SORSOGON CITY

LCCAP
Local Climate Change Action Plan

CHAPTER 1: BACKGROUND AND RATIONALE

Rationale of the Plan

The Global Climate Risk Index 2016 listed the Philippines as 4th from the top 10 countries most affected by extreme weather events for the period 1995-2014. According to the study, the top 10 countries can be divided into two groups: those that only have a high ranking due to exceptional catastrophes and those that are continuously affected by extreme events. The Philippines belongs to the latter group.

Climate change is real. And the Philippines, because of its geographic location, is one of the most vulnerable countries to the threats of climate change such as sea level rise, increase in temperature, changes in rainfall patters, and intense tropical cyclones.

Early in 1991, the Philippines created the Inter-Agency Committee on Climate Change (IACCC) to address the issue of climate change. In addition, the country has manifested its commitment of addressing global environmental issues by supporting the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol ratified in 1994 and 2003, respectively.

The passage of Republic Act 9729 otherwise known as Climate Change Act of 2009, ensures the mainstreaming of climate change, in synergy with disaster risk reduction, into the national, sectoral, local development plans and programs. The Act also created the Philippine Climate Change Commission (PCCC) that established the National Framework Strategy on Climate Change (NFSCC) and the National Climate Change Action Plan (NCCAP).

Specifically, Section 14 of RA 9729 states that *"The LGUs shall be the frontline agencies in the formulation, planning and implementation of climate change action plans in their respective areas, consistent with the provisions of the Local Government Code, the Framework, and the National Climate Change Action Plan."*

Seven priority areas were identified under NCCAP which include: (1) food security; (2) water sufficiency; (3) ecosystem and environmental stability; (4) human security; (5) climate-smart industries and services; (6) sustainable energy; and (7) knowledge and capacity development.

The NCCAP has become the basis in the drafting of the Sorsogon City Local Climate Change Action Plan (2017-2021).

Sorsogon City is no stranger to the impacts of the changing climate. Having been frequently visited by typhoons and storm surges way before climate change was mainstreamed, Sorsoganons somehow managed to cope with the stress and uncertainties brought by these disasters. Those living in urban barangays especially those residing in exclusive villages believe that they are relatively safe from strong winds and inundation. Those dwelling along coastal areas and those from rural areas rely on the existing system of rescue, evacuation, and rehabilitation in times of disasters. Those whose houses are made of light, wooden, or makeshift materials somehow have been accustomed to patch up whatever remains from the havoc.

With Climate Change exacerbated through time, it is time for the City to properly and seriously assess its capacities, deficiencies, disadvantages, and resources to adapt to all these changes.

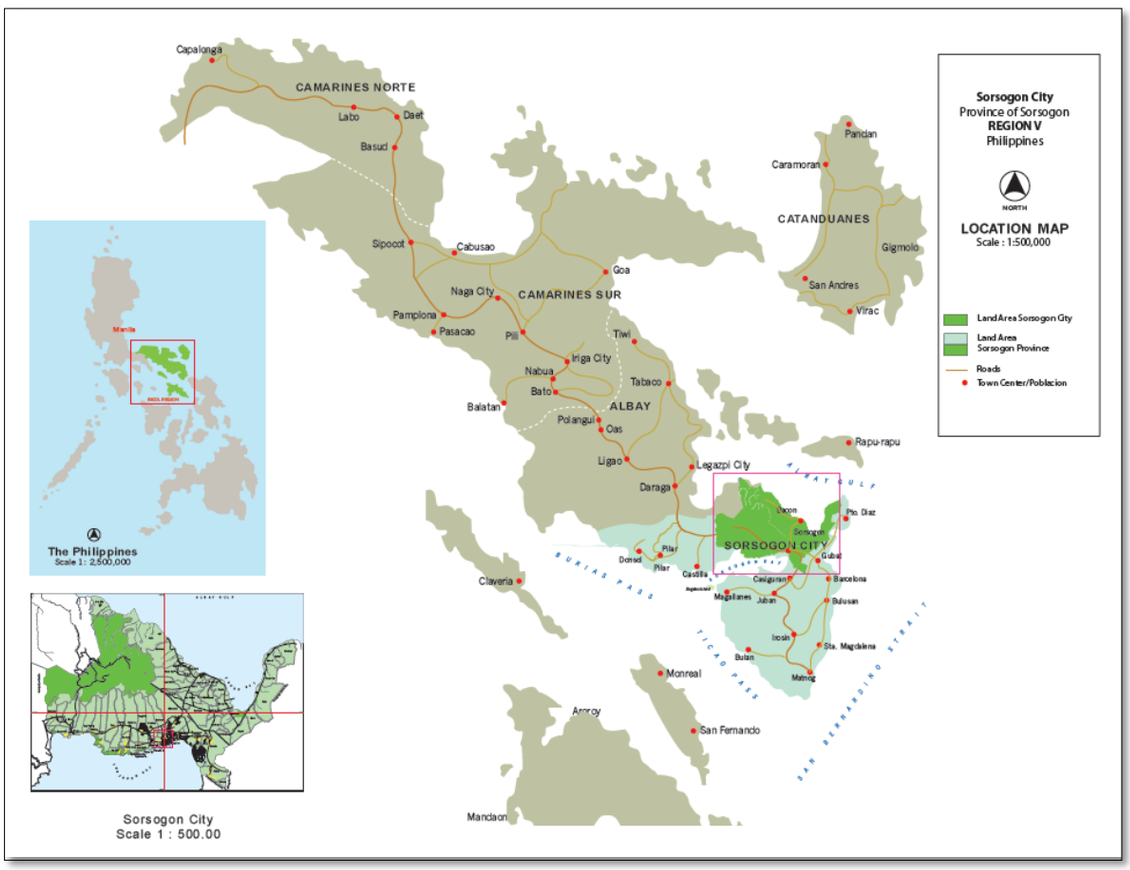
City Profile

Location

Sorsogon City lies from 123° 53’ to 124° 09’ east longitude and from 12° 55’ to 13° 08’ north latitude, and is situated in the Philippines’ Bicol Region. It is 600 kilometres southeast of Manila and is located at the southernmost tip of Luzon. As part of the geographical chain linking Luzon to the rest of the Philippines, it is a transshipment corridor and serves as the gateway to the Visayas and Mindanao Islands. Its geographical location is such that it opens into the Pacific Ocean to the West and East, through Albay Gulf and Sugod Bay and the China Sea through the Sorsogon Bay.

The city is bounded on the east by the municipalities of Prieto Diaz and Gubat, on the south by the municipality of Casiguran and Sorsogon Bay, on the west by the municipality of Castilla, on the northeast by the municipality of Manito in Albay, and on the north by Albay Gulf. It covers 31,292 hectares and is composed of 64 barangays.

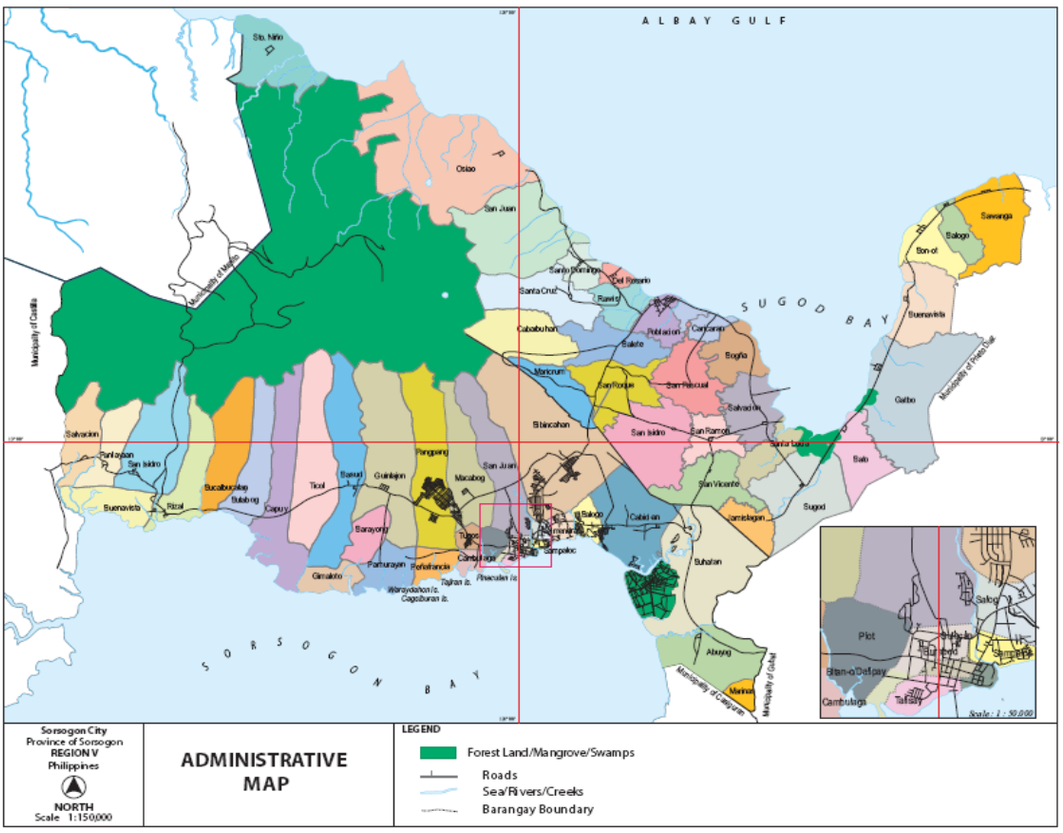
Figure 1: Location of Sorsogon City



Demography

The City has a total population of 155, 144 based on the 2010 national census of population. It is considered as the largest city in Bicol Region in terms of land area and one of the region's leading cities in terms of urbanization as it is one of the most populous cities in the region.

Figure 2: Administrative Map of Sorsogon City



Climate

The climate of Sorsogon is Type II under the Coronas classification system. There is no pronounced dry season but with a very pronounced maximum rain period from November to January. Rains start late September or early October. Annual rainfall ranges from 2,800 mm to 3,500 mm. Rain is expected 200 days in a year and even in the driest months unexpected downpour occurs.

Temperature ranges from 21 ^{0}C to 32 ^{0}C. Relative humidity is 82 percent. Prevailing winds are the monsoons and Pacific Trade Winds. The Northeast Monsoon (Amihan) occurs from October to March while the Southwest Monsoon (Habagat) occurs from June to September. The Pacific Trade Winds (Gurang na Habagat) occurs during April and May. Wind speed ranges from 7 to 12 kph.

Based on typhoon frequency, the country has been divided into six zones. Sorsogon together with the rest of Bicol Peninsula and the island-province of Catanduanes is passed by three tropical cyclones every two years. In the past ten years, three destructive typhoons have directly hit the city.

Figure 3: Climate Type of Sorsogon City

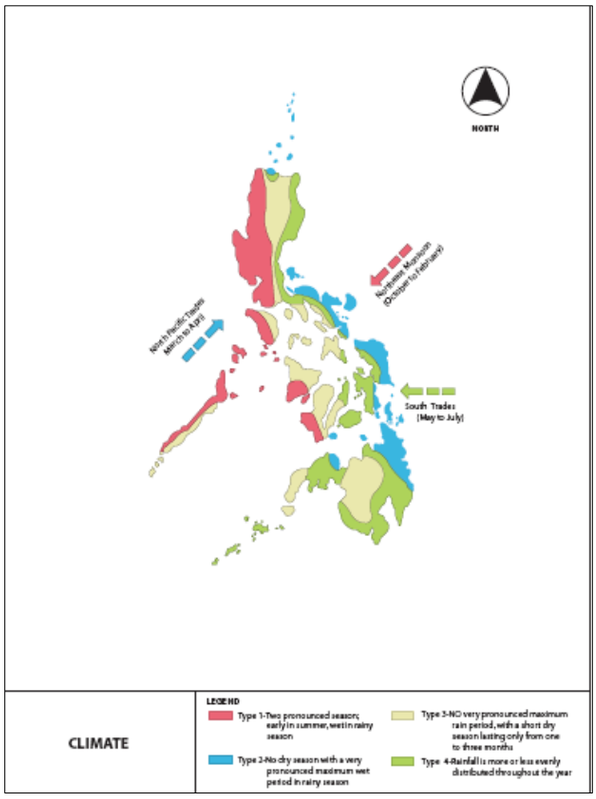
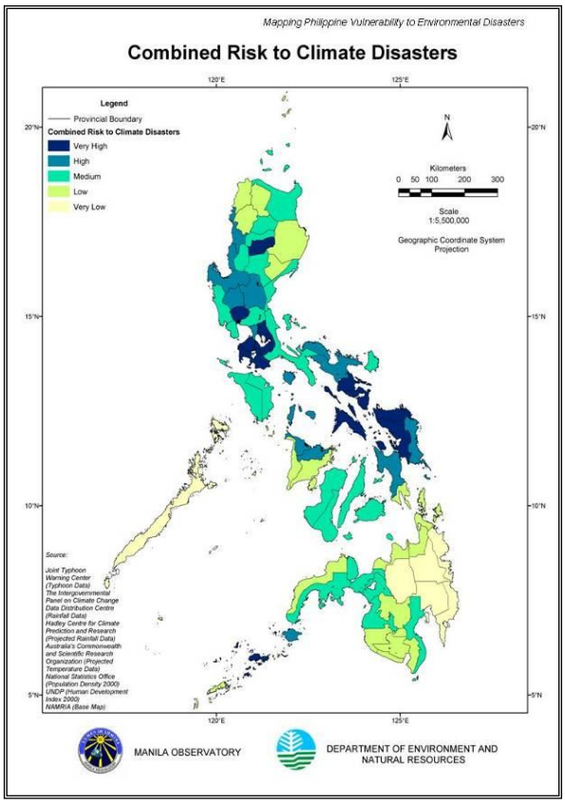


Figure 4: Combined Risks to Climate Disasters



Typhoons, tropical depressions, and cold fronts affect both rainfall and winds. The Province of Sorsogon, where the City is located, has been identified by a study of the Manila Observatory and the Department of Environment and Natural Resources being at Very High Risk from combined Climate Disasters

Previous disaster events caused massive destruction in SorsogonCity the most recent of them being Super Typhoons Milenyo (September 2006) and Reming (November 2006) which took place in the last quarter of 2006.

Facing these challenges becomes more difficult for the city as year-on-year it continues to face climate induced disasters which not only affect physical structures but also social infrastructure that reduces its capacity to achieve sustainable urbanization. The city has recognized that indeed climate over time has changed and that local actions are needed citing the experiences they have had from the disastrous Typhoons Reming and Milenyo.

As such, the city fully considers that climate change is not just a global or national issue, but a direct local issue as well. Climate risks are further discussed in succeeding sections.

Topography

Sorsogon may be divided into four physical areas – the northeastern range, the sloping uplands, the plain area, and marshlands.

The northeastern range is part of the Bacon-Castilla range, bordering Sorsogon's north and serves as its watershed covered mainly by secondary forest growth and thicket. It starts from 200 m above sea level to Mt.Rangas, the highest point at 1,000 meters. The sloping uplands are

the shoulders of the range and the series of hills in the southeast. Coconut, abaca, and fruit trees cover this area. The plain is generally low and level. Settlements and other built-up areas and rice fields occupy the plain area. Marshlands are the mouth of rivers vegetated mainly by nipa and are developed into fishponds.

