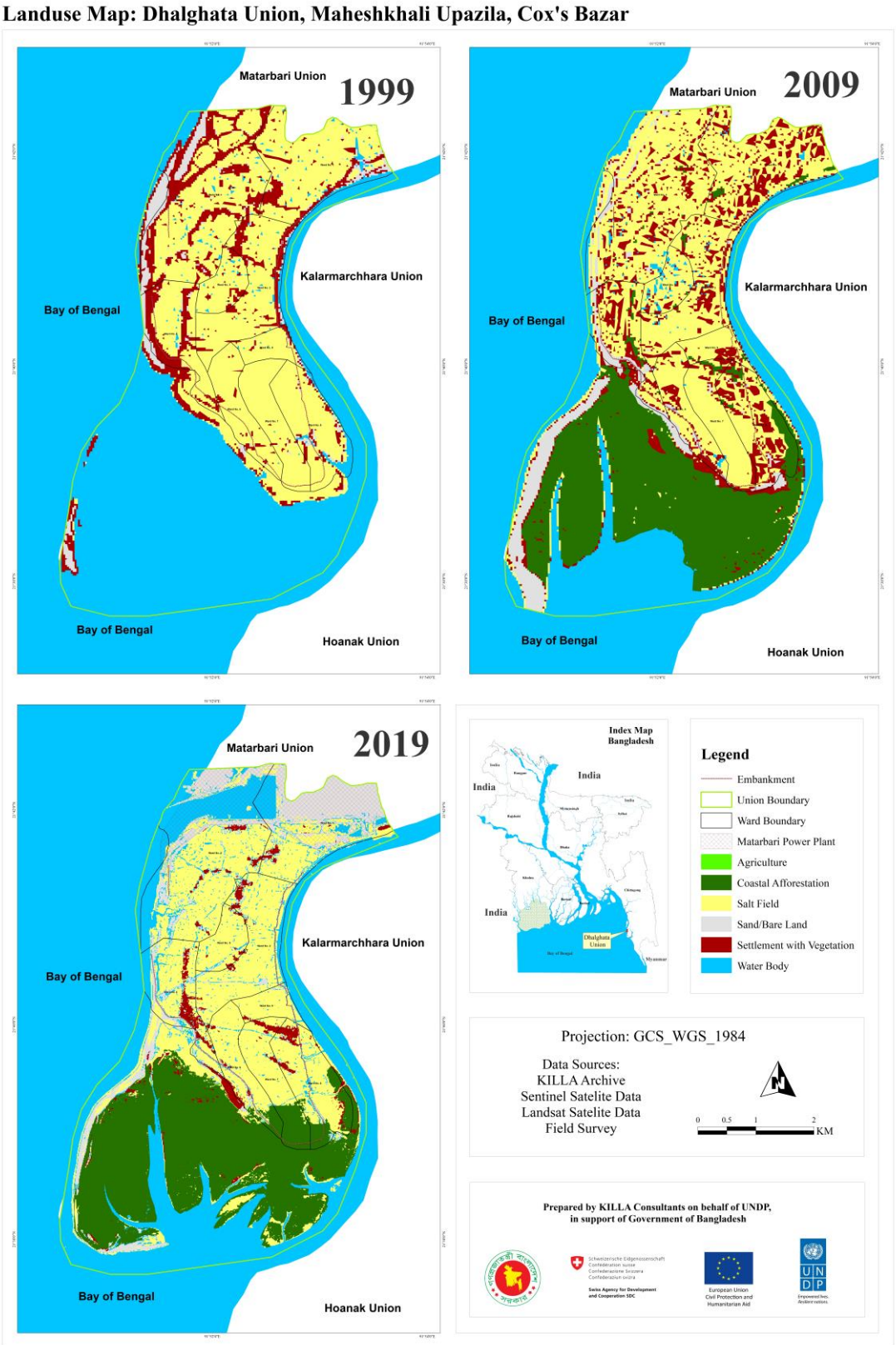

Figure 20: Landuse Map of Dhalghata Union (1999, 2009, 2019)

2.5. Livelihood Options and Vulnerability

In Dhalghata union around 20% people are involved in farming and aquaculture. and their major vulnerabilities are cyclone and storm surge. Most of the farmers are mainly salt cultivators or shrimp cultivators due to soil quality and inappropriate climate for other crops. Cultivators are anxious about their land due to the rapid expansion of the industrial area in this union. They are worried about their future as they lack the skills for a job in the industrial sector and private services are not willing to provide jobs to the locals.

The major vulnerability of farmers is due to cyclones and storm surges. As cyclone early warning is still not in place properly, farmers are not able to tackle the impact. As a result, their crops are damaged. Farmers are also worried about land appropriation for the power plant projects in this union.

Around 25% of people are involved in fisheries. They have to face risks associated with storm surges and coastal floods. Their complaints are that they do not get proper wages for fishing. They do not earn enough through fishing nowadays due to climate change. They have to risk their lives for fishing but the wages they get are not worth it.

Around 20% of people in this union are day laborers and their vulnerabilities are the scarcity of jobs during disaster prone seasons. During normal periods the wage of a male day laborer is about 600tk. In contrast hand, during a disaster period, the wage of a male day laborer is about 300 takas (Field Survey, 2019).

Around 10% of people run businesses which are often affected by poor communication systems, weak markets and a lack of access to consumer products. They have to take loans than to continue running their businesses.

Around 5% of people are involved in the services industry, either as permanent or temporary workers. Permanent service workers face the problems of a low wage and poor accessible facilities during disasters season. Temporary service holders face job insecurity during the emergency period. Due to waterlogging they fail to transport their goods and products, and products get sodden due to water. Customers also do not come to the market during these periods hampering business further.

People of this union are not included inthe social safety net program. Around 20% people of this union are unemployed. The reason behind the unemployment is lack of skills, lack of job opportunities, lack of willingness, lack of interest in education, and the economic instability of households. Moreover, new industrial expansion has created a new scarcity of jobs as private sector corporations are not willing to provide jobs to the locals. They are also placing pressure on local people through land acquisition. Everyone is worried about their future employment opportunities.

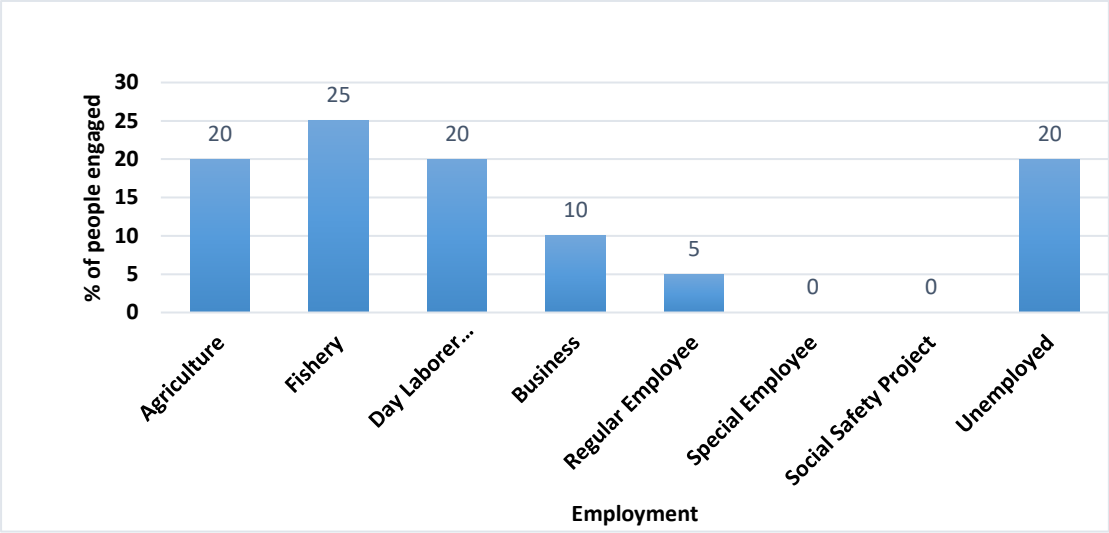

Figure 21: Types of Employment (Field Survey, 2019)

2.6. Vulnerability of Population and Local Economy to Climatic Hazards

It is known that females, children and the elderly are more vulnerable to hazards in comparison to males. 65% people of this union are extremely poor (Field Survey, 2019). People living below the poverty line are most vulnerable tonatural hazards, as they do not have any assets to enhance their resilience. Only 5% of people ae wealthy, which is very low considering the overall population (Field Survey, 2019).

Most of the families of this union are dependent on salt or shrimp cultivation. However, they are worried about their future as they do not get a proper wages for their work. Fishermen are anxious about their sector as the population of fish available is decreasing at a rapid rate due to climate change. Moreover, natural hazards like cyclones, storm surges, coastal erosion and water logging add a new dimension to the

existing difficulties. Cyclones and storm surges have caused huge damage in previous years. The cyclones of 1997 and 2016 devastated this union with a huge loss to assets. The coastal floods of 1997 and 1998 was also remarkable due to its huge damage to this union (Field Survey, 2019). Along with these, the new man-made hazard of industrial expansion in this union is affecting livelihoods. Expansion of industrial land use are creating a threat to farming and aquaculture cultivationlands. Farmers are worried as they are not skilled in jobs in the industrial sector and private sectors are not willing to provide jobs to the locals.

Chapter 3. Community Risks and Vulnerability

3.1. Sector-wise Risks and Consequences

Dhalghata union has many features exposed to different types of natural hazards throughout the year. The elements can be classified into broader classes i.e. Physical features, Crops, Livestock and Fisheries, Land, and Transport. Among the physical features, there are Primary Schools, Colleges, Hospitals, Mosques, Temples, Graveyards, Community Clinics, Cyclone Shelters, Organizations, Offices, Mills and Industries, Other educational Institutions, Madrassas and Households. Transport sectors include roads, embankment, and bridges. These elements are highly exposed to the cyclone, storm surge, water logging and coastal erosion.

The physical features schools, madrassa, cemetery, health complex, cyclone shelters and households in all wards arealmost certain to be damaged during cyclones and coastal floods. Major historical disasters like the cyclone of 1991 or coastal floods of 1997 and 1998 or coastal erosion from previous years resulted in huge damage to the physical structures across all of the union (Field Survey, 2019). This demonstrated that physical structures like schools, madrassas, health complex, mosques, temples are extremely vulnerable to future cyclones or coastal flood like previous years. School buildings may be damaged, classrooms may be flooded, school-going children cannot attend school, and the whole education system is disrupted. The mosques and temples are also very much vulnerable to cyclones and floods. Regular prayer routines are disrupted due to floods and surges.

Roads and culverts are vulnerable to surges, coastal floods and water logging, they may be inundated and soil may be eroded. Surge water undermines roads, causing cavities in the roads and disrupting t road communications. Coastal erosion causes damage to embankments. Once the embankment become damaged, soil from the sides of the embankment can erode and collapse due to coastal erosion and coastal floods.

Shrimp cultivation and salt production are one of the major sources of livelihood. They are highly vulnerable to cyclones, coastal flood and surge. As 20 % people are day laborers their vulnerability to climatic hazards is signifcant. During disaster season there is a scarcity of work and people have to sit idle (Field Survey, 2019).

3.2. Risk Statement with High Priority

Table 3: Risk prioritization

Elements	Risk Statement	Consequence	Rank
Embankment	If riverbank erosion continues for some years, the embankment of the eastern side of the Union will be severally damage, more than 5000 people will face transportation problems, and more likely to damage the local resources.	Transportation disruption, economic lossses, hampered normal life; households are damaged, damage to fisheries and salt production, loss of livelihoods.	1
Sutaria Bazar	Due to weak structure and consecutive natural disasters the Sutaria Bazar was damaged moderately by coastal floods and cyclones, if a cyclone like Gorky and high tide occur in this ward, this bazaar will be damaged severely and about 300 people will lose their livelihoods and 2000 people will face lose access to the market.	Economically losses, people will not be able to buy and sell their products, will create food crises	2
Road	If a cyclone like Gorky, tides, heavy rainfall occur in ward no 9, about 2km road from Sapmarardail Ghat to the Western side of RGS, the cyclone shelter will be severally affected and more than 500 people will face transportation problems.	Transportation disruption, economic losses, hampered normal life, students will not be able to go to school	3
Earthen Road	Cyclones, high tides, heavy rainfall and water logging occur frequently in this union, in future if these hazards occur, the residential roads in the Union will be severally damaged and more than 3000 people will face transportation problems, and be unable to fulfill other basic needs.	Transportation disruption, economic losses, hampered normal life, students will not be able to go to school	4
Embankment	If shoreline erosion and a cyclone like Gorky continue in occurs by this shoreline, the embankment of the western shoreline will be damaged severally and more than 5000 people will face transportation problems.	Transportation disruption, economic losses, hampered normal life, households are damaged, damage to fishery and salt production, loss of livelihoods.	5