Figure 5: Topography Map

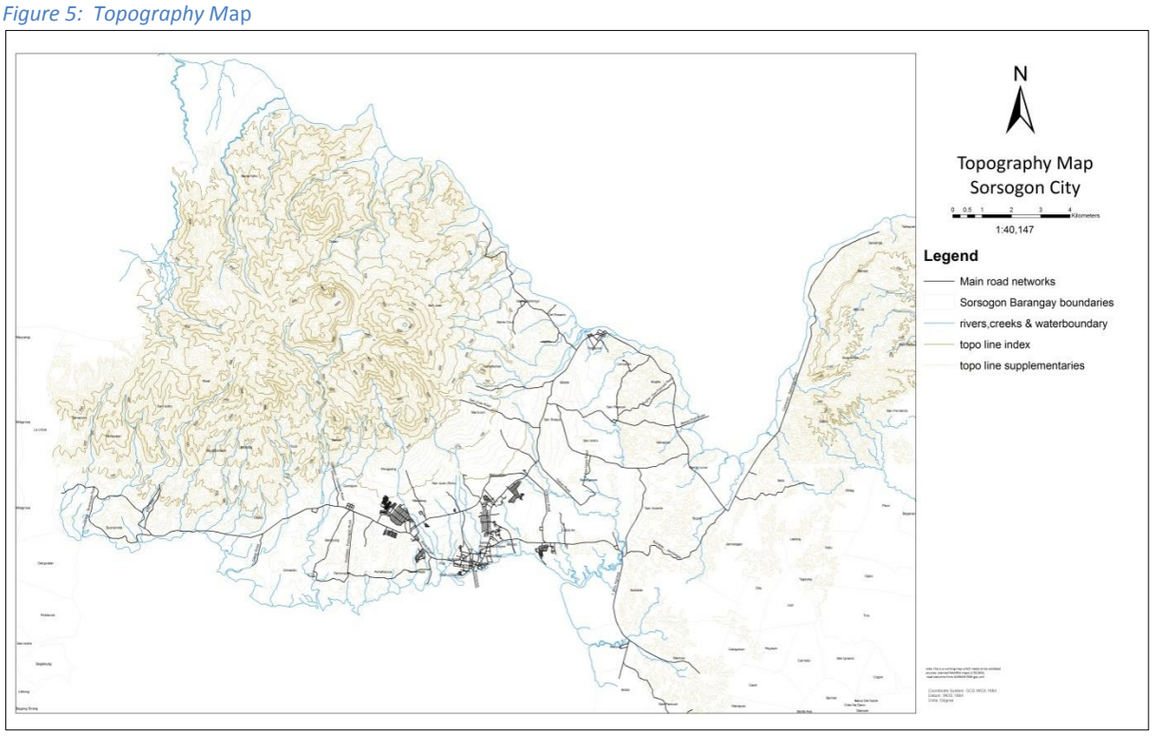
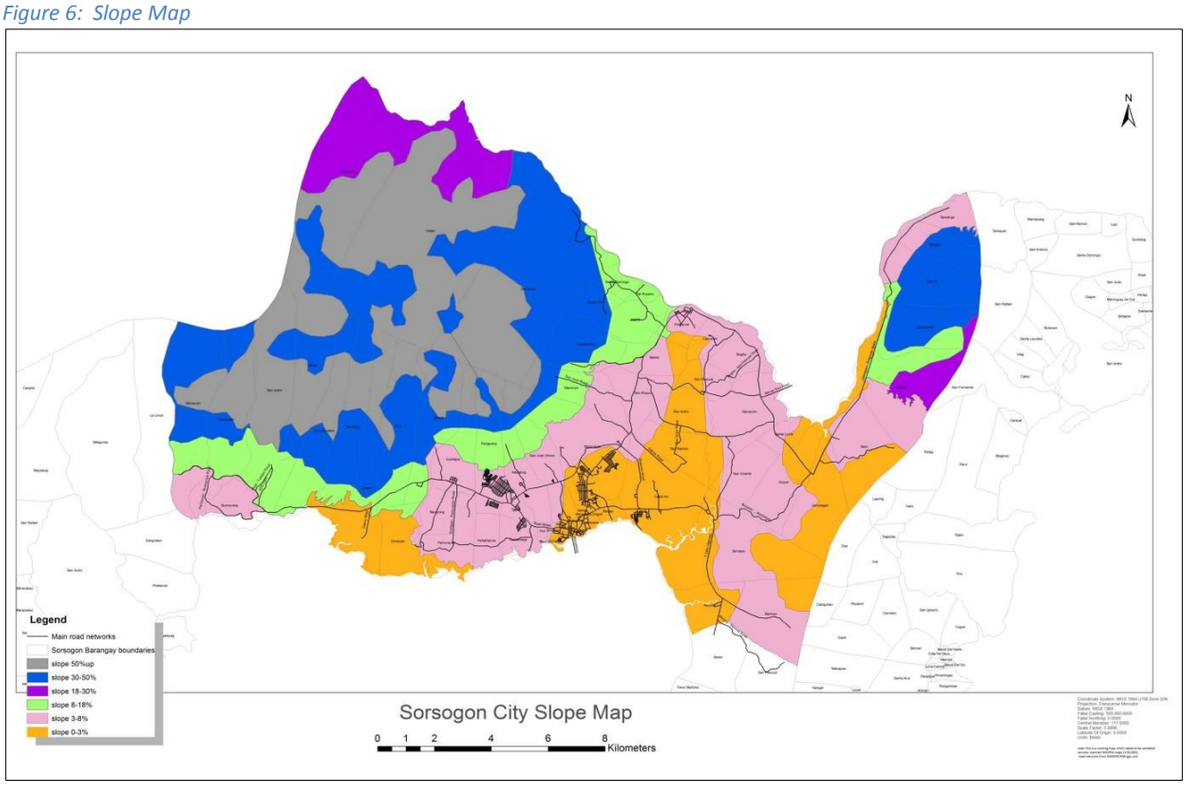


Figure 6: Slope Map



Surface Drainage

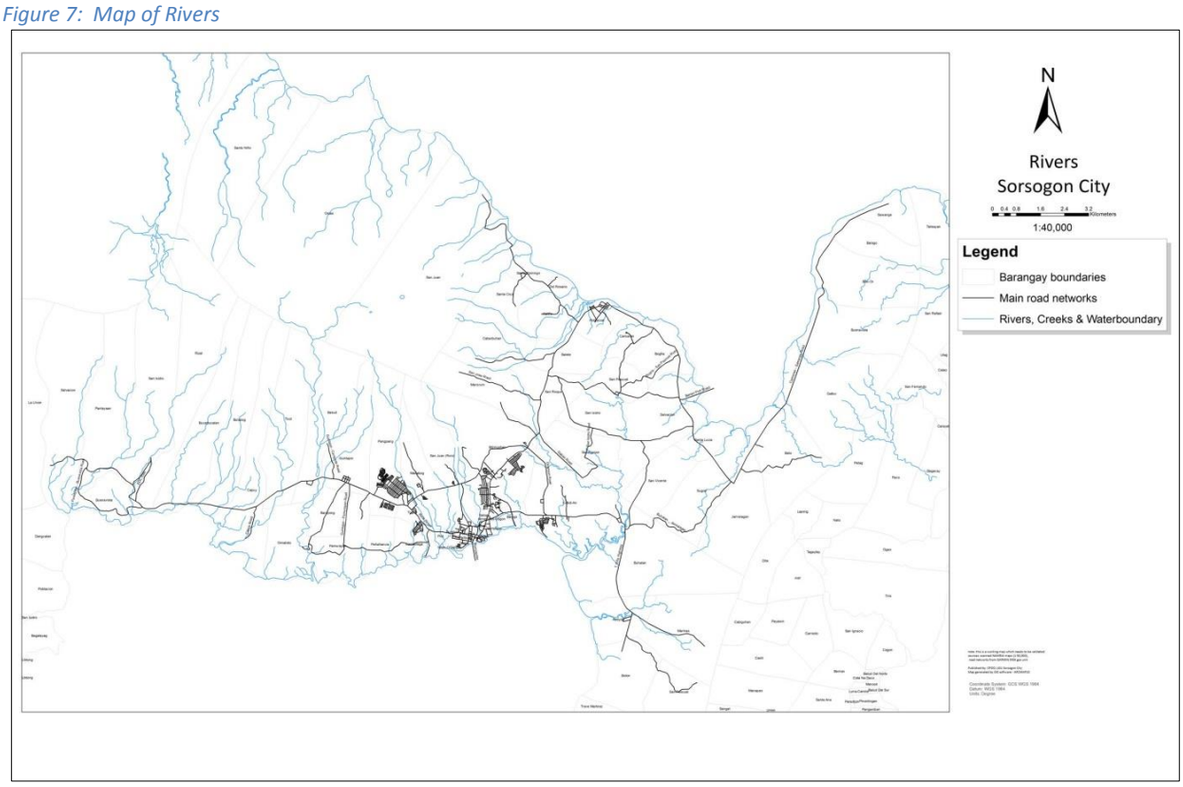
A system of rivers and creeks and several small waterways drain the general area of the city: Salog River is an urban river originating from Mt. Alinao and traversing eight barangays before discharging into the Sorsogon Bay. San Isidro, Rizal, and Cawayan Rivers originate from springs and tributaries of secondary forest areas within EDC Geothermal Reservation.

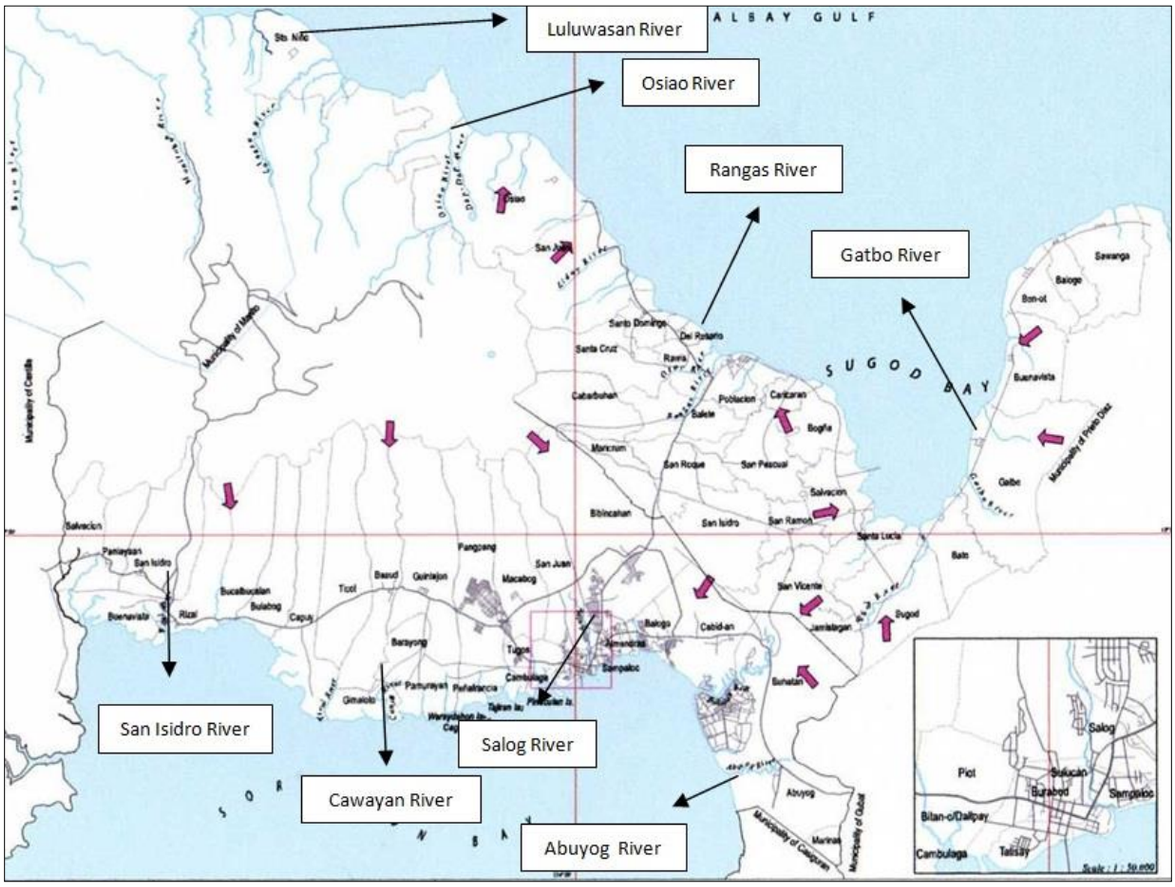
Rivers in Bacon District, at the northwestern to northeastern portion of the city, drain to the Albay Gulf. These include Luluwasan Osiao, Gatbo, and Rangas Rivers. Rivers in the southwest & south namely San Isidro, Cawayan, Salog, and Abuyog Rivers at the East & West District drain into the Sorsogon Bay.

Fresh water rivers, upon reaching the lowlands, are often tapped for irrigation and domestic uses. Brackish ones are source of shrimps and shellfish.

Water resources in the City are generally classified into surface and groundwater. Springs and networks of creeks and tributaries at the upland converges at the down streams to form major river systems. There are also creeks that only exist during rainy periods and dries up during dry season

Figure 7: Map of Rivers





Geology

The northern part of Sorsogon is made up of andesitic lava flows and other volcanic rocks. Rocks in the northeast are coralline limestone which is now being quarried for marble produced by different episodes of volcanic intrusions.

The rest of the flatlands are recent alluvial deposits composed of clays, silt, sand, gravel, and corral.

Geothermal energy has been successfully exploited in the northern part of the city. From wells drilled and developed by the Philippine National Oil Corporation, the National Power Corporation is operating three plants with a capacity of 130 MW connected to the Luzon Grid. As to non-metallic minerals, the Bureau of Mines and Geosciences has determined a sulfur deposit of 755 metric tons in Rizal. Its grade ranges from 10 percent to 40 percent. Gravel and sand can be quarried at the Cawayan River.