Road	If a cyclone like Gorky, high tides, heavy rainfall or water logging occur in ward no 1 the road from Nasir Mohammaddail to the power plant will be severally damaged and more than 1000 people will face transportation problems.	Transportation disruption, economic losses, hampered normal life, students will not be able to go to school	6
Road	If a cyclone like Gorky, high tides, heavy rainfall or water logging occur in the union, the 2.5 km road from Sutaria bazar to Sapmarardail Ghat will be severally damaged and more than 1000 people will be affected directly or indirectly due to transportation disruption.	Transportation disruption, economic losses, hampered normal life, students will not be able to go to school	7
Road	If a cyclone like Gorky, high tides, heavy rainfall or water logging occur in the union, the 2 km road from Sutaria bazar to Begunbania Ghat will be severally damaged and more than 1000 people will be affected directly or indirectly due to transportation disruption.	Transportation disruption, economic losses, hampered normal life, student will not be able to go to school	8
Sluice Gate	Due to poor structural integrity and high-water pressure, the sluice gate on the south side of Sapmarardail Ghat was damaged moderately by recent cyclones, if a cyclone such as Gorky occurs in this area the sluice gate will be damaged severally and restrict water flow into salt fields.	Disrupt normal transportation, infrastructure loss, restrict vehicle movement, isolate localcommunities, students will not be able to go to school	9
Muhurighona Community Clinic	If a cyclone like Gorky occurs in this area, Muhurighona Community Clinic Ward N-2 will be moderately damaged and more than 2000 people will not be able to receive emergency and primary health care.	Emergency health care disruption, limiting of primary treatment facilities and family planning ervices.	10
Sluice Gate/ Water outlet	Due to poor structural condition and high-water pressure, the water outlet of the eastern embankment is in a moderate state of disrepair, if a cyclone like Gorky and high tides occur in this area, this water outlet will be damaged moderately and restrict water flow into salt fields.	Disrupt normal transportation, infrastructure loss, restrict vehicle movement, isolate communities, students will not be able to go to school	11
Settlement	Due to poor structure and consecutive natural disaster the settlements of ward no -5 were severally damaged by cyclone Gorky. If a cyclone as Gorky and high tide occur in ward 5, these settlements will be completely damaged and about 1000 people will lose their households.	Loss of houses and livelihoods. Life insecurity, sanitation and hygiene disruption	12
Settlement	Due to poor structure and consecutive natural disasters the settlements of ward no -8 were moderately damaged by cyclone Gorky. If a cyclone such as Gorky and high tide occur in ward 8, these settlements will be affected seriously and about 1000 people will lose their households.	Loss of houses and livelihoods. Life insecurity, sanitation and hygiene disruption	13
Settlement	Due to poor structure and consecutive natural disasters the settlements of ward no -3 were severely damaged by cyclone Gorky. If a cyclone such as Gorky and high tide occur in the ward 3, these settlements will be completely destroyed and about 500 people will lose their households.	Loss of houses and livelihoods. Life insecurity, sanitation and hygiene disruption	14
Settlement	Due to poor structure and consecutive natural disasters the settlements of ward no -1 were severeley damaged by previous cyclones. If cyclone such as Gorky and a high tide occur in the ward 1, these settlements will be	Loss of houses and livelihoods. Life insecurity, sanitation and hygiene disruption	15

	completely destroyed and about 800 people loss their households.		
Multi-purpose disaster shelter	If a cyclone like Gorky occurs in this area, the Multi-purpose disaster shelterof Ward No-5 will be severely damaged and more than 1000 people would not be able to take shelter during the emergency period.	Loss of shelter, security crisis during disaster, health and sanitation problem, disruption of social activities	16
Red Crescent Cyclone Shelter	If cyclone like Gorky occurs in this area, the Muhurighona Cyclone shelter Ward N-2 will be severely damaged and more than 500 people would not be abke to take shelter during the emergency period.	Loss of shelter, security crisis during disaster, health and sanitation problem	17
Dhalghata High School	If a cyclone like Gorky occurs in this area, Dhalghata High School Ward N-5 will be severely damaged and more than 2000 students would be able to study.	About 15 people will lose their jobs and 500 student would not be able to attend school	18
Family Planning and Health Care	If a cyclone like Gorky occurs in this area, the Family Planning and Health Care clinic in Ward N-5 will be severely damaged and more than 3000 people would not seek emergency and primary health treatments.	Emergency health care disruption, loss of access to primary treatment facilities and family planning services.	19
Settlement	Due to poor structural integrity and consecutive natural disasters the settlements of ward no -9 were severally damaged by cyclone Gorky. If a cyclone such as Gorky and high tides occur in ward 9, these settlements will be completely destroyed and about 1000 people will lose their households	Loss of houses and livelihoods. Life insecurity, sanitation and hygiene disruption	20
Culvert	Due to poor structure and water pressure the culvert near Muhurighona Madrasah in ward no-1 was moderately damaged by cyclones, if a cyclone like Gorky and high tides occur this area, this culvert will be severely damaged.	Disrupt normal transportation, infrastructure loss, restrict vehicle movement, isolation of communities, students will be unable to attend school	21
Multipurpose cyclone shelter	If a cyclone like Gorky occurs in this area, the Muhurighona Multipurpose Cyclone shelter in Ward N-2 will be moderately damaged and more than 1000 people would not be able to take shelter during the emergency period.	Loss of shelter, security crisis during disaster, health and sanitation problem, other services also affected	22
CCDB Cyclone Shelter	If a cyclone like Gorky occurs in this area, the CCDB Cyclone shelter in Ward No-3 will be severely damaged and more than 500 people would not be able to take shelter during the emergency period.	Loss of shelter, security crisis during disaster, health and sanitation problem	23
Dakshin Muhurighona Culvert	Due to poor structure and water pressure the culvert near Dakshin Muhurighona Culvert in ward no-2 was moderately damaged by cyclones, if a cyclone like Gorky and high tides occur this area, this culvert will be severely damaged	Disrupt normal transportation, infrastructure loss, restrict vehicle movement, segregate community with other community, students will be unable to attend school	24
CCDB Cyclone Shelter	If a cyclone like Gorky occurs in this area, the CCDB Cyclone shelter in ward No-4 will be severely damaged and more than 500 people will be unable to take shelter during emergency periods.	Loss of shelter, security crisis during disaster, health and sanitation problem	25
CCDB Cyclone Shelter	If a cyclone like Gorky occurs in this area, the CCDB Cyclone shelter in ward No-5 will be severely damaged and more than 500 people will be unable to take shelter in emergency periods.	Loss of shelter, security crisis during disaster, health and sanitation problem	26