Soil

Dominant Soil types are Annam clay loam. Annam clay loam has a relief of slightly undulating, roughly rolling to undulating. It covers about half of the area. It is suited to lowland rice, root crops, vegetables, and permanent planting. Sorsogon clay loam is the soil on the plains and valleys. It is suited to lowland rice, abaca, and corn

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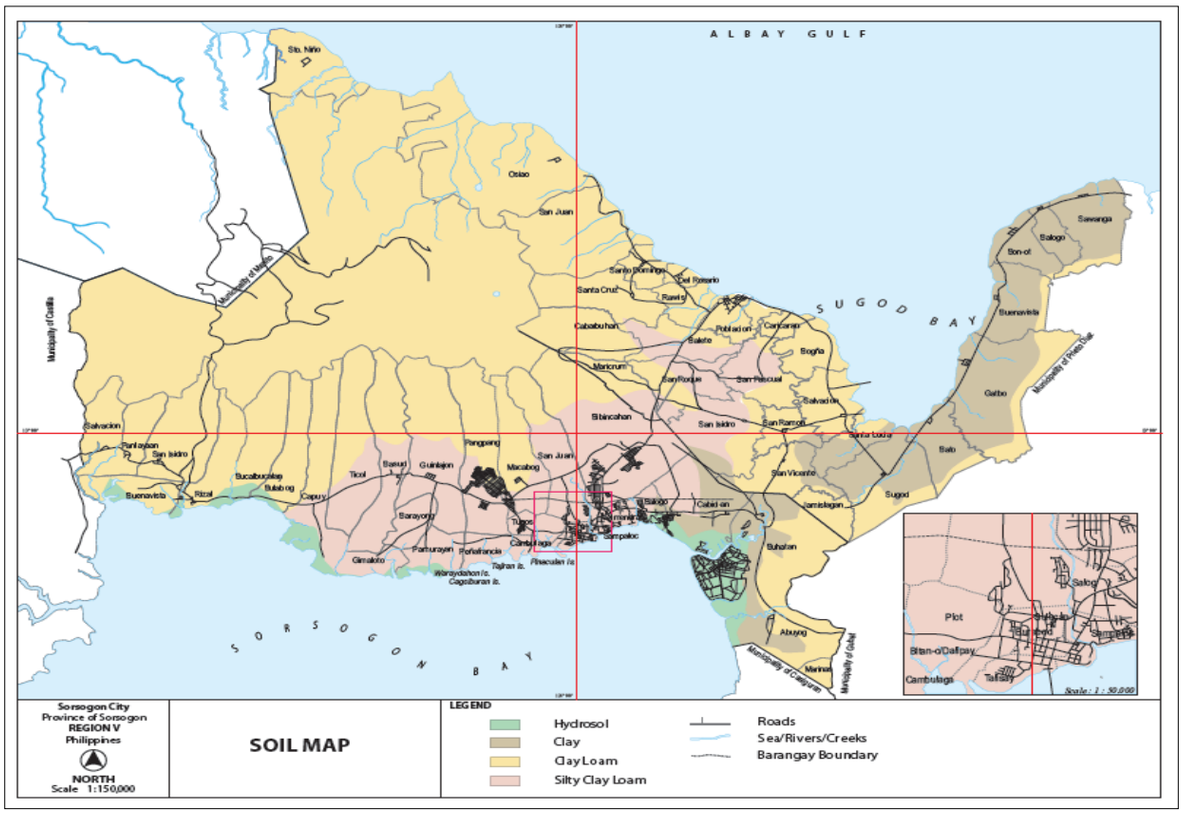
Figure 8: Soil Map



Planning Context

The city has reformulated its vision to pursue development considering climate change and aspires to be:

> "A model city in climate change and disaster risk resiliency with a contented, empowered and values oriented society that pursues socio-economic development within the limits of nature thru genuine commitment to good governance"

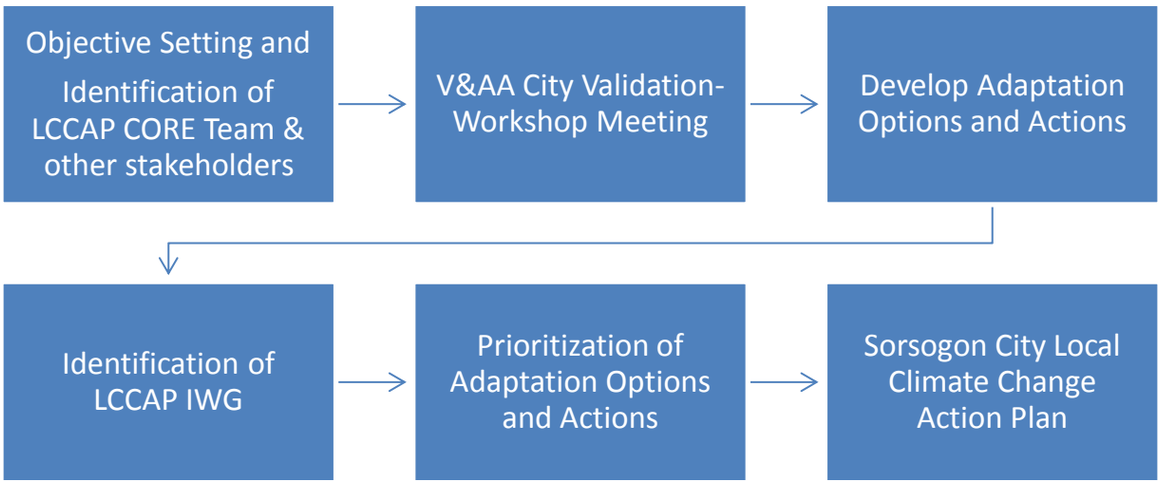
The development thrust of Sorsogon City is focused on the following:

- an alternative sub-regional center for Bicol region and administrative, commercial, and educational center for the Province
- an agricultural production center (particularly for coconut, high value crops, and marine products) with supporting agro-industries
- an alternative tourism destination (specifically for beach, diving, mountain resort, climbing, hiking, biking, agri-tourism)

Planning Approach

The process is participatory involving different stakeholders. Participation of stakeholders is needed in all aspects. Strong community mobilization is needed so that people could better understand the need for safe housing and the need to cooperate and participate in improving and maintaining basic community infrastructure. No single institution or group could resolve disaster related issues and the responsibility should be shared among all. Civil society plays a main role in working with communities while governments provide the appropriate policy environment to make things work on ground.

Framework



LCCAP CORE TEAM & STAKEHOLDERS

The following are the mandatory members of the LCCAP Core Team as recommended in DILG Memorandum Circular No. 2014-135 dated 21 October 2014, *"Guidelines on the Formulation of Local Climate Change Action Plan (LCCAP)"*, namely: City Planning and Development Office, City Health Office, City Engineering Office, City Agricultural Services Office, City Social Welfare & Development Office, City Budget Office, City Treasurers Office, City DRRM Office and DILG City Officer.

Other stakeholders include members of the Sangguniang Panlungsod, Sorsogon City Water District, Sorsogon Electric Cooperative, Kapisanan ng Broadkasters ng Pilipinas, Department of Education, Bureau of Fire Protection, Philippine National Police, Philippine Coast Guard, City Veterinary Office, City ENR Office, and Social Action Center.

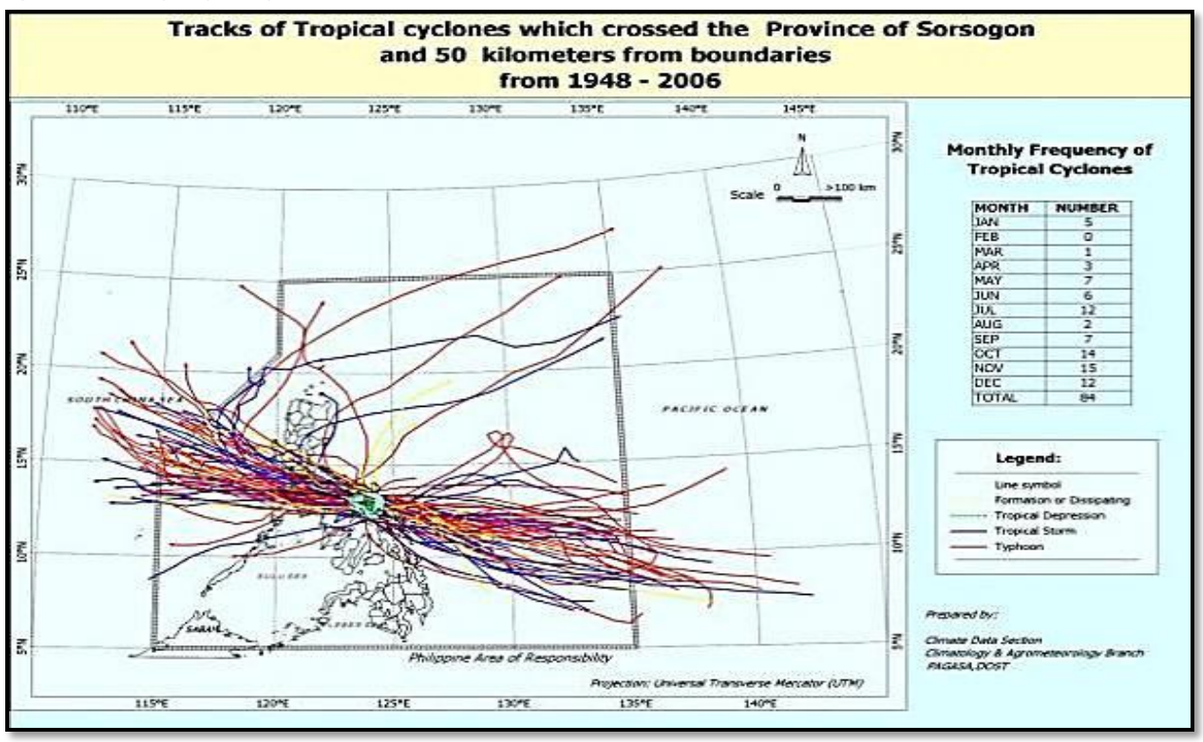
CHAPTER II. VULNERABILITY AND ADAPTATION ASSESSMENT RESULT

Climate Related Hazards and Its Impact to LGUs

Typhoons/Tropical Cyclones

The Philippines in general is visited by an average of 20 typhoons yearly. Sorsogon, based on national typologies, is regularly visited by at least 3 direct hits from typhoons every two years. The map in Figure 9, shows that in the period of almost 60 years we have been affected by 2 typhoons on the average every year. The green line stands for tropical depressions, the blue line is for tropical storms, while the red line represents typhoons. For the same period, we were directly hit by 33 typhoons. Most of the typhoons that directly hit the city were recorded during the last quarter of every year. These typhoons are stronger than the first to third quarter typhoons.

Figure 9: Tracks of Tropical Cyclones



Records show that Sorsogon City, due to previous events, is highly vulnerable to the impact of typhoons. Typhoons Milenyo (2006) and Glenda (2014), caused massive destruction in the city as reflected in Table 1.

Table 1: Typhoon damage assessment

	Milenyo (2006)	Glenda (2014)
Affected Families	27,101	
Totally Damaged houses	10,070	8,352
(estimated) Damage to Agriculture and Fisheries Sector	Php 234 Million	Php 394 Million
(estimated) Damage to Public Infrastructure and Utilities	Php 208 Million	Php 380 Million

Below is the list of recorded hydro-meteorological events that happened from 2006-2015 (Table 2).

Table 2: Hydro-meteorological Events from 2006-2015

Event Description	Area Affected	Impacts
TYPHOON MILENYO September 27, 2006	Whole Province	21 Dead, 37 injured PDH – 51,768 ; TDH – 19,717 27,101 Affected Families Php 234 Million (est) Agri- Damage Php 208 Million (est) Infra- Damage
TYPHOON REMING November 29, 2006	Whole Province	6 Dead, 18 Injured, 3 Missing Evacuated 277 fam/1,602 pax PDH – 19,690 ; TDH – 4,812
TYPHOON MINA Nov. 23 – Dec. 14, 2007	12 Municipalities, 68 Brgys	Evacuated 24,766 pax PDH – 92 ; TDH – 13 Agri- Damage – 4,819,417.96
HEAVY RAINFALL **(Cold Front)** February 27, 2008	12 Municipalities	Infra Damage – 20,635,350
TS ONDOY September 24-27, 2009	Sorsogon	Agri-Damage – 238,992
TYPHOON PEPING Sept. 30 – Oct. 3, 2009	Sorsogon	Evacuated 1,085fam/5,157pax
TYPHOON MINA November 2007	Sorsogon City	2,582 families/15,594 persons affected in various Evacuation Centers
TYPHOON DANTE May 2009	Sorsogon City	Php200Million (est) Agri- and Infra- Damage
TYPHOON BEBENG May 2011	Sorsogon City	860 families affected in various Evacuation Centers Rizal: 7 families affected by landslide
TYPHOON CHEDENG May 2011	Sorsogon City	3846 families affected in various Evacuation Centers
TYPHOON JUANING July 2011	Sorsogon City	486 families affected in various Evacuation Centers
TYPHOON PEDRING September 2011	Sorsogon City	459 families affected in various Evacuation Centers
TYPHOON GLENDA July 2014	Whole Province	8,352 Totally Damaged houses Php 394 Million (est) Agri-Damage Php 380 Million (est) Infra-Damage
TYPHOON RUBY December 2014	Whole Province	1.1 Million (est) Agri-Damage 1.2 Million (est) Infra-Damage
TYPHOON AMANG January 2015	Sorsogon City	14.4 Million (est) Infra-Damage 6.9 Million (est) Agri-Damage
TYPHOON CHEDENG April 2015	Sorsogon City	2,900 passengers stranded
TYPHOON DODONG May 2015	Sorsogon City	1,993 passengers stranded
TYPHOON NONA Dec 2015	Whole Province	2.8 Million (est) Infra-Damage 60 Million (est) Agri-Damage 10,282 families evacuated

Flood

Vulnerability to flooding can be influenced either by intense rainfall and/or sea level rise. Figure 10 cited the study conducted by Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA) PRECIS, the projected climate change scenarios for the Province of Sorsogon relative to rainfall for 2020 and 2050 using the A1B scenario of the IPCC. With the projected increase in rainfall, the City is continuously exposed to flooding events. Typhoon Dante, with Warning Signal No. 1, brought intense heavy rainfall in the City within a short period of time but caused major destruction in infrastructure and agriculture with an estimated worth of Php200Million.

Figure 10: PAGASA projection

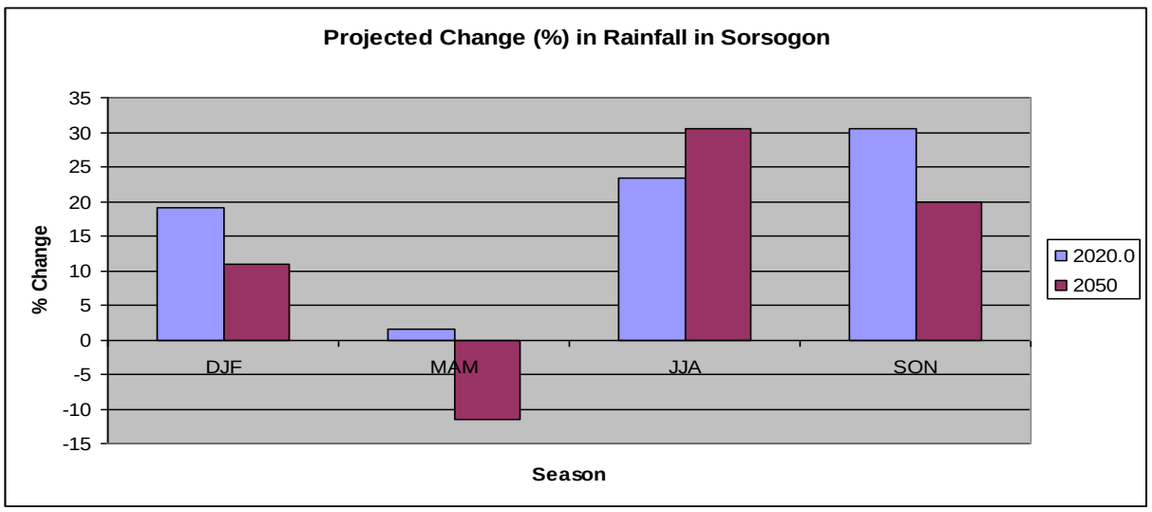


Figure 11 presents the sea level rise obeservations gathered by PINCCC in the five primary tidal gauge stations in the country including that in the Coast and Geodetic Survey Department (CGSD) of NAMRIA in Legaspi City, Albay. Given that Sorsogon City and Albay shares territory in Albay Gulf and faces the Pacific Ocean, sea level rise poses immense threat to almost all the barangays located in low-lying coastal areas, hence increasing the risk of many people to flooding as shown in Figure 12.