CCDB Cyclone Shelter	If a cyclone like Gorky occurs in this area, the CCDB Cyclone shelter in ward No-7 will be severely damaged and more than 500 people will be umnable to take shelter in emergency periods.	Loss of shelter, security crisis during the disaster, health and sanitation problem, disruption of social activities	27
Sluice Gate/ Water outlet	If a cyclone like Gorky occurs in this are the BGS cyclone shelter of ward no 8 will be severally damaged and more 500 people will be unable to take shelter in emergency periods.	Loss of shelter, security crisis during disaster, health and sanitation problem, disruption of social activities	28
Gher/Fishery	If a cyclone like Gorky occurs in this area, the CCDB Cyclone shelter ward No-9 will be severely damaged and more than 500 people will be unable to take shelter in emergency periods.	Loss of shelter, security crisis during disaster, health and sanitation problem, disruption of social activities	29
Red Crescent Cyclone Shelter	If a cyclone like Gorky will occurs in this area, the Sapmarardail Govt. Primary School of ward no 9 will be damaged severely and 300 students will not be able to attend school.	About 5 people will lose their jobs and 500 students would be unable to attend school	30

3.4. Sensitivity and Exposure Analysis

Elements	Risk Statement	Exposure to Hazards	Key Components	Sensitivity -1	Sensitivity-2	Sensitivity-3
Embankment	If riverbank erosion continues in coming years to this riverbank, the embankment of the eastern side of the Union will be severely damaged, more than 5000 people will face transportation problems, and it is more likely hazards will damage local resources.	Storm Surge Tidal Flood Erosion	Brick (Slop and toe protection)	Quality	Base materials	Stability
			Soil	Cohesion	Soil type	Soil texture
Sutaria Bazar	Due to poor construction and consecutive natural disasters the Sutaria Bazar was damaged moderately by coastal floods and cyclones. If a cyclone like Gorky and high tides occur in this ward, the bazaar will be damaged severely and about 300 people will lose their livelihoods and 2000 people will lose access to the market.	Cyclone Storm Surge Tidal Flood	Goods	Highly sensitive to Water	Perishable	Storage Environment
			Wood	Highly sensitive to Water	Less strength	
			Brick	Quality	Base materials	Stability
			RCC	Materials	Construction Quality	
			Sn Sheet	Highly sensitive to Water	Highly Corrosion Prone	
Road	If a cyclone like Gorky, tides, and heavy rainfall occur in ward no 9, about 2km of road from Sapmarardail Ghat to the Western side of RGS Cyclone shelter will be severally affected and more than 500 people will face transportation problems.	Storm Surge Tidal Flood Water logging	Brick (Guide wall)	Quality	Base materials	Stability
			Soil	Cohesion	Soil type	Soil texture

Earthen Road	Cyclones, high tides, heavy rainfall and water logging occur frequently in this union. In the future if these hazards occur, the residential roads in the Union will be severally damaged and more than 3000 people will face transportation problems and be unable to receive other basic needs.	Storm Surge Tidal Flood Water logging	Soil	Cohesion	Soil type	Soil texture
Embankment	If shoreline erosion and cyclones like Gorky continue in future years by this shoreline, the embankment of the western shoreline will be damaged severely and more than 5000 people will face transportation problems and damage to local resources	Storm Surge Tidal Flood Erosion	Brick (Guide wall)	Quality	Base materials	Stability
			Soil	Cohesion	Soil type	Soil texture
Road	If a cyclone like Gorky, high tides, heavy rainfall or water logging occur in ward no 1 the road from Nasir Mohammaddail to the Power plant gate will be severely damaged and more than 1000 people will face transportation problems	Storm Surge Tidal Flood Water logging	Brick (Guide wall)	Quality	Base materials	Stability
			Soil	Cohesion	Soil type	Soil texture
Road	If a cyclone like Gorky, high tides, heavy rainfall or water logging occur in the union, the 2.5 km road from Sutaria bazar to Sapmarardail Ghat will be severally damaged and more than 1000 people will be affected directly or indirectly due to transportation disruption.	Storm Surge Tidal Flood Water logging	Brick (Guide wall)	Quality	Base materials	Stability
			Soil	Cohesion	Soil type	Soil texture
Road	If a cyclone like Gorky, high tides, heavy rainfall or water logging occur in the union, the 2 km road from Sutaria bazar to Begunbania Ghat will be severally damaged and more than 1000 people will be affected directly or indirectly due to transportation disruption.	Storm Surge Tidal Flood Water logging	Brick (Guide wall)	Quality	Base materials	Stability
			Soil	Cohesion	Soil type	Soil texture
Sluice Gate	Due to poor structural integrity and high-water pressure, the sluice gate on the south side of Sapmarardail Ghat was damaged moderately by recent cyclones, if a cyclone such as Gorky occurs in this area the sluice gate will be damaged	Storm Surge Tidal Flood	RCC	Materials	Construction Quality	
			Brick	Quality	Base materials	Stability
			Base Soil	Cohesion	Soil type	Soil texture

	severally and restrict water flow into salt fields.					
Muhurighona Community Clinic	If a cyclone like Gorky occurs in this area, Muhurighona Community Clinic Ward N-2 will be moderately damaged and more than 2000 people will not be able to receive emergency and primary health care.	Cyclone Storm Surge Tidal Flood Water logging	RCC	Materials	Construction Quality	
			Brick	Quality	Base materials	Stability
			Base Soil	Cohesion	Soil type	Soil texture
Sluice Gate/ Water outlet	Due to poor structural condition and high-water pressure, the water outlet of the eastern embankment is in a moderate state of disrepair, if a cyclone like Gorky and high tides occur in this area, this water outlet will be damaged moderately and restrict water flow into salt fields.	Storm Surge Tidal Flood	RCC	Materials	Construction Quality	
			Brick	Quality	Base materials	Stability
			Base Soil	Cohesion	Soil type	Soil texture
Settlement	Due to poor structure and consecutive natural disaster the settlements of ward no -5 were severally damaged by cyclone Gorky. If a cyclone as Gorky and high tide occur in ward 5, these settlements will be completely damaged and about 1000 people will lose their households.	Cyclone Storm Surge Tidal Flood Water logging	Furniture	Highly sensitive to Water	Perishable	Storage Environment
			Wood	Highly sensitive to Water	Less strength	
			Brick	Quality	Base materials	Stability
			RCC	Materials	Construction Quality	
			Sn Sheet	Highly sensitive to Water	Highly Corrosion Prone	
Settlement	Due to poor structure and consecutive natural disasters the settlements of ward no -8 were moderately damaged by cyclone Gorky. If a cyclone such as Gorky and high tide occur in ward 3, these settlements will be affected seriously and about 1000 people will lose their households.	Cyclone Storm Surge Tidal Flood Water logging	Furniture	Highly sensitive to Water	Perishable	Storage Environment
			Wood	Highly sensitive to Water	Less strength	
			Brick	Quality	Base materials	Stability
			RCC	Materials	Construction Quality	
			Sn Sheet	Highly sensitive to Water	Highly Corrosion Prone	
Settlement	Due to poor structure and consecutive natural disasters the settlements of ward no -3 were severely damaged by cyclone Gorky. If a cyclone such as Gorky and high tide occur in the ward 3, these settlements will be completely	Cyclone Storm Surge Tidal Flood Water logging	Furniture	Highly sensitive to Water	Perishable	Storage Environment
			Wood	Highly sensitive to Water	Less strength	
			Brick	Quality	Base materials	Stability
			RCC	Materials	Construction Quality	

	destroyed and about 500 people will lose their households.		Sn Sheet	Highly sensitive to Water	Highly Corrosion Prone	
Settlement	Due to poor structure and consecutive natural disasters the settlements of ward no -1 were severeley damaged by previous cyclones. If cyclone such as Gorky and a high tide occur in the ward 1, these settlements will be completely destroyed and about 800 people loss their households.	Cyclone Storm Surge Tidal Flood Water logging	Furniture	Highly sensitive to Water	Perishable	Storage Environment
			Wood	Highly sensitive to Water	Less strength	
			Brick	Quality	Base materials	Stability
			RCC	Materials	Construction Quality	
			Sn Sheet	Highly sensitive to Water	Highly Corrosion Prone	
Multi-purpose disaster shelter	If a cyclone like Gorky occurs in this area, the Multi-purpose disaster shelterof Ward No-5 will be severely damaged and more than 1000 people would not be able to take shelter during the emergency period.	Storm Surge Tidal Flood Water logging	RCC	Materials	Construction Quality	
			Brick	Quality	Base materials	Stability
			Base Soil	Cohesion	Soil type	Soil texture
Red Crescent Cyclone Shelter	If cyclone like Gorky occurs in this area, the Muhurighona Cyclone shelter Ward N-2 will be severely damaged and more than 500 people would not be abke to take shelter during the emergency period.	Storm Surge Tidal Flood Water logging	RCC	Materials	Construction Quality	
			Brick	Quality	Base materials	Stability
			Base Soil	Cohesion	Soil type	Soil texture
Dhalghata High School	If a cyclone like Gorky occurs in this area, Dhalghata High School Ward N-5 will be severely damaged and more than 2000 students would be able to study.	Storm Surge Tidal Flood Water logging	RCC	Materials	Construction Quality	
			Brick	Quality	Base materials	Stability
			Base Soil	Cohesion	Soil type	Soil texture
Family Planning and Health Care	If a cyclone like Gorky occurs in this area, the Family Planning and Health Care clinic in Ward N-5 will be severely damaged and more than 3000 people would not seek emergency and primary health treatments.	Storm Surge Tidal Flood Water logging	RCC	Materials	Construction Quality	
			Brick	Quality	Base materials	Stability
			Base Soil	Cohesion	Soil type	Soil texture
Culvert	If a cyclone like Gorky occurs in this area, the culverts of this union will be severely damaged and more than 20000 people will be affected	Storm Surge Tidal Flood Water logging	RCC	Materials	Construction Quality	
			Brick	Quality	Base materials	Stability
			Base Soil	Cohesion	Soil type	Soil texture
Settlement	Due to poor construction and consecutive natural disaster the settlements of ward no -9 were severely damaged by cyclone Gorky. If a cyclone such as	Cyclone Storm Surge Tidal Flood	Furniture	Highly sensitive to Water	Perishable	Storage Environment
			Wood	Highly sensitive to Water	Less strength	

	Gorky and high tides occur in ward 9, these settlements will be completely damaged and about 1000 people will lose their households	Water logging	Brick	Quality	Base materials	Stability
			RCC	Materials	Construction Quality	
			Sn Sheet	Highly sensitive to Water	Highly Corrosion Prone	

3.5. Adaptive Capacity

The people of this union have taken some adaptive measures to cope with the hazards they face every year and also on a day to day basis. People are repairing and strengthening the embankments through their own effort. The settlements and physical infrastructure are also getting strengthened by local people by their own efforts. The physical structures like schools and houses are being built with stronger construction materials. Additionally, sluice gates have been installed to manage the entrance of water into crop fields.

Based on the socioeconomic conditions of the people of Dhalghata unions have taken some adaptive measures against extreme climate events and natural disasters. The people of this union mostly use indigenous practices but with the help of different NGOs, INGOs, Development Partners and govt., some scientific knowledge-based intervention has been implemented. Sluice gates have been installed to manage the entrance of water into the crop fields. In the union level, they have no financial capacity to implement the new knowledge, skills and technology-based adaptation strategies. The human resources of the union are limited and they have no technical skills and knowledge to implement the Disaster Risk Reduction (DRR) and Climate Change Adaptation (CCA) strategy. To ensure that the DRR and CCA can be adopted, the union needs new financial systems and financial organization.

Chapter 4. Risk Reduction Options and Action Plan

4.1. Risk Reduction Option

Dhalghata union vulnerable to the risk of climatic hazards like cyclones, storm surges, coastal floods and to manmade hazards like industrial pollution and industrial hazards. To reduce the risks of both climatic and manmade hazards both community and local authorities need to participe actively.

As fishing is one of the major economic activities in this union, saline water-tolerant fish and crab cultivation can be encouraged along with shrimp cultivation. Most of the fishermen complain about the poor early warning system during disaster periods. Improved early warning information can be provided to fishermen so that they can prepare themselves before going going out to sea.

All the roads and culverts in every ward of this union are at high risk. To reduce the exposure of roads, culvert and bridges from storm surges and coastal floods, their height can be increased from the historical flood level so that they are not inundated. Trees can be planted on both sides of culverts and bridges to reduce soil erosion. Embankments on both sides can be installed to reduce the impact of flooding. Sluice gates can be installed and proper monitoring can be encouraged.

Physical infrastructure like schools, houses, offices, and mosques can be built on elevated land. Shelters can be built to protect people from emergency situations. Shelters should be multipurpose so that they can be used as a school or health center during non-disaster periods. Protection walls should be built around this infrastructure to protect from surge water. Good building material must be used in the construction, floor must be covered with concrete and tree plantation on open places around the structuresmust be done. Important places e.g. markets, cemeteries, and crematories should be surrounded by guide wall or revetments if necessary. Tube wells should be on high platforms so that drinking water is not contaminated during floods. Sanitary latrines should also be on a high platform.

Special concern towards women, elders and children should be kept in mind while constructing shelters. Moreover, installing a community-based early warning system

can reduce risks. Risk transfer mechanisms for life, assets and livelihood should be introduced.