Figure 11: Amadore, 2005; PINCC

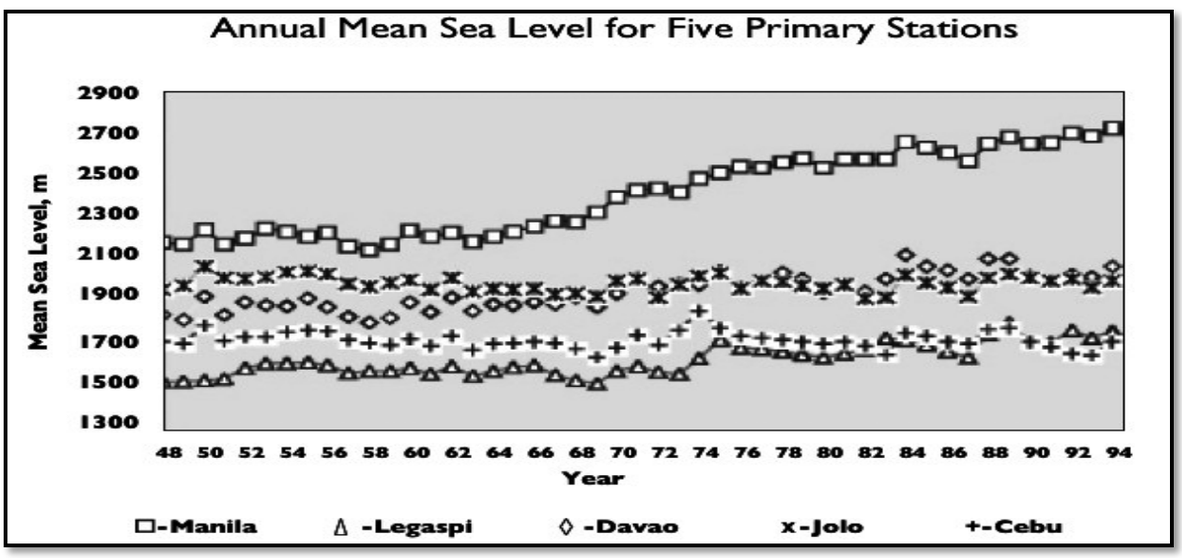
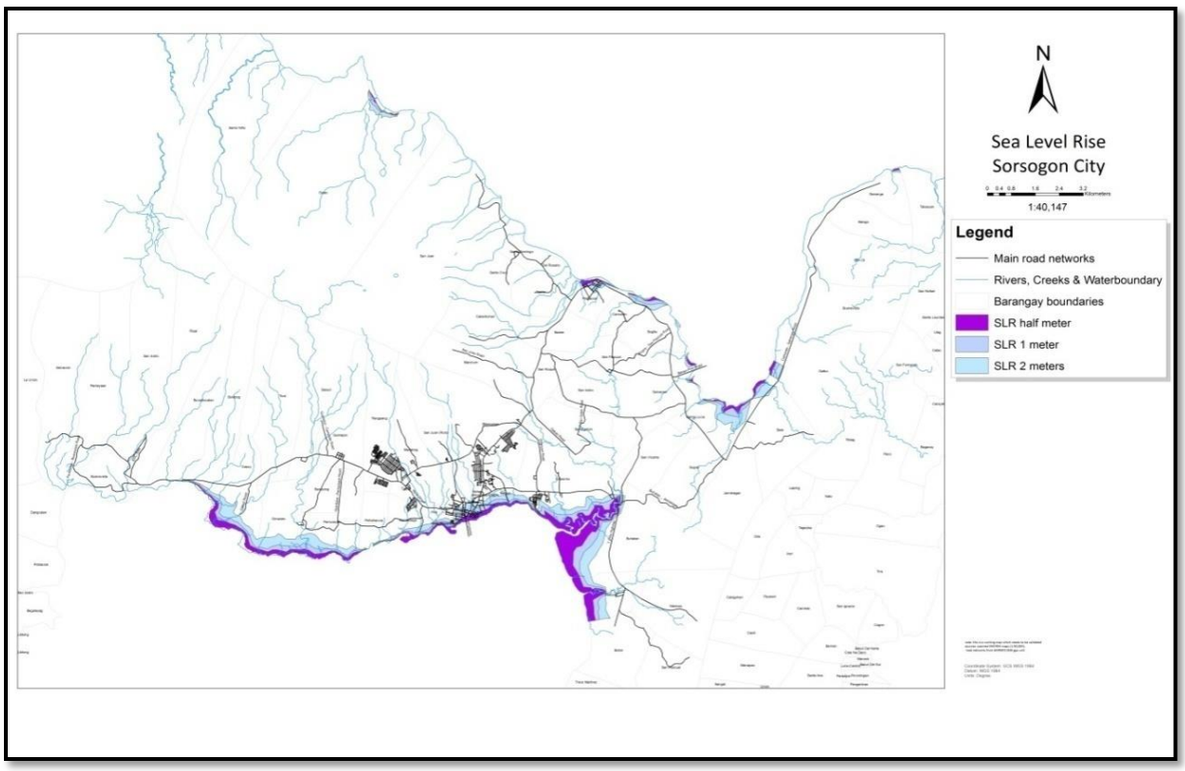


Figure 12: Map of Sea Level Rise (Source: CPDO)



Based from people's account, there are 9 barangays already affected by sea level rise shown in Table 3. Table 4 shows the list of flood-prone barangays in the City.

Table 3: Barangays Affected by Sea Level Rise (Source: CPDO)

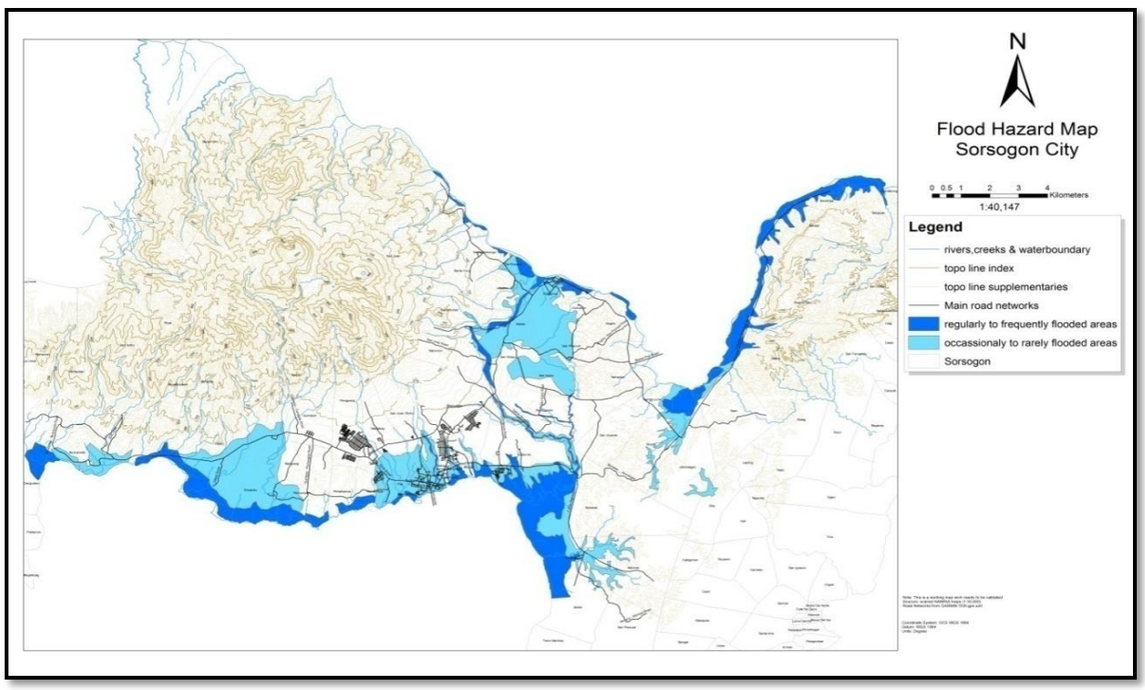
Name of Barangay/Village	Population	Land Area (has.)
Balogo	6,932	152.85
Bitan-O	3,240	19.20
Cabid-an	7,255	223.56
Cambulaga (urbanizing)	4,418	37.10
Piot	2,647	65.96
Sampaloc	4,719	12.58
Sirangan	2,595	4.96
Talisay	2,600	12.40
Poblacion	4,187	174.51
Total	38,593	703.12

Table 4: Barangays At Risk to Flooding (Source: CPDO)

HAZARD	AREA	
Flooding	**East/West Districts**	Population
	Basud	2,811
	Buhatan	3,395
	Burabod	2,867
	Capuy	2,561
	Gimaloto	1,050
	Salog	2,920
	Sirangan	2,595
	Talisay	2,600
	Sampaloc	5,214
	Piot	2,647
	Bitan-O	3,240
	Cambulaga	4,418
	Balogo	6,932
	Sulucan	523
	Bacon District	
	Poblacion	4,187
	Balete	2,684
	Buenavista	1,469
	Gatbo	2,494
	Osiao	3,174
	Sto. Niño	2,455

Below is the Flood Hazard Map of Sorsogon City, taking into consideration the barangay's topography and exposure to sea level rise.

Figure 13: Flood Hazard Map (Source: CPDO)



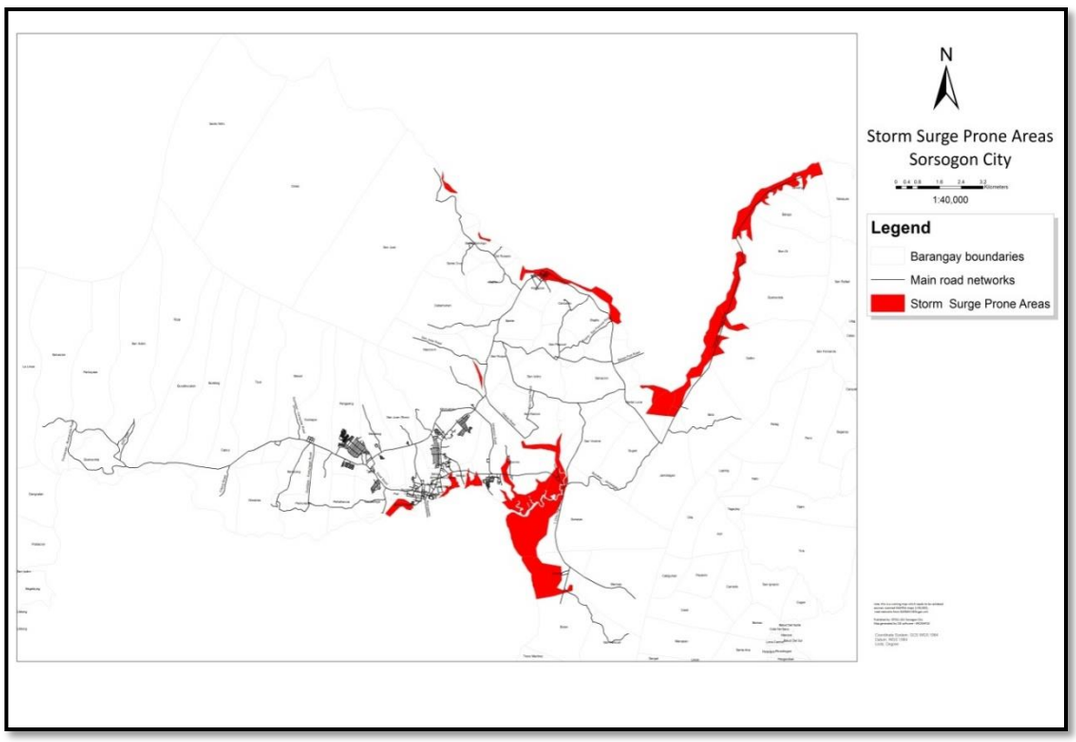
Storm Surge

The storm surge brought by Typhoon Sisang in November 1987 caused the death of more than 700 people in Sorsogon. With the City's geographical location, the 34 coastal barangays shown in Table 5 remains to be highly at risk to storm surges.

Table 5: List of Coastal Barangays affected by Storm Surge (source: CPDO)

EAST/WEST DISTRICT Coastal Areas		BACON DISTRICT Coastal Areas	
Barangay	**Population**	**Barangay**	**Population**
1. Abuyog	4,359	1. Bato	1,756
2. Balogo	6,932	2. Bogna	1,413
3. Bitan-o-Dalipay	3,240	3. Bon-ot	623
4. Bucalbucalan	2,533	4. Buenavista	1,469
5. Buenavista	1,736	5. Caricaran	2,371
6. Bulabog	2,443	6. Gatbo	2,494
7. Buhatan	3,395	7. Del Rosario	950
8. Cabid-an	7,255	8. Osiao	3,174
9. Cambulaga	4,418	9. Poblacion	4,187
10. Capuy	2,561	10. Rawis	1,354
11. Gimaloto	1,050	11. Salvacion	1,308
12. Pamurayan	1,966	12. Sta. Lucia	481
13. Penafrancia	1,763	13. Sto. Domingo	1,300
14. Piot	2,647	14. Sto. Nino	2,455
15. Rizal	3,645	15. Sawanga	1,533
16. Sampaloc	4,719	16. Sugod	2,148
17. Sirangan	2,595	---	
18. Talisay	2,600	---	
TOTAL	**59,857**	**TOTAL**	**29,016**

Figure 14: Map of Strom Surge Prone Areas (Source: CPDO)



Landslide

Incessant intense rainfall and/or earthquake can trigger soil erosion, mass movement or landslide. In 2009, Barangays Osiao and Sto. Niño in Bacon District, after a nonstop heavy rainfall brought by a Tropical Depression, caused massive soil erosion in the area.

Figure 15: Map of Landslide Prone Areas (Source: CPDO)

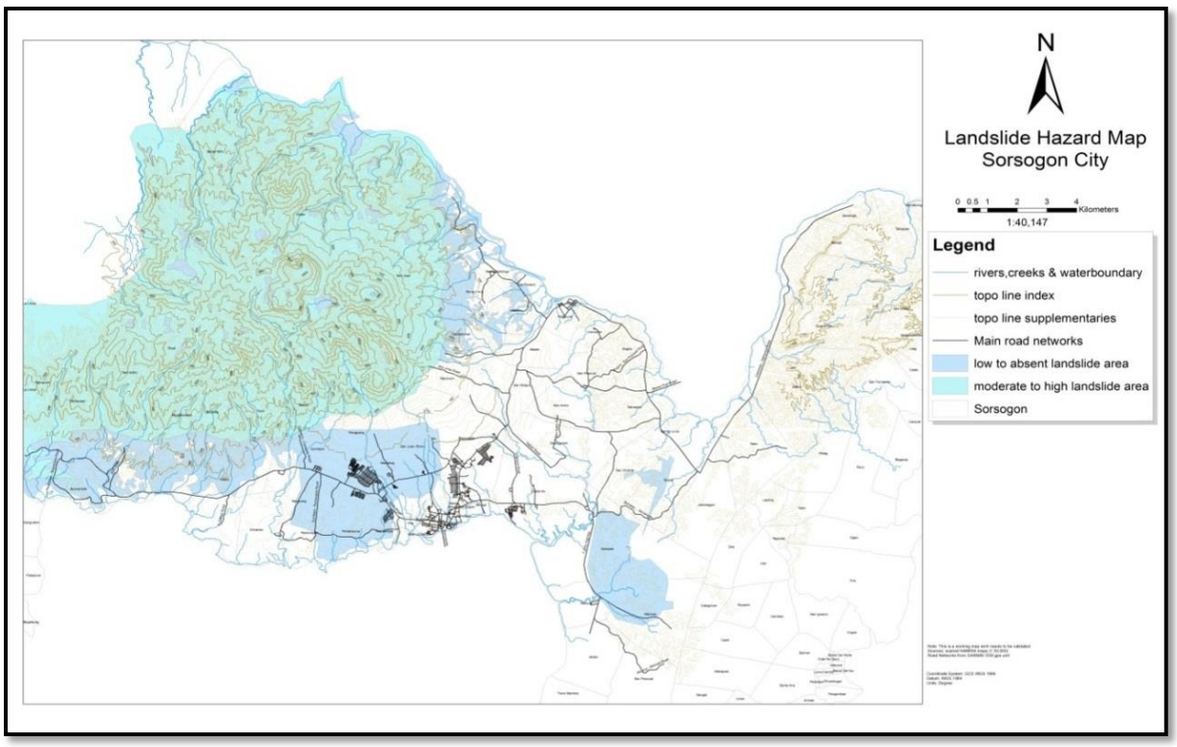


Table 6 shows the list of landslide-prone barangays in the City.