The activities are given below:

1. Embankment Construction and Repair
2. Construction of Sluice gates
3. Increase the height of roads
4. Resettlement Projects
5. Surge Resilient Households
6. Increase the height of house plinths
7. Repair and Reconstruction of Roads
8. Construction of the guide wall
9. Erosion control measures e.g. revetment work, dumping geobags where necessary.
10. Alternative sources of livelihoods

4.2. Risk Reduction Action Plan

No	Activities	Who	When	How	Where	Approximate Cost	Other Consideration
1	Embankment Construction and Repair	BWDB/LGED	2019-2020	Participation with local People Ensure Slope and Toe Protection	North side of the Soraitola west shoreline of the Union		Local labour must be used
2	Embankment Construction and Repair	BWDB/LGED	2019-2020	Participation with local People Ensure Slope and Toe Protection	From Southside of Sapmarardail to Power plant of eastern side of the Union		Local labour must be used
3	Repairing the Culverts	UP, LGED, Govt./Non-Govt. Organization, MoDMR, UNDP	2019-2020	Ensure the construction materials are sustainable in the high salinity concentration water Ensure the ramp stability	All Culverts in the Union		Local labour must be used
5	Sluice Gate Construction	BWDB, UP, BWDB, Development Partners	2019-2020	Ensure they can regulate thecapacity of the flood's flow.	Sluice gate and water outlets on the eastern embankments		Local labour must be used
6	Road repairs	UP, LGED, Govt./Non-Govt. Organization, MoDMR, UNDP	2019-2020	Use local labour, locally available soil and other materials. Ensure sustainability. Increase the height of the road	The road from Nasir Mohammaddail to the Power plant gate		Local labour must be usedUse locally available construction materials.
7	Road repairs	UP, LGED, Govt./Non-Govt. Organization, MoDMR, UNDP	2019-2020	Use local labour, locally available soil and other materials. Ensure sustainability.	2.5 km road from Sutaria bazar to Sapmarardail Ghat		Local labour must be used

				Increase the height of the road			
8	Road repairs	UP, LGED, Govt./Non-Govt. Organization, MoDMR, UNDP	2019-2020	Use local labour, locally available soil and other materials. Ensure sustainability. Increase the height of the road	4.5 km road from Sutaria bazar to Muhurighona		Local labour must be usedUse locally available construction materials.
9	Road repairs	UP, LGED, Govt./Non-Govt. Organization, MoDMR, UNDP	2019-2020	Use local labour, locally available soil and other materials. Ensure sustainability. Increase the height of the road	about 2km road from Sapmarardail Ghat to the Western side of the RGS Cyclone Shelter		Local labour must be usedUse locally available construction materials.
10	Road repairs	UP, LGED, Govt./Non-Govt. Organization, MoDMR, UNDP	2019-2020	Use local labour, locally available soil and other materials. Ensure sustainability. Increase the height of the road	All the residential roads in the union		Local labour must be usedUse locally available construction materials.
11	Repairing of the Cyclone shelters	UP, LGED, Govt./Non-Govt. Organization, MoDMR, UNDP	2019-2021	Adding basement protection and repairing the building Increase the basement height	**1.** Muhurighona Multipurpose Cyclone shelter Ward N-2 **2.** the CCDB Cyclone shelter Ward No-3 **3.** CCDB Cyclone		Local labour must be usedUse locally available construction materials. use saline tolerant materials

					shelter Ward No-4 **4.** CCDB Cyclone shelter Ward No-5 **5.** CCDB Cyclone shelter Ward No-7 **6.** CCDB Cyclone Shelter Ward no-1 **7.** Red Crescent Cyclone Shelter ward no-9		
12	Increase the plinthHeight of Households	UP, LGED, Govt./Non-Govt. Organization, MoDMR, UNDP, Owner of the House	2019-2020	Basement protection Increase the plinth height	**1.** Households of Sikder Para Ward no-5 **2.** Households of Ponditerdail Ward no-8 **3.** Households of Banjamara ward no-3 **4.** Households of Utter Muhurighona ward no-1		Provide information and training for house construction

					5. Households of Sapmarardail Ward no-9		
13	Increase the plinth Height	UP, LGED, Govt./Non-Govt. Organization, MoDMR, UNDP, Owner of the House	2019-2020	Materials must the resistant to waves and high salinity	Sutaria Bazar shops shop and platform		Provide information and training for house construction
14	Construction of guide wall	UP, LGED, Govt./Non-Govt. Organization, MoDMR, UNDP	2019-2020	Ensure construction quality and materials quality that will be sustain in the high wave and salinity.	All roads of the union		Local labour must be usedUse locally available construction materials. Use saline tolerant materials
15	Resettlement of households	UP, LGED, Govt./Non-Govt. Organization, MoDMR, UNDP, Owner of the House	2019-2021	Ensure the height of new settlements is higher than the 100 year return period inundation	1. Households of Sikder Para in Ward no-5 2. Households of Ponditerdail in Ward no-8 3. Households of Banjamara in ward no-3 4. Households of Utter Muhurighona in ward no-1 5. Households of Sapmarardail in Ward no-9		Provide information and training for construction the households
16	Alternative Livelihoods sources	UNDP, JICA, NGO	2019-2025	Provide some technical training so that local	The most vulnerable		Must provide training of marketable skills

				workers can work in the power plant and other development activities.	community lives on the shoreline of Ward nos - 6,7and9		

*UP - Union Parshad

*NGO – Non-Government Organization

*UNDP – United Nations Development Programme

*UPz – Upazila Parishad

*JICA – Japan International Corporation Agency

*BWDB – Bangladesh Water Development Board

*LGED – Local Government Engineering Department

*MoDMR – Ministry of Disaster Management and Relief

Chapter 5. Conclusion

The findings presented in this report are intended as a guide to addressing the risk reduction options for the Dhalghata union in order to prevent and mitigate everyday hazards and to reduce community vulnerability.

It is clear from risk reduction options and the risk reduction action plan that th construction of embankments is the main risk reduction priority. The people of Dhalghata are economically vulnerable so their households are not so strong enough to face the high wind speed and storm surges generated by cyclones. The absence of embankments is making them more exposed to tides and storm surges. So, the construction of embankment is one of the main solutions.

Due to frequent natural disaster, roads are often not useable so repairing and construction the roads must be followed the build back batter strategy. Due to the high salinity conditions present in local soils agriculture cannot occur and people are dependent only on salt cultivation and shrimp farming. This dependence on highly vulnerable income sources increases the risk to the the lives and livelihoods of locals from these threats.

Chapter 6. Reference

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Chapter 7. Annex

KII Checklist

Respondent Name (s)	Village	Date
Interviewer (s)		

1. What are the main changes that have taken place in the locality in the last few years? When did they take place (approximately what year)? What are the causes of these changes? What have been the effects of these changes on the community?
2. Have you noticed changes in (i) flooding, (ii) rainfall, (iii) drought (*monga*), (iv) cyclone, (v) tornado, (vi) storms, (vii) river bank erosion and (viii) salinity intrusion in the last few years?
3. If yes, ask for each of the changes -

   How is it (are they) different from original situation?