Table 6: Landslide-prone Barangays (Source: CPDO)

Hazard	Area	Total Population (2007)
Landslides	Osiao	3,174
	Sto. Niño	2,455
	Salvacion	787
	Panlayaan	1,524
	San Isidro	1,563
	Rizal	3,645
	Buenavista	1,736
	Bucalbucalan	2,533

Summary and Findings of Climate Change Vulnerability and Adaptation Assessment

Briefly, there are three (3) major causes of the vulnerability of Sorsogon City to Climate Change. The first inescapable cause is the fact that climate change is global in nature and character. Climate change affects and impacts every nation and based from scientific projections island nations, is at the highest risk to climate induced hazards. The next one is the probability and sensitivity. Sorsogon City is a coastal city directly facing the west Pacific Ocean basin where 75%

of world's typhoons originate, and as such, the City is very likely to be impacted by climate change hazards or stimuli, and the degree of the impact is very severe and severe as shown in Tables 7, 8 and 9. Lastly, the first two (2) causes are further exacerbated by socio-economic condition. The social condition of people in the City is a very critical factor because it greatly influences how people could possibly adjust or adapt to climate change impacts. Poverty defines the social condition of people. Poverty incidence of the Province which includes the City is placed at 41.3% according to the latest PSA report.

In 2007, according to the participatory climate change vulnerability and adaptation assessment (V&AA) initiated by UNHABITAT, the poverty incidence of the City was 43%. According to the same assessment, "the people's poverty situation is closely linked to the vulnerability of the City to natural hazards." Poverty therefore exacerbates the City's vulnerability to both natural and climate-induced hazards.

From the V&AA conducted in 2007, the different climate-related/induced hazards and risks to which the entire City is exposed were identified. Arranged according to risk ratings (Tables 7-9) recently updated by the LCCAP core team of the City, they are: increased rainfall, typhoon and sea level rise. Increased rainfall breeds flooding, landslide and erosion. The resultant hazards from typhoon are flooding, storm surge and strong wind. From sea level rise (SLR), permanent flooding and salinization were the identified resultant climate-induced hazards.

The findings of the V&AA that the City is exposed to flooding and storm surge are validated by the latest geo-hazards maps provided by MGB-DENR. Besides, the same maps added other geologic hazards like liquefaction and ground subsidence, occurrence of which is very likely when triggered by climate hazards and risks. The tsunami hazard map from PHIVOLCS confirmed that the City is at risk not only to flooding and storm surge, but also to tsunami most likely to hit the 14 coastal barangays of the City as shown in Figure 16 below.

Figure 16: Map of Tsunami Prone Areas (Source: CPDO)

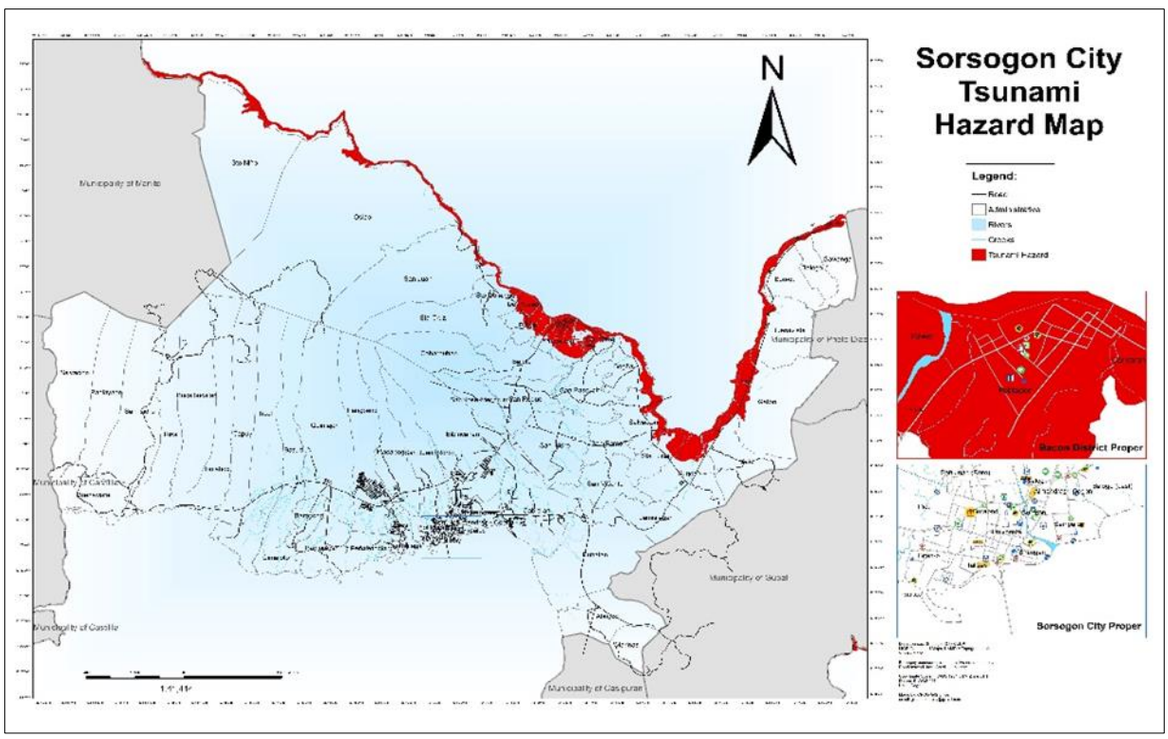


Figure 17: Map of Liquefaction Prone Areas (Source: CPDO)

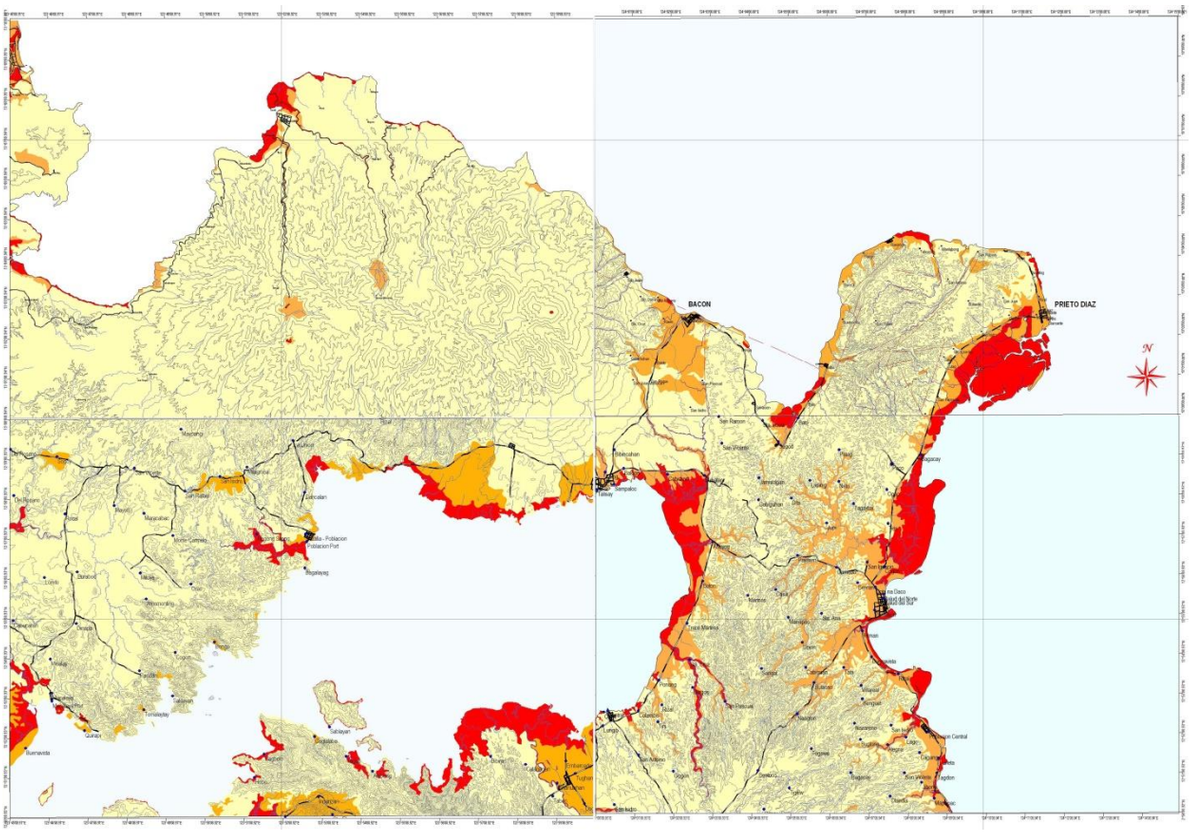
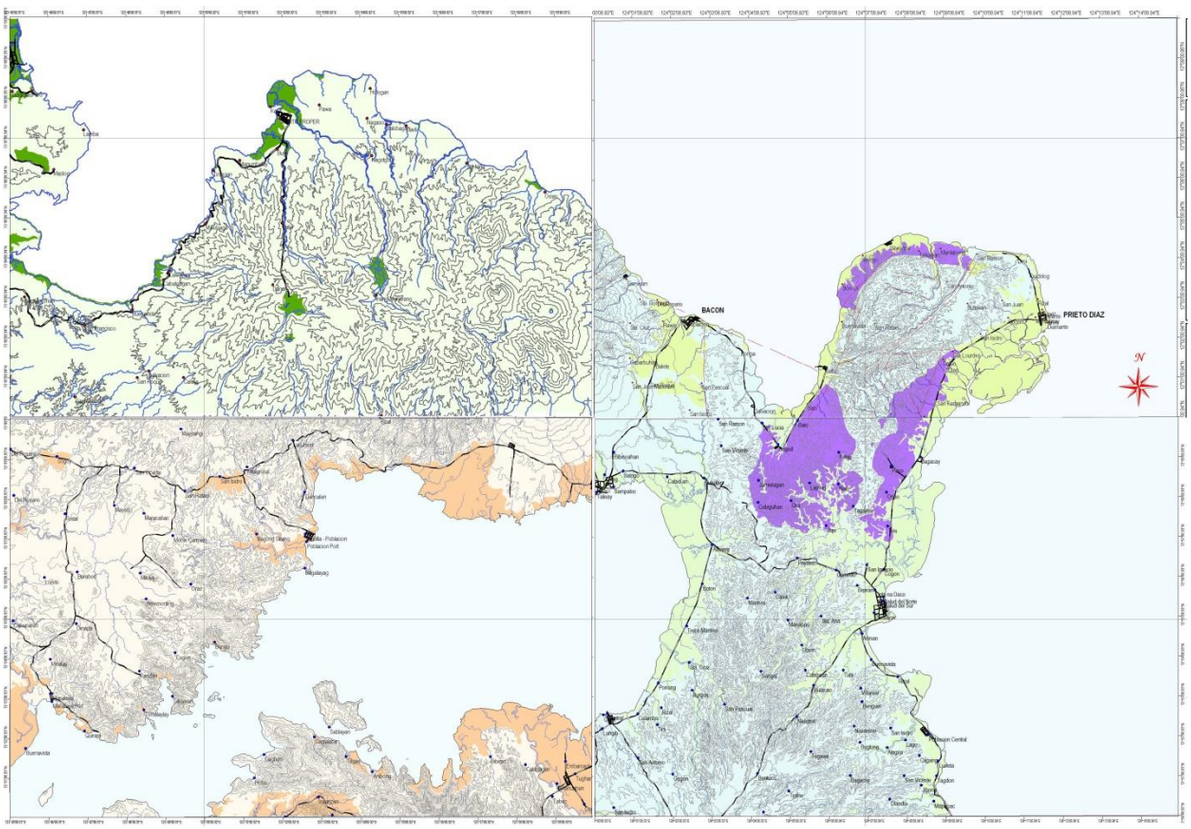


Figure 18: Map of Liquefaction Prone Areas (Source: CPDO)



Used as bases in the formulation of this Plan are the identified climate related/induced hazards resulting from the four (4) climate variables with their corresponding changes and projected impacts based from PAGASA climate projections together with the different climate hazards and risk appearing in the V&AA.

The PAGASA climate projections lent credence to the V&AA of the City. Except for extreme events triggered by increased number of warmer or hotter days having a temperature greater than 35°C and increasing number of days with less than 2.5mm rain, all other findings of V&AA Sorsogon City are consistent with that of PAGASA.

Climate Risk Analysis

FACTORS TO CONSIDER	VARIABLES	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
Annual weather systems	Habagat												
	Thunderstorms												
	Amihan												
Usual climate related impact	Farm flooding and intense rainfall												
	Strong winds												
	Drought / Dry Spell												
	Pest Infestations												
Local agri activities that may be affected	Rice	DRY SEASON					WET SEASON						
	Coconut												
	Pili												
	Vegetables												
	Livestock and Poultry												
	Fresh Water												
	Brackish water												
	Seawater (Bacon) - (Mariculture)												
	Sea water (Sorsogon Bay)												
Climate related risks	Rice and other crops	Typhoon destroys standing crops during flowering and ripening stage especially if varieties are susceptible to lodging											
	Coconut												
	Pili												
	Vegetables												
	Livestock and Poultry	Sudden change of weather condition affect the productivity of animal breeding and new diseases emerge											
	Fresh water												
	Brackish water	During dry spell - culture species are affected											
	Sea water (Bacon - Mariculture)												
	Seawater (Sorsogon Bay)	Long dry spell and then sudden fall of heavy rain can cause algal bloom (may result to red tide)											

III. LCCAP OBJECTIVES

Goal:

The National Climate Change Action Plan 2011-2028 is the anchor of the Local Climate Change Action Plan (2017-2021) of Sorsogon City following the ultimate goal stated as *"to build to adaptive capacities of women and men in their communities, increase the resilience of the vulnerable sectors and natural ecosystems to climate change, and optimize mitigation opportunities towards gender-responsive and rights-based sustainable development".*

The specific objectives to be pursued per sector are as follows:

SOCIAL SECTOR (HEALTH and EDUCATION)

1. To introduce climate-resilient health programs;
2. To strengthen educational capacities of local communities

ECONOMIC SECTOR (AGRICULTURE AND TOURISM)

1. To strengthen livelihood opportunities;
2. To increase food production;
3. To protect prime agricultural lands.

INFRASTRUCTURE AND LAND USE SECTOR

1. To protect the coastal communities against coastal flooding

ENVIRONMENT SECTOR (FORESTRY, BIODIVERSITY, ENERGY)

1. To lessen greenhouse gas emission;
2. To minimize biodiversity degradation;
3. To protect and enhance environmental assets.

INSTITUTIONAL SECTOR (PEACE AND ORDER AND DRR)

1. To protect the coastal communities against coastal flooding and storm surges;
2. Minimize disaster impact to people and damage to physical development.

IV. ADAPTATION OPTIONS

To align this Plan to the National Climate Change Action Plan (NCCAP), the priority actions appearing the NCCAP provided guidance in the identification of appropriate adaptation and mitigation measures. Consistent with the rationalized planning system prescribed by DILG at all LGU levels, the traditional development sectors including the different program areas/systems in local governance were also made reference in the identification of applicable and implementable adaptation and mitigation actions and initiatives reflected in the following Plan.

LCCAP for Extreme Weather Events

Climate Variable	Changes in Climate Variable	Develop-ment Sector	Systems / Program Area	Effect	Impact	Adaptation/ Mitigation Activity	NCCAP Priority Responded	O/P Respon-sible	Funding Require-ment	Timeline of Implementation				
										2017	2018	2019	2020	2021
Extreme weather events	**INCREASE / LONGER DRY SEASON**	Environ-mental Develop-ment	Climate resilience design	Hotter days	Increased demand for natural ventilation of residential houses	Where space allows, promote greening of residential surroundings (Urban greening)	Ecological and Environmental Stability	CENRO	₱ 640,000.00					
	INCREASE / LONGER DRY SEASON	Environ-mental Develop-ment			Drying/dying of urban and open space carbon sinks	Conduct landscaping/greening of public parking areas/spaces	Ecological and Environmental Stability	CENRO	₱ 1,600,000.00					

Climate Variable	Changes in Climate Variable	Develop-ment Sector	Systems / Program Area	Effect	Impact	Adaptation/ Mitigation Activity	NCCAP Priority Responded	O/P Respon-sible	Funding Require-ment	Timeline of Implementation				
										2017	2018	2019	2020	2021
Extreme weather events	**INCREASE/ LONGER DRY SEASON**	Institutional Development			Decresed engine efficiency due to high atmospheric temperature (over-heating of engines)	Enact and implement an Ordinance encouraging the use of coolant additive for gasoline and diesel engines or increasing the engine radiator's water capacity to improve cooling system; promotion of electronic vehicles (E-bike and E-jeepney)	Ecological and Environmental Stability	SP & CENRO						
Climate Variable	**Changes in Climate Variable**	**Develop-ment Sector**	**Systems / Program Area**	**Effect**	**Impact**	**Adaptation/ Mitigation Activity**	**NCCAP Priority Responded**	**O/P Respon-sible**	**Funding Require-ment**	**Timeline of Implementation**				

										2017	2018	2019	2020	2021
Extreme weather events		Institutional Development	local legislation			Enact and implement an Ordinance encouraging families/households to install solar-powered lighting system for economy and reduction on reliance to fossil generated electric power	Sustainable Energy	SP & LCE	₱ 100,000.00					
Extreme weather events	**LONGER PERIOD/INTENSE RAIN FALL**	Infrastructure Development		Weather system in terms of heavier precipitation/ more intense rains	Flooding of floodplains and coastal inundation affecting communities, structures, livelihood and basic services	Modify/retrofit in floodplains and coastal barangays local critical infrastructures to withstand floods and for coastal inundation	Human Security	CEO	₱ 3,000,000.00					
			local planning		More frequent and severe floodings	Formulate Contingency Plan for severe and frequent flooding	Human Security	CDRRMO	₱ 50,000.00					

Climate Variable	Changes in Climate Variable	Develop-ment Sector	Systems / Program Area	Effect	Impact	Adaptation/ Mitigation Activity	NCCAP Priority Responded	O/P Respon-sible	Funding Require-ment	Timeline of Implementation				
										2017	2018	2019	2020	2021
Extreme weather events		Infrastructure Development	community awareness		Flooding/ landslides/ground subsidence/ mudflow	Conduct dredging of natural waterways and construction of additional drainage canals	Ecological and Environmental Stability	CEO	₱ 2,000,000.00					
Extreme weather events		Environmental Development	local legislation			Organize the City Solid Waste Management Board through EO or SP Resolution	Ecological and Environmental Stability	SP & LCE	₱ 30,000.00					
Extreme weather events		Environmental Development	Enforcement of Law			Develop and implement Solid Waste Management Plan (RA 9003)	Ecological and Environmental Stability	CENRO	₱ 500,000.00					
Extreme weather events		Environmental Development				Implement the Material Recovery Facility (MRF) program especially in floodplain barangays	Ecological and Environmental Stability	CENRO	₱ 100,000.00					

Climate Variable	Changes in Climate Variable	Develop-ment Sector	Systems / Program Area	Effect	Impact	Adaptation/ Mitigation Activity	NCCAP Priority Responded	O/P Respon-sible	Funding Require-ment	Timeline of Implementation				
										2017	2018	2019	2020	2021
Extreme weather events		Social Development	local planning			Provide standby motorized bancas for emergency evacuation of residents located in seasonally flooded barangays	Human Security	CDRRMO	₱ 1,920,000.00					
Extreme weather events		Social Development				Install Automatic Rain Gauges (ARG)/water level sensors in flood prone barangays and conduct community IEC on ARGs in coordination with DOST;	Human Security and climate friendly service	CDRRMO	₱ 20,000.00					
Extreme weather events					Damage to lives and Properties	Installation of Tsunami sensor at the Bacon area	Human Security and climate friendly service	CDRRMO	₱ 500,000.00					

Climate Variable	Changes in Climate Variable	Develop-ment Sector	Systems / Program Area	Effect	Impact	Adaptation/ Mitigation Activity	NCCAP Priority Responded	O/P Respon-sible	Funding Require-ment	Timeline of Implementation				
										2017	2018	2019	2020	2021
Extreme weather events		Institutional Development				Integrate flood prevention and mitigation measures in all local development plans such as CLUP, CDP, Tourism Plan, Solid Waste Management Plan, Health Plan, Education Plan, ELA, etc.	Human Security	CDRRMC	₱ 300,000.00					
Extreme weather events		Infrastructure Development				Institutionalize non-structural and structural mitigation measures like reforestation, riverbank stabilization and construction of concrete barriers	Ecological and Environmental Stability	CENRO & CEO	₱ 500,000.00					

Climate Variable	Changes in Climate Variable	Develop-ment Sector	Systems / Program Area	Effect	Impact	Adaptation/ Mitigation Activity	NCCAP Priority Responded	O/P Respon-sible	Funding Require-ment	Timeline of Implementation				
										2017	2018	2019	2020	2021
Extreme weather events		Institutional Development	Community empowerment			Conduct community quarterly river and creek clean up activities	Ecological and Environmental Stability	CDRRMC	₱ 50,000.00					
Extreme weather events		Institutional Development	local legislation		Human settlements located in geoologically hazardous are most likely to be affected by heavier and more intense rains	Pass and implement an Ordinance prohibiting settlements in all areas identified by MGB-DENR as geologically hazardous based from latest geo-hazard maps	Human Security	SP & LCE	₱ 20,000.00					
Extreme weather events		Economic Development				Clearing of distribution lines; Ensure power reliability and sustainability		SORECO	₱ 50,000.00					
Climate Variable	**Changes in Climate Variable**	**Develop-ment Sector**	**Systems / Program Area**	**Effect**	**Impact**	**Adaptation/ Mitigation Activity**	**NCCAP Priority Responded**	**O/P Respon-sible**	**Funding Require-ment**	**Timeline of Implementation**				

										2017	2018	2019	2020	2021
Extreme weather events		Social Development	Security Planning		Increase in the the number of robbery and theft incidents	Deployment of sufficient number of PNP personnel at affected areas to maintain peace and order		PNP	₱ 100,000.00					
Extreme weather events		Infrastructure Development	local planning			Construct/reconstruct damaged public buildings considering the capacity of buildings to withstand wind load, gustiness and velocity (under worst case scenario)	Human Security	CEO	₱ 5,000,000.00					
Extreme weather events		Infrastructure Development				Construct all weather Learning and Public Use School buildings (LAPUS)	Human Security	DepEd	₱ 25,000,000.00					
Climate Variable	**Changes in Climate Variable**	**Develop-ment Sector**	**Systems / Program Area**	**Effect**	**Impact**	**Adaptation/ Mitigation Activity**	**NCCAP Priority Responded**	**O/P Respon-sible**	**Funding Require-ment**	**Timeline of Implementation**				

										2017	2018	2019	2020	2021
Extreme weather events		Social Development				Ensure that Barangay Emergency Response Teams are able to respond timely and effectively; regular simulation exercises/drills	Human Security	CDRRMO	₱ 10,000.00					
Extreme weather events		Social Development				Develop Emergency Response Manual to ensure that all response activities are done with coordination, effectiveness and timeliness	Human Security	CDRRMO	₱ 50,000.00					
Extreme weather events		Infrastructure Development	Agriculture			Provide safe evacuation area for livestocks and poulty	Food Security	CAO	₱ 3,000,000.00					
Climate Variable	**Changes in Climate Variable**	**Develop-ment Sector**	**Systems / Program Area**	**Effect**	**Impact**	**Adaptation/ Mitigation Activity**	**NCCAP Priority Responded**	**O/P Respon-sible**	**Funding Require-ment**	**Timeline of Implementation**				
										2017	2018	2019	2020	2021

Extreme weather events		Institutional Development				Conduct orientation training on Typhoon Tracking in coordination with PAGASA-DOST, and on basic Incident Command System (ICS) in coordination with OCD5 for BDRRMC members	Knowledge and Capacity Development	CDRRMO	₱ 50,000.00					
Extreme weather events		Institutional Development	local planning		Higher storm surges and stronger water current	Develop and implement Storm Surge Contingency Plan for coastal barangays	Human Securiy	CDRRMO	₱ 30,000.00					
Extreme weather events		Institutional Development				Develop and implement Integrated Coastal Management Plan 'Ridge to Reef' through an ordinance	Ecological and Environmental Stability	CENRO	₱ 30,000.00					
Climate Variable	**Changes in Climate Variable**	**Develop-ment Sector**	**Systems / Program Area**	**Effect**	**Impact**	**Adaptation/ Mitigation Activity**	**NCCAP Priority Responded**	**O/P Respon-sible**	**Funding Require-ment**	**Timeline of Implementation**				
										2017	2018	2019	2020	2021

Extreme weather events		Institutional Development		Prolonged drought / Dry Spells (El Niño)	Scarcity of water for household and agricultural purposes	Develop and implement Water Conservation Plan	Human Security and water sufficiency	CAO	₱ 30,000.00					
Extreme weather events		Economic Development	Agriculture		Threat to Food Security	To ensure food sufficirency, start planting Adlai Seed (Coix seed), a grain bearing tropical drought resistant plant that can be a substitute to rice and corn and other indigenous crops (namo, uraro, galiang, ube, burot, baribaran, rimas)	Food Security	CAO	₱ 50,000.00					
Climate Variable	**Changes in Climate Variable**	**Develop-ment Sector**	**Systems / Program Area**	**Effect**	**Impact**	**Adaptation/ Mitigation Activity**	**NCCAP Priority Responded**	**O/P Respon-sible**	**Funding Require-ment**	**Timeline of Implementation**				
										2017	2018	2019	2020	2021

Extreme weather events		Economic Development	Agriculture		Threat to traditional rice varieties	Start planting Less water/drought, dry seeded varietiesch as PSB Rc16; PSB Rc24; PSB Rc70; UPL Ri7 § UPL RI5	Food Security	CAO	₱ 1,000,000.00					
Extreme weather events		Economic Development	Agriculture			Encourage planting of a drought resistant fruit, the dragon fruit	Food Security	CAO	₱ 50,000.00					
Extreme weather events		Economic Development				To promote water holding capacity of the soil, promote organic farming aside from the potential of organic farming to reduce GHG emission	Food Security	CAO	₱ 100,000.00					
Climate Variable	**Changes in Climate Variable**	**Develop-ment Sector**	**Systems / Program Area**	**Effect**	**Impact**	**Adaptation/ Mitigation Activity**	**NCCAP Priority Responded**	**O/P Respon-sible**	**Funding Require-ment**	**Timeline of Implementation**				
										2017	2018	2019	2020	2021

Extreme weather events		Economic Development	Agriculture			In coordination with DA, conduct training on verminculture for farmers for production of organic fertilizer	Knowledge and capacity development	CAO	₱ 50,000.00					
Extreme weather events		Economic Development				To beat the scarcity of water for agriculture, encourage farmers to shift to the production of HVCs requiring shorter production cycle in barangays where prolonged dry spell is regularly observed	Food Security	CAO	₱ 1,500,000.00					
Climate Variable	**Changes in Climate Variable**	**Develop-ment Sector**	**Systems / Program Area**	**Effect**	**Impact**	**Adaptation/ Mitigation Activity**	**NCCAP Priority Responded**	**O/P Respon-sible**	**Funding Require-ment**	**Timeline of Implementation**				
										2017	2018	2019	2020	2021

Extreme weather events		Institutional Development	Agriculture			Enrol farmers to participate in the Climate Resciliency Field School (CRFS)	Knowledge and capacity development	CAO	₱ 50,000.00					
Extreme weather events		Economic Development				Plant early maturing rice varieties or plant crops requiring less water	Food Security	CAO	₱ 1,500,000.00					
Extreme weather events		Institutional Development	Agriculture			Devrlop and implement Integrated Pest Management Program for agriculture sector	Food Security	CAO	₱ 1,000,000.00					
Climate Variable	**Changes in Climate Variable**	**Develop-ment Sector**	**Systems / Program Area**	**Effect**	**Impact**	**Adaptation/ Mitigation Activity**	**NCCAP Priority Responded**	**O/P Respon-sible**	**Funding Require-ment**	**Timeline of Implementation**				
										2017	2018	2019	2020	2021
Extreme weather events		Institutional Development	local legislation		Threat to Water Sufficiency	City Ordinance requiring business establishments not covered by local water district to present water	Water Sufficiency	SP	₱ 30,000.00					

						rights certificates prior to the application or renewal of business permits								
Extreme weather events		Institutional Development				Integrate drought mitigation and adaptation measures in the CDP and Annual Investment Program	Food and Human Security	CDRRMC	₱ 30,000.00					
Climate Variable	**Changes in Climate Variable**	**Development Sector**	**Systems / Program Area**	**Effect**	**Impact**	**Adaptation/ Mitigation Activity**	**NCCAP Priority Responded**	**O/P Responsible**	**Funding Requirement**	**Timeline of Implementation**				
										2017	2018	2019	2020	2021
Extreme weather events		Institutional Development			Heatwaves to impact vulnerable population, poultry and livestock	Implementation of special social services to the elderly under RA9994 to PWDs under RA1995 including children/special children and women	Human Security	CSWD	₱ 2,000,000.00					