   How measured (indicator)?

   When did you first notice the change (year, if possible) and Where?

   What do you think are the main causes or reasons for the change?

   What are the effects of the change that you have seen so far?

   What areas in the union/ aspects of life will be vulnerable to this change?

   What will be the likely effects in the medium to long term? How would you rate the consequence of this change (Not Bad, Bad, Very Bad, Plenty Bad)?

   What do you think is/are the best way(s) to cope with such change?

What should Government/ UP council do? What should Community groups do (specify)?

What should family/individuals do? How have people coped with such change(s) in the past?

Can such traditional coping mechanisms be applied in the present context (Elaborate)?

4. List 5 practices, which contribute to increase the vulnerability of our environment. Detail the effect of each practice. What can be done to increase public awareness of the negative effects of such practices?

5. List 5 practices/ cultural values/institutions, which can contribute to increasing the robustness and resilience of the Union to the impacts of climate and other changes? Detail how each can be harnessed to the Union adaptation efforts

KII List

Sl. No	Name	Designation	Contact No	Date
1	Kamrul Hasan	Chairman	01816352046	22-09-19
2	Delowar Hossain	Headmaster (Acting), Sapmarardail Government Primary School	01811340126	22-09-19
3	Wahid Muhamad Shovon	Salt Farmer	Muhurighona	22-09-19
4	Mohammad salim	Local Influencial Person	Sutaria Bazar	23-09-19
5	Razia Sultana Parvin	Female Entrepreneur	Sapmarardail	23-09-19
6	Lamong	Union Parishad Secretary	01878376547	22-09-19

FGD Checklist

Livelihood Options, Challenges & opportunities: What are the major occupations in this area? What are the new occupations that have been adopted by the people of this area for their livelihood? What are the occupations gone lost? What are the challenges faced by the existing occupations? Do you predict any future challenges for the existing occupations? If so, do you think there might be new occupations evolved? What might be those new occupations?

Hazard (past, present and future): In the past (Ten / twenty years before from now) what sort of hazards caused disastrous situation in your area? What are the hazards currently causing the same? If the hazards are the same do you notice change of magnitude of causing damages? Or they are the same as before? From

your experiences do you predict that the type of hazards might be changed in future (ten to twenty years from now)? If so what might be the new hazards?

Here are some examples of different type of hazards as ready reference: natural (Cyclone, flood, erosion, heat stress, storm surge, storm, strong winds (tornado), earthquake, drought (monga)), human induced (River bank erosion, pollution of water supply), biological (Spread of disease, pests or contaminants among plants, animals or people), and technological (Failure of socio-technical systems related to agriculture, food processing and storage, communications, industrial sites, infrastructure and transportation)

FGD List

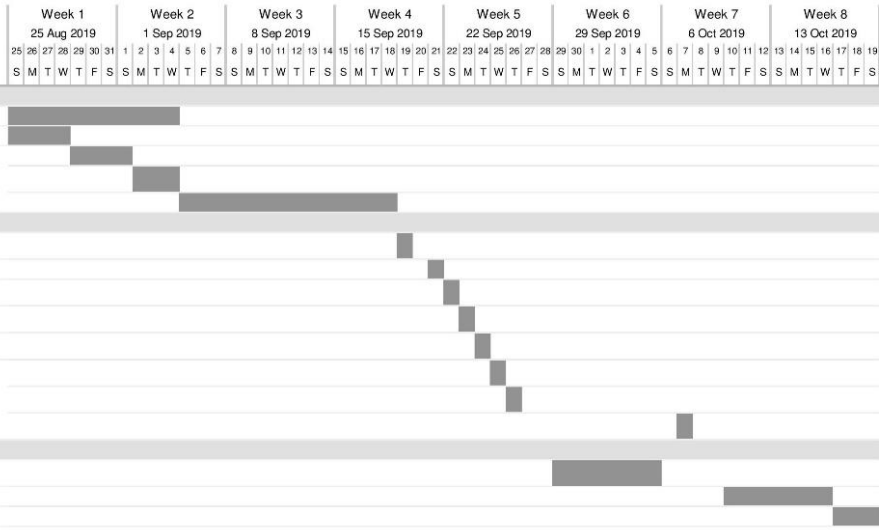
Sl. No	Location	Community	Date
1	Poditer Dail Ward no 9	Female	22-09-19
2	Sapmarar Dail Ward no 8	Seasonal unemployed people	22-09-19
3	Sutariya Bazar	Businessmen	22-09-19
4	Soraitola (Ward no-4)	Fisherman	23-09-19
5	South Muhurighona (Ward no-2)	Day labor (Salt Field)	23-09-19
6	Muhurighona (Ward no 1)	Farmer (Salt cultivation)	22-09-19
7	Sapmarardail Jetty Ghat	Fisherman, Boat owner	23-09-19
8	Sikderpara (Ward no-5)	Female	22-09-19