Extreme weather events		Economic Development			Animals	Propagation of heat resilient livestock like cows/other animal breeds resilient to intense heat	Human Security	CAO	₱ 1,500,000.00					
Extreme weather events		Institutional Development	Livelihood		Farmers income	Organize farmers into marketing cooperatives for a better return of farming investment	Human Security	CAO	₱ 100,000.00					
Climate Variable	**Changes in Climate Variable**	**Develop-ment Sector**	**Systems / Program Area**	**Effect**	**Impact**	**Adaptation/ Mitigation Activity**	**NCCAP Priority Responded**	**O/P Respon-sible**	**Funding Require-ment**	**Timeline of Implementation**				
										2017	2018	2019	2020	2021
Extreme weather events		Social Development			Continuity of education among the poor	Enact and implement an Ordinance granting special scholarship program for the poor but deserving children of farming households living below poverty threshold per PSA standards,	Human Security	SP & LCE	₱ 1,000,000.00					

						giving priority to the hotspots barangays								
Extreme weather events		Social Development			Food price increase	For highly vulnerable farmers and fisher folk, provide off-farm employment or other livelihood activities where possible	Food and Human Security	CESO	₱ 3,000,000.00					
Climate Variable	**Changes in Climate Variable**	**Develop-ment Sector**	**Systems / Program Area**	**Effect**	**Impact**	**Adaptation/ Mitigation Activity**	**NCCAP Priority Responded**	**O/P Respon-sible**	**Funding Require-ment**	**Timeline of Implementation**				
										2017	2018	2019	2020	2021
Extreme weather events		Social Development			Consumption and expense	Reduce consumption of non-food items and avoidance of vices and unnecessary expenditures and teaching	Food and Human Security	CAO	₱ 20,000.00					

						people the basics of home economics								
Extreme weather events		Social Development	Human Health		Health and education services among the farming and fishing communities		Human Security	CSWDO						
									₱ 121,460,000.00					

LCCAP for Rainfall

Climate Variable	Changes in Climate Variable	Develop-ment Sector	Systems/ Program Area	Effect	Impact	Adaptation/ Mitigation Activity	NCCAP Priority Responded	O/P Respon-sible	Funding Require-ment	Timeline of Implementation				
										2017	2018	2019	2020	2021
Rainfall	Decreased Seasonal Rainfall	Econo-mic Develop-ment		Drought	Lack 0f supply of potable water	Desalination - processing of salt water into freshwater	potable water sufficiency	SCWD	10 M					10M
Rainfall				Drought	Lack 0f supply of potable water	Bio sand filter installation	potable water sufficiency	LGU/ SCWD						
Rainfall		Economi c Develop ment		Drought	decline in water supply	Passage of a Muncipal Ordinace regulating extraction of ground water for irrigation or industrial purposes	Water suffiency	SP						
Rainfall		Economi c Develop ment				Implement Small Water Impounding Project (SWIP)	water sufficiency	MAO						
Rainfall						Small farm reservoir			750,000	250,000	250,000	250,000	250,000	250,000
Climate Variable	**Changes in Climate Variable**	**Develop-ment Sector**	**Systems/ Program Area**	**Effect**	**Impact**	**Adaptation/ Mitigation Activity**	**NCCAP Priority Responded**	**O/P Respon-sible**	**Funding Require-ment**	**Timeline of Implementation**				
										2017	2018	2019	2020	2021

Rainfall						Rehab and improve existing irrigation facilities	water sufficiency		50M	10	10	10	10	10M
Rainfall						Rain harvesting by installing rain collectors	agriculture and household							
Rainfall		Environmental Development			Watershed instability	Implement Upland Reforestation Program	Ecological and Environmental Stability	MENRO						
Rainfall		Institutional Development				Irrigation (water) rationing for agriculture during drought period	Food Security	MAO						
Rainfall		Institutional Development				Organize community-based water associations to manage water supply and local water resources	Water Sufficiency	CSWDO						
Climate Variable	**Changes in Climate Variable**	**Development Sector**	**Systems/ Program Area**	**Effect**	**Impact**	**Adaptation/ Mitigation Activity**	**NCCAP Priority Responded**	**O/P Responsible**	**Funding Requirement**	**Timeline of Implementation**				
										2017	2018	2019	2020	2021

Rainfall		Institutional Development				Passage of an Ordinace regulating and imposing fees for abstraction of ground water for domestic, commercial, livestock, recreational, irrigation or industrial purposes pursuant to PD 1067	Water Sufficiency	CDRRMC						
Rainfall		Environmental Development			Forest and grassland fires most likely to occur during dry season	Develop and implement forest fire prevention program	Ecological and environmental stability	CENRO						
Rainfall		Institutional Development				Document, share and institutionalize good Climate Change practices especially on water conservation	Knowledge and capacity development	CDRRMO						
Climate Variable	**Changes in Climate Variable**	**Development Sector**	**Systems/ Program Area**	**Effect**	**Impact**	**Adaptation/ Mitigation Activity**	**NCCAP Priority Responded**	**O/P Responsible**	**Funding Requirement**	**Timeline of Implementation**				
										2017	2018	2019	2020	2021

Rainfall		Institutional Development				Conduct orientation training on the mainstreaming of CCA in barangay development plans	Knowledge and capacity development	MDRRMO						
Rainfall		Institutional Development			Need to generate collective support to climate change related PPAs from LGU officials and employees	Conduct orientation training on climate change for LGU officials and employees	Knowledge and capacity development	MDRRMO						
Rainfall		Economic Development				Conduct regular monitoring of precipitation projections released by PAGASA to help farmers adjust planting calendar	Water Sufficiency for Agriculture	CAO						
Climate Variable	**Changes in Climate Variable**	**Development Sector**	**Systems/ Program Area**	**Effect**	**Impact**	**Adaptation/ Mitigation Activity**	**NCCAP Priority Responded**	**O/P Responsible**	**Funding Requirement**	**Timeline of Implementation**				
										2017	2018	2019	2020	2021
Rainfall		Economic Develop				Promote direct rice seeding technology	Food Security	MAO						

		ment												
Rainfall						In partnership with DOST, provide farmers with multi-scale climate forecasts for shiftings of planting dates	Food Security	MAO						
Rainfall		Economic Development				Develop and implement crop insurance program for vulnerable farmers	Food Security	MAO						
Rainfall		Social Development			Pressure on food sufficiency, availability and distriction due to rapid population growth	Implement Responsible Parenthood Programs and RP RH Law	Human and Food Security	CHO						
Climate Variable	**Changes in Climate Variable**	**Develop-ment Sector**	**Systems/ Program Area**	**Effect**	**Impact**	**Adaptation/ Mitigation Activity**	**NCCAP Priority Responded**	**O/P Respon-sible**	**Funding Require-ment**	**Timeline of Implementation**				
										2017	2018	2019	2020	2021
Rainfall	**Increased Seasonal Rainfall**	Economic Development		Frequent and intense Flooding	Damage to agricultural crops	Plant flood resistant rice varieties or crops resitant to flooding	Food Security	MAO						

Rainfall					Rice varieties adaptable to excessive rain water and flooding	IR 64; Rc18; PSB Rc 76H; and IR 42	Food Security	MAO						
Rainfall		Economic Development			Reduced agricultural production	implement climate smart agriculture program ,/climate resiliency field school including organic agriculture	Food Security	MAO						
Rainfall		Institutional Development			Need of farming and fishing communities to be educated on climate change	Establish farmers' and fisher folk field school to demonstration best climate adaptation practices	Knowledge and capacity development	MAO						
Climate Variable	**Changes in Climate Variable**	**Develop-ment Sector**	**Systems/ Program Area**	**Effect**	**Impact**	**Adaptation/ Mitigation Activity**	**NCCAP Priority Responded**	**O/P Respon-sible**	**Funding Require-ment**	**Timeline of Implementation**				
										2017	2018	2019	2020	2021
Rainfall		Economic Development			Decrease in availability of forage and pasture	Practice silage making	Livestock food security	MAO/Vet						

Rainfall		Institutional Development			provision of alternative source of livelihood	Capability skills training other than fishing and farming	Knowledge and Capacity Developmentg	LGU & other agencies						
Rainfall		Economic Development			Provision of sustained assistance in all possible forms to cushion heavy impacts of climate related hazards	Provide extension service and agricultural support to farming and fishing communities most likely vulnerable to climate change hazards	Knowledge and capacity development	MAO						
Climate Variable	**Changes in Climate Variable**	**Develop-ment Sector**	**Systems/ Program Area**	**Effect**	**Impact**	**Adaptation/ Mitigation Activity**	**NCCAP Priority Responded**	**O/P Respon-sible**	**Funding Require-ment**	**Timeline of Implementation**				
										2017	2018	2019	2020	2021

Rainfall		Economic Development				Provide seed capital or access PSF for the implementation of CCA programs/projects for farmers and fisherfolk	Food Security and Human Security	LGU						
Rainfall		Economic Development				Provide climate change risk transfer mechanism for agriculture through crop insurance	Food Security and Human Security	LGU						
Rainfall						provision of palay sheds, mechanical dryers,evacuation centers, shed houses for animals during emergencies	Ecological and Environmental Stability							
Climate Variable	**Changes in Climate Variable**	**Develop-ment Sector**	**Systems/ Program Area**	**Effect**	**Impact**	**Adaptation/ Mitigation Activity**	**NCCAP Priority Responded**	**O/P Respon-sible**	**Funding Require-ment**	**Timeline of Implementation**				
										2017	2018	2019	2020	2021

Rainfall		Institutional Development			Submersion of residential houses and public buildings and families in flood water	Enact an Ordinance requiring floor elevation of residential houses including public buildings and facilities in flood prone areas exceeding the average observed flood level based from average decadal recurrence or return period	Human Security	SB						
Rainfall		Infrastructure Development				Use of water resistant construction materials for residential houses and public buildings in flood prone and recurrently flooded areas	Human Security	CEO						
Climate Variable	**Changes in Climate Variable**	**Development Sector**	**Systems/ Program Area**	**Effect**	**Impact**	**Adaptation/ Mitigation Activity**	**NCCAP Priority Responded**	**O/P Responsible**	**Funding Requirement**	**Timeline of Implementation**				
										2017	2018	2019	2020	2021

Rainfall		Environmental Development				Regular Dredging of rivers, creeks and estuaries	Ecological and Environmental Stability	CEO						
Rainfall		Social Development			Increase in vector-borne diseases	Conduct regular IEC on vector-borne diseases	Human Security	CHO						
Rainfall		Social Development			Drinking water contamination	Aquisition of water purifiier								
Rainfall		Social Development			Drinking water contamination	Install in strategic areas/cluster centers water purification stations to ensure supply of drinking water	Human Security and Water Sufficiency	LWU/LGU						
Rainfall		Social Development			Increase in water-borne diseases	Conduct regular monitoring and surveillance of water-borne diseases	Human Security	CHO						
Climate Variable	**Changes in Climate Variable**	**Development Sector**	**Systems/ Program Area**	**Effect**	**Impact**	**Adaptation/ Mitigation Activity**	**NCCAP Priority Responded**	**O/P Responsible**	**Funding Requirement**	**Timeline of Implementation**				
										2017	2018	2019	2020	2021
Rainfall		Institutional Development			Need of health and sanitation awareness in flood	Community IEC on Health and Sanitation	Knowledge and capacity development	MHO						

					prone barangays									
Rainfall		Institutional Development		Flash flooding	Threat to human life and damage to livelihood, assets and environment	Develop system for rain water collection/rain water impounding project to address flooding and shortage of water	Water Sufficiency for agriculture and fishery and Human Security	MAO						
Rainfall		Social Development			Need for flash flood EWS	Install Automated Rain Gauges (ARG) and Automated Water Level Monitoring Stations in areas vulnerable to flashflooding in coordination with PAGASA-DOST under project NOAH	Human Security	MDRRMO						
Climate Variable	**Changes in Climate Variable**	**Development Sector**	**Systems/ Program Area**	**Effect**	**Impact**	**Adaptation/ Mitigation Activity**	**NCCAP Priority Responded**	**O/P Responsible**	**Funding Requirement**	**Timeline of Implementation**				
										2017	2018	2019	2020	2021

Rainfall		Social Development			Changes in water qualify	Regular conduct of water quality test, especially drinking water in flood prone and recurrently flooded barangays	Human Security	MHO						
Rainfall		Infrastructure Development			Prevent intrusion of flood water	Construction/repair of breakwater along riverrine barangays	Human Security	MEO						
Rainfall		Infrastructure Development		Flooding and rain-induced landslides or mudslides	Transport service and other basic services disrupted due to flooded roads or damaged bridges	Conduct -bi-annual structural assessment of roads, bridges and flood control networks including evactuation centers and school buildings	Human Security	MEO						
Rainfall		Environmental Development			Clogged drainage canals and waterways	Continue solid waste management program	Ecological and Environmental Stability	CENRO						
Climate Variable	**Changes in Climate Variable**	**Development Sector**	**Systems/ Program Area**	**Effect**	**Impact**	**Adaptation/ Mitigation Activity**	**NCCAP Priority Responded**	**O/P Responsible**	**Funding Requirement**	**Timeline of Implementation**				
										2017	2018	2019	2020	2021

Rainfall		Infrastructure Development				Design and construction of flood resilient structures	Ecological and Environmental Stability	MEO						
Rainfall		Institutional Development			Reducing human settlements in flood prone areas	Continue relocation of human settlements from flood prone areas to safe areas	Human Security	SB						
Rainfall		Infrastructure Development			Disruption of classes in flood prone barangays	Construction of elevated classrooms in barangays affected by flooding caused by sea level rise	Human Security	MEO						
Rainfall		Environmental Development		Rainfall-induced Landslides/mudflow	Damages to all elements at risk to landslides	Installation of landslides EW devices (ARGs/Indigenous landslides EW devices) in identified landslides prone areas	Human Security	MDRRMO						
Climate Variable	**Changes in Climate Variable**	**Development Sector**	**Systems/ Program Area**	**Effect**	**Impact**	**Adaptation/ Mitigation Activity**	**NCCAP Priority Responded**	**O/P Responsible**	**Funding Requirement**	**Timeline of Implementation**				
										2017	2018	2019	2020	2021

Rainfall		Environmental Development			Hillslope erosion especially in mountain barangays	Installation of landslides control structures (concrete barriers) or non-structural measure like tree-planting in steep slopes based from the landslides susceptibility map	Human Security	MEO						
Rainfall		Environmental Development			Destruction of forest cover	Develop and implement Forest Protection Program	Human Security	MENRO						
Rainfall		Social Development			Need for landslides awareness and preparedness among communities in the mountain brangays	Formulate landslides Contingency Plan for mountain barangays	Human Security	MDRRMO						
Climate Variable	**Changes in Climate Variable**	**Development Sector**	**Systems/ Program Area**	**Effect**	**Impact**	**Adaptation/ Mitigation Activity**	**NCCAP Priority Responded**	**O/P Responsible**	**Funding Requirement**	**Timeline of Implementation**				
										2017	2018	2019	2020	2021

Rainfall		Institutional Development				Conduct annual IEC on landslides preparedness, preferably before typhoon months in mountain barangays	Knowledge and capacity development	MDRRMO						
Rainfall		Institutional Development				In coordination with DepEd authorities in the mountain barangays, conduct IEC on landslides preparedness at elementary schools	Knowledge and capacity development	MDRRMO						
Rainfall		Environmental Development				Develop and implement a system monitoring slope excavation and illegal logging activities in the mountain barangays	Ecological and Environmental Stability	MENRO						
Climate Variable	**Changes in Climate Variable**	**Development Sector**	**Systems/ Program Area**	**Effect**	**Impact**	**Adaptation/ Mitigation Activity**	**NCCAP Priority Responded**	**O/P Responsible**	**Funding Requirement**	**Timeline of Implementation**				
										2017	2018	2019	2020	2021

Rainfall		Institutional Development				Implement Zoning Ordinance in mountain barangays to mitigate landslide risks	Ecological and Environmental Stability	CZAO					
Rainfall		Institutional Development			Increased rainfall increases susceptibility to ground subsidence	Identify areas within the barangays where susceptibility to ground subsisdence is high and conduct IEC on ground subsidence to increase public awareness	Knowledge and capacity development	MDRRMO					

LCCAP for Sea Level Rise

Climate Variable	Changes in Climate Variable	Develop-ment Sector	Program Area	Effect	Impact	Adaptation/ Mitigation Measure	NCCAP Priority Addressed	O/P Responsible	Funding Requirement	Timeline of Implementation				
										2017	2018	2019	2020	2021
Sea Level	Rise/ increase	Environ-mental Manage ment	Mangrove Forestation/ reforestation	Sea water inundation of inland areas resulting in coastal flooding	Loss/disappe arance of coastal land areas, damage to properties and structures	Conduct of mangrove planting and growing/mang rove reforestation	Ecological and Environme ntal Stability	CENRO	500,000					
Sea Level			Info. Drive/ IEC	Lack of awarenes s of the constituen ts on coastal barangays / Coastal Erosion	Damage to properties at sea and loss of lives	Implement information drives especially among coastal barangays	Human security and properties	CENRO						
Sea Level			Solid Waste Management/ Coastal Clean-up/ dreging of canals	Coastline / seashore pollution	Accumulation of all kinds of garbages and waste materials along coastlines/Cl ogging of canals	Implement Solid Waste Management Program emphasizing monthly coastal clean up activity/MontH	Ecological and Environme ntal Stability	CENRO	150,000					
Climate Variable	**Changes in Climate**	**Develop-ment Sector**	**Program Area**	**Effect**	**Impact**	**Adaptation/ Mitigation Measure**	**NCCAP Priority Addressed**	**O/P Responsible**	**Funding Requirement**	**Timeline of Implementation**				

	Variable													
										2017	**2018**	**2019**	**2020**	**2021**
Sea Level				Intrusion of salt water in agricultural zone	Threat to the survival of traditional rice/ corn varieties	Promotion of SALT resistant ()	Food security	CAO	50,000					
Sea Level				Intrusion of salt water into fresh water resource	Contamination of fresh water for drinking	Develop coastal community solar-powered water purifier station funded by People's Survival Fund pursuant to RA1017, Identify and develop other source of water away from from coastal areas	Human Security and Water Suffiency	CEO	500,000					
Sea Level						Implement joint coastal resource management ordinance requiring formulation of an Integrated Coastal Resource Management Program	Ecological and Environmental Stability	CDRRMO	50,000					

Climate Variable	Changes in Climate Variable	Develop-ment Sector	Program Area	Effect	Impact	Adaptation/ Mitigation Measure	NCCAP Priority Addressed	O/P Responsible	Funding Requirement	Timeline of Implementation				
										2017	2018	2019	2020	2021
Sea Level						Apply Sloping Agricultural Land Technology (SALT) to prevent/mitigate erosion	Ecological and Environmental Stability	CAO	200,000					
Sea Level		Social Development	Human Resettlement	Exposure of population in coastal barangays to coastal flooding/ inundation	Potential casualty due to lack of EWS is very likely	Relocation of informal settlers from hot spot barangays and installation of flood EW devices	Human Security	City Housing Project Office						
Sea Level			Social sevice	Decreased in agricultural production due to coastal erosion of agricultural land	Decreased farmers and fisher folk income resulting to increase in poverty incidence	Provision of post disaster financial assistance to affected families	Human Security	CAO	2M					
Sea Level				Evacuation of flood affected families in coastal communities	Greater demand for evacuation service	Develop coastal Evacuation Plan	Human Security and Water Suffiency	CDRRMC	50,000					

Climate Variable	Changes in Climate Variable	Develop-ment Sector	Program Area	Effect	Impact	Adaptation/ Mitigation Measure	NCCAP Priority Addressed	O/P Responsible	Funding Requirement	Timeline of Implementation				
										2017	2018	2019	2020	2021
Sea Level				Disruption of the delivery of basic services	Greater demand for protective, health and education services among vulnerable population	Implement special social services for the elderly pursuant to RA 9994; Protective Services for Children, Women and PWDs	Human Security	CSWDO						
Sea Level					Cost-effective investment	Relocate coastal communities through socialized housing program with basic facilities	Human Security	CDRRMC	15M					
Sea Level					Poor families find it difficult to send their children to school	Granting of scholarship program to poor but deserving students of poor families in coastal barangays	Human Security	CSWDO	2.5M					
Climate Variable	**Changes in Climate Variable**	**Develop-ment Sector**	**Program Area**	**Effect**	**Impact**	**Adaptation/ Mitigation Measure**	**NCCAP Priority Addressed**	**O/P Responsible**	**Funding Requirement**	**Timeline of Implementation**				

										2017	2018	2019	2020	2021
Sea Level					Greater number of Out of School Youth (0SY) abound in poor coastal communities	Implement the Alternative Learning System (ALS) for OSY including PWDs in coastal communities	Human Security	CSWDO	2M					
Sea Level					Likely occurrence of Tsunami/Stor msurge	Install tsunami signages in coastal barangays and develop tsunami evacuation plan	Human security	CDRRMO	50,000					
Sea Level					Disruption of the delivery of basic services	Conduct of expanded program for immunization for young elderly and pregnant women	Human Security	CHO	100,000					
Sea Level		Institution al Develop ment	Low Public Awareness	Threat to human safety	Increase public awareness on coastal flooding and other climate induced hazards	Develop and implement IEC Program for coastal communities	Human Security	CDRRMO	50,000					
Climate Variable	**Changes in Climate Variable**	**Develop-ment Sector**	**Program Area**	**Effect**	**Impact**	**Adaptation/ Mitigation Measure**	**NCCAP Priority Addressed**	**O/P Responsible**	**Funding Requirement**	**Timeline of Implementation**				

										2017	2018	2019	2020	2021
Sea Level			Local Planning	Coastal barangays submerged in sea water	High exposure of all elements at risk to coastal flooding	Formulation of Flood Contingency Plan for the hotspot and coastal barangays	Human Security	CDRRMO	30,000					
Sea Level						Implemen-tation of the building code	Human Security	CO						
Sea Level						Introduce computer based approach instruction in primary School in Coastal and remote poor Barangays	Knowledge Developme nt and capacity building	DepEd	25,000					
Climate Variable	**Changes in Climate Variable**	**Develop-ment Sector**	**Program Area**	**Effect**	**Impact**	**Adaptation/ Mitigation Measure**	**NCCAP Priority Addressed**	**O/P Responsible**	**Funding Requirement**	**Timeline of Implementation**				
										2017	**2018**	**2019**	**2020**	**2021**

Sea Level		Infrastructure Development	Engineering Resilience Design	Exposure of built assets and coastal resources to coastal flooding/coastal inundation	Residential houses and public buildings and facilities highly vulnerable to coastal inundation	Floor elevation of residential houses and public buildings in coastal barangays must be above the projected sea level increase of 40cm between 2020-2036 according to IPCC-AR5.Construction of Seawall and River Control	Human Security	CEO	1M					
Sea Level					Residential houses in low lyiong areas/brgys highly susceptible to flooding	Flood Elevation of residential houses in low lying barangays must be 2.5 mtrs per PAGASA recommendation	Human Security	CEO	1M					
Climate Variable	**Changes in Climate Variable**	**Development Sector**	**Program Area**	**Effect**	**Impact**	**Adaptation/ Mitigation Measure**	**NCCAP Priority Addressed**	**O/P Responsible**	**Funding Requirement**	**Timeline of Implementation**				
										2017	**2018**	**2019**	**2020**	**2021**
Sea						Construction/ repair of higher and	Ecological and Environme		10M					

Level						stronger seawalls	ntal Stability							
Sea Level				Stronger and higher Storm surge	Damage to coastal infrastructures	Public buildings and structures are constructed in accordance with the National Structural Code of the Philippines (NSCP)	Ecological and Environmental Stability	CEO						
Sea Level				Coastal flooding	Infrastructure stress	Retrofitting of infra-structures in coastal barangays	Human Security	CEO	1M					
Sea Level						Construction/repair/re-design of elevated flooring of public buildings in flood prone barangays	Human security		17M					
Climate Variable	**Changes in Climate Variable**	**Develop-ment Sector**	**Program Area**	**Effect**	**Impact**	**Adaptation/ Mitigation Measure**	**NCCAP Priority Addressed**	**O/P Responsible**	**Funding Requirement**	**Timeline of Implementation**				
										2017	**2018**	**2019**	**2020**	**2021**

Sea Level		Economic Development	Livelihood	Decreased or loss of marine products	Decrease on income of fisher folk	Develop and implement sea and land based/Alternative livelihood program	Human security and Food sufficiency	CAO						

LCCAP for Temperature

Climate Variable	Changes in Climate Variable	Develop-ment Sector	Systems/ Program Area	Effect	Impact	Adaptation/ Mitigation Activity	NCCAP Priority Responded	O/P Respon-sible	Funding Require-ment	Timeline of Implementation				
										2017	2018	2019	2020	2021
Temperature	**Increase in Annual Mean Tempe-rature**	Economic, Social, Institutional Develop-ment	Agriculture	More frequent, longer and severe drought	Decline in food production	Apply climate-smart agriculture	Food Security	CAO	10 M	2M	2M	2M	2M	2M
Temperature		Institutional Development			Science-based knowledge on the projected effects/impacts of climate change on agriculture	Use customised SIMCLIM Software to determine the effects of climate variability and change over time and space	Knowledge and capacity development	CDRRMO / CAO	500,000	500,000				
Temperature		Institutional Development	Local Planning			Formulate Contingency Plan for Severe and Frequent Droughts	Water Sufficiency and Food Security	CDRRMO / CAO	150,000	150,000				
Temperature		Economic Developmen t	Water Conservati on		Increased demand for water for agricultural purposes	Develop and implement local water management program in coordination with NIA	Water Sufficiency	CAO						

Climate Variable	Changes in Climate Variable	Develop-ment Sector	Systems/ Program Area	Effect	Impact	Adaptation/ Mitigation Activity	NCCAP Priority Responded	O/P Respon-sible	Funding Require-ment	Timeline of Implementation				
										2017	2018	2019	2020	2021
Temperature		Social Development	Water Source Development (San Juan, Sta. Cruz, Sto. Domingo, Bacon Dist.)(Rizal, Bucalbucalan, West Dist.)	Decrease in water supply	Gradual draining of water sources will cause insuficiency of potable water	Develop and improve water sources in different districts	Water Sufficiency	CEO	5 M	1M	1M	1M	1M	1M
Temperature		Institutional Development	Enforcement	Decrease fish catch, destruction of marine ecosystems	Low income of fisherfolks, poverty	Strict implementation of Fishery Code/Ordinance prohibiting illegal fishing/activities in city waters	Ecological and Environmental Stability	CAO	5 M	1M	1M	1M	1M	1M
Temperature		Institutional Development	Community empowerment	Lack of knowledge of fisherfolks on climate change	Proliferation of illegal or inefficient fishing and farming methods	Conduct climate change orientation training for farming and fishing communities	Knowledge and capacity development	CDRRMO / CAO	1.5M	300,000	300,000	300,000	300,000	300,000
Climate Variable	**Changes in Climate**	**Develop-ment Sector**	**Systems/ Program Area**	**Effect**	**Impact**	**Adaptation/ Mitigation Activity**	**NCCAP Priority Responded**	**O/P Respon-sible**	**Funding Require-ment**	**Timeline of Implementation**				

	Variable													
										2017	2018	2019	2020	2021
Temperature		Economic Development	Livelihood	Decrease fish catch	Low income of fisherfolks, poverty	Introduce wholistic seaweed farming/program for coastal barangays	Food Security	CAO	2.5M	500,000	500,000	500,000	500,000	500,000
Temperature		Institutional Development			Several marine species die due to indigestion and choking from plastic materials	Coastal BLGUs to initiate regular coastal clean up focusing on collection of plastic materials	Ecological and Environmental Stability	BDRRMC	500,000	100,000	100,000	100,000	100,000	100,000
Temperature		Social Development	Climate resilience design	Warmer days and nights	More heat-related stress especially among elderly during warmer days and nights	Promote tropical housing design using natural ventilation with green friendly materials/avoidance of heat conducting materials, IEC on prevention of heat stroke. Provision of Anti hypertensive medication.	Human Security	CEO	5M	1M	1M	1M	1M	1M

Climate Variable	Changes in Climate Variable	Develop-ment Sector	Systems/ Program Area	Effect	Impact	Adaptation/ Mitigation Activity	NCCAP Priority Responded	O/P Respon-sible	Funding Require -ment	Timeline of Implementation				
										2017	2018	2019	2020	2021
Temperature		Social Development	Human health	Warmer days and nights	Increase incidence of diarreha, allergy, ashma, hypertension and related diseases	Strict Implementation of health programs such as Control of diarrhea diseases. Communicable diseases and Non-communicable diseases. Implement community health emergency preparedeness and response plan,	Human Security	CHO	10M	2M	2M	2M	2M	2M
Temperature		Social Development			increase incidence of emerging and re-emerging diseases such as SARS, EBOLA, ZIKA, CHIKUNGUNYA, etc	capacity building of Health personnel on management of ERED. Implementation of Emerging and Re emerging Diseases PLAN	Human security	CHO	10M	2M	2M	2M	2M	2M

Climate Variable	Changes in Climate Variable	Develop-ment Sector	Systems/ Program Area	Effect	Impact	Adaptation/ Mitigation Activity	NCCAP Priority Responded	O/P Respon-sible	Funding Require -ment	Timeline of Implementation				
										2017	2018	2019	2020	2021
Temperature		Social Developmen t			Mosquito population is likely to increase under increased temperature	Conduct regular community clean-up like 4O'clock habit, destroying of breeding sites of mosquitoes. Training of BHW on Larvitrap and Medtech/RSI on Entomology.	Human Security	CHO						
Temperature		Social Developmen t	Community awareness	increasin g incidence of dog bites and snakebite s	POSSSIBL E DEATH	Massive information Educational campaign on rabies and snakebites. Provision of anti rabies (pre and post exposure prophylaxis) and anti venom. Procurement of anti-venum	Knowledge and capacity development and human security	City Vet/ CHO	CHO/ City Vet / DOH/ CDRRMO fund					

Climate Variable	Changes in Climate Variable	Develop-ment Sector	Systems/ Program Area	Effect	Impact	Adaptation/ Mitigation Activity	NCCAP Priority Responded	O/P Respon-sible	Funding Require -ment	Timeline of Implementation				
										2017	2018	2019	2020	2021
Temperature						capacity building on awareness in health programs to adjust in increasing temperature through massive Information , Education campaign and behavior change project and living a healthy lifestyle	Knowledge and capacity development and human security	CHO	CHO/ DOH Fund					
Climate Variable	**Changes in Climate Variable**	**Develop-ment Sector**	**Systems/ Program Area**	**Effect**	**Impact**	**Adaptation/ Mitigation Activity**	**NCCAP Priority Responded**	**O/P Respon-sible**	**Funding Require -ment**	**Timeline of Implementation**				

										2017	2018	2019	2020	2021
		Social Development	Infant and Children Health		Infant death and malnutrition	Encourage Exclusive breast feeding of infants for six months and onwards with complementary feeding and micronutrient supplementation on the first 1000 days of life. Support the National Deworming Month. (January & July)	Human Security	CHO						
			X X X X X X X X X X X X X X X X X X X X											