Schedule of Map and CRA Production

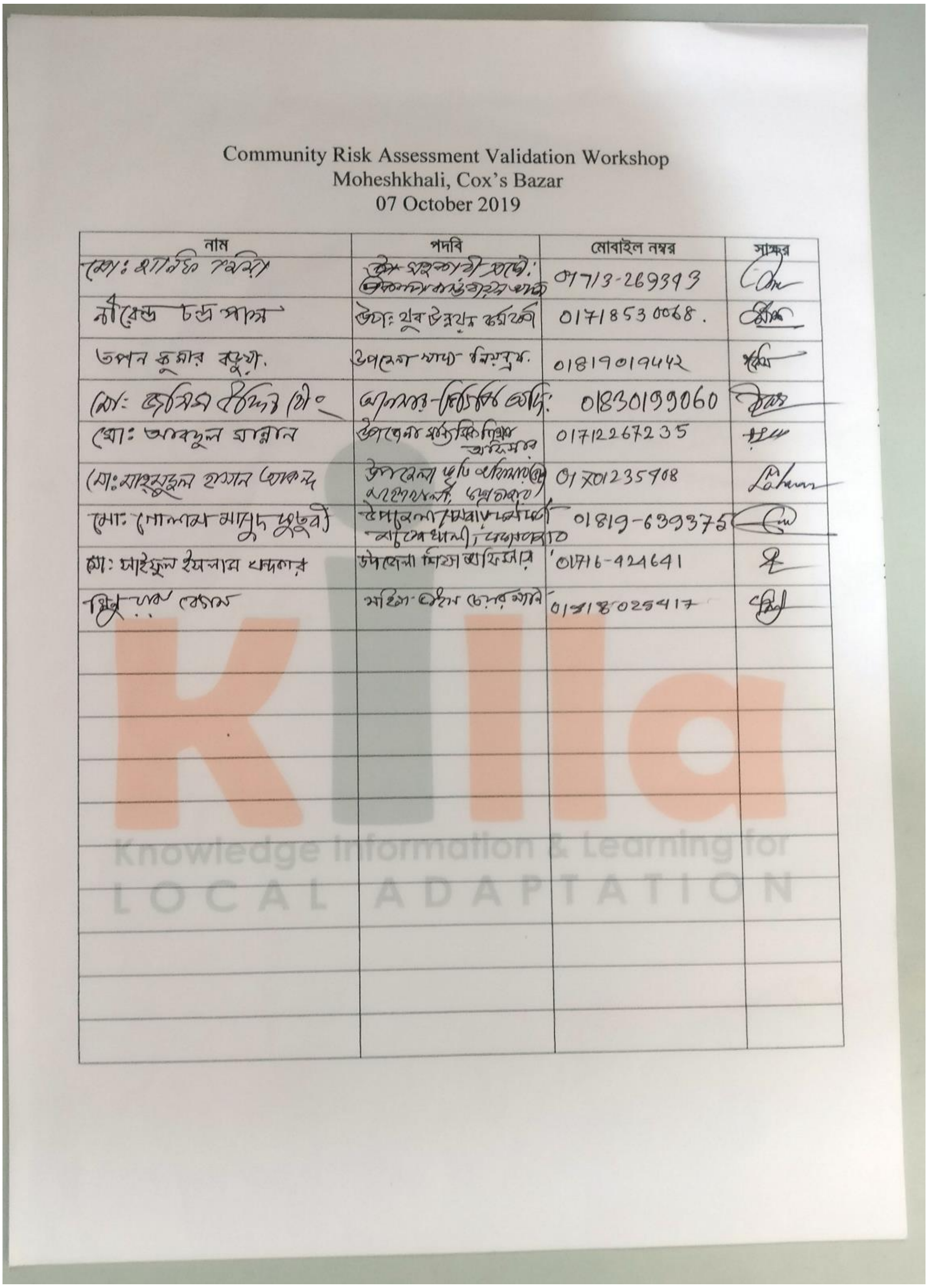
UNDP

Project Start Date 8/25/2019 (Sunday)
Project Manager Cathrine Tranberg Haarsaker

No.	TASK	START	END	DAYS	% DONE	WORK DAYS
1	**Pre-CRA Activities**		-			-
1.1	Mapping	Sun 8/25/19	Wed 9/04/19	11	100%	8
1.1.1	Base Map	Sun 8/25/19	Wed 8/28/19	4	100%	3
1.1.2	Google Map	Thu 8/29/19	Sun 9/01/19	4	100%	2
1.1.3	Landuse Map of 1999, 2009, 2019	Mon 9/02/19	Wed 9/04/19	3	100%	3
1.2	Field Preparation	Thu 9/05/19	Wed 9/18/19	14	100%	10
2	**CRA Field Activities**		-			-
2.1	Travel (Dhaka-Cox's Bazar)	Thu 9/19/19	Thu 9/19/19	1	100%	1
2.2	Village Transect	Sat 9/21/19	Sat 9/21/19	1	100%	0
2.3	FGD (Focus Group Discussion)	Sun 9/22/19	Sun 9/22/19	1	100%	0
2.4	KII (Key Informant Interview)	Mon 9/23/19	Mon 9/23/19	1	100%	1
2.5	LGD (Large Group Discussion)	Tue 9/24/19	Tue 9/24/19	1	100%	1
2.6	Validation Workshop with UDMC	Wed 9/25/19	Wed 9/25/19	1	100%	1
2.7	Travel (Cox's Bazar-Dhaka)	Thu 9/26/19	Thu 9/26/19	1	100%	1
2.8	Validation Workshop with UzDMC	Mon 10/07/19	Mon 10/07/19	1	100%	0
3	**CRA Report Writing**		-			-
3.1	Map Updating & Correction	Sun 9/29/19	Sat 10/05/19	7	100%	5
3.2	Data Analysis	Thu 10/10/19	Wed 10/16/19	7	100%	5
3.3	Report Writing	Thu 10/17/19	Fri 10/25/19	9	100%	7



Participants list of Upazila CRA Validation Workshop



Community Risk Assessment Validation Workshop
Moheshkhali, Cox's Bazar
07 October 2019

নাম	পদবি	মোবাইল নম্বর	স্বাক্ষর
মো: হামিদ ফকির	উপ-সহকারী প্রকৌ: উপজেলা কার্যালয়	01713-269393	
নীরেন্দ্র চন্দ্র পাল	উপ: যুব উন্নয়ন কর্মকর্তা	01718530068.	
তপন কুমার বড়ুয়া.	উপজেলা খাদ্য নিয়ন্ত্রক.	01819019442	
মো: জসিম উদ্দিন চৌ:	সভাপতি-সিপিপি মহে:	01830199060	
মো: আবদুল মান্নান	উপজেলার মাধ্যমিক শিক্ষা অফিসার	01712267235	
মো: মাহমুদুল হাসান খোন্দ	উপজেলা কৃষি অফিসার মহেশখালী, কক্সবাজার	01701235408	
মো: গোলাম মাসুদ চৌধুরী	উপজেলা সমবায় অফিসার মহেশখালী, কক্সবাজার	01819-639375	
মো: সাইফুল ইসলাম খন্দকার	উপজেলা শিক্ষা অফিসার	01716-424641	
মিনু আরা বেগম	মহিলা ভাইস চেয়ারম্যান	01818025417	

Community Risk Assessment Validation Workshop
Moheshkhali, Cox's Bazar
07 October 2019

নাম	পদবি	মোবাইল নম্বর	সাক্ষর
Md Kamal Uddin.	Area Manager PIC.	0131-431626	
Sapan Kumar Dey	Fireman Fire service.	01825-442490	
Mosharaf Hossain Talukder	Chairman, Matabari Union.	01819396767	
Md. Saleh Ahamad	UP FF Commander	01823 381104	
Nurul Hoque	Chairman Sapleepur	01819633662	
Md. Rashedul Islam	PIO, Moheshkhali	01913602441	
Anwar Pasha. ely.		01922300676	

Settelements and communication of Muhurighna(Date: 23.09.19)

Settelements of ward no 2 (Date: 23.09.19)

FGD of ward no 1,2,and 3 at Union Parshad (Date: 24.09.19)

Sign of the effects of storm surge at ward no -3 (Date: 23.09.19)